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Index Supplement to the Electrical Review
January 7th, 1910.

THE
ELECTRICAL REVIEW.

VOL. LXV.

JULY 2 – DECEMBER 31, 1909.

LONDON:
H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, E.C.

Index Supplement to the Electrical Review,
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London:
Published by the Proprietors,
at 4, Ludgate Hill, E.C.

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VOL. LXV. JULY 2, 1909. No. 1,649.

ELECTRICAL REVIEW.

Vol. LXV.] CONTENTS: July 2, 1909. [No. 1,649.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

AN ENGINEER'S CERTIFICATE.

THE case of Musgrave & Sons, Ltd., *v.* The Bradford Corporation, of which we published a report in our issue of June 25th, affords an example of the difficulties which sometimes beset the contractor who is bound by the certificate of an engineer.

The contractor may well feel inclined to rub his eyes on perusing a report of this case. It was clear upon the evidence, and was decided by a judge of the High Court, that an engineer had unreasonably withheld his certificate; nevertheless, the contractor was held bound by his refusal!

A glance at the decision on the subject makes it plain that this part of the case was decided in accordance with the law. It has been clearly held that an action will not lie on a building contract for money payable upon an architect's certificate without its production or proof of waiver of production, and such waiver will not easily be inferred. Indeed, it may be said that a certificate can only be dispensed with by proving fraud. As Lord Lindley said in one case: "The certificate, of course, might be impeached for fraud; it might be impeached for collusion; on the other hand, it cannot be impeached for mere negligence, or mere mistake, or mere idleness on the part of the architect" (see Clemence *v.* Clarke, 1789, 2 H.B.C. 207).

That, of course, was the case of an architect; but the principle underlying it applies with equal force to the case of an engineer. His certificate is equally binding—not only on the contractor but on the employer also. One example of this should suffice. In Dunaberg Railway *v.* Hopkins and Co., 36 L.T.N.S. 733, the defendants contracted with the plaintiff, a railway company, to supply rails of a certain pattern and sample, to be inspected by the engineer. The rails were supplied and found satisfactory by the engineer, but after delivery it was discovered that they were defective. The employer sued for breach of contract. It was held that the company had no right of action, as it was the intention of the parties in the construction of the contract to make the satisfaction of the engineer final, and to take away any subsequent right of action.

We have seen that fraud or collusion constitutes a ground for setting aside or dispensing with an engineer's certificate. It may be said, with some show of reason, that it is difficult at any time for the engineer employed by one party to a contract to act with propriety as mediator in the contract. The question whether or not a certificate is to be granted is really an issue between the contractor and the employer. But the contractor knows all about this before he signs the contract. As Lord Justice Bowen said in Jackson *v.* Barry Railway Co., 1893, 1 ch. 238: "An engineer could not be expected, nor was it intended, that he should come with a mind free from preconceived opinion. The perfectly open judgment, the absence of all previously formed or pronounced views, which in an ordinary arbitrator are natural and to be looked for, neither party

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proposed to exact from the arbitrator of their choice. They knew well that he probably must be committed to a prior view, and that he might not be impartial in the ordinary sense. What they relied on was his professional honour, his position and his intelligence."

While the contractor cannot complain about bias which he knows of before signing the contract, it is otherwise if it turns out that, unknown to one party, the engineer is biased or has formed an opinion. "A perfectly even and unbiased mind is essential to the validity of every judicial proceeding. Therefore, when it turns out that, unknown to one or both of the persons who submit to be bound by the decision of another, there was some circumstance in the situation of him to whom the decision was entrusted which tended to produce a bias in his mind, the existence of that circumstance will justify the interference of the Court" (per Stuart, V.C., in Kemp *v.* Rose, 1858, 1 Gibb 258). What happened in that case was that an architect, unknown to the builder and previously to a contract being signed, gave an assurance to his employer (but declining to bind himself by any guarantee) that a building would not exceed a certain amount, upon the faith of which the employer embarked in the undertaking. It was held, without alleging fraud, that the architect's decision was not binding on the builder, if there was the smallest speck or circumstance which might unfairly bias his judgment which was unknown to the builder.

A fortiori, if an actual fraudulent agreement can be proved, a certificate may be set aside, or it may be held not to be a condition precedent to the right to sue.

Fraud is an ugly word; but, in the absence of fraud, it is a well-nigh superhuman task to set aside a certificate. These are precepts which every contractor should bear in mind before he consents to sign any contract which binds him, hand and foot, to the employer's engineer.

Municipal Ethics.

In giving judgment on the case mentioned above, his Lordship stated, among other things, that the engineer did refuse the certificate for the purpose of *obtaining an obligation from the plaintiffs, to which he was not entitled under the agreement*, but he thought he tried to do so because he was not satisfied with the engine—*although he ought to have been;* but as the engineer did not act in collusion with the Corporation, the action failed on legal grounds, in the absence of the engineer's certificate.

Though the Bradford Corporation obtained a legal victory, it must be said that the moral victory rested with the engine builders; owing to the one-sided and unfair clause in the contract, it did not make any difference whether the engine was good or bad, or whether the technical contentions of the engineer were right or wrong—the Corporation could refuse payment as long as the engineer considered himself dissatisfied, and refused the certificate. It may be impossible to force an engineer to give his certificate, even though it has been decided that the engineer is technically in the wrong, but there is very little doubt in the mind of any right-thinking man as to what, apart from any legal obligations, the Corporation *ought* to do under the circumstances.

It would be interesting to see what would happen if ordinary commercial contracts were arranged on the municipal plan. The world's business would in a few weeks be reduced to a state of chaos.

Speaking generally, and quite apart from the above case, the omission of an arbitration or similar clause for the protection of a contractor from an agreement is a clear confession of weakness or technical incompetence on the part of the engineer. An engineer worthy of his profession, who believes in his own sense of justice and technical ability, will not hesitate to refer his action to an arbitrator or independent tribunal, and in the case of an adverse verdict will admit that even the greatest man is liable to mistakes, and that there are two sides to every question.

For many generations the Englishman has been noted among the nations of the world for his sense of fair play and business integrity; though stress of competition, American hustle, and the presence of many not too conscientious financiers in our midst have lowered the standard of commercial morality, the Englishman of to-day has still something in this direction to be proud of.

It would be thought at first sight that municipal bodies would become models of fair play and straight dealing, in their relations with the commercial world, but the repeated complaints heard of one-sided contracts and sharp practice show that there is a good deal to be desired. It must be said that this more frequently arises from excessive official zeal, thoughtlessness and desire to appear smart than from any deep-seated vice or wish to be unfair.

A few days ago a very serious criticism of the Budget was made by the Lord Chief Justice, on the ground that it introduced a new principle into English law by denying the right of the taxpayer to appeal to an independent body or court of law in the case of disagreement over the taxation of land or income, any disagreements between the taxpayer and assessors being referred to an interested Treasury official, whose decision was to be final, contrary to the principle with regard to civil disagreements which has existed in this country almost since Saxon times. He probably was not aware that for the last 10 years many municipalities have violated this national principle in their machinery contracts, refusing the right of arbitration, and by means of carefully-worded clauses have practically contracted out of the law, and arranged so that in cases of dispute, the borough engineer or other official can assume the *rôle* of plaintiff or defendant, judge, jury, Court of Appeal and House of Lords, all in one; in fact, become a sort of technical and legal "Pooh-Bah."

When a contractor receives a specification for machinery, it is very usual to assume that where one-sided clauses exist the municipality will have too much self-respect to put them into action, except in cases of downright dishonesty on the part of the contractor; but this is evidently a dangerous and illusory assumption. It should not be impossible for the leading electrical contractors to come to a mutual agreement and refuse to sign contracts containing such clauses; largely owing to the concerted action of the manufacturers, the terms of contract of the leading Continental municipalities are much more equitable with regard to payments and conditions than those in this country. The Institution of Electrical Engineers has drawn up model conditions of contract, but they do not go far enough.

Public bodies are the servants, not, as many people wish them to be, the masters of the public, and while even contractors are not all saints or all black sheep, it should be in the interest of everybody to uphold that standard of commercial morality for which this country has long been so justly famous.

Charging for Electricity.

Under Sec. 32 of the Electric Lighting (Clauses) Act, 1899, the principle is established of a compulsory revision of the maximum prices for electrical energy every seven years, and Clause 20 of the Electric Lighting Act, 1882, provides that in making agreements for a supply of electricity, the undertakers under provisional orders shall not "show any undue preference to any local authority, company or person." These provisions recognise, in the first place, that changes in the conditions of supply are to be anticipated in the development of electrical undertakings; and, secondly, (from the grandmotherly point of view), the necessity for the protection of the consumers.

The right under the Act to demand an inquiry into a revision of prices rests with the local authority (if not themselves the undertakers), or with the suppliers under the provisional order, so that if individual consumers desired the protection of this clause of the Act, they would have to make their application through the local authority.

In some cases provisional orders contain variations in the term for revising prices; for example, under an order granted in 1900, there is an alteration, in the following words:—

"Sec. 32 of the schedule to the Electric Lighting (Clauses) Act, 1899, shall, as incorporated with this Order, be read, as if, as respects the revision of price authorised by that section, two years were substituted for seven years." But the usual clause in provisional orders is as follows:—"The maximum prices which may be charged by the undertakers as mentioned in Sec. 32 of the schedule to the Electric Lighting (Clauses) Act, 1899, are those stated in the fourth schedule to this Order."

The question of undue preference involves *similarity in the conditions of supply*, and this allows for the necessary freedom in making contracts for exceptional demands. It is absurd to suppose, for instance, that a sausage maker employing a small motor for a few hours a week should be able to claim a supply of power on the same terms as a chemical factory working day and night, and taking hundreds of thousands of units, or that consumers during the peak of the load should be charged the same as those only requiring a supply during the day-light hours.

In considering the question of the proper charge for energy during a new period of, say, five or seven years, many interesting points arise which require the utmost skill of the parties concerned to deal with. For example, the actual and probable improvements in the cost of the energy have to be considered, and in this respect the development of the undertakings for supplying electricity in bulk over large areas plays a very important part. Instead of generating a comparatively small amount of electricity in local works, with dear coal and other disadvantages, the power company supplies at a considerably lower cost, besides saving capital outlay and expenses in management.

This development is seen in the closing down of local generating stations established a few years ago and limiting them to the distribution of electricity received in bulk from distant power supply works.

As an instance of the economy of this "up-to-date" system, we will take the case of a small local company in the North of London—which commenced supply about seven years ago from a self-contained plant—with steam power, but which now takes all its energy in bulk from a power station. In the last year of generating locally, the cost per unit sold was 3·306 pence, whereas under the arrangement for taking all the energy in bulk from the power supply company, the cost is reduced to 1·872 pence.

Cases arising out of the revision of prices clause of the Act have not been numerous, but one is now *sub judice*, to which we shall refer when the award of the arbitrator appointed by the Board of Trade is made; meanwhile, the evidence in the case has been given, embodying many points of interest, the price charged being the subject of a sliding scale agreement with a special clause for revision of rates after a term of years.

The Human Factor in Commercial Illuminating Engineering.

In the June issue of the American *Electrical Record*, Dr. Louis Bell emphasises some instructive points in an entertaining manner, regarding the difficulties which the illuminating engineer experiences in dealing with those who require their lighting improved.

In America, illuminating engineering is a science *in esse*, whilst here it is still *in posse*. It is true that there is now an Illuminating Engineering Society amongst us, but to a large extent, for the present, we are bound to get our information from American sources, and it is interesting to note, in this connection, that those who have had practical experience are not slow to communicate it to the electrical papers. It appears, as Dr. Bell picturesquely puts it, that those who undertake the science commercially are "forthwith led by the nose up to the strenuous life," or to put it more plainly, "ordinary illuminating engineering deals with the application of artificial sources of light to practical illumination, while the commercial kind has to do with their application to human nature." We all know the man who thinks that he is getting most light when the source of illumination is staring him in the face. Try to persuade him that he will get most illumination by shading that light or putting it out of the range of vision, and he thinks we do not know our business. So much about illuminating engineering we do know, however, and we are able, therefore, fully to appreciate the difficulties they are having in America. Again, an architect designs a Gothic or Georgian interior, with sombre decorations, and only allows for lighting it with the conventional candle sconces, quite forgetting that the people of those times either could not read or did not trouble to do so, whilst nowadays man does as much of his work by artificial light as by natural light. Try to get the architect to provide for a proper system of reflected illumination, and he calls us wanting in the artistic sense. Dr. Bell classifies consumers in respect of illuminating engineering as follows:—The majority, who require their bills reduced; a large minority who want better light at the same, or less, cost, with a few who want better light "anyhow." The first class, being generally fairly well lighted, no doubt owing to their rooms being small, are not difficult to deal with. The second class, who consider reduced bills a secondary matter, are necessarily badly lighted, and this is generally owing to some fault of the decorator or architect. But both classes, being only human, have their own ideas, and the illuminating engineer has often to make a compromise in order to satisfy them. We are told, however, that most people seem to "catch on" to the drift of what the expert is aiming at, although they may, and will, alter details to their own disadvantage. This is information that we might have been led to expect, but it would be as well to be prepared, in this country of conservatism and conventions, for greater opposition than is experienced in America. It is of no use to attempt to ram new ideas down people's throats (to quote a mixed metaphor), but to proceed carefully, tactfully and without undue haste. The human factor cannot be neglected, and, no doubt, this point of view will present itself to those who are about to undertake the uphill work on this side of the Atlantic.

The Birthday Honours.

As usual, there is little encouragement meted out to electrical or engineering men in the list of Birthday Honours—presumably it is because they do not take sufficient active interest in matters political. Everybody will be ready to congratulate Dr. Joseph Larmor, F.R.S., the secretary of the Royal Society—whose deep knowledge of mathematical and physical science always commands for him an attentive and interested audience at the British Association gatherings, or wherever else he may occupy the platform—upon the knighthood which has been conferred upon him, an honour as well merited as any in the list, regarded from our point of view. Sir Robert Hunter, the solicitor to the Post Office, is made a C.B. Mr. John Newlands, Officer on Special Duty in connection with the reorganisation of the Indian Telegraph Department, receives the order of C.I.E., as does also Mr. H. A. Kirk of the India Office, late Director in Chief, Indo-European Telegraph Department. Mr. Thomas Briggs, the vice-controller of the London Postal Office, and Mr. J. K. Logan, superintendent of Electric Lines, Post Office and Telegraph Department of the Dominion of New Zealand (incidentally it may be mentioned that Mr. Logan represents the interests of the I.E.E. in that quarter of the globe), are both appointed to be Companions of the Imperial Service Order. To all of these we extend our hearty congratulations. They are good as far as they go, but they do not go far enough. Many of our readers will easily call to mind the names of men who have rendered sterling service in connection with the science and practice of electrical and other branches of engineering, or who are by virtue of their great learning in these departments creditable ornaments thereto, the public recognition of whose claims is overdue. We think of men who could carry national honours with appropriate credit and dignity, and who would in these days of easily-won political honours, help better to ensure a continuance of a high standard among those elected by His Majesty's advisers to carry our national distinctions.

THE I.M.E.A. CONVENTION.

Now that the 1909 Convention has become a thing of the past, and we have had time to ponder over the doings of the week and their more immediate results, we must confess to a feeling that the meetings, at any rate, did not come up to the level of former years; this more particularly applies to the discussions, which were more remarkable for quantity than for quality.

Of course, it must be admitted that the executive are likely to be faced with increasing difficulty in obtaining suitable papers, as owing to the growth of local engineering societies, and more particularly of the provincial centres of the I.E.E., where engineering matters are promptly dealt with, as well as to the general acceptance of supply methods, as dictated by experience, the matters which may be profitably discussed are strictly limited. The social side of these meetings must, however, remain a very valuable feature.

In our last issue we referred to the earlier doings of the week; on Wednesday a special train conveyed the members to Liverpool, where, in St. George's Hall, Messrs. Hoadley's and Hollingsworth's papers were read and discussed.

The former paper will be found in this issue; so far as electricity revenue is concerned, the influence of metallic-filament lamp was clearly demonstrated, but we were left somewhat in doubt as to how far the loss in revenue has been compensated for by the good commissions in the case of those who are dealers in lamps as well as light.

Arising out of this it appears that some engineers are rather worried over the long and efficient life of the new lamp and its falling price, and it is further interesting to note that an attempt has been made to improve its efficiency at the expense of burning hours, but without success.

Mr. Hollingsworth's paper on cable systems and its discussion were both curtailed owing to lack of time, which was a matter for regret.

There is no orthodox cable system, and, evidently, near neighbours are quite opposed as to the most suitable type of cable to use for similar work. One matter, however, which was mentioned by several speakers, and which will sooner or later require the serious attention of the Association, is overhead mains. There is a growing disposition in favour of these in certain circumstances, and there is no doubt that, granted a more consistent and less obstructive policy—in fact, a common-sense attitude—on the part of the Board of Trade, engineers generally would, by making greater use of such systems, open up their areas more rapidly than they can under present expensive conditions.

The Corporation luncheon at Liverpool took place in the Exchange Hotel, where, owing to the large attendance and limited accommodation, a division of forces was necessary. However, as regards our particular group, this arrangement proved a very happy one, and we cannot let it pass without recording our appreciation of the astute chairmanship of Ald. Lloyd, of the Tramways Committee.

The afternoon was spent mainly in special tramway cars, Lister Drive being visited in the first place, and subsequently the Cunarder *Mauretania*.

The turbine section of the Lister Drive station had been thoroughly spring cleaned in expectation of visitors, and those who anticipated finding any skeletons were agreeably disappointed, as both the Westinghouse and Curtis plants were apparently upholding their makers' reputations.

As to the visit to the *Mauretania*, the less said the better; those who expected nothing were not disappointed. The vessel being under lock and key, and time being strictly limited, nothing remained but a walk round the decks, and to make our way back to the Central Station *en route* for Manchester.

At Thursday's meeting, Mr. Blackman's turbine and Mr. Lunn's condenser papers were read and jointly discussed, and quite appropriately the majority of the members visited the Westinghouse Works at Trafford Park in the afternoon, where recent examples of such plant were on view. The discussion did not produce any noteworthy expression of opinion from the users, the latter being apparently very well satisfied with their turbine acquisitions.

The visit to Trafford Park was the most important of the week, and as the company had made every provision for the reception of its guests, the tour round these huge works, which deal with every type of prime mover and electrical plant, proved of more than ordinary interest.

Of special interest were the new 5,000-KW. Westinghouse-Rateau impulse turbines for the L.C.C., in which the mechanical features of the blading, and as regards the electrical end, the sound mechanical construction of the stator, attracted general attention. A considerable number of single and double flow and mixed pressure turbines, Le Blanc jet and surface condensers, also gas engines galore, were on view in the mechanical section, whilst generators, motors, transformers and switchgear of every description were also shown, including examples of the new radial brush gear fitted to direct-current turbo-generators. Later in the day, the annual dinner was held at the Midland Hotel, under the chairmanship of the President, who was supported by the Rev. Bishop Welldon, the Lord Mayor, Sir Thos. Shann, and many others well known in municipal and electrical circles; speeches and music occupied the later stages of the evening, which passed off very successfully.

Friday, the last day of the Convention, was reserved for the annual general meeting, at which the principal business was the election of Mr. W. W. Lackie as President for the coming year, and the decision that Glasgow should be the venue of next year's conference. The new council and its officers are as follows:—

President, *W. W. Lackie (Glasgow).
Sen. Vice-President, *J. Christie (Brighton).
Jun. Vice-President, *G. Wilkinson (Harrogate).

Past-Presidents.

*J. E. Edgcome (Kingston-on-Thames).
*S. E. Fedden (Sheffield).
*H. Talbot (Nottingham).
*S. L. Pearce (Manchester).

Council.

Coun. Howarth (Manchester).
Coun. Sinclair (Swansea).
Ald. J. P. Smith (Barrow).
Ald. West (Coventry).
Ald. Wilkinson (Luton).
Baillie Willock (Glasgow).
*V. A. H. McCowen (Salford).
*Charles Furness (Blackpool).
*F. M. Long (Norwich).
*J. E. C. Shawfield (Wolverhampton).
*T. P. Wilmshurst (Derby).
*A. C. Cramb (Croydon).
*A. A. Day (Bolton).
*H. Richardson (Dundee).

Hon. Solicitor, Ald. G. Pearson (Bristol).
Hon. Treasurer, *J. E. Edgcome (Kingston-on-Thames).
Hon. Secretary, *H. Faraday Proctor (Bristol).
Secretary, C. McArthur Butler.

* Engineers.

Some discussion took place on the Council's report, more particularly in regard to Lord Avebury's amendment to the original Clause 15 in the Electric Lighting Acts (Amendment) Bill, which particular clause was intended to empower local authorities to provide and hire out fittings, &c.

Eventually the question of dropping Clause 15, unless it could be passed in its original form, proposed by Mr. Faraday Proctor, or, as a alternative, adopting an amendment by Mr. Hoadley, that, if it were not possible to obtain the original clause, it should be accepted in its amended form, was put to the vote, the resolution being carried. The amendment, however, secured considerable support.

One cannot pass over the business meeting without reference to the valuable services rendered by Ald. Pearson, the legal "inquire within" of the Association—a sort of village pump (as he suggested) because everybody went to him.

This year's Convention was attended by very ill-luck in the matter of weather, nor can it be said that the choice of the large lecture hall in the Municipal School of Technology for the meetings was a particularly happy one, owing to the extreme difficulty in hearing the average speaker.

In Mr. S. L. Pearce the Association had an excellent president, whose ability and experience in electrical matters generally, and in municipal electrical matters in particular, are unquestioned; and we have every reason to believe that in selecting Mr. W. W. Lackie as president for the coming year, an equally appropriate choice has been made. For the rest, the Glasgow authorities may be trusted to make the Association as much at home as if they were over the border, perhaps a little more so.

The Influence of Metallic-Filament Lamps on the Electrical Industry and on Street Lighting.

By E. E. Hoadley, Chief Electrical Engineer, Maidstone.

(*Abstract.*)

From the point of view of most manufacturers of generating plant, the metal lamp is anything but a blessing. For the past two or three years extension of plant, except in a few favoured localities, has been slow enough, and on top of this comes an invention which will certainly keep the peak load in a generating station from rising at anything like its normal rate for a year or two to come, and in many cases will actually reduce it; and it is the peak load which determines whether extension plant is wanted or not. Cable makers may not be so unfortunate, as with the undoubted lessening of lighting cost to the consumer, people who have hitherto held back on the score of price may become consumers; and to supply them, mains will have to be run.

On the manufacturing side, the reapers of the harvest brought about by metal lamps will be first and foremost the lamp makers themselves; next, the accessory makers and wiring contractors should reap a decided benefit.

We now come to the point of view of the supply station engineer. The result of the introduction of the metal lamp varies according to whether the station supplies alternating or continuous current, whether the output is solely for lighting or is made up of power, lighting and traction; and if the supply is practically a lighting supply, whether that supply has a large proportion of shop lighting or is to a great extent residential. Taking the case of the A.C. stations first, these may be roughly divided into two classes—those stations in manufacturing districts supplying two or three-phase current and having a large proportion of their output used for power; then there are the single-phase stations, most of them of somewhat ancient date and generally supplying an area in which the demand is chiefly for the lighting of residential property. It is undoubtedly the latter class that will feel the pinch first and will feel it hardest, as practically all the circumstances are against them. The property they supply is the better class houses, whose owners will face the outlay demanded by a transformer and metal lamps with equanimity. Not having a large late-closing shop demand, the raising of the standard of illumination will not help them very much, as it is not so much increased light for the same amount of money that the consumer will go in for, but the same amount of light for a greatly reduced amount of money. It is doubtful if new consumers will come along fast enough to take all the units that existing consumers will save; even if they do, it means that the capital charges per unit sold will be increased, as although the generating plant will not need addition, yet new mains and services must be provided, and in the residential towns these are generally an expensive item per consumer, and with the poor load factor generally prevalent capital outlay should be kept as low as possible.

To stations of this class it must be confessed that the outlook is not a particularly rosy one for the next few years, and it can hardly be wondered at that several are considering the raising of prices In some special cases this may be the right policy, but the author is of opinion that what may be called the domestic uses of electrical energy should be pushed as widely and as hard as possible—heating and cooking in the better-class houses are not exploited nearly as much as they should be.

Where an A.C. station has the benefit of a good shop-lighting load and at the same time supplies a fair amount of power, the metal lamp should be looked on as a blessing, for the amount of harm done to the revenue account now will be amply repaid later on.

Most engineers of D.C. stations, particularly of those where the pressure is 200 volts or over, look with distinct favour on the lamp, but even they must look further than some of them have done up to the present. The time must be faced when a lamp of 16 C.P., or even less, can be obtained for all pressures commonly in use, and at a price which will be but little in advance of the selling price of the ordinary carbon-filament lamp. There is plenty of precedent for a great lowering of the price, and in spite of what the lamp-makers say as to the fine margin of profit at present prices, the reduction is bound to come.

To get the utmost good from the metal lamps it is practically certain that most central stations owned by municipalities must have legal rights and privileges which they do not at present possess. In the opinion of the author the first and foremost necessity is that municipal bodies generally should have the power to raise money for the purposes of wiring houses and other premises, for letting out cooking and heating apparatus as well as motors on hire and hire-purchase. Most municipal bodies would be quite satisfied if the powers were granted with the proviso that the wiring work should be done by contractors; with regard to cooking and heating apparatus, how many contractors could truthfully say that an appreciable source of income will be taken from them if the supply authority is allowed to hire heating-stoves, ovens, and things of like nature, it being understood that the wiring for these is done by a contractor? In this connection, if it be good law for some 44 towns to possess these powers, then how stupid it is for the rest to be denied them unless they go to the expense of a special Act; further, if it be fair and just for the gas companies themselves to do all these things, and many others besides, is it more unfair to the electrical contractors than to gas fitters that electricity supply authorities should possess equal or similar powers? Electrical engineers have too long been content to sell the consumer electricity, whereas it is light or heat that he buys, and it is vital to the interest of the supply authority to see that he is satisfied with the amount of heat or light that he gets for the money he pays. But how can this be done when the supply authority is bound down by silly restrictions? A determined effort should be made to get these necessary powers.

Next to the above comes the necessity for cheaper wiring. The author can state from his own experience that the Continental system of flexibles on special insulators requires a lot of beating—among other places, he has tried it in the damp warm atmosphere of a conservatory for 18 months without the slightest trouble. With cheap wiring, the necessary powers to hire out cooking and heating apparatus, wiring and fittings, and the improvements in cooking and heating apparatus which are bound to come with extended experience, most central stations should be able to look on the metal lamp as an ally and not as an enemy; to the above advantages should be added the very important fact of a large reduction in the selling price of the lamp. From 8d. to 10d. a week is about the average revenue obtained from a working man for light, and this serves to show how ridiculous it is to ask him to buy lamps at 4s. 9d. each, when he can get a gas mantle for 4d.

That there will be a diminution in revenue from lighting consumers cannot be denied, as although the standard of lighting demanded will undoubtedby be increased, yet it will be in very few cases that the standard of illumination will be raised some three and half times.

In the field of public street lighting the importance of the new invention cannot be over-estimated; the author feels sure that when engineers and Committees responsible for the lighting of streets have fully realised the possibilities of a lamp with an efficiency of approximately 1 watt per candle-power, that can be obtained in single units, giving candle-power ranging from 50 to 1,000, there will be many schemes of street lighting by arc lamps and by incandescent gas that will be altered and modernised.

An ordinary 60-watt metal lamp without any reflector will, from the point of view of the ordinary public, produce the same results as a good gas mantle in the heyday of its youth, while with reflectors the effect can be considerably increased. The other advantages, from an electrical point of view, are that no special mains are necessary; with the same fitting, different candle-power lamps, graded according to the importance of the streets, can be employed, lamps that fail can be renewed at any time without trouble, the candle-power of the lamp does not appreciably diminish with age, and last, but not least, the average life of the lamps is a revelation. In the author's own experience, some 18 months has given an average life of very nearly 1,100 hours, individual lamps lasting 6,750, 5,450 and 5,044 hours on a circuit at 230 volts where a large and fluctuating power demand does not make for a particularly steady volt chart, however admirable may be the intentions of the switchboard men.

The discussion was opened by Mr. S. E. Fedden (Sheffield), who remarked on the effect of the new lamps in deferring the necessity for plant extensions, an effect which had not been realised. He did not quite know the cost of making these lamps, although he had heard 7d. mentioned, which appeared to leave a large margin for profit; the retailers were also obtaining a good commission, and the only one not making money was the central-station engineer. As showing the effect of the more economical lamps, he mentioned that the Sheffield lighting revenue was down £4,000 this year; his own department had carried out replacements by 5,000 200-volt, 10,000 100-volt, and some thousands of lower voltage metal-filament lamps, and it was probable that the number of new lamps in use in Sheffield was quite double this amount. In one Sheffield club the lighting bill was 64 per cent. less since the new lamps were introduced; and he considered that three new consumers were required to balance one carbon-lamp consumer who changed over. The new lamp had, however, deterred many people from going back to gas. He hoped, in one way, that the price would not fall quickly, as his department sold lamps. He could not agree with the author's suggestion that most municipal bodies would be satisfied to carry out wiring through contractors; in Sheffield, where they had a wiring department, they set the standard of work, and it was much higher than formerly. Of his 8,000 orders last year, quite one half were little orders carried out mostly at night, a class of work which it would not pay the small contractor to undertake. He cautioned members against buying heating plant to let out on hire, on account of the rapidity with which it became obsolete; he considered it only reasonable that his department should have as much control of its affairs as the gas company had of its business.

Councillor Dykes (Beckenham) said his Council did a large amount of free wiring; about half the consumers were so wired. With the carbon lamp the energy consumption averaged 15 units per lamp per annum, and the net revenue 6s. 6d., or, including wiring charges, &c., 8s. per lamp. Since changing over to the new lamps the illumination had been increased 50 per cent., the energy used fell to 9·8 units, the net revenue to 4s. and the revenue, including wiring charges, to 6s. 4d. per lamp, although the rentals were raised. He had found that gas consumers in Beckenham were paying from 12s. to £1 per burner per annum, with gas at 2s. 6d. per thousand feet; from a comparison based on actual figures obtained, it appeared that electricity was very slightly dearer than gas in the district. Taking into account that they were at present supplying consumers at 6s. 4d. per lamp per annum, he thought it might be safely assumed that the extra units which might be used would still make a fixed lamp charge of 10s. per annum a profitable figure, this system being one he advocated for small consumers, as it did away with the necessity for meters. In this connection he pinned his faith on concentric wiring and a transformer for each terrace or block of houses, supplied at, say, 3,000-volt pressure.

Mr. Haydn Harrison said that in a contract which he was carrying out for converting gas standards to electric lighting, the services cost £2 10s. per post, while the replacement of the gas by an electrical fitting only cost £1; he found that many authorities did not yet appreciate the possibilities of the new lamp for street lighting. He favoured a series system, grouping the lamps on, say, 100 volts, as being much cheaper and more efficient than the present system.

Mr. H. Collings Bishop (Newport) said they had to thank the metal lamp for the present position of street lighting; he had Osram lamps which had lasted 2,800 hours, and found alternating circuits and high voltage lamps to give the better results. During the past year some 400 of their 1,500 consumers had taken up the new lamp, new consumers, however, were coming on, and this practically kept the revenue stationary. He had some 400 to 500 arc lamps on hire, and found this business very satisfactory.

Councillor Dudley Stuart (Wimbledon) gave some particulars of the Wimbledon street lighting since the adoption of metallic-filament lamps, which showed that many lamps burned satisfactorily for 3,000 hours, and that a 95 per cent. better candle-power was now obtained, as compared with the carbon-filament days, and this with a decreased energy consumption.

Mr. F. Sells did not agree as to the happy position of the manufacturer of the new lamps, nor as to the cost suggested by Mr. Fedden. He was not sure that the decreased plant requirement of central stations was a drawback to the manufacturer, taking into account the poor prices offered for plant now. He was credibly informed that although the makers tried to shorten the life of the new lamp by giving a better efficiency, they could not do it.

Alderman Smith (Liverpool) took up the cudgels on behalf of the ratepayer, who expects a contribution to the rates; Councillor Crowther (Sheffield) replied, advocating better service rather than rate aiding, and this side issue having been settled, Mr. Hoadley replied briefly to the only controversial point raised, *i.e.*, the question of wiring, and submitted that it would not harm the supply authority if the contractor made the initial wiring installation.

Metallic-Filament Lamps.

The contribution by Mr. E. E. Hoadley shows a close and reasoned study of a subject which has, perhaps, occupied the attention of supply managers more than any other question between themselves and their consumers of recent years, excepting, perhaps, only the theory of tariffs and charging with which it is intimately related; he may also, perhaps, be congratulated upon his courage in holding up a deaths-head for the edification of any thoughtless feasters, who displayed an unseemly desire to forget their troubles in the giddy pastime of conventing.

To the manufacturer of heavy plant the new lamp certainly brings little at present, and if the cable maker is to reap the greatest benefit from new work, he should devote himself to the cheapening of cable networks and service connections, and so help the engineer with the immediately important problem of serving dwellings which may not yield more than 30s. per annum for a 15 to 20 ft. frontage. The maker of meters has so far perfected and cheapened his productions under the stress of competition, that to urge him further were almost an insult, but his success in meeting the demand for very substantial and reliable instruments for small loads will do much for the supply industry at the present juncture, and help to save us from contract tariffs and restrictive devices with which it would be a pity to encumber the supply of electricity to very small consumers, if by any means avoidable.

With regard to internal fittings, simple and efficient glassware is likely to be called for rather than metal work, and it behoves British glass makers to give every attention to the requirements of the electrical trade in connection with the new lamp, or much valuable work may be lost to the enterprising Continental glass makers.

The question of the price of lamps raised by the author is not likely to pass unanswered by manufacturers; apart from the operation of the natural law, which does not tend to let prices fall whilst lamp works are unable to cope with orders, it must be borne in mind that many of the later competitors in this field have by no means fully perfected their productions, and are at present booking orders rather than securing customers!

With the difficulty of the station engineer, set forth with so much feeling by the author, one can have nothing but sympathy. The A.C. man is being rapidly denuded of his revenue, and the D.C. supplier abused, because it is less easy to treat him in the same fashion, but the only sound course of action appears to be to devote all the available energy to getting new business by means of the improved lamps, and by freely making known to every one the advantages of the change; undoubtedly legitimate though it may be to induce consumers to use as much light as possible, it is neither wise or desirable for a supply manager to dwell exclusively upon the superior lighting to be obtained by his present consumer, whilst putting forward only the greatly decreased cost when attempting to convert a user of gas.

The engineer is looked upon by the bulk of the consumers as their adviser, and their confidence is certainly of sufficient value to his undertaking to be guarded with care.

The residential towns which are feeling the reduction in output so severely, have certain compensations. Mains extensions can frequently be carried out in a more simple and inexpensive manner than is possible in large industrial centres, and the residents in many cases are in a position to listen to the canvasser who suggests that they should spend some of their saving on lighting on a supply for heating and cooking.

Although the prices of warming stoves and utensils for odd cooking operations have fallen greatly during recent years, their sale cannot be looked upon as much more than a practical lesson in the possibilities of the electric supply; before any considerable and steady heating load is obtainable, it will be necessary for the makers to put forward a comprehensive heating and cooking system which will be useable by the domestic of *unaverage* intelligence, and provide those supplies of hot water, local warmth and comfort, and drying facilities which are now provided by the kitchen range as a sort of by-product of the household cooking; given such an appliance, hiring arrangements should offer no great difficulty.

Cheaper wiring must be close at hand, in view of the attention which is being devoted to it, but those who hold the most divergent views on this subject appear to be seldom able to submit costs of work actually done, and would presumably be rather surprised at the comparatively small money saving to be effected by some of the newer methods; in any case, the difference seems likely to be but a small percentage of the annual bill for current consumed, and an almost infinitesimal portion of the cost or value of the premises fitted.

The author's remarks on street lighting can be freely endorsed; at the average ruling prices of gas, electricity consumed in metal-filaments admittedly provides a cheaper and better light, and probably in the future the engineer's energies will be more occupied in combating vested interests than in trying to prove that he has something better to offer. If, however, arc lamps are to be replaced by incandescents, it would seem better engineering to distribute them on the usual short standards, and obtain that better diffusion which has always been the gas engineer's advantage.

In asking for the removal of restrictions and increase of powers, the author voices the wish of every supply manager who is interested in the future of the industry; a word of caution only with regard to how the powers are used. The engineer has little to gain by himself becoming a direct trader with his consumers, and may easily fall in their estimation from that neutral position which allows them to look to him for guidance in their use of the supply, which, however much they appreciate it, they seldom have the opportunity or desire to understand.

European Industries.—Mr. George Westinghouse recently returned from Europe after a trip that lasted more than three months. Regarding conditions in the electrical and engineering trades in Europe, says the *Electrical World*, N.Y., he stated that there had been a notable improvement within 60 days in Germany, France, Belgium, Italy, Austria and Great Britain, as well as a fair degree of improvement in most of the markets to which those countries export electrical engineering products. Engineers in charge of very large hydro-electric undertakings and the electrification of steam railroads told him that work in progress would require more than 125,000,000 lb. of copper within a twelve-month. One concern in Cologne would work up 15,000 tons of American copper this year in ocean cables. Italy and Switzerland were doing a great deal of work in hydro-electric power plants for industrial purposes and in the electrification of steam railways. A dozen nations in Europe that, until lately, were large importers of coal, were carrying out hydro-electric plants that would reduce their imports of coal for steam power by at least 75 per cent.

ECONOMICAL LIGHTING.

By W. H. F. MURDOCH, B.Sc.

In calculating the saving effected by exchanging one type of lamp for another in any building, the usual process consists in making some such calculation as the following :—If n is the number of lamps, each taking W watts and running for A hours per annum, at p pence per unit, then the cost of energy will be—

$$\frac{n \mathrm{W} \mathrm{A} p}{240 \times 1{,}000} \text{ pounds.}$$

And, again, if the lamps cost s shillings each, and have a life L, the cost of replacements will be—

$$\frac{n s \mathrm{A}}{20 \mathrm{L}} \text{ pounds.}$$

The total cost, therefore, is—

$$\frac{n \mathrm{W} \mathrm{A} p}{240{,}000} + \frac{n s \mathrm{A}}{20 \mathrm{L}}.$$

Now, if these lamps were replaced by N others, taking w watts, having a life l, and costing S shillings each, the saving would be given by—

$$\mathrm{E} = \frac{\mathrm{A} p}{1{,}000} \left(\frac{n \mathrm{W} - \mathrm{N} w}{240}\right) - \mathrm{A} \left(\frac{\mathrm{N} \mathrm{S}}{20 l} - \frac{n s}{20 \mathrm{L}}\right) \text{ pounds,}$$

and no saving would be effected if—

$$p = \frac{\dfrac{\mathrm{N} \mathrm{S}}{20 l} - \dfrac{n s}{20 \mathrm{L}}}{n \mathrm{W} - \mathrm{N} w} \times 12{,}000.$$

Generally, therefore, the saving effected is represented by a straight line, or

$$\mathrm{E} = p k - k'.$$

If, for instance, 35 50-C.P. ordinary incandescent lamps were replaced by 70 30-C.P. metallic-filament lamps, one finds—

$$\mathrm{E} = 17{\cdot}75 p - 9$$

as equation for a 1,000-hour year, taking list prices for lamps, and assuming the life of carbon lamps 1,000 and other 800 hours. We see also it would pay to make the exchanges until the limiting price per unit of about ½d. was touched. From the same equation it is easy to calculate the limiting candle-power for such an exchange. The above then is the usual method adopted, and one notices that in a large building where there are numbers of different lamps, a similar equation still holds good, viz. :—

$$\mathrm{E} = p (k_1 + k_2 + \&\text{c.}) - (k_1' + k_2' + \&\text{c.}),$$

or

$$\mathrm{E} = p \Sigma k - \Sigma k'.$$

Now, we see the limiting value for p, or p_0, is—

$$p_0 = \Sigma k' / \Sigma k ;$$

and we might write—

$$\mathrm{E} = (p - p_0) \Sigma k.$$

In this expression we have the units saved multiplied by the price per unit reduced by the limiting value given above. If p_0 was known this would enable one conveniently to calculate the saving without referring to the life and cost of the lamps. Noticing that if—

$$\mathrm{E} = p \Sigma k (1 - p_0/p),$$

if an error is made in estimating p_0, it only affects the result to the extent $\delta p_0/(p - p_0)$. For instance, if $p = 4$d. and $p_0 = \frac{1}{2}$d. and we write $\delta p_0 = \frac{1}{2}$, making a 50 per cent. error in our estimation, the value of $(1 - p_0/p)$ is only affected by 14 per cent., and if p was 6d., it would affect the result by 9 per cent. Now, by writing the equation, say—

$$\mathrm{E} = (p - \tfrac{3}{4}) \Sigma k,$$

we shall probably be correct to within a few per cent., and it enables one to rapidly estimate the saving for any building in which various numbers of different lamps are installed. Further, owing to the uncertainty regarding the life of lamps and the variation of wattage with time, such a method of calculation is probably as nearly correct as a much more laborious method.

The equations above deal with the usual case where the lamp using less electrical energy costs more than the lamp which it replaces. If there is a saving in the lamp, then—

$$\mathrm{E} = p \Sigma k + \Sigma k',$$

viz., another straight line.

By taking the ratios of these quantities and expanding by the Binomial Theorem it is easy to compare the savings effected in different cases.

It is interesting to note how dear coal sends up the demand for high-economy lamps, and why it is a dead loss to use certain types of lamps, even though these were given away free of charge. One can also see whether or not it is "worth while" to replace lamps burning only for a short time, by more economical lamps.

From the above equations we notice that the saving is greater, the greater the difference between n W and N w. If we assume 1 watt per candle to be the limit likely to be reached, it is clear that no great saving is made in using fewer high candle-power lamps. There is a direct saving in replacements, since a higher-candle-power lamp costs generally less than its equivalent in lower candle-power, but we see that this can only affect the annual saving slightly. In wiring the building also, there is the advantage of fewer points. It seems, therefore, unlikely that high-candle-power incandescent lamps will be largely used for interior illumination, so long as the cost of electrical energy remains as at present. It is interesting, however, to speculate as to what would happen if the price per unit was sufficiently reduced to make it worth one's while to use high-candle-power incandescents.

From a consideration of the above expressions, we see that for some time to come it is unlikely that high-candle-power incandescent lamps will be in much demand.

SOME NOTES ON FRICTION IN WATER PIPES.

By FLAMBARD.

To those engaged on hydraulic work it is very apparent that engineers have different ideas as to the amount of friction head due to the flow of water in pipe lines. It is not safe to assume that the pipes are clean, new and smooth ; corrosion, due to chemical action, most commonly to the combination of oxygen with iron, will occur sooner or later, not only increasing the frictional coefficient by reason of the resultant rougher surface, but also reducing the effective diameter of the pipe because of the nodules formed internally, thus further increasing the friction head. The increment of friction loss due to the roughening of the internal surface may be as much as 100 per cent., as will be seen from the results of Darcy's experiments, considered later. Special allowances must be made for special cases, as when pumping water from Cornish tin mines, containing a high percentage of ochre, or unwatering coal pits, the water in which is often heavily acidulated. In such circumstances, where the chemical action is immediate and severe, it is best when figuring the pipe line not merely to allow for rough pipes, but to calculate the friction as for the next smaller internal diameter to that actually installed, thus anticipating the reduction in bore which will occur in practice. In any case, it is wisest to obtain an analysis of the water, so that its action upon the pipes may be foretold with the greatest accuracy possible. Scrapers have been devised for cleaning pipe lines, notably that of Appold, which was actuated by the pressure of the water, but they cannot be regarded as generally practicable. All iron and steel pipes for water should be treated with Angus Smith's composition before rusting sets in, and at the proper heat, the temperature of the pipe being about 310° F. and that of the bath of oil and pitch at least 210° F. This is a most excellent preservative, and also renders the pipe more smooth, while the process is quite cheap, costing about 5s. per ton for ordinary sizes, and pays for itself owing to the smaller effort necessary to push the same quantity of water through the pipe. It is an interesting fact that the reinforced concrete pipes now frequently installed in connection with sewage disposal works, &c., are as smooth as, if not smoother than, varnished cast-iron. The most valuable experiments on the friction of water in pipe lines are those of Darcy, who crystallised his results into the following formula:—

$$h = z\left(1 + \frac{1}{12\,d}\right) \times \frac{4\,l}{d} \times \frac{v^2}{2\,g},$$

where—

h = head lost in friction in feet;
d = internal diameter of pipe in feet;
v = velocity of the water in feet per sec.;
l = length of pipe in feet;
g = acceleration due to gravity, 32·2 ft. per sec. per sec.

The experimentally determined coefficient z
= ·005 for new cast-iron pipes,
= ·01 for incrusted cast-iron pipes.

Considering the case of 500 gallons of ordinary water flowing per minute in a 7-in. pipe 100 yards long, with a velocity of 5 ft. per sec., with the above formula:—

$$h = {\cdot}005\left(1 + \frac{1}{7}\right) \times \frac{1.200}{{\cdot}583} \times \frac{25}{64{\cdot}4}$$

= 4·6 ft. for a clean pipe, and obviously, 9·2 ft. for a rough one.

The best and most convenient formula giving accurate all-round results is that of Box, who makes

$$h = \frac{G^2 \times l}{(3\,d)^5},$$

where h = head lost in friction in feet;
G = gallons of water flowing per minute;
l = length of pipe in yards;
d = internal diameter of pipe in inches.

Working the same example as before, we get—

$$h = \frac{500^2 \times 100}{(21)^5} = 6{\cdot}1 \text{ ft.},$$

a good mean value between those already obtained on Darcy's authority. Box states that his formula is intended for clean cast-iron pipes, but there is no doubt that, save where the circumstances are very exceptional, the results obtained from it are well on the safe side, and its use can be recommended from actual experience.

CONTRACTORS AND THE NEW HOME OFFICE RULES.

[COMMUNICATED.]

On July 1st the use of electricity in factories and workshops became subject to the Rules and Regulations drawn up by His Majesty's Home Office. These must be complied with by the electrical contractor, and it is well for him to note that compliance can be enforced by law. Hitherto the new Rules have not been seriously regarded by the average contractor. He has, perhaps, glanced through them when seen in one or other of the electrical journals, but it is doubtful if, offhand, he could mention half-a-dozen of the new conditions. The makers of electrical machinery and accessories have, on their part, been experimenting with and developing new types of appliances, in order to meet the new circumstances, but the contractor has not troubled to make himself familiar with the new requirements. There are also certain eventualities which have not received due attention—as, for instance, the possibility of a factory owner being served with an injunction against the use of electricity in any particular premises, obtained at the instance of some third party.

Those engineers who are acquainted with the circumstances which led up to the framing of the Home Office Rules, are aware that prior to 1907 the Home Office had been considering means whereby accidents caused by electricity or by electrically-driven machinery might be prevented, and early in that year they issued the draft Regulations governing the generation, transformation, distribution and use of electricity in premises under the Factory and Workshops Act. At that time all public supply undertakings were subject to the Rules of the Board of Trade, but with the exception of collieries, no privately owned plant was governed by any regulations whatever of a technical character, except those issued by the Fire Office in which the premises were insured. Apart from fire and common law risks, the interior arrangements might be carried out as the owner or contractor pleased. It was felt that this was a state of things which could no longer be tolerated, and that in the interests of all parties concerned, it was desirable that a set of regulations should be drawn up, which after mature consideration, should become law.

The form of the draft resolutions was severely criticised, and objections were received by the Home Office from some 200 or more objectors representing a number of important firms, and many public bodies. Consequently an inquiry was held, in which the draft regulations were very considerably modified. The points to which the greatest attention was given, were the overlapping in many instances by the new Regulations of the older Board of Trade requirements; the advisability of providing for arbitration in cases where a dispute arose between a Home Office inspector and the occupier or owner of any premises; and the application of the Regulations to existing plant.

The first objection was obviously sound, and in the case of premises such as electricity supply stations, it was clear that the best course to adopt to secure uniformity would be for the Board of Trade Rules to be withdrawn. This was decided upon, and it was announced that in all instances where the two sets of regulations overlapped, the Board of Trade Rules would not be enforced. With regard to this promise, it is curious to note that although some 15 months have elapsed, and the Home Office Regulations have become law, no public notice has as yet been issued by the Board of Trade confirming this declaration.

Ably drawn as the Regulations are, it is not certain from a legal point of view that they are so framed as to prevent annoyance to the occupiers of premises who may be doing their utmost to carry out the requirements, and to make their premises as safe as possible from an electrical point of view. The occupier may have to deal with a factory inspector possessing little or no technical knowledge. Provision is made in the new enactments whereby apparatus may be exempt from certain of the Rules, provided it has been made perfectly safe in some other way. At the same time, if the inspector does not agree with the method which has been adopted, the occupier may be prosecuted. In such an event the case would be heard before a bench of magistrates, who might quite easily, being themselves non-technical men, lean towards the views of the inspector, and fall back on the fact that a Regulation had apparently been broken, and convict on that ground.

A further disquieting feature of the rules is that although an occupier may arrange his electrical plant in a manner which, in his opinion, is perfectly safe, and of which the inspector may not disapprove, indeed may even approve, he may yet be prosecuted by any member of the public whatsoever; thus subjecting him to annoyance, with possibly vexatious results. In face of this it would appear most desirable that some provision should be made for arbitration, and Mr. Swinburne, in his report, made a recommendation to the effect that, before prosecuting under certain sections of the Act on the ground of non-compliance with the requirements, the Home Office should serve a notice and not take any further proceedings until after the lapse of 30 days, during which time the occupier might make representations to the Home Office describing and defending the means he had adopted to ensure safety. This would admit of a special inspection of these by the electrical inspector of the Home Office, or his representatives, before any further action was taken. Mr. Swinburne also recommended that "nothing in these Regulations shall render any occupier or agents liable for non-compliance unless the Home Office says there has been non-compliance."

It is regrettable that these recommendations have not been adopted by the Home Office. As they now stand, any factory occupier is liable to meet with an unreasonable interpretation of the Home Office Rules by the local inspector; to suffer prosecution at the instance of any person, even a discharged employé; and in the event of an accident occurring, to the infliction of severe damages if the letter rather than the spirit of the law has not been complied with. And there is no doubt that the contractor who was responsible for the carrying out of the work could be proceeded against in turn by the occupier, or would be coupled with him in any action for damages.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Engineer's Department v. Accountant's Department.

In reply to "Quid Nunc" in yours of June 25th, I am afraid we must agree to disagree. I cannot see any necessity to make a prior entry at all. If, as I presume, the creditors' ledger and the cash-book are both kept by the accountant, there is no need for an entry into the ledger until the account is paid, upon which an entry will be made in the Cr. of the cash-book, and posted to the debit of the creditor's account in the ordinary way. If the two books are kept by separate departments, the misunderstandings between them will probably continue until some more up-to-date system is adopted.

Your correspondent cannot get over his idea that I am jealous of the works staff. I have already assured him that this is not so, and as I am not a municipal man, his references to the Municipal Treasurers and Accountants do not affect me in the least. At the same time, I cannot see what my aspirations—whatever they may be they are not to become a municipal financial officer—have got to do with a dispute as to the correct method of book-keeping.

Accountant.

Electrical Exporting.

Reading your article of June 18th, it occurred to me that while I was in Mauritius in 1905-6-7, an English firm obtained a contract for machinery, &c., for a power house for the supply of Port Louis with electric light. Mauritius is plentifully supplied with water power, and has developed rapidly as a cheap-power colony. The demand for electrical goods is fairly heavy, and yet there is not, to the best of my belief, one English firm with a man on the spot, the whole of the supply being in the hands of French and German firms. Alternating current, high-tension single and polyphase, is in use, with transformers reducing to mostly 235 volts. As the price of coal is from Rs. 35 to Rs. 45 per ton, and hydro-electric power is supplied at about 5 cents per unit (Rupee 1s. 4d., cent = $\frac{1}{100}$ of Rupee), it will be seen that electricity is much the cheaper power. The voltages on the transmission lines vary, 20,000, 6,600 and 2,000 being most general. I personally inspected the various supply stations, and was rather surprised to note the lack of English goods in general use.

Jas. Richards.

E.M.F. in a Dead Underground Cable.

I have read the various letters relating to the above, and, from the explanations put forward, I do not think the actual condition of affairs has been made sufficiently clear. As the writer of the original article, I beg to take the liberty of again stating the principal points of the case.

The E.H.T. feeder cables were being laid from the site of a sub-station where a supply was not then available. They had been laid well over two miles towards the generating station, and there was—at the time when the incident referred to occurred—about another mile of cables to lay to the station.

Now the points I wish to emphasise are: that the cable had never been made alive, nor was it near a source of supply; and that in this case it was not the conductors of the cable the shock was received from, but the lead sheathing, which, being laid solid, was unintentionally insulated from earth. It was, therefore, not a question of surface leakage.

It should also be noted that the jointer was working on the lead of the cable, and thus earthing it through his body for quite 20 minutes before the lightning discharge took place, and immediately the discharge occurred he received a severe shock off the lead of the cable to earth.

"Ajax" in his letter states that "the phenomenon was clearly due to a discharge of lightning causing an induced static charge in the cable, which was discharged to earth when the jointer touched the cable."

Might I suggest that the phenomenon was rather that of "conduction"—that is to say, during the period the jointer was working on the lead sheathing of the cable it was being charged to the same potential as earth, right up to the time the discharge occurred. Then, immediately the lightning discharge took place, earth assumed normal potential and simultaneously the lead sheathing, the discharge between the lead and earth passing through the jointer's body, and producing the shock he received.

Enquirer.

Earth Indicating Device.

I shall be glad to learn through your columns if there is on the market an instrument or device for indicating insulation defects on private installations fed from a public supply system. What is wanted is an instrument somewhat similar to the centre-zero voltmeter or to the two-lamp indicating device commonly used on private two-wire installations. The difficulty I have met with is that in putting a continuously indicating instrument on one of our installations fed from a public supply, if our neighbour gets a fault on his installation this fault is indicated on the instrument in our works, because, of course, both are supplied from the same feeder.

W. H. B.

Chichester Electrified.

I do not envy the engineer-in-charge of the above scheme. His supply is dependent upon oil engines, *one* feeder cable and *one* balancer. The poor balancer will be running day and night, year in and year out, and should it dare to fail in any way, down goes the supply! What was the matter with putting two dynamos of 250 volts each in tandem on each oil engine and being independent of balancers? I gather, however, from the tremendous network system, that there is not very much power to be supplied, and I should have thought that a simple two-wire system would have been the thing for Chichester, as a good two-wire scheme is far safer and better than a three-wire scheme, where there is a grave danger of losing the balance and blowing consumers' lamps to atoms. Trusting that Chichester may soon obtain a spare balancer and another feeder—

Not too Cheap.

Municipal Trading and the Electric Lighting Acts (Amendment) Bill.

I fear that "Borough Electrical Engineer" in his letter on the above subject, in your issue of June 25th, has scarcely succeeded in strengthening his position. He refers to the House of Lords' amendment as "an attack upon municipal trading by which it was hoped to cripple municipal electricity schemes," but it would surely be more correctly described as a defence against encroachment by municipalities upon the rights of private traders, and one moment's consideration would show that, far from wishing to cripple municipal electricity schemes, it is all to the advantage of electrical contractors that these should prosper, so long as they are confined to their legitimate sphere, namely, the supply of current.

I must confess that I am at a loss to understand his application of the term "abusive" to my letter, seeing that in it there is not one word of abuse, either direct or implied.

He further charges me with being unable to read with understanding, and I must admit my inability to differentiate between his original statement that the wiring contractor's grievance "is, at the outside, a matter of 4s. 2d. per annum," and mine that "the money value of the damage done to the contractor is put by your correspondent at 4s. 2d. each." "Borough Electrical Engineer," however, takes great exception to the latter statement, and now tells us that he "did not say or think that a contractor's *total* loss is equal to his rate contribution" (*i.e.*, the 4s. 2d. per annum above referred to), so that one is led to the conclusion that the balance of the contractor's loss beyond the 4s. 2d. is *not* a grievance. Perhaps "Borough Electrical Engineer" will tell us what it is?

I am told that my second paragraph is based on several unwarranted assumptions. Looking through the same, I find that the total number of assumptions is exactly two. The first is the likelihood of the loss on a municipal wiring department being equal to a penny rate. This is taken from his original article, his words being "it cannot very well cost more than a 1d. rate," and he feelingly adds "if it did, the general body of ratepayers would be up in arms." He now admits the statement to be both unwarranted and absurd. The second assumption is that the average loss made by a municipal wiring department does not exceed 10 per cent. This he characterises as "equally absurd." Well, I hesitated to put it at a higher figure out of deference (I feel unappreciated) to "Borough Electrical Engineer's" feelings, but I will gladly accept, without question, his own estimate of the average percentage of loss made in the case of a municipal wiring department costing the ratepayers a 1d. rate. If he puts it at a lower figure than mine, he strengthens my argument, as this would mean a larger amount of work taken away from contractors. If, on the other hand, he puts it at a higher figure than 10 per cent., he will scarcely advance the cause of municipal wiring, at any rate so far as the ratepayers are concerned.

The only point in the original article with which I attempted to deal in my letter was the damage done to contractors by the institution of municipal wiring departments, and "Borough Electrical Engineer" now admits—

1. That the loss to the contractor is greater than that mentioned in his article.
2. That one of his assumptions is unwarranted and absurd.
3. That his contention was something quite different from that which he stated so clearly and explicitly in his article. That is practically equivalent to withdrawal, and I am content to so regard it.

Of the extraordinary attack upon electrical contractors generally with which his letter concludes, probably the less said the better. It is quite clear that in the heat of argument the writer has let his pen get the better of his judgment, and, doubtless, had he seen his letter in cold print before the same was published, it would never have appeared in its present form. Possibly the best reply is the fact that the great London supply companies, although possessing full power to carry out wiring, should they so wish, have not found it either necessary or desirable to do so. Surely no better argument than this can be needed against the establishment of municipal wiring departments.

Contractor.

Electric Power at Messrs. Cassell & Co.'s Printing Works.

I read with interest the article on this subject in your issue of June 25th, and would like to call your attention to fig. 9, showing toggle press in black shop.

In the context this is described as a self-contained equipment of a toggle press in black shop driven by a spur-geared motor mounted on the top of the machine. This toggle press—if it is such—is the most peculiar thing of its kind I have ever seen, and I cannot help thinking that the author has incorrectly described this, as it is apparently a hydraulic press with its own pump electrically driven.

I shall be interested to hear whether Mr. Broadbent claims credit for the drive shown in fig. 2, which is a Victoria platen, driven by a belted motor with a jockey pulley. I might mention that these machines, with their drives, are imported from Germany, exactly as shown in the photograph.

Printers' Engineer.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"West Country" writes:—"Would you kindly answer me the following inquiry viz.:—A private company have been formed here for the purpose of generating and selling electricity. The same company also take on wiring and sell fittings. If a contractor steps in and carries through the wiring of any premises in their district in a satisfactory manner, and conforms to their rules, can they refuse to connect him up to their mains? I do not know whether a provisional order was got out, and as far as I can understand there has been no B. of T. inspection."

⁂ The answer to this query depends entirely upon whether there has or has not been a provisional order obtained by the company. If they have no provisional order, they are under no obligation to supply electricity to anyone. If, on the other hand, they have a provisional order, each consumer in the district is entitled to be supplied on the same terms upon which a supply is granted to any other consumer. "West Country" had better make inquiry with this object.

THE BRUSSELS EXHIBITION OF 1910.

From the different communications that have lately reached us, we gather that the new Exhibition Branch of the Board of Trade is doing its utmost to ensure that British exhibitors shall make a display worthy of British manufacturing and industry at the Brussels Exhibition of 1910 (May to October).

Exhibitors are no longer to be dependent on a voluntary committee; or left to install their goods as best they can; or exposed to the risk of being obscurely placed; or required to defray the cost of a general scheme of decoration; or engaged in a speculation the cost of which they cannot ascertain beforehand. The new Department is acting in personal touch with them, and is taking responsibility for these matters.

French and German exhibitors have long been assisted in systematic ways. But the new organisation undertakes to do more than is done for the exhibitors of any other country, and Mr. U. F. Wintour, the British Commissioner General, is approaching all the staple trades of the country with a view to secure at once that arrangements shall be made for an exhibit showing the scope and real importance of British manufactures.

It is stated that perhaps the most prominent position in all the Exhibition has been secured for the general section; visitors must pass through the British galleries to reach those of Germany, the United States, France, Italy and other nations. In the Machinery Hall the portion allotted to Great Britain occupies the centre; and the total space, 203,410 sq. ft., compares favourably with what has been granted by the Belgian Commissioners to our rivals. The Royal Commission, which is presided over by the Prince of Wales, has its offices in Queen Anne's Chambers, Westminster. It is constituted wholly of well-known business men; and the occasion being unique, His Royal Highness is giving active help to the Commissioners.

A departmental inquiry, concluded two years ago, was the means of opening this fresh chapter in the history of International exhibitions. It was presided over by Sir Alfred Bateman. Taking the opinion of a large number of important manufacturers, the Committee found a strong and growing prejudice against exhibitions on the old lines, and came to the conclusion that it was largely justified. But, as it would evidently be ruinous for Great Britain to abstain alone from a form of advertisement which was already well established, they recommended effective means of meeting the grievances of British exhibitors.

The Exhibitions Department of the Board of Trade, which has been placed under the direction of Mr. Wintour, is the chief outcome. Instead of every exhibition being treated as a new problem of organisation—a problem more or less hastily and badly solved—this Department exists as a permanent machinery for the care of British interests in such matters.

To enumerate the facilities now first offered to exhibitors is to realise that a principal aim of the Exhibitions Department has been to simplify the business of exhibiting. These facilities are such that an exhibitor may know beforehand to a penny what his venture will cost him.

Except in the case of machinery, the only charge made within the Exhibition itself is a low one for space; and tenders will be obtained from Belgian contractors for the installation of machinery. This charge for space covers the provision of show-cases, the cost of the general decorative scheme, the handling of exhibitors' goods, the publication of a catalogue in French and English, and some other benefits to be noted presently. "Handling" means that officials of the Commission will take delivery of packages at the Exhibition entrance; unload and place them on the space allotted; take away, store and return the packing cases; re-load at the close of the Exhibition. Further, the Commissioners will provide free of cost, as far as possible, an adequate supply of unskilled labour to assist exhibitors with the installation of their goods.

Machinery will involve, of course, the additional cost of foundations and shafting; that of main switches, safety fuses and meters for electricity, stop-valves for steam, and valves and meters water; and that of the power used for driving. Crane power is free of charge.

Samples of show-cases may be seen at the offices of the Royal Commission, 30, Broadway, Westminster, where particulars may also be obtained of the tariff of charges for space.

For motive power the charges are low. The Royal Commission will defray half the charges made for it by the Belgian Administration, on all machinery driven to illustrate processes of manufacture. Thus exhibitors will pay:—For steam (133 lb. pressure), ½ centime per kilogramme; for gas, 1s. 3d. per 1,000 ft.; electricity (2 × 220 volts continuous), 1½d. per KW.-hour. Water will be supplied free for pumps or condensers.

Not only will there be crane-power, but the laying of foundations by Belgian contractors will be superintended by a competent engineer employed by the Royal Commission. It is claimed that, with the above particulars, the railway and shipping freights, and the contractors' tender, an exhibitor of machinery can make his calculations with a degree of confidence not hitherto possible.

The special catalogue for the British section, published in English and French, will give free insertions, and a suite of rooms will be provided for exhibitors' agents.

The Belgian State Railways, charging full rates on the outward journey, will return exhibits to their termini free of charge. The British railway companies will make a reduction of 50 per cent. on returned exhibits not sold, and travelling by the same route to the station from which they were sent out. Twelve shipping companies have also agreed to this 50 per cent. reduction.

The chairman of the Royal Commission is Lord Lytton, and the vice-chairman Sir Swire Smith. The interests of machinery and electricity are represented among the Commissioners, who include:—For machinery: Mr. W. J. Crossley, M.P., chairman of Crossley Bros.; Mr. John McLaren (J. and H. McLaren), President of the Agricultural Engineers' Association; Sir William Mather; and Mr. T. Hurry Riches, President of the Institution of Mechanical Engineers. For electricity: Dr. R. Tetley Glazebrook, F.R.S., director of the National Physical Laboratory and ex-President of the Institution of Electrical Engineers; Mr. Guglielmo Marconi (managing director, Marconi International Marine Communication Co.).

The Machinery and Electricity Committee has the following co-opted members of the Commission:—Mr. E. B. Ellington (London Hydraulic Power Co.), Mr. W. H. Allen (Allen, Sons & Co., Bedford), Mr. Mark Robinson, Mr. H. F. Donaldson (chief superintendent Ordnance Factory, Woolwich), Mr. J. H. Wickstead (Joshua Buckton & Sons), Mr. R. H. Fowler (Fowler & Co., Leeds), Mr. W. Duddell, F.R.S., Mr. H. J. Brackenbury (Armstrong, Whitworth & Co.), Mr. J. E. Kingsbury, Mr. W. H. Patchell, Mr. W. M. Mordey, Sir John Gavey, C.B., Col. W. Shanks, V.D., Mr. W. D. Ford-Smith, Mr. Allen Baker, M.P., Mr. Frank E. Musgrave, Mr. Arthur Greenwood, Mr. J. G. Barford, Mr. John Fielding, and Mr. W. Harrison.

We recommend British electrical firms to place themselves in communication with the new Department. We have frequently urged the necessity for Governmental organisation and guidance in this matter of foreign exhibitions, and it is the duty of our manufacturers to support the present effort, if only for the purpose of testing what measure of success they can obtain from efficient representation at a Continental Exhibition in which they have the benefit of this Governmental assistance.

LEGAL.

Electric Co.'s Stamp Duties.

On Monday last the case of The Attorney-General *v.* The Somerset and District Electric Power Co. came before Mr. Justice Ridley in the King's Bench Division on a motion by the plaintiff for leave to issue *scire facias* against a shareholder in the defendant company.

Mr. Finlay, in support of the motion, said that under the old Act the Companies' Clauses Act was commonly incorporated by railway, gas and light companies. One of the Sections of that Act provided that execution might be obtained against a shareholder where stamp duties had been assessed and had not been paid by the company. He asked for an order against a gentleman who was a shareholder and who had been one of the original directors of the company. The gentleman in this case assented to the order asked for, but as he held an official position he desired that his name should not be mentioned. Counsel supported that request, and his Lordship assented to it.

Leave was accordingly given to issue *scire facias* without the name of the person against whom it was to be issued being disclosed.

British Westinghouse Electric and Manufacturing Co., Ltd., *v.* Braulik.

(*Continued from Vol.* 64, *page* 1037.)

Mr. Jas. Swinburne, examined by Mr Walter, said he had read the plaintiffs' specification, No. 18,786 of 1902. It was important in the regulation of electric lamps that the governing of the external conditions of the arc should be independent of the downward feed mechanism. He had tested fig. 1, and found that it worked. He thought there was no difficulty in making a lamp from the description in the plaintiffs' specification. The invention was obviously useful, and was commercially of great value. He did not find that there was any disconformity between the provisional and complete specifications. He had read the list of documents that were set out by the defendant alleging that the invention was not novel, but he did not find the invention therein described. He did find, however, the invention which had been described of the plaintiffs' in defendant's. There was nothing to mark the distance apart of the lower carbons until you got them to a certain point, and it then released the downward feed. The mechanism did nothing but move the lower carbons apart and together.

His Lordship: You say there is no essential difference between the parts?—It was essentially the same mechanism, though, of course, the details were different. In both cases, the escapement was regulated by a shunt magnet which only allowed escapement after a certain amount of movement of the carbons had taken place horizontally.

On the resumption of the case, Mr. Swinburne was cross-examined by Mr. Bousfield, to show that the method of regulating the arc by solenoid control in addition to the gravity feed was not new.

Supposing the arc burnt to a greater length before you got the irreversible feed of the carbon, this gripping movement allows the carbons slowly to approach?—Yes.

And also if for any reason it should want to adjust itself, then this gives power of adjustment?—Yes.

That is precisely what the patentee has tried to introduce in this specification to these inclined carbon lamps?—No; because in the mechanism you have shown, the part which is to adjust the arc, has practically to work a feed mechanism. According to the patent, the adjustment is done by the movement at right angles to the direction of the feed, and it involves, therefore, only moving a very small body.

Counsel then referred the witness to Graham No. 268,218, but the Witness said that the method of attachment was different from the plaintiffs', but was like the defendant's.

Were there not scores of lamps in which the governing armature of the magnet for the striking gear was in equilibrium between the force of the magnet coil and the force of the spring?—Yes.

Witness was referred to the specifications of Serrin, Brush, Crompton, Gramme, Siemens, Joel, Thomson-Houston, Abdanck, Maxim, and Brockie, all before 1882, and he admitted that in all of these there was an armature acted on by an electromagnet in such a way that the armature floated and did not strike.

If it did float it would far more satisfactorily fulfil the purposes described on page 1 about obviating the inconvenience arising from irregularity?—Yes, it would be a better lamp in every way.

Referring to Sheridan's United States patent, the Witness said that there the carbons were allowed to feed by means of cords through drums. The drums were of different sizes in order to compensate for the different rates of feed of the carbons, and there was also an arrangement of series coil and shunt coil arranged differentially. When that was done the core was necessarily a floating core.

The purpose of it was to have this floating in position?—Yes. It was not only to arrange the feed, but also to allow a pull back.

Witness was then cross-examined in detail as to Crosby, and said that long before the date of the plaintiffs' patent, there were plenty of arrangements of the Brockie-Pell type, in which the striking of the arc was effected by mechanism which controlled the main feed.

What I want to put to you is whether it required any invention to apply that to the known type of lamps with inclined carbons and a striking mechanism which operated horizontally on these carbons?—I think it did.

Surely, if you told any workman to control the feed mechanism by the striking mechanism, which would allow the swinging before the feed came on, he would have been able to do it?—If you told the man that he was to make his horizontal movement not only to strike the arc but to regulate the arc, keeping the vertical movement for feed only, then you would have made Bremer's invention?—Witness said he considered the plaintiffs' invention was having axial feeding of the carbons and horizontal striking, plus horizontal adjustment, all worked by one electro-magnet or one mechanism.

All that you find in Graham's specification, if it be allowed that the armature or core of the solenoid is floating?—That is really law. All I can say as an engineer is if you work the model and it floats, it floats. Whether or not you find the idea in the specification, I am not lawyer enough to say.

I suggest to you that, at all events, if the true reading of Graham's specification be that the armature or the core of the solenoid does float . . . .?—Then it is an anticipation of the unamended claim.

Mr. Swinburne, in re-examination, was taken by Mr. Walter through the various specifications relied upon by the defendant as anticipations. He said that there was nothing in the prior specifications which would have enabled him, as an engineer, to have made the plaintiffs' invention. The prior specifications differed from the plaintiffs' and the defendant's apparatus in that the system by which the carbons were fed was independent from the system that moved the carbons apart. With regard to the practical utility of the lamps relied upon as anticipations, so far as witness knew, none of them had ever seen daylight. In the defendant's lamp he found all the features, that were described in the plaintiffs' specification.

Mr. Dugald Clerk, examined by Mr. Walter, said that he had examined the plaintiffs' specification. The first and main feature was the combination of a striking mechanism with a horizontal adjustment, and the relation between the horizontal adjustment and the feed. That was, in his opinion, the invention, but there were other important features. It was important that the electrode holders that held the carbon should be firmly clipped at the middle, as shown in the first figure of Bremer's specification. It would be seen from that that the current entered the carbons by means of a metal connection firmly clipped on to them. Then it was important with regard to the downward feed mechanism that it should be so connected that the two carbons fed downwardly simultaneously in separate clutch slides. The third point was that the horizontal feed mechanism, as operated on by the electromagnet by which the arc was sprung and the resistance of the arc reduced, should be by some device operating not far from the lower ends of the carbons. It was important that the feed mechanism should be relieved of every work other than that. In the specifications of Brokie-Pell and Serrin the mechanism had a great deal of work to do. Neither would have acted the same as plaintiff's arrangement. In witness's opinion, there was room for invention between the lamps described in prior specifications and the plaintiff's arrangement. The defendant's lamp had every feature of the plaintiffs' that he had referred to.

Mr. Justice Joyce: They are the same thing, but different.

Mr. Walter: There is a slight difference, but alternative methods of sliding feed were known. To witness: Is the plaintiff's mechanism *per se* new?

Witness: New, but perhaps not new *per se*. Continuing, he said that, in Graham's specification, you did not find the floating adjustment. He saw nothing in the prior specification that would suggest the plaintiff's invention.

Cross-examined by Mr. Bousfield, Witness said that there was nothing omitted from the plaintiff's specification that would prevent a competent workman from making the invention. He did not think that a man instructed as suggested would find it easy to apply the old mechanism to the plaintiff's invention. The principle of having an arc striking device connected with the main feed in such a way that the arc-striking device gave a certain amount of regulation before the main feed was operated on was old and well known before the date of the plaintiff's patent, in vertical operating lamps. Carbons with a swinging adjustment so as to strike the arc were well known.

Mr Herbert Edmund Mould, technical engineer of the Union Electric Co., Ltd., who were agents for Korting & Mathiesen, called for the plaintiffs, said that of the flame arc lamps made in this country nearly all had the plaintiffs' invention. In the course of his business he saw the lamps of other makers, and he should say that about 11 or 12 out of 16 were constructed on the principle of the plaintiff's invention. His firm sold lamps manufactured under a licence from the plaintiffs, and under that licence they had sold some 12,000 or 14,000 lamps in this country. They paid a large royalty to the Westinghouse Co. In his opinion the plaintiff's invention was the commercial solution of the flame-arc lamp.

In opening the case for the defence, Mr. Gray said his submission was that the points raised on behalf of the plaintiff company were destructive of each other. First they alleged that the question was one of principle, and then it was said that the real change was certain mechanical details which did not appear on the specification. His contention was that there was no subject matter whatever in the plaintiffs' patent. The expressions that appeared in the specification must be taken as the real subject matter of the patent. Broadly speaking, there were two. They were defined as a horizontal feed and a downward feed. These expressions were illusions and had no real meaning as applied to the lamps. There was neither a horizontal feed nor a downward feed in these lamps. He should call the horizontal feed the "adjustment," and the downward feed merely "the feed." The former merely involved the swinging about of the carbon. In 1882, which was one of the dates more or less in dispute, there were a large number of lamps that had an adjustment of feed. His witnesses would prove that such lamps were practically universal. In the plaintiffs' patent the steps taken were in the same order. First, there was an adjustment of the mechanism, and then there was the adjustment of the feed. Unless the plaintiffs could prove the contrary, he should maintain that that was the invariable practice in all arc lamps in 1882. It was a cardinal principle in arc lamps of that date to have both the operations. It was quite clear that the carbons had to be fed forward to bring the points together, as they burned away. All that the plaintiffs' patentee had done, was to apply these well-known principles to inclined carbons. The patentee had taken the principle of the other arc lamps, and used it in the same way, and for the same purpose, and in his specification did not describe any mechanism which enabled it to be done. All the operations were the same. There was swinging for the purpose of striking the arc, and a feed afterwards. There was nothing left after that for the plaintiffs to do. The system of adjustment and feed were perfectly well known before 1882. His witnesses would prove that the real difficulty was not adjustment at all, but the feed. There were different methods of feed and different results. The method shown by the plaintiffs' specification was absolutely and entirely useless, and the defendant was not using it. He submitted that the patent was hopelessly bad, not only because of lack of subject matter, but also because of want of novelty.

Prof. Silvanus P. Thompson, examined by Mr. Gray, said that in 1882 there was a great deal of activity on arc lamp questions. In 1882 it was perfectly well known that you might have the mechanism in an arc lamp so that the striking mechanism might be brought into action before the feed back applied, or that it might be arranged to be fixed without any return on adjustment, and in the majority of cases they were so designed that approach of the carbon points must occur before the feed back applied. In 1900 practically all the lamps possessed that feature—that was to say, they had the power of return before feed. They were not hard fixed; floating armature was practically the same thing as the power of return. As he understood it, the device described in Bremer's specification of 1902 was that in arc lamps he was proposing to make there would be two movements—a feed movement and a striking movement capable of adjustment, and he specially drew attention to the requirement that the approach during adjustment should occur before feeding began. There was nothing new in that. The only thing that witness found that was new in the specification was in his providing in figs. 2 and 3 a very special and unusual form of electro-magnet. Looking at the specification he did not obtain any useful information for the construction of an arc lamp from those figures. He considered that Graham's American specification practically described what was described in Bremer's specification.

Cross-examined by Mr. Walter: He did not know of a single downwardly pointing inclined carbon lamp, before the date of Bremer's specification, in commercial use in this country.

Prof. John George Cormack, examined by Mr. Gray, gave evidence generally corroborating the evidence of the last witness. He said he found in Graham what was described in Bremer's specification. He failed to find any feature or information in Bremer's specification which was new at the date of the specification.

Cross-examined by Mr. Walter: May I take it that until the Bremer patent such a lamp had never been made or sold?—I had not seen any.

Witness said that he did not agree with the evidence of Mr. Clark.

Mr. Bousfield, in summing up the defendant's case, submitted that there was a complete anticipation of the alleged invention of the plaintiffs in the specifications of Graham and Crosby—Graham's was much nearer to the present case, and was the chief thing he was going to rely upon. He contended that there was nothing in the point put forward by the other side as to making flame-arc lamps successfully. He contended that all that Bremer had done was to apply an old idea to an old form of lamp, and that there was no subject matter.

Mr. Walter, replying on the whole case, submitted that from the evidence it was abundantly clear that until the date of the plaintiffs' patent in 1902, there was never an effective electric arc lamp on the market with downwardly inclined carbons. Neither Prof. Thompson nor Prof. Cormack had ever seen one. This invention was undoubtedly one of great commercial importance, and he asked his Lordship to hold that the patent was a good one, and that the defendants had infringed it.

At the conclusion of the arguments, his Lordship reserved judgment.

Uxbridge and District Electric Supply Co.

Mr. Justice Neville, sitting for the disposal of companies winding up business, had before him on Tuesday last a petition by Callender's Cable and Construction Co., Ltd., for the compulsory winding up of the Uxbridge and District Electric Supply Co., Ltd.

Mr. Peterson, K.C., in support of the petition, stated that he represented a creditor for £2,210 7s. 3d. due on a dishonoured bill of exchange. The company, when called upon to pay, said they had no assets with which to meet the debt. The Metropolitan Electric Supply Co. were also creditors, and supported the petition.

Mr. Serjeant said he appeared for creditors for between £40,000 and £50,000, and supported a compulsory winding up.

His Lordship made the usual compulsory order.

PARLIAMENTARY.

Bury and Heywood Tramways Bill.

On Tuesday, June 22nd, Mr. W. Clough, manager of the Bury Tramways, continued his evidence. Replying to Mr. Helme, a member of the Committee, witness said that the reason why he thought Bury should provide a through service instead of Heywood, who already were in possession, was that if Heywood gave the service it could only be partial. Through running to be successful must be continuous. If Bury ran right through, it would provide a more convenient and regular service. For an authority in the middle of two districts to have through running, in his opinion, would cause great inconvenience. Of course it would be better to have only two authorities providing a through service. Mr. Clough was in the witness box the whole of the day.

The Witness was re-examined on June 23rd by Mr. Ram, K.C., for the Bury Corporation. In answer to the Chairman, Mr. Clough said that the cost of working in Heywood was greater than in Bury and Rochdale owing to the steeper gradients. Replying to Counsel, Witness said that in his opinion the through-route fares should be less than the aggregate individual short-distance fares. That was a universal practice with tramway undertakings. The Rochdale and Heywood authorities wanted to keep the same scale of fares as at present. If, as he had said, they were to charge a lower fare for a though journey, it would mean that Bury would have to bear the loss.

The consideration of the tramway portion of the Bill was adjourned to see whether the parties could come to any mutual arrangement.

After a week's adjournment to allow of the parties coming to a mutual understanding, the Committee of the House of Commons (Mr. Nicholson presiding) on Tuesday had before them the proposed new clauses of the Bury and Heywood Corporation Bills. Mr. Keene, for the Heywood Corporation, announced that the parties had come to an agreement, which would be in force for 10 years, whereby the Bury and Rochdale Corporations ran a through service of tramways between those two cities, running across Heywood, the last-named doing nothing. Each Corporation would take the profits in its respective areas. If the agreement was terminated by mutual arrangement, then the Heywood Corporation alone would have through running powers. The Committee allowed the agreement to stand part of the Bill, and clauses were adjusted to meet this.

Scotch Electricity Bills.—The Chairman of Committees of the House of Lords and the Chairman of Ways and Means of the House of Commons have reported that they are of opinion that the provisions of Clause 108 of the Colinton Tramways Order, and of Clause 10 of the Hamilton Burgh Order are of such a character that they ought to be dealt with by Private Bill and not by Provisional Order under the Private Legislation Procedure (Scotland) Act, 1899. Clause 108 of the Colinton Tramways Order provides for the company applying for and taking transfers of electric lighting orders. The petitioners against the Bill are the Hon. A. R. Douglas Elliott and Lieut.-Colonel Trotter, the North-British Railway Co., the Caledonian Railway Co., the trustees of the Craiglockhart Estate Co., the County Council of Midlothian and the Suburban District Committee of the Council, Sir A. O. Riddell and others, the Lord Provost and Council of the Royal Burgh of Edinburgh, the Water and Sewage Commissioners of Leith, and the Edinburgh and Leith Corporations Gas Commissioners. Clause 10 of the Hamilton Burgh Bill provided that "No company or person shall be entitled to supply electrical energy within the burgh without the previous consent in writing of the Corporation, and such consent may be given upon such terms and conditions as the Corporation may prescribe." The opponents of the Bill are the Caledonian Railway Co.

Nationality of Postmasters.—Sir Wm. Bull asked the Postmaster-General how many persons other than those of English birth now hold positions as postmaster or sub-postmaster; whether in view of the importance of avoiding any possibility of the interruption of telegraphic communication, he will terminate such appointments as now exist without delay; whether he can see his way to give any assurance that no further appointments of such a nature shall be made; whether he is aware that the telegraphic communications in a small area adjoining a part of the Yorkshire coast are now entirely controlled by postmasters and sub-postmasters all of German birth; and who is responsible for sanctioning the appointments. Mr Buxton replied that most of the postmasters in Scotland and Ireland are not of English birth, but he was unable to give the numbers. He might add that foreigners are not now eligible for appointment to any permanent and established position in the Post Office, and they would not be selected for any situation for which suitable British subjects are available. The honourable member will, of course, let him have particulars of the cases to which he refers.

Sub-Engineers and the Post Office Service.—Answering Mr. Claude Hay in Tuesday's Parliamentary Papers, Mr. Buxton states that steps are being taken to promote all the sub-engineers with three years' service who passed the recent qualifying examination. The unsuccessful candidates will have adequate opportunities for study before another examination is held, the date of which is not yet arranged.

Third Readings.—In the House of Commons on June 28th the Oxford and District Tramways Bill was read a third time.

In the House of Commons on June 22nd the Edgware and Hampstead Railway Bill and the Watford and Edgware Railway Bill were read a third time.

Radium.—A remarkable contract has been made between the British Metalliferous Mines, Ltd., and Lord Iveagh and Sir Ernest Cassel, for the supply of 7½ grammes of radium bromide at a cost of £30,000, from the company's mine in Cornwall. The radium will be presented to the Radium Institute by the purchasers.

Electric Smelting of Iron Ore.—A report has been received from South Africa by the Permanent Exhibition Committee for German industry in relation to new endeavours to smelt iron ore in the Transvaal. It is stated that the titanic or magnetic iron ore existing in large quantities in the neighbourhood of Pretoria is considered difficult to reduce, but it is now intended to smelt it with the aid of a chemical admixture forming the subject of a patent. It is proposed to invite tenders in public competition for the supply of an electric smelting furnace of a capacity of 6 tons in 24 hours. If the trials with this furnace should also yield satisfactory results, the inventor states that the Transvaal Government will request South African or transmarine capitalists to erect a large iron and steel works in the colony. The import duties on iron and steel products would, in this event, not be increased, although a bounty per ton of output made by the works is held in prospect.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Elliott Maximum Power Demand Indicator.

The demand for electricity for power purposes has increased very rapidly during the past few years, and the question of the price to be charged is undoubtedly a most important one. One of the fairest methods is that which is based on a fixed charge per annum per kilowatt demanded, combined with a flat rate per unit registered on the meter. This gives the consumer a benefit from long-hour use, and at the same time ensures that the supply company obtains a sufficient return to cover standing charges.

It is necessary, if this system of charging is to be correctly carried out in practice, that an instrument be used which measures the maximum number of kilowatts taken under ordinary circumstances, while taking no account of any momentary excess or short-circuit. Moreover, it is absolutely essential to use an accurate instrument, for an error of a few per cent. on a large power job may mean a considerable loss of revenue.

Hitherto the instruments used for this purpose have only registered the maximum current taken, which, in the case of A.C. circuits, gives no indication of the actual power demanded. The instrument which Messrs. Elliott Bros., of the Century Works, Lewisham, are now introducing indicates the maximum power in kilowatts, and is accurate at all loads at any power factor within large variations of pressure and periodicity.

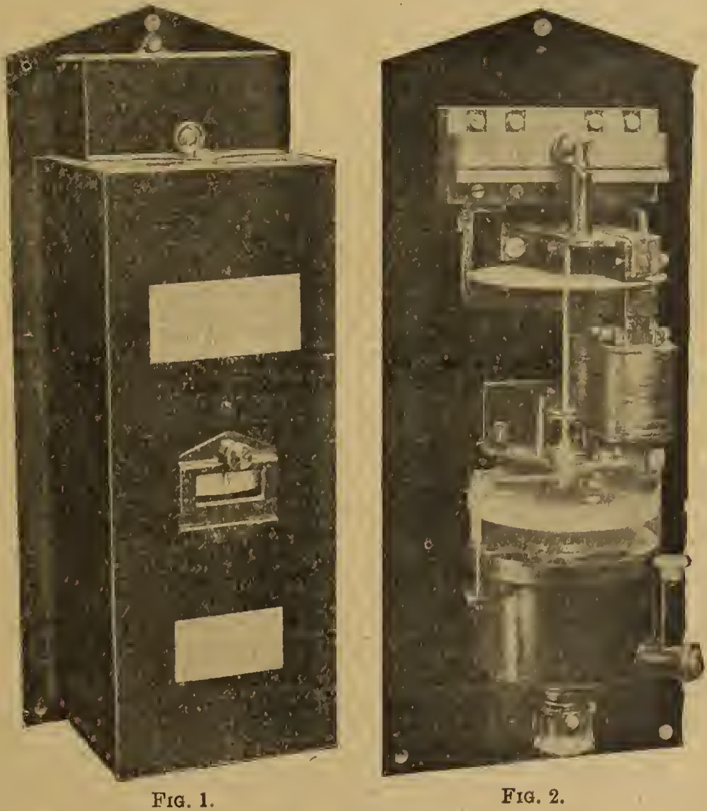


Fig. 1. Fig. 2.

Elliott M.P.D. Indicator.

The instrument can be made for single and polyphase, and also for D.C. circuits, and it will be seen from the accompanying illustration, fig. 2, which is of a single-phase instrument, that it consists of a disk rotating between magnets against a spring, the amount of torque measuring the kilowatts. The spindle with its disk is fixed on a float which moves in a vessel containing oil, which not only provides the retarding medium, but also reduces friction to a minimum by allowing the spindle to be pivoted on a top jewelled bearing.

The time lag can be varied according to the density of the oil, which is supplied by the makers, from one minute to one hour or more. The float very nearly fills the containing vessel, so that a very small quantity of oil is required.

The registering is effected by a ratchet fixed to the spindle wheel, which also serves to carry the scale. A very light pawl prevents the ratchet wheel from moving backwards, and at the same time allows the scale to revolve to its correct reading.

The resetting is accomplished without removing the cover or seals, by lowering the oil vessel by means of a bottom thumb-screw until the pawl is released and just allows the disk to return to zero. On further screwing down the oil vessel the latter is sealed for transit.

The valuable qualities of the instrument will be readily appreciated, and the makers claim that its simplicity, accuracy, long uniform scale, and direct kilowatt readings, combine to make it a thoroughly sound piece of apparatus for the purpose of arriving at the price to be charged for power.

Street Lighting Switchgear.

The Neath Rural District Council, on the recommendation of its electrical engineer, Mr. G. H. Thomson, recently installed a novel form of switchgear for controlling the electric lights in the outlying districts. Previously the lamps were switched on and off at sub-stations by hand, and a great saving will now be effected in the wages of the men (one in each district) employed for this purpose.

The switches are further found valuable, because in the summer it was found impossible to rely on men turning out at 2 or 3 o'clock in the morning to extinguish the lights, with the result that they were often left on circuit for many unnecessary hours. Again, on bright moonlight nights artificial lighting is not necessary in rural districts, and the lights may now be put out without having to depend on reluctant men to leave their pastimes or repose for the purpose.

The new switches were supplied by Mr. A. L. Furneaux, electrical engineer, 11 and 12, Wind Street, Swansea, who has acquired the patent rights from the inventor Mr. Campbell Smart, Swansea, and the following description and diagram will show how simple is the mechanism, and how very remote is the probability of failure. During six months' trial not the slightest hitch has occurred.

The distance switch (see fig. 3) consists of a solenoid a having a core b, which carries in a suitable position a strong pin c projecting on either side of it. Below the solenoid a and above the pin c are suspended two metal arms or guide pieces $d\ d_1$, at right angles to each other, and of such shape and so pivoted that they hang normally with their undersides sloping at a steep angle to the vertical. Below the pin c, and fastened to (but insulated from) the core b is a metal bar e carrying at each end a metal pin $f\ f_1$, which form a bridge piece capable of joining together two mercury cups suitably placed and connected into the circuit to be controlled.

On an extension of the core, below this bridge piece, is a second pin h capable of rising above, and falling to the bottom of, one or other of four slots between four upright pointed teeth $g\ g$, &c., (only two shown) arranged in a circle round the core.

This pin h, together with the slots referred to, acts as a stop to prevent the core falling too far, and also as a guide to ensure the core rising and falling vertically when the pins $f\ f_1$, of the bridge piece are leaving and entering the mercury cups. The action of the switch is as follows:—Assuming the switch to be in the off position, when current is applied to the solenoid, the core is raised through a certain distance, without turning, until the pin c strikes the underside of one of the guide pieces $d\ d_1$, causing the core as it continues to rise to be turned through a quarter circle. This turning movement has carried the bridge piece attached to the core into a position directly over the mercury cups, so that, when current is cut off from the solenoid, the core falls and the bridge piece enters the mercury cups, closing the lighting circuit. To switch "off" the lights, exactly the same operation is gone through, and the bridge piece takes up a position out of, and at right angles to, the mercury cups, ready for the operation of switching on again.

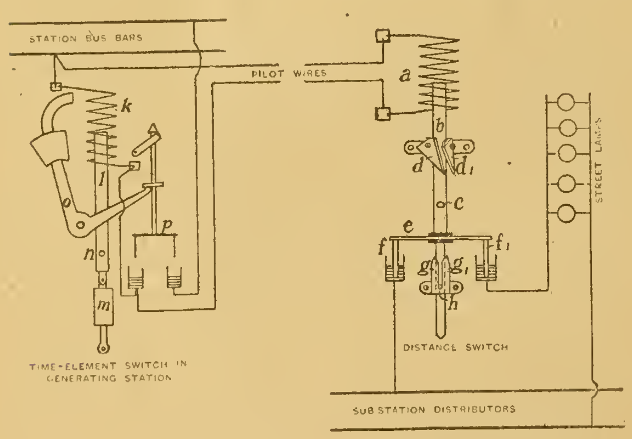


Fig. 3.—Remote Control Switch for Street Lighting.

To ensure that the switches are not left with their solenoids energised (when they would be inoperative) and also to indicate whether the street lights are on or off, a special controlling switch, having a "time element" and an indicator, is installed at the generating station, one being connected to the pilot circuit of each distance switch; the action of this is as follows:—

When it is desired to operate a distance switch, the time-element switch in the generating station is closed by the attendant; this energises the solenoid k, as well as that of the distance switch. The core l then rises slowly against the retarding action of a dashpot m, till a pin n in the core l raises and tilts over a weighted lever o, and thus opens the pilot circuit by raising the bridge piece p out of the mercury cups. An indicator, actuated by the lever o, shows the word "on" at a small window in the cover, because the distance switch is now closed and the lights are on. The same action takes place when switching off, only that the indicator moves to "off."

The supply at Neath is 220 volts A.C. 50 periods, and the largest current controlled by any distance switch is 60 amperes, but one of them, on test, dealt perfectly satisfactorily with 90 amperes 440 volts D.C., the break being very long and quick.

The pilot wires are ·007 sq. in. and vary in length from ¾ mile to 3¾ miles' run from the generating station, and on this long line three distance switches are operated simultaneously.

Hand-Regulated Arc Lamp.

Messrs. T. Francis & Sons, 41, Hampden Street, Bolton, are introducing a simple mechanism for hand-regulated arc lamps. The device, as shown in the accompanying sketch (fig. 4), consists of two interlocking levers forced apart by a hand screw, against the pull of a spiral spring. The carbon holders are insulated from the levers, and can be adjusted by means of the levers shown while the lamp is burning. Racks, worm gear, &c., have been completely eliminated, and the design is as simple as could be wished. The frame is made of aluminium.

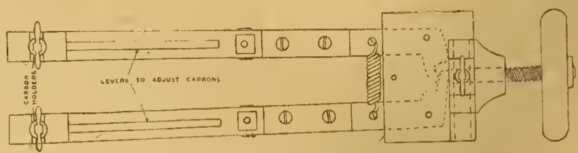


Fig. 4.—Arc Lamp Mechanism.

Safety Pendant Lampholder.

The influence of the new Home Office Regulations is making itself felt in various directions—especially in that of avoiding the use of an earthing wire. When one considers the inconvenience and complication of running an earthing wire to every ceiling-rose and wall-socket, of using a three-wire flexible, and of adapting the roses, sockets and lampholders to receive the earth connection, or replacing these accessories with special patterns for the purpose, it will be seen that the cost of labour and material is likely to mount up to a considerable figure. To obviate this at small cost the British Central Electrical Co., Ltd., of 17, Hatton Garden, E.C., who recently introduced a portable hand lamp which does not require an earthing wire, have now brought out a pendant lampholder on similar lines. The lampholder itself—of the ordinary pattern—is completely enclosed in wood, so that it is impossible to touch any part of the metal; the handle of the switch, in the case of a key-holder, is of insulating material, and the wood is soaked in melted paraffin to ensure that damp shall not render it conducting. An india-rubber ring is placed round the flexible where it enters the shank of the wood fitting, to prevent fraying of the flexible. The device is not unduly obtrusive in appearance. It has, we understand, received the approval of Mr. G. Scott Ram, Electrical Inspector to the Home Office, and has been provisionally protected.

BUSINESS NOTES.

Consular Notes.—Roumania.—The British Consul at Bucharest reports that the following electric tramways are working in Roumania: Bucharest, 5 km.; Jassy, 20 km.; Galatz, 13·3 km.; and Braila, 18 km. New lines of a total length of 40 km. are proposed at Bucharest, to be completed in 1916, and the municipality is endeavouring to find the necessary capital for their construction.

The British Vice-Consul at Galatz reports that gas and oil engines are imported in considerable numbers for use in mills for grinding maize and for other purposes. At present this demand is supplied by Germany, although British engines are no dearer than the German product. German firms, however, have agents at Galatz, whereas no British manufacturers of gas or oil engines are represented locally. An opening might be found in the district by British firms if they would appoint capable agents. Pumps are imported from Germany principally and some from the United States; it is said that British pumps are not sold because they are dearer than those of foreign manufacture. The question arises as to how British exporters should take advantage of the openings for trade if they wish to do so. Foreign firms send commercial travellers, and they appear to produce satisfactory results. British firms do not seem to approve of this method, probably because they think that the orders to be booked are not worth the trouble and expense entailed. If they do not wish to send a commercial traveller frequently, like their foreign rivals, they might, at any rate, send their representative once to report on the chances of trade, and select a suitable commission agent to carry on their business. If, however, it is not feasible to send a representative even once, firms wishing to find an outlet for their goods should apply to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C., which is in a position to supply them with the names of commission agents and buyers, and also to give them advice. Above all things, it is desirable that British firms should not accept, at hazard, the first commission agent who may offer his services. In this district business can but rarely be done on a cash basis. Austro-Hungarian and German firms give from six to eight months' credit, but they generally take good care to inquire into the financial position of the customer. The question of credit is closely connected with the rate of interest in the country. The local buyer will not borrow money at 8 per cent. or more in order to pay cash for British goods, even if they suit him better, if he can obtain more or less similar wares from a German or an Austro-Hungarian firm at eight months' credit. The phrase "cash against documents," which is so often the ultimatum of British exporters, is quoted, half jokingly, half sadly, by importers and commission agents when one inquires why such and such an article, which can be obtained cheaper and better in the United Kingdom, is only imported from one of our foreign rivals. It is necessary to give credit, but care must be taken to watch the market, which depends entirely upon the crops. If a good harvest is assured, all is well, but if the crops are in danger of failure, it is well to restrict business. Price lists should be in French or German, preferably the latter, prices should be in francs and centimes, and weights and measures in kilogrammes and metres. The value of a catalogue in a foreign language was amply demonstrated in Galatz in the course of the past year, when several British firms were competing for the same order. Only one firm had taken the trouble to produce a catalogue in a foreign language, and the only offer which was comprehensible was the only one taken into consideration. At the close of the year 1908 the commission agents at Galatz, whose sphere of activity extends throughout Moldavia, formed an Association known as the Union des Représentants de Commerce de Galatz, with the object of defending their professional interests and the interests of the foreign firms which they represent. According to the statutes of the Union, members whose business methods are unfair or dishonest are liable to exclusion. The settlement of disputes between agents and local buyers, the defence of the interests of the creditors in cases of insolvency, and the exercise of pressure, perhaps in the form of a boycott, on those importers who refuse goods on arrival, a well-known cause of complaint, are the principal objects of the body. If this union becomes firmly established, and if it lives up to its statutes, it should be able to do much to raise the reputation of this market, which has too often suffered in the past for the faults of a few.

Spain.—The German Consul at Madrid reports that the Union Electrica Cartagena has been formed at Madrid with a capital of 10,000,000 pesetas to supply electric energy to the mining district of Cartagena.

Turkey.—Applications have been made to the Turkish Minister of Public Works for concessions for the construction of electric tramways from San Stefano to Makrikein on the Sea of Marmora, and from Bostandjik to Anatoli-Hissar on the Bosphorus.

China.—The British Consul at Antung reports that an electric lighting plant has been set up in the Japanese settlement, and both the Chinese town and the Japanese settlement share the benefit of it. The generators, which were imported from Japan, are of British manufacture.

Italy.—The British Consul at Naples reports that the work on the new smelting works at Bagnoli belonging to the Ilva Co. is progressing rapidly, and it is hoped to commence working about the end of 1909, giving employment to 2,000 workmen. Large works are being erected to collect the water from the surrounding hills, and it is hoped to obtain the 12,000 cb. metres (2,461,242 gallons) per day which are required. A large fresh water reservoir is being built. For ordinary use there is the Serino water, from the same source that supplies Naples. Powerful electric pumps are being constructed for the supply of sea water. The Ilva Co. has a capital of 20,000,000 lire (£800,000).

Tungsten Lamp Patents.—The *Electrical World*, N.Y., states that the General Electric Co., U.S.A., has purchased the patent rights to the Just-Hanaman and Kuzel tungsten lamps for America and certain other countries outside Europe. These lamps, which have been imported for some time, will, in future, be manufactured by the General Electric Co.

Electric Light in an Ancient Castle.—With reference to the article in our last issue on the electrical installation at Lumley Castle, the Earl of Scarborough's seat at Durham, we learn that the electric radiators used are of the "Electroyl" type supplied by Messrs. Purcell & Nobbs. These radiators, to the tune of £200, were selected after test by the consulting engineers and approved by his Lordship. They are in antique brass finish, with temperature-regulating switches. Provision is being made for more "Electroyl" radiators for the cold season that comes when the present one is ended.

Bankruptcy Proceedings.—J. G. S. Cunnington and H. P. Allison, electrical engineers and contractors, trading as Laing, Wharton & Cunnington, at 7, Great Newport Street, St. Martin's Lane, W.C.—The public examination was held on Wednesday, June 23rd, at the London Bankruptcy Court. The statement of affairs was referred to in our last issue. Mr. W. P. Bowyer appeared for the Official Receiver; Mr. Hair for Mr. Alfred Page, the trustee; and Mr. Harris for the debtor, Cunnington, whose examination was first taken. He stated, in reply to Mr. Bowyer, that prior to May, 1907, he had carried on the business of an electrical engineer for some years in the neighbourhood of St. Martin's Lane. In that month he entered into partnership with Mr. Allison, and they adopted the style of Laing, Wharton and Cunnington. The partnership was constituted for the express purpose of acquiring the business of the Improved Electrical Supplies, Ltd. Witness had the concern offered to him, and as he was without sufficient capital to acquire it, he entered into partnership with Mr. Allison. Asked regarding the alleged overvaluation of the business, the debtor said they did not actually take stock before purchasing, but walked through the place and viewed it in a cursory manner.

Mr. Bowyer: You do not suggest there was any concealment in the matter?—Witness replied that it was impossible to see that £5,000 worth of stock was actually there when simply walking through the premises. In the course of the action they entered a counterclaim for £3,000 on the ground of misrepresentation, but they failed in that, and ultimately judgment was given against them both on the claim and counterclaim. About the end of March they got out a balance-sheet showing the position of the firm as at the end of February, and it then appeared that they had about £3,000 surplus in the business to meet the liability of £4,000 odd in respect of the Improved Electrical Supplies, Ltd. They had since incurred fresh liabilities to the amount of about £500, but, at the same time, they had reduced the total amount of debts by £1,200.

Mr. Bowyer questioned the debtor at some length regarding the withdrawal of the firm's money in April last. Witness said each partner was entitled to draw £10 weekly from the business for household and personal expenditure. He frankly admitted that he paid two cheques for £62 10s. and £146 5s. respectively received from customers into his private banking account because his partner refused to sign cheques drawn against the firm for witness's personal needs. The £62 10s. was repaid to the firm's credit by witness out of the £146 5s. cheque, and on April 22nd he drew a cheque for £95 2s. 2d., which cleared out the firm's bank balance, and paid that into his private account. That was done because he knew that judgment in the matter of the Improved Electrical Supplies, Ltd., had been given against them, and that, consequently, the business must come to an end. The money thus withdrawn from the firm was used in paying off certain of witness's private debts and providing for living expenses.

Mr. Allison corroborated the evidence of the previous witness so far as it related to the partnership affairs, and added that he only became aware of his partner's action relative to the withdrawal of the firm's money, when informed of the facts early in May by their book-keeper. Witness, on his part, drew out £50 on May 8th for his private needs. Mr. Bowyer: Why?—Because I wanted money. You knew that trouble was coming?—Yes. And on that ground you took more than usual?—Yes. Further questioned the debtor said he might have lost a few pounds in betting during the last three years, but he was by no means a gambler. This was his first failure. Before entering into partnership with Mr. Cunnington, he was employed in India by an important electrical firm. Replying to Mr. Hair, witness said the £50 drawn out by him on May 8th was due to him on the drawing account.

The debtor Cunnington was recalled, and, in reply to Mr. Harris, said the balance of the £146 cheque, after repayment of the £62 10s., was due to him in respect of salary. This was also his first failure. The examination was concluded.

J. R. W. Middleton and A. E. E. Daniels (trading as Middleton and Co.), electricians, 11a, King Street, Dover, Kent.—The adjourned public examination of these debtors was held last week at the Guildhall, Canterbury, before Mr. Registrar Furley. The Official Receiver stated that the case had been adjourned in order that a list of the debts assigned to Mr. Letts might be produced, but these he had not yet received. In answer to the Official Receiver, the debtor Middleton stated that he had never seen Letts, who had advanced the money. The debtors were further questioned at some length by the Official Receiver, who asked that the case be again adjourned in order that the accounts might be properly prepared, and that the assignment debts might be produced. An adjournment was ultimately ordered.

The Fair Wages Clause.—In the House of Commons on June 28th, Mr. William Thorne asked the Postmaster-General what inquiries, if any, had been made in reference to the various complaints that had been made against the Western Electric Co., Woolwich, for violating the Fair Wages Clause; and, when inquiries were made, by whom they were made; and why this firm was allowed to be the only contractor asked to tender for general work. Mr. Buxton, in a written reply, said that he had arranged to receive a deputation from the Scientific Instrument Makers' and Trade Society on the subject.

Dissolutions and Liquidations.—North-Western Electricity and Power Gas Co.—A petition for the winding up of this company has been presented by Harper Bros. & Co., engineers, and D. Balfour & Son, Newcastle, creditors of the company, and it is to be heard in London on July 6th.

Mountain & Gibson, Ltd.—A petition for the winding up of this company has been presented by Cyril Renton Heron, of 143, Manchester Road, Bury, and is to be heard at Liverpool on Monday, July 5th. On June 21st, Mr. Hugh N. Bowden was appointed receiver for the debenture-holders of this company, to take possession of the assets on their behalf.

Santoni Arc Lamp and Engineering Co., Ltd.—This company, on March 1st, resolved to wind up voluntarily on account of its inability to meet its liabilities, with Mr. W. McIntosh Whyte, 11, Queen Victoria Street, E.C., as liquidator.

Geneva Tramways Co. (1906), Ltd.—This company is to be wound up voluntarily in view of the agreement with the Omnium Lyonnais de Chemin de Fer et Tramways as to sale of shares. The Hon. A. Brand, of 101, Mount Street, W., and Mr. J. Seear, of Finsbury Pavement House, E.C., are liquidators.

United Kingdom Tramway, Light Railway and Electrical Syndicate, Ltd.—A meeting of creditors is to be held at 28, Victoria Street, S.W., on July 1st. Mr. G. E. S. Venner, liquidator.

International Telescriptor Syndicate, Ltd.—A meeting is to be held at Norfolk House, Norfolk Street, W.C., on July 28th, to hear an account of the winding up from the liquidator, Mr. R. H. Hoare.

Bury, Rochdale and Oldham Tramways Co., Ltd.—A meeting is to be held at Manchester on July 26th to hear an account of the winding up.

Schmidt Stationary Engine Co., Ltd—A meeting is to be held at 28, Victoria Street, S.W., on July 28th, to hear an account of the winding up from the liquidator, Mr. W. T. Norton.

Buenos Ayres Electric Tramways Co. (1901), Ltd., and the Buenos Ayres Grand National and La Capital Tramways Joint Committee, Ltd.—Meetings of these companies are to be held at 62, London Wall, E.C., on August 5th, to hear an account of the winding up from the liquidators, Messrs. E. A. Lazarus and F. Thursby.

Edmunds Bros., electricians, iron and brass founders, &c., Christchurch Road, Boscombe, Bournemouth.—Messrs. F. T. Edmunds and J. C. Edmunds have dissolved partnership. Part of the business will be continued separately by each partner.

Lumb Electrical Bleaching Co., Ltd.—This company is winding up voluntarily, with Mr. W. B. Winnicott, Prudential Buildings, Queen Street, Nottingham, as liquidator.

Burroughs Adding and Registering Machine Co., Ltd—Creditors must send particulars of their debts, &c., to Mr. W. H. Langford, 65, High Holborn, W.C., the liquidator, by August 14th.

Vaughan & Cook, Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. L. V. Houseman, 1, Clement's Inn, W.C., by July 31st.

Annual Outings.—On Saturday, June 19th, the staff of the Sun Electrical Co., Ltd., held their tenth annual outing. The party went for a trip by Immisch electric launch *Rosalind* from Reading to Maidenhead, calling at Henley-on-Thames for lunch and at Marlow for tea. In the course of his remarks after lunch, Mr. A. G. Beaver, the manager, said that the progress of the firm continued on the upward grade, notwithstanding the present general low state of trade. As a matter of fact, he anticipated that this year's turnover would eclipse that of all previous years.

The thirteenth annual outing of the employés of Messrs. Galsworthy, Ltd., was held at Ramsgate on Saturday last. After dinner at the Castle Hotel, a musical programme followed, during which a silver mallet was presented to Mr. F. A. Denning, the works manager, by the employés, as a mark of their esteem. The toasts to the continued success of the firm, the visitors, &c., followed. The party afterwards went for a brake drive to Minster.

The electrical staff of the New System Private Telephone Co., Ltd., held their fourth annual outing at Hastings on Saturday, 26th ult. Dinner was served at the Old Jenny Lind, Mr. R. L. Murray, the chief engineer, being in the chair. After the usual loyal toasts, the chief engineer, in his speech, gave a brief outline of the firm's progress during the last few years, and expressed great pleasure at the loyalty of the staff during these days of keen competition.

High-Voltage 16-C.P. Metallic-Filament Lamps.—The arrival of the low-candle-power high-voltage metallic-filament lamp has been prophesied ever since the new lamps came into practical use; but those who were acquainted with the process of manufacture of metallic filaments were well aware of the great difficulties in the way, and while they were too cautious to reject the idea as impossible of achievement, they were disposed to regard it as a rather remote possibility.

Our readers will therefore be interested to learn that we have received from the Stearn Electric Lamp Co., Ltd., of 47, Victoria Street, S.W., a 16-c.p. lamp for 210 volts, made by the company at their own works by an improved process which enables the exceedingly fine filament to be produced. The lamp is, in shape, quite similar to the ordinary carbon-filament lamp, and contains nine loops of metallic filament. The consumption of the lamp is stated to be 24 watts, or at the rate of 1·5 watts per British candle-power. The efficiency is thus slightly lower than is generally claimed for metallic-filament lamps, but this is a matter of small moment, for the power consumed is still but little more than one-third of that required by carbon-filament lamps. Like the other metallic-filament lamps made by the Stearn Electric Lamp Co., the lamp is named "Leuconium." It is not actually on the market, but it is, at any rate, in existence—a specimen is burning in our office. The makers are to be congratulated on this very noteworthy advance, due, we believe, to Mr. Stearn himself; the new lamp will be of the greatest benefit, not only to the users of alternating current, but also and particularly to those who use direct current at 200 volts and upwards, who have hitherto gained little benefit from wire lamps; it will prove a most valuable weapon to suppliers in competition with gas lighting.

Catalogues and Lists.—Messrs. Hofler, Ltd., 26a, Soho Square, W.—Illustrated list showing examples of their oak panelling work.

The Sanitas Electrical Co., Ltd., 61, New Cavendish Street, W.—"The Book of the Multostat" is the title of a 42-page illustrated catalogue, in which, among other specialities, is described the Earth-Free Multostat, which, when connected to the electric light mains, generates all the various currents used in electro-therapeutics, electro-surgical work, massage, &c. The title of the apparatus means that it is so constructed as to be quite free from any danger of leakage to earth. A number of pages are occupied with particulars of accessories and appliances for use in connection with the machine. Copies of the list will be forwarded on application.

Messrs. Thos. W. Ward, Ltd., Albion Works, Sheffield.—Catalogue of close upon 400 pages, in which they give particulars and prices of a large variety of new and second-hand machinery, second-hand boilers, tanks, tubing, rails, &c., that they hold in stock.

Messrs. Nursey & Marr, 53, Victoria Street, S.W.—16-page booklet (Section D) describing their small petrol-electric generating sets, switchboards and batteries, for private installations.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—16-page illustrated pamphlet, entitled "What Every Woman Should Know," showing the patent "Sucleen" vacuum cleaner for electrical and hand power which they are placing upon the market. Its construction is described, and a view of the interior of the machine appears. Prices are stated.

Messrs. O. A. Vandervell & Co., Warple Way, Acton Vale, W.—Well illustrated 16-page publication—"Electricity *versus* Acetylene and Oil"—containing an account of the "C.A.V." system of electric lighting for motor-cars, motor-boats, &c., by the Leitner variable speed dynamos. Full particulars of the different parts—dynamo, automatic switch and battery—appear, together with line drawings and diagrams of alternative wiring schemes for car lighting, and illustrations of a few types of lamps. Motor-car owners and others interested can obtain a copy of the list by applying to the firm.

Messrs. Weldless Chains, Ltd., Gartsherrie, Coatbridge.—Pamphlet No. 5, giving description and prices of the "Universal" patent chain adjuster for shortening, joining or adjusting the length of chains and slings.

The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—16-page catalogue (No. 137) describing their new system of electric cooking by incandescent heat. It is expected that this system will have an important influence in increasing the popularity of electric cooking apparatus. A copy of the pamphlet should be obtained by all interested in the subject.

The Reason Manufacturing Co, Ltd., Brighton.—Fourth edition of their catalogue of street lighting fittings and accessories. It is neatly produced in loose-leaf form, in an expanding file binder allowing of the inclusion of additional lists as issued. A number of new designs of fittings are included, and many of the original patterns have been modified to suit modern requirements. The booklet is divided into sections dealing respectively with lanterns, brackets, pendant lanterns, water-tight fittings, and switches and accessories, and while electric street lighting with metal-filament lamps is receiving such great attention, electricity works engineers would find the list, which is fully-illustrated and gives prices, of considerable service to them. A second catalogue (40 pages) deals very fully with Clark Fisher potentiometers and accessories, describing the 15-unit ordinary and 35 and 150-unit compensating potentiometers, as well as a number of accessories. Notes on the method of use, and special points on compensating, together with general hints on potentiometry, are followed with a list of prices.

Messrs Anderson's Bristol Rubber Co., Ltd., St. Mary-le-Port Street, Bristol.—Catalogue, with a note of trade discounts, of belting hose and other rubber and asbestos goods.

Hart Accumulator Co., Ltd., 35, Marshgate Lane, Stratford, E.—Small and neat pocket edition (stiff covers) of their 1909 catalogue. In the course of its 70 pages it gives lists of places where the cells are used, instructions for erecting and working same, illustrations with tabulated price and other particulars of "N" lighting type cells, special batteries for 25-volt metallic-filament lamps, special cells for traction work, central station cells, ignition batteries, portable batteries, sheet separators, and a number of sundries.

British Insulated and Helsby Cables, Ltd., Prescot.—Pamphlet No. P97 (16 pages), containing illustrated particulars of their Prescot house service boxes (non-disconnecting type) for low-tension concentric and triple-concentric mains; No. P101 (six pages) gives tabulated and other information regarding Monnot copper-clad steel wire for electrical purposes.

Weston Electrical Instrument Co., Audrey House, Ely Place, Holborn, W.C.—Small 32-page pocket-size preliminary list, giving particulars, prices and illustrations of some new Weston instruments, a.c. and d.c. types, which they are now placing upon the market.

Messrs. G.m.b.H. Classen & Co., Barbarossastrasse, 16, Berlin, W 30.—Price list of "Fludor" soldering materials—paste, cored solder, fluid, &c., and spirit lamp.

Book Notices.—*Electrical Practice in Collieries.* By Daniel Burns. London: C. Griffin & Co., Ltd. Price 7s. 6d. net. Third edition.—The call for a third edition of this book, which forms one of Messrs. Griffin's excellent series of "Scientific Text-Books," shows that there was a demand for a work of this description. We reviewed the second edition some time ago, and pointed out that there was a lack of explanatory matter relating to the construction of electrical machinery, and we regret to find that the present edition is practically a reprint of the second. Chapter I, however, has an addition of a few useful notes on "earthing," "three-phase cables," and "coal-cutter trailing cables." Chapters II, III and IV have not been altered, while Chapter V has a description of the Nernst lamp added, but we notice the illustration is upside down. Chapter VII has also been improved by a description of electrical "gathering" and "rack-rail" locomotives for underground haulage. Chapter VIII has a description of the Sullivan electric coal-cutter added, but we also note that fig. 118 is printed upside down; and Chapter IX has been enlarged with a few notes on electrical winding. As a text-book for the use of mining students studying for the various examinations in mining science, it no doubt serves a useful purpose, and the numerous arithmetical examples are very helpful to the student. The volume would be very much improved, even as a text-book, if a little more information and explanation were added to the chapters dealing with dynamos and motors, much of which is quite out of date, and, in fact, before another edition is published, we would recommend the entire re-writing of this portion of the work.

Trade Announcements.—We are asked to state that, in view of the increase of business in their large gas engine department, and of their intention to take up the direct sale of their Diesel oil engines in England, the M.A.N. (Maschinenfabrik Augsburg-Nurnberg A.G.)—in the English gas engine trade hitherto known in England as "The Nuremberg Co."—have, as a result of a friendly arrangement, terminated their agency agreement with Mr. James Halcrow, 18, Coleman Street, London, E.C., and have opened an office in London. All communications should in future be addressed M.A.N., 219, Caxton House, Westminster S.W. Telegraphic address, "Klettillo, London." Telephone "3775 Victoria."

Messrs. Jackman & Marchant, electrical engineers, have opened new premises at 69, Sandgate Road, Folkestone.

Mr. H. W. Teeton, electrical engineer, has removed from 7, 9 and 11, Albion Street, to 19, Lichfield Street, Hanley, Staffs.

Messrs J. E. Neal & Sons, electricians, 402-4, Evelyn Street, Deftford, S.E., announce that they are retiring from business. The stock is to be disposed of by auction.

New Zealand and British Trade.—Press dispatches from Wellington, N.Z., quote Mr. McKenzie, Minister for Agriculture, as follows:—"We hear a good deal about patriotism, but when it is remembered that the money spent on importing goods from foreign countries assists those countries to build armaments for the destruction of our commerce and the humiliation of our flag, we are constrained to advocate a policy on the lines of that of Canada, and give a preference to British goods in British markets."

Brescia Electrical Exhibition.—Those who are interested in this international exhibition (August to October next), can obtain particulars from the Italian Chamber of Commerce, 4, St. Mary Axe, London, E.C.

LIGHTING and POWER NOTES.

Baillieborough (Ireland).—The R.D.C. has petitioned the L.G.B. to grant it urban powers for the purpose of giving effect to the proposed electric lighting scheme for the town.

Barnstaple.—At the last meeting of the Board of Guardians the Visiting Committee recommended that the house, hitherto lit by oil lamps, be lighted either with gas or electricity. The cost of installing gas would range, according to the tenders received, from £63 to £95, and for electricity, from £125 to £152. Mr. H. Radford said they had ascertained the cost of lighting Taunton and Exeter workhouses by gas and electricity, respectively, and on this basis electricity would cost 8s. 2d. per lamp, and gas 8s. 5½d. per lamp per annum. He was satisfied that if electricity was adopted it would prove cheapest, most convenient and safest. The Master said the workhouse cost £23 10s. to light with oil last year. Mr. M. Clogg thought that gas would be more useful for heating and cooking. The Chairman pointed out that the workhouse was heated with hot water pipes, and that the cooking was in connection with the same installation. If jets were left on by careless persons—and they had to remember that some of the inmates in that institution were "on the border-land"—there would be more danger than with electricity. Several members strongly advocated the claims of electricity, whilst one or two championed the use of gas. It was decided by a large majority to install the electric light, only six members voting for gas.

Bath.—A L.G.B. inquiry was held on June 23rd relative to the application of the T.C. for a loan of £11,700 for electric light purposes. There was no opposition. The sum is made up as follows:—Spent in excess of loans and on work for which a loan has not been applied for, £5,199 11s. 8d.; mains extensions and services, £6,000; automatic stokers, £500. The inquiry was adjourned until July 2nd.

Canada.—The Minister of Railways and Canals has agreed to grant a lease to the Northumberland-Durham Power Co. at Port Hope, of the remaining portion of the Healey Falls water power controlled by the Federal Government. Development of the power will proceed concurrently with the construction of the Trent Valley Canal which passes through the company's property, and will also facilitate the early construction of the Cobourg, Port Hope and Havelock Electric Railway.

Cape Colony.—Uitenhage.—On June 4th the Mayor laid the foundation stone of the electric power house. The Deputy-Mayor explained that the town was to be lighted by 16 arc lamps of 1,250 c.p. each and 280 lamps of 40 c.p. each. It is expected that the scheme will be sufficiently advanced to light the streets within six months. Private lighting will follow.

Chile.—La Sociedad de Alumbrado Electrico, of Punta Arenas, has secured a concession to install poles and electrical mains in the streets of the town in connection with the electric lighting undertaking during a period of 20 years.

Continental Notes.—Germany.—The Paderborner Electricitätswerke und Strassenbahn Gesellschaft is the title of a new company, which has just been formed at Paderborn, with a capital of £60,000, to acquire and extend the electric tramways in the town and to establish a central electric lighting station. The Rhenische-Westfalische Electricitätswerke Gesellschaft is interested in the new undertaking.

Droylsden.—The local co-operative society has decided to light its premises by electricity in place of gas. The parish church is also to be wired, and several large firms have decided to become consumers of electricity.

Finchley.—The accounts of the electricity undertaking for the year ending March 31st last show that on capital account there was spent during the 12 months £13,405, as against £12,638 in the previous year. The maximum load had increased from 509 to 610 kw., and the amount of electricity generated had increased from 897,502 units to 980,000 units. The amount sold to consumers was 580,750 units, as against 485,060 in the preceding year, and for public lighting 233,725 units had been sold, as against 244,700 in the previous year. The income from private lighting was £9,433, as against £8,000 in 1907-8. The receipts from power had increased from £642 to £797, while the amount for public lighting had decreased from £1,685 to £1,678. The balance carried to net revenue was £6,809, as against £5,550 last year. After payment of interest, &c., there was a balance of £86 odd to carry forward, as against a deficit of £292 last year.

Gosport.—The U.D.C. has decided to give the gas company 12 months' notice to terminate its agreement for street lighting, and then to ask for fresh terms. It was pointed out by Mr. Harvey that the cost of gas at 3s. per 1,000 cb. ft. worked out at £2 12s. 6d. per lamp per year, which, at their present price, left £1 for labour and maintenance. But electric light at 2½d. per unit would be £3 per lamp; or 12s. 6d. cheaper than gas. It was desired to light the Fareham Road with electric light, but negotiations could not be entered into until the gas company had received notice.

Llanberis.—The P.C. has asked Mr. Paton, of the Electric Power Co., to submit terms for lighting the parish by electricity.

London.—Poplar.—Negotiations have taken place between the borough electrical engineer and the engineer of the Stepney undertaking, for a supply in bulk to Stepney during the removal of plant to the new generating station. The contemplated demand is for a minimum of 250 kw. running continuously for 24 hours per day, except for a short interval on Sundays, with liberty to raise the demand to 500 kw. The contract is to run from July 1st to September 30th, 1909, the price to be 0·3d. per unit, for all energy supplied, untransformed, at the Limehouse sub-station, subject to a clause relating to coal strikes. The minimum quantity is estimated at 550,000 units. The committee has agreed to the foregoing arrangements.

Marylebone.—The general manager (Mr. Seabrook) of the electricity undertaking has reported to his committee that the sale of current for lighting purposes is going to seriously decrease when the metallic-filament lamp becomes better known, and from other directions the department is likely to experience a decreased revenue. In a year or so there would also be an increased assessment. His position was that he had two different and equally important classes of work to do (1) overhaul of organisation; (2) development of supply. He was anxious, and it was necessary for the two to go on simultaneously, but he did not feel it would be wise to tackle the two together single-handed, and he asked permission to engage a gentleman (Mr. H. H. Holmes, sales manager at West Ham) of great experience in the direction of development, at a salary of £400 a year. Mr. Holmes was aged 32. The committee decided in favour of Mr. Holmes being appointed, subject to a month's notice on either side.

Maidstone.—The local gas company has written to the Mayor protesting against the proposal of the Corporation to convert 158 street lamps to electric lighting.

Morecambe.—The Electric Lighting Committee has decided that the engineer shall report on the possible improvement of the Corporation electrical plant, by substituting either oil or gas for steam power.

Plymouth.—The T.C. has decided to extend the mains in order to supply electricity for lighting and power to the works of the new Patent Candle Co., and Messrs. R. & R. Bayly, Sutton Road.

Radcliffe (Lancs.).—The U.D.C. has received sanction to a loan of £4,336 for additional generating plant.

A supply of energy for power purposes to the new mill of Messrs. J. C. Hamer, Ltd., has been offered at ¾d. per unit net.

St. Germans.—A committee of the Board of Guardians recently passed a resolution recommending the acceptance of the tender of the West of England Agricultural Co-operative Society for installing the electric light in the workhouse. After some discussion by the Guardians the matter was deferred.

Shrewsbury.—The E.L. Committee is urging the necessity of developing the electrical undertaking, and that a loan of £10,000 should be obtained for this purpose. Among the various items included in the above are mains, £2,700; services, £900; meters, £450; mechanical stokers, £900; boiler, pump, &c., £800; street lighting, £500; amount overspent on capital account, £3,672, &c.

Southampton.—The borough electrical engineer has been in communication with the South-Western Railway Co. as to the supply of energy to the Docks, the present supply from the company's own works being insufficient. The company's chief engineer asked whether the Corporation would be prepared to supply the whole of the Docks with electricity. The consumption at present is about 1¼ million units; at the end of the present year it will be about 1¾ millions, reaching 2 millions on the completion of the new wet dock. The price offered was 1d per unit, which would bring in a revenue of between £7,000 and £8,000 per year. The borough electrical engineer informed his Committee that the present opportunity appeared the last the municipality would ever have of supplying that undertaking with electricity. The Committee decided to accept the offer of the company for a supply at 1¼d. per unit on a consumption of not less than 400,000 and not more than 600,000 units per annum conditionally that the supply is a day load and is partially discontinued during the months of December and January.

Uxbridge.—Dr. Lock, the medical officer to the Guardians, has written to the Board, urging it to consider the advisability of substituting electricity for gas in those portions of the workhouse in which the last-mentioned illuminant is used. Dr. Lock says: "From every point of view electric light is superior for surgical and medical purposes. It is healthier, cleaner, safer and more economical, and perhaps the most important point is that by means of wall plugs and hand lamps it can instantly be brought to any point in the ward for examination, operative and nursing purposes. In every hospital with which I am acquainted electric light has been installed and gas superseded. The Metropolitan Asylums Board last year, after carefully comparing and considering the two systems, came conclusively to the opinion that electric light is healthier, cleaner, safer, more convenient and more economical, and have installed it universally in their institutions. Your advising engineer, Mr. Wingfield Bold, is very strongly of the same opinion. Your gas bill for the last 12 months was £161 9s. 8d., more than double the electric light bill, which was £77 8s., while the number of lights by each system is probably nearly the same." In conclusion, the medical officer asked that in any case a certain number of electric light sockets be put in each ward.

Walthamstow.—A recommendation of the electrical engineer has been adopted with reference to the lighting of shops by means of Osram lamps. The terms are to be as follows:—200-c.p. lamps at a minimum inclusive price for current and maintenance of £2 10s. per lamp per annum, and 100-c.p. lamps at £1 10s. per lamp per annum, the charges to be based on a consumption of 150 and 80 units per lamp per annum respectively.

Whitchurch.—The Llandaff and Dinas Powis R.D.C. has applied for a loan of £2,960 for the provision of E.L. plant at Whitchurch.

Yardley.—A difficulty has arisen over the electric lighting. A few nights ago a special meeting of the District Council was held, when the following recommendation from the Tramways and Electric Lighting Committee was presented:—"That in view of the serious objections to the terms of the agreement with the City of Birmingham Tramways Co., Ltd., of June 8th, 1908, raised by the reports of the Council's electrical engineer (Mr. C. H. Gadsby) and the consequent impossibility of framing a scheme for putting into operation the Council's electric lighting orders, based on such agreement, which would be at all likely to meet with the approval of the B. of T. and L.G.B., notice be given to the said company terminating the agreement, above referred to." Mr. A. Blackham, the chairman of the Council, in moving the adoption of the recommendation, pointed out that there appeared to be a good deal of misconception as to the position of affairs. It seemed to be feared that with the carrying out of the recommendation the whole of the Council's electric lighting order fell to the ground, and the work had to be commenced again. That was not so. Of course, the Committee had been compelled during the past few months to do all it could to carry out the agreement, but the recommendation now proposed only affected, as they knew, one particular part of the electricity supply scheme, that of traction, and did not touch the general supply of electricity to the district. Speaking for himself and not for the Council, he could not help feeling that the threatened annexation of the district was an element in the question which they could not exclude, and which would have to be very carefully considered if the matter came up for consideration. Mr. S. Mason seconded the motion, and Mr. Blackham stated that it was not advisable for the Council to discuss the new schemes prepared at present. The motion was carried.

TRAMWAY and RAILWAY NOTES.

Chile.—A project has been submitted to the Chilian Government by Don Roberto von Braun to convert the No. 1 section of the State Railways to electric traction, and a Special Commission has been appointed to consider and report upon the scheme.

Continental Notes. — Switzerland. — The *Feuille Fédérale Suisse* publishes particulars of a decree granting to a preliminary committee, represented by M. Antonio Soldini, of Bissone, an 80 years' concession for the construction and working of an electric tramway from Capolago to Bissone. The line will be single-track, and of 1 metre gauge.

According to the latest returns, the length of electrical lines, which in 1901 was 400 km., amounted to 1,019 km. in 1908, which represented about 18 per cent. of the Swiss railway system. The total amount of capital invested, so far, in electrical railways and tramways, is about 104,000,000 fr.

Spain.—La Société des Tramways de Madrid is about to commence the construction of a new line of electric tramway between the Paseo de Recoletos and the Calle de Florida in the Spanish capital.

Dartford.—The U.D.C. on June 24th sealed the assignment of the lease of the tramways from Messrs. J. G. White & Co., Ltd., to Messrs. Balfour, Beatty & Co., Ltd.

Fife.—Dunfermline T.C. has had a conference with representatives and the promoters of the tramway company which proposes to run tramways from Kirkcaldy to Inverkeithing by way of Burntisland and Aberdour. An agreement had been come to with the other local authorities, and the company desired permission to enter the south side of Dunfermline. Another company, which has running powers between Dunfermline and Lochgelly, has, however, intimated its intention of constructing a tramway to link up Dunfermline with the naval base at Rosyth, and it is understood that in the event of its powers being put into operation, the promoters of the Kirkcaldy to Inverkeithing scheme will not proceed with the proposal to enter Dunfermli[illegible] but will link up with the other system at Inverkeithing. It is [illegible] that there is every prospect of the line from Inverkeithing to Kirkcaldy being carried through. This tramway is to connect with the Corporation system at Kirkcaldy, and the entire scheme will provide a direct route of tramway all the way from Inverkeithing to Leven, a distance of about 16 miles.

Halifax.—The B. of T. has refused the application of the Corporation for doubling the tramway between Broad Street and Woolshops, also for a loop line in Broad Street and a further line in George Street. Col. Druitt states that he is not convinced of the necessity for the new work, which would be undertaken against the wishes of the owners of property affected.

Leeds.—The opening of the last section of the Yeadon and Guiseley extension of the Corporation lines was fixed for Wednesday last, when the B. of T. inspection would also take place.

London.—The Metropolitan Railway Co. announces that from July 1st, it will run a number of non-stop trains from stations on the Aylesbury extension to the City without change at Baker Street, as heretofore. For this purpose, an additional junction has been provided at Baker Street.

Middlesex.—At the meeting of the County Council on June 24th the Highways Committee reported that it had been agreed to join with London in a Bill for the proposed tramway from Cricklewood to Marble Arch. Under this scheme Middlesex will construct the tramway (on the overhead trolley system) and widen the road from Cricklewood to Netherwood Street at an estimated cost of £80,000. The portion of the line from Netherwood Street to Bridge Terrace is to be constructed by the L.C.C. at an estimated cost of £70,000. From Bridge Terrrace to Marble Arch the tramway is to be on the conduit system, and from Netherwood Street to Bridge Terrace on the dual system of overhead trolley and conduit. The managing director of the lessee company is prepared to recommend his board to take a lease of the Middlesex portion of the tramway. On the recommendation of the Committee the Council passed a resolution approving of the principle of the proposed scheme.

U.S.A.—According to the daily Press, some 3,000 street car employés of Pittsburg, Allegheny City and district struck work on Sunday last, shutting down over 600 miles of tramways, &c. When the local steel workers found that they were deprived of their usual holiday, an attempt was made to wreck the cars and mob the strikers.

New York.—The New York, New Haven and Hartford Railroad Co. has decided to electrify its entire line from New York to New Haven; the electric zone now runs only to Stamford. The company intends also to electrify the Harlem River branch, which runs from the Harlem River to New Rochelle. It is proposed that four tracks on each of these roads be electrified. It is expected that the work will be completed in about 18 months. It was decided at the directors' meeting on June 12th that the electrical extension should first be operated for freight, and later for passengers. The work, which will cost $20,000,000, will be put up to open competition.

Chicago.—The final report of the Subway Bureau of the City of Chicago has been made public. The *Electrical World*, N.Y., says that it contains four sets of plans for subways for street railways in the central district, ranging in estimated cost from $100,000,000 to $112,000,000. Each of the plans is so arranged that it may be made to include, besides the subway itself, galleries for public utilities. The plan which appears to meet with most favour provides for the construction of six through routes; two of these will connect the north side and south side, two the north side and west side and the others the south side and west side. This plan also contemplates a subway which will run around the heart of the city in close proximity to nearly all the railroad stations. The plans provide for a seating capacity of about 500,000 passengers; this should provide for the growth of the population of Chicago, at the present rate of increase, until the year 1932. Including standing room, the system will not reach its ultimate maximum capacity until 1950. The plans are not worked out in detail, and the proposals are largely tentative in form.

TELEGRAPH and TELEPHONE NOTES.

Imperial Press Conference.—On Friday last the committee appointed to consider "Cable Rates and Press Intercommunication" presented its report to the Conference. The committee had passed resolutions to the effect that it was urgently necessary that the Governments of the British Empire should take steps to increase the means and to reduce the cost of electric communication between the different parts of the Empire; that steps should be taken to draw the attention of the India and Colonial Offices and the Eastern Telegraph Co. to the high charges made by the Indian authorities on all cable messages to and from the United Kingdom placed on the Indian wires, and to the present scale between ordinary and Press cable rates, with a view to securing immediate relief in both respects; that the attention of the Colonial office and the companies be called to the prohibitive rates at present obtaining in the West Indies; and that the desirability of establishing a chain of wireless telegraph stations between all British countries, for the cheapening of electrical intercommunications and for the safety of the mercantile marine, be urged upon the Governments concerned.

A further resolution called upon the secretary to inquire whether the Pacific Cable Board and the Eastern Telegraph Co. were prepared to grant a reduced Press rate.

The Chairman (the Hon. H. L. W. Lawson) stated that in reply to the last proposition the Pacific Cable Board had consented to reduce their charges for Press messages to one-half. The New Zealand Government would similarly reduce its terminal charge, and probably the Commonwealth Government would do likewise.

It was agreed that the standing committee, of which five members would form a quorum, should continue to act on behalf of the Conference until the next Conference was held, and the resolutions were adopted unanimously.

In the discussion Mr. Moherly Bell pointed out that the concession made by the Pacific Cable Board represented a reduction of 2½d., reducing the Press rate to Australia from 1s. to 9½d. a word. Mr. T. Temperley said that while the Pacific cable was 7,800 miles long, and the Atlantic cables only 1,800 to 2,000 miles, the Atlantic cable companies received 5d. a word, and the Board received only 4d. to Australia and 5d. to New Zealand.

Mr. P. D. Ross reintroduced his resolution that there should be State-owned electric communication between the British Isles and Canada, and State control of electric communication across Canada. He pointed out that he did not use the words "Atlantic cable," as he believed that they were on the eve of great advances in wireless telegraphy. Mr. Marconi had said that morning that next August he hoped to be able to supply a service of 15,000 words at least across the Atlantic at half the existing cable rates.

Mr. Marconi said that at present there were difficulties in connection with transmission over the landlines of the North American continent, but he believed they could be overcome. The cost of stations capable of communicating over a distance of 3,000 miles would be about £50,000 each. In the near future, he believed, distances of 6,000 miles or more might be covered. At present they could transmit a limited amount of Press messages across the Atlantic at 2½d. a word; if the traffic was considerable the charge might be reduced to 2d. a word between England and Canada. The present speed across the Atlantic, he said, was 25 words a minute; they hoped to double it by duplexing.

The question whether the resolution should refer to cables or to wireless communication was discussed at some length. Mr. E. S. Cunningham remarked that wireless could not yet be regarded as practicable, and that the resolution therefore implied either State competition with private interests (which was practically confiscation) or purchase of the latter; and Mr. Charles Bright pointed out that the speed of cable telegraphy had been estimated at half the proper value, while the cost of an Atlantic cable was not one million sterling, as had been stated, but half a million. Eventually the resolution was adopted.

Other resolutions recommended the establishment of State-owned electric communication between Great Britain and South Africa, and that the Governments of Australia and New Zealand be asked to co-operate with the Pacific Cable Board in reducing the cost of Press messages.

Several of the resolutions were brought before the Prime Minister yesterday. Mr. Asquith received the deputation with sympathy, and assured the members that such influence as the Government possessed would be used in the direction of the reduction of rates. He pointed out, in fairness to the cable companies, that they had provided a world-wide system of enormous value to the Empire, and had very substantially reduced their rates in recent years. He agreed that any Imperial line of communication ought to be self-supporting, and that wireless communication could not be ignored, but pointed out that Mr. Marconi had not yet applied for the facilities which the Postmaster-General was bound to give as soon as he could show that he could carry on a service across the Atlantic with reasonable facility and speed. The Government would be anxious to keep in touch with the standing committee, which he regarded as the solid and substantial result of their deliberations on the acknowledged necessity of cheap and certain electric communication for the Empire.

Newfoundland.—As the result of a change of Ministry, the Government has declined to ratify the agreement with the Commercial Cable Co. made last February. The agreement, says Reuter, granted the company a special concession equivalent to the free landing of a new cable on the colony's shore next month, whereas the other companies are obliged to pay 4,000 dollars a year cable tax. The Government insists that the Commercial Cable Co. shall pay the same tax.

Portsmouth.—The Corporation Telephone Committee has been asked whether it will be prepared to combine with its own the service of the National Telephone Co. in its area, when the latter has to be taken over by the Post Office. The charges which the latter proposes to levy are very much higher than the municipal rates. The Committee is, however, slightly raising the rates for the lower scales. The Corporation's licence does not run out for another 16 years. There was a decrease in ordinary expenditure of £117 last year as compared with the previous year, and the income was also less by £138. Principal and interest payments were also heavier, and after all charges were met, including a payment of £1,011 to the Post Office as royalty, the sum to be carried forward is £140, which is £100 less than in 1907-8. The Committee has gone thoroughly into the question of rates, and finds that there has been a loss on the cheapest service. It will retain as at present the unlimited service rate at £5 17s. 6d., the second connection at £5 5s., and the service of 1,800 calls for £5, but the service of 1,000 calls, which hitherto has been charged £4, is to be raised to £4 5s.; and the £3 15s. toll service plus a halfpenny per call is to be abolished, while the £2 10s. service plus a penny per call is to be raised to £3 and a penny per call. The principal rates of the Post Office and the Portsmouth and Hull municipal services will therefore compare as follows:—

Calls.	P.O.	Hull. Business.	Hull. Residence.	Portsmouth. Business and residence.
1,000	£7 0 0	£5 0 0		£4 5 0
1,800	£9 10 0	£6 6 0	£5 0 0	£5 0 0
		(unlimited tariff)		
4,000	£14 0 0	£6 6 0	£5 0 0	£5 17 6
		(unlimited).		

Post Office Agreements.—On Monday, at Dublin, Mr. Justice Dodd decided that while telegraph apparatus and workmen were carried free of charge by the Great Southern and Western Railway of Ireland, under agreement with the P.M.G., the covenant did not cover telephone apparatus and employés, and therefore the carriage of these would have to be paid for.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Jamaica-Colon	May 6, 1909	June 8, 1909
Dakar-Conakry	May 13, 1909	
Tangier-Cadiz	May 19, 1909	
Paramaribo-Cayenne	June 8, 1909	June 27, 1909
Cayenne-Salinas	June 7, 1909	
Rome-Constantinople	June 14, 1909	June 16, 1909
Trinidad-Demerara	June 19, 1909	

CONTRACTS OPEN and CLOSED.

OPEN.

Acton.—July 12th. Lead-covered paper-insulated cables for the U.D.C. See "Official Notices" June 18th.

Australia. — MELBOURNE. — July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 KW., for the Council. See "Official Notices" May 14th.

MELBOURNE.—August 4th. Overhead travelling crane, for the Electricity Supply Committee. See "Official Notices" June 4th.

MELBOURNE.—August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

MELBOURNE.—July 7th. 18 transformers for the City Council. See "Official Notices" June 18th.

MELBOURNE.—July 7th. 80 A C. flame arc lamps for the Council. See "Official Notices" June 25th.

MELBOURNE.—July 23rd. Insulated copper cables for the Council. See "Official Notices" to-day.

Belfast.—Feeder panels for lighting switchboard in the Corporation electricity supply works. See "Official Notices" June 11th.

Belgium.—July 10th. The municipal authorities of Tongres are inviting tenders for the contract for the extension of the electric lighting undertaking.

July 14th.—Tenders are being invited until July 14th by the Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), for transformer sub-station plant (continuous to alternating current) in connection with the Spa-Verviers electric railway.

Canada.—WINNIPEG.—August 2nd and 16th. The city of Winnipeg is advertising for tenders for the hydraulic and electric equipment of the generating station now under construction on the Winnipeg River, at Thirty-foot Falls. The initial installation will consist of five direct-connected 3,000-K.V.A

60-cycle three-phase generating units, and two banks of transformers, each consisting of three single-phase transformers of 3,000 K.V.A. capacity. All electrical control and other auxiliary apparatus, excepting turbine governors, will also be tendered on at the present. Tenders for the hydraulic machinery are due on August 2nd, and for the electrical equipment on August 16th. The distribution of plans and specifications will be made from the office of Messrs. Smith, Kerry & Chace, Winnipeg, Man. The contractors at the site of the works have made good progress, have a large plant installed, have unwatered the power house, and will shortly begin placing concrete in the dams and walls of plant. The execution of the transmission line contract is well under way, and shipments of towers, cables and insulators will begin during June, July and August, respectively.

France.—July 21st. The Paris municipal authorities are inviting tenders for a 60-H.P. steam engine and a 40-KW. continuous-current dynamo at the Paris Municipal School of Physics and Industrial Chemistry.

Germany.—COLOGNE.—July 15th. The Städtische Maschinenbau-Amt requires tenders for four electrically-driven goods lifts for the harbour installations on the left bank of the Rhine. Particulars may be obtained at 1s. 6d. per set.

EMDEN.—July 20th. The Koenigliche Maschinenbau-inspection requires two electrically-worked bucket dredges.

SAARBRUECKEN.—July 19th. The Prussian State Railways require a number of cranes and a transporter bridge.

Gravesend.—July 3rd. Automatic stoker for the Electricity Committee. See "Official Notices" June 11th.

Hornsey.—Electric light installation for the North Harringay Schools, for the B.C. A reference to this matter appears in our "Business Notes" June 25th.

Italy.—VENICE.—July 10th. The Director-General of the Arsenal of Marine requires tenders for two lots of electric lamps and carriers estimated at £1,032. A deposit of 10 per cent. is required.

London.—ST. PANCRAS.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

Luton.—July 19th. 500-KW. steam-driven generator, and condensing plant for the Electricity Department. See "Official Notices" to-day.

Manchester.—July 13th. Special permanent way tramway trackwork for the T.C. (deposit £2 2s.). J. M. M'Elroy, General Manager, 55, Piccadilly, Manchester.

Pontypridd.—July 12th. Condensing plant, circulating pump, air pumps, pipe work, &c., for the U.D.C. electricity department. See "Official Notices" June 25th.

Rotherham.—July 13th. Meters for the Electricity Department. See "Official Notices" June 18th.

Salford.—July 12th. Re-wiring at the Royal Technical Institute for the Electricity Committee. See "Official Notices" to-day.

Spain.—The municipal authorities of Castellon are at present inviting tenders for the concession for the electric lighting of the town.

Stevenage.—The U.D.C. is prepared to receive applications from companies or persons willing to carry out its provisional order. See "Official Notices" June 11th.

Swansea.—July 7th and 14th. Arc lamps, resistances, choking coils, &c.; cables; arc lamp pillars, brackets and gear; arc lamp feeder pillars, joint boxes, &c., for the Corporation Electricity Department. See "Official Notices" June 25th.

Wallasey.—July 12th. Battery, reversible booster and switchboard for the U.D.C. See "Official Notices" June 25th.

Whitehaven.—July 20th. Lighting the Harbour Quays for five years, by electricity, gas, or other means, for the Harbour Commissioners. See "Official Notices" June 11th.

CLOSED.

Barking.—The Electricity Committee has received the following tenders for the supply of a 250-KW. three-phase alternator, switchboard and motor:—

	Sec. 1.	Sec. 2.	Sec. 3.
Brush Electrical Engineering Co.	£354	£112	£84
General Electric Co.	360	154	87
Crompton & Co. (accepted for Sec. 1)	340	175	90
Electric Construction Co.	405	116	83
Electrical Co.	395	128	100
British Thomson Houston Co.	402	143	110
Vickers, Sons & Maxim, Ltd.	456	169	91
Bruce Peebles & Co.	450	120	107
British Westinghouse Co.	438	135	118
Siemens Bros. Dynamo Works, Ltd. (accepted for Secs. 1 and 2) (Query)	536	102	80
Ferranti, Ltd.	—	109	—

Burnley.—The Education Committee has accepted the tender of Messrs. Simpson Bros., of Burnley and Hapton, amounting to £1,425, for the electrical installation at the new Technical School, as per specifications of the borough surveyor and electrical engineer.

Canada.—Our correspondent writes that the contract for the building of the electric line between Cobalt and Haileybury was let to the Nova Scotia Construction Co., of Sydney, C.B., for $125,000, work to commence within a week from the Cobalt end. The contract calls for the completion of the grading, ties and rails to be laid by September 1st. Final arrangements for power to operate cars have not yet been decided upon, but one of the various companies constructing plants on the Montreal River will supply it.

Dundee.—The offer of Messrs. Kelvin & White to supply the main switchboard for the Dundee Technical College, at a cost of £300, has been accepted.

Hounslow.—The D.C. has placed an order with Messrs. Babcock & Wilcox, Ltd., at £310, for a mechanical chain grate stoker.

London.—L.C.C.—The Highways Committee received the following tenders for roadwork and platelaying, exclusive of rails and special trackwork, in connection with the construction, on the underground conduit system, of tramways along the Victoria Embankment east of John Carpenter Street, Blackfriars Road, and Southwark Street:—

R. C. Brebner & Co.	(recom.)	£11,420	W. Manders	£13,599
Dick, Kerr & Co.		12,055	J. Mowlem & Co.	14,707
A. N. Coles		12,945		

Chief engineer's estimate .. £11,953

Messrs. W. T. Henley's Telegraph Works Co. are to receive the contract for low-tension cables required in the reconstruction of the Cambridge Road tramways, at a reduction of 1½ per cent. on the prices in their existing cable contract. The total is estimated at £2,750.

Messrs. Hadfield's Steel Foundry Co., Ltd., are to supply a junction and cross-over in connection with the tramway tracks leading into the Greenwich Road permanent way tramways depôt, at £515.

STEPNEY.—The result of the tenders for demand indicators for the next two years is as below:—

Chamberlain & Hookham, Ltd.	(not complying with specification)	£311
Engineering Instruments, Ltd.	(no sample)	400
B.I. & Helsby Cables, Ltd.	(not complying with specification)	405
Reason Manufacturing Co.	(recommended)	563
Electrical Co.	(no sample)	1,669
General Electric Co. (combined meter and demand indicator; meter not complying with specification)		2,397

For time switches for a like period the following tendered:—

Reason Manufacturing Co.		£559
Venner & Co.	(recommended)	818

WANDSWORTH.—An error crept into our last week's table of the tenders for the electric lighting and bell work at Putney Secondary School. The price quoted by Messrs. Tilley Bros. was £723, not £523.

MARYLEBONE.—The B.C. has accepted the tender of Cory & Son, Ltd., for the supply of 10,000 tons of coal to the electricity undertaking in the New Year, at 10s. 11d. per ton.

Margate.—The T.C. has accepted the tender of Messrs. Stuart & Moore for electrical fire alarm apparatus, at £68.

Middlesex.—The County Council on June 24th placed an order with Messrs. Dick, Kerr & Co., Ltd., for the construction, at an estimated cost of £45,500, of the Southbury Road, Enfield, tramway (Railway No. 4, Order, 1906). The work is to be done on the contract price on which the firm are constructing the Regent's Park Road, Ballards Lane, &c., and the Cricklewood Lane tramways.

Southampton.—The T.C. has accepted the tender of Messrs. P. Brotherhood, Ltd., at £60, for an air compressor for the tramways department.

The T.C. has received the following tenders for the supply of cable:—

1. Frankenburg & Sons. (*a*) 3,000 yards 1·0 sq. in. single-conductor cable (1) lead-covered —, (2) non lead-covered £1,770; (*b*) 1,500 yards 0·5 sq. in. single-conductor cable (3) lead-covered —, (4) non lead-covered £465.
W. T. Glover & Co. (accepted for *a* and *b*).—(*a*) (1) £1,828, (2) £1,794; (*b*) (3) £484, (4) £471.
St. Helens Cable and Rubber Co.—(*a*) (1) £1,862, (2) £1,817; (*b*) (3) £503, (4) £477.
Johnson & Phillips, Ltd.—(*a*) (1) £1,850, (2) £1,820; (*b*) (3) £490, (4) £476.
W. T. Henley's Telegraph Works Co.—(*a*) (1) £1,850, (2) £1,825; (*b*) (3) £493, (4) £477.
Western Electric Co.—(*a*) (1) £1,847, (2) £1,828; (*b*) (3) £491, (4) £478.
British Insulated and Helsby Cables, Ltd.—(*a*) (1) £1,853, (2) £1,830; (*b*) (3) £492, (4) £480.
Siemens Bros. & Co.—(*a*) (1) £1,873, (2) £1,840; (*b*) (3) £495, (4) £481.
Callender's Cable and Construction Co.—(*a*) (1) £1,950, (2) £1,900; (*b*) (3) £540, (4) £530.
Craigpark Electric Cable Co.—(*a*) (2) £2,200; (*b*) (4) £480.
New Gutta-Percha Co.—(*a*) (2) £3,180; (*b*) (4) £843.

Walsall.—The T.C. has accepted the tender of Messrs. Doulton & Co., Ltd., for 1,000 yd. of stonework troughing, at 5d. per yard.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, July 2nd. At 7.30 p.m. Visit to the engineering workshops and laboratories of the East London College.

NOTES.

Electricity Works Table.—We are informed that the voltage given in our table for Eltham (200 v.) under the heading "London—Woolwich, Plumstead and Eltham," is incorrect; the supply voltage there is 220 volts.

The Eight-Hours Act.—July 1st, 1909, is a day fraught with grave consequence to the mining industry, and indirectly to all the great manufactures of this country. It witnesses the coming into force of an Act which embodies a new principle, namely, control by the State of the number of hours which a grown man may do in a day. If an eight-hours day is prescribed for the miner, who shall say that it may not, in future years, be made unlawful for any artisan to exceed this "time limit"? We have grave misgivings as to the results of this class of legislation. Signs are not wanting that this very measure is likely to strain the relations of miners and employers, and there are certain remoter consequences which may be looked for. Let us glance at the text of the measure, which is now in force elsewhere than in the Counties of Durham and Northumberland. Sec. 1 (1) provides that, "Subject to the provisions of this Act, a workman shall not be below ground in a mine for the purpose of his work and of going to and from his work, for more than eight hours during any consecutive 24 hours. Then follows Sub-sec. (2), which enacts certain limitations to the application of the principal section, with the result that it is not intended to enforce a hard-and-fast eight-hours day. Sub-sec. (2) provides for overtime to be worked under certain circumstances, which are enumerated. It appears to amount to this—that the section will not be held to be contravened in cases where workmen are kept underground beyond the time limit if they are so detained to meet an emergency such as accident, danger, apprehended danger, or work requiring to be completed before the ordinary work in the mine can be resumed, which had required more time to complete than was foreseen. Sec. 1 also provides for a "shift" of workmen—that is, a body of men whose hours for beginning and terminating work in the mine are approximately the same. In such a case the legal period underground counts from the time the last workman in the "shift" leaves the surface up to the time the first workman in the "shift" returns to the surface. Later in the same section (Sub-sec. 4) it is provided that the periods of time occupied in lowering and raising a "shift" must have the approval of the Inspectors of the district. By Sec. 1 (7) (*a*) foremen, examiners, deputies, pump minders, onsetters, fanmen or furnacemen are entitled to be under ground 9½ hours, and apparently these men, or any of them, may be employed overtime like the regular miners. Subject to what has been said, there are but two sections which apply to relieve the employer from the rigour of this extraordinary statute. In the first place, an addition of one hour may be made to the working day on 60 days in the year. Again, in time of war, grave national peril or industrial disturbance, the King may, by Order in Council, suspend the operation of the Act for such period as he thinks fit.

Electrical Football League. — A special general meeting is being held on Wednesday, July 14th, at 7 p.m., in the offices of the St. James's and Pall Mall Electric Supply Co., Ltd. The last day for receiving applications from those clubs who intend joining, is Monday, July 12th. The hon. sec., Mr. J. W. Fraser, 59, Wearside Road, Lewisham, S.E., will be pleased to give any information required.

Cricket.—Aberdeen Corporation electricity department employés' cricket eleven met St. Williams C.C., and defeated them by 23 runs.

Morrison v. British Aluminium Co., Ltd.—In the Chancery Division on Tuesday, Mr. Cave, K.C., M.P., applied to Mr. Justice Warrington that Mr. A. W. Tait, C.A., be appointed receiver and manager of the company on behalf of the debenture stock-holders. The company, he said, was incorporated in 1894, and had a capital of over a million. Of its debenture stock, amounting to a million, £300,000 was reserved to pay off a Loch Leven security. The plaintiffs were the executors of the late Mr. Charles Morrison, and held £175,000. A great part of the company's property was the entire share issue of the Loch Leven Electric Co. The company had made large sales of aluminium, but the position at the present moment was one of considerable jeopardy for the holders of the large issue of stock. The company had endorsed bills amounting to £100,000, which were due that day, and had also borrowed from bankers, who were pressing for the reduction of the loan. Mr. H. E. Wright, for the company, said it did not offer any opposition to the application. The company had been very successful in the past, and it was hoped that with further working capital it would be even more successful in the future. The appointment was asked for in order to facilitate the reconstruction of the company. His Lordship appointed Mr. Tait receiver and manager, the managership not to extend beyond October 31st.

The Electrical Engineers' London Division (Territorial Force).—A good many members of the Corps were competing at the Stadium, Shepherd's Bush, in the Territorial Force Athletic, Swimming and Cycling Championships, on June 26th, and had the satisfaction of getting second in the grand aggregate for the £200 Challenge Trophy, just missing being the winners by one point, and beating the London Scottish by one point. Nine prizes were won by the Corps, as follows:—

High Jump Championship.—Sapper C. J. R. Stewart, 2nd Prize.
Quarter Mile Cycling Championship.—Sapper W. E. Cox, 3rd Prize; Second Corporal J. Roden, 6th Prize.
Five-Mile Cycling Championship.—Sapper W. E. Cox, 3rd Prize; Sapper A. E. Argent, 5th Prize.
110 Yards Swimming Championship.—Sapper A. J. Monk, 3rd Prize; Sapper A. R. Frazer, 6th Prize.
440 Yards Swimming Championship.—Sapper A. J. C. Williams, 3rd Prize.
120 Yards Hurdle Championship.—Corporal F. G. Engholm, 4th Prize.

Electric Shock Fatalities.—It is reported that on 24th ult., while John Smith, of Armley, was employed by the Leeds Forge Co. erecting an electric crane, he accidentally put his arm upon a live wire, which immediately ignited his clothing. It was found that death had been instantaneous.

It is also stated that Samuel Higgs and Daniel Eyre, miners, were killed by electric shock on 28th ult. at the Clifton Colliery, Nottingham, where they were working upon an electric coal-cutting machine. Eyre, the motor driver, discovered that there was something wrong with the machine. He pulled the starting lever, but immediately fell to the ground lifeless. Higgs, who, it is said, was not touching the machine, was next seen to fall backwards. His face was badly bruised, but when comrades went to his assistance, it was found that he was still breathing. Artificial respiration was tried, but without avail.

Manchester Engineering Dispute Settled.—According to the *Financial Times*, the wages dispute in the Manchester and district engineering trade was amicably settled on 24th ult. Masters' and men's representatives met in conference to consider the proposed reduction of 1s. per week in time rates and 2½ per cent. on piece rates. It was ultimately agreed to recommend that the present rate of wages should remain undisturbed for a period of five years from July, and that any subsequent alteration should be subject to two months' notice.

Annual Sports.—Portsmouth Corporation Tramways Social and Athletic Society held their second annual sports meeting on Wednesday last week, when they carried through a long programme of over forty events. Our correspondent says that the racing was of a high order, and the events were keenly contested. The chairman of the Committee was Mr. W. R. Spaven, the manager of the tramways; Mr. V. G. Lironi was vice-president, and the hon. sports secretary was Mr. P. H. Roscoe. One of the most popular events of the afternoon was the tug-of-war between police and tramwaymen, in which the first-named proved to be unpopular with the public.

Appointments Vacant.—Switchboard attendant for Stockton-on-Tees electricity works (27s. 6d.); Electrical engineer as manager of the Pontypool electric light and power station (£125); Tramways clerk for Rawtenstall (25s.). See our "Official Notices" to-day.

Fair Wages Clauses.—A committee has been appointed to advise the Departments of Government with a view to promoting uniformity of administration and co-operation between Departments in dealing with the Fair Wages Clauses of Government contracts.

National Electrical Manufacturers' Association (Inc.).—A committee meeting of this Association will be held at the offices, Balfour House, Finsbury Pavement, E.C., on Tuesday, July 13th, at 2.30 p.m.

Institution and Lecture Notes.—The Iron and Steel Institute.—The autumn meeting will be held in London from Monday to Thursday, September 27th to October 1st. The mornings of Tuesday and Wednesday will be devoted to the reading and discussion of papers at the Institution of Civil Engineers, Great George Street, Westminster. The afternoons of Tuesday and Wednesday will be devoted to visits to works and to places of interest in and around the metropolis. These visits will include the Royal Arsenal, Woolwich; the works of Messrs. Siemens Bros., Woolwich; the generating station of the L.C.C. at Greenwich; the works of Messrs. Fraser & Chalmers, Ltd., Erith; the Lambeth Potteries of Messrs. Doulton & Co., Ltd., and the motor-car works of Messrs. Napier & Son, Ltd., Acton. A visit will also be arranged to the Royal Small Arms Factory at Enfield and to the National Physical Laboratory, Teddington. On Thursday afternoon the Lord Mayor and the Lady Mayoress will hold a reception at the Mansion House. There will also be visits to the Mint, to the Halls of several of the City Companies, and to the places of interest in the City. On Friday, October 1st, it is hoped to arrange an excursion to Portsmouth, to visit any men-of-war that may be there on that day.

Institution of Mining Electrical Engineers.—At a meeting on Saturday last, held in Newcastle, it was decided to form a local centre of the Institution. Mr. H. J. Fisher, Burn House, Shiney Row, Fence Houses, Durham, is honorary secretary *pro tem.*

The formation of a branch in Scotland is projected, and a meeting for this purpose will take place on Saturday, July 3rd, at 7 p.m., at the offices of the Institution of Engineers and Shipbuilders in Scotland, Elmbank Street, Glasgow.

Mining Students' Association.—Prof. F. G. Baily recently lectured on the dangers to be guarded against when electricity was employed in coal mines, and suggested that the men responsible for the safety of mines, both managers and inspectors, should have a more exhaustive training in all parts of the knowledge they were supposed to possess, that they should be paid more liberally, and that facilities should be afforded for the testing of electrical mining plant under realistic conditions.

Conversaziones.—On Wednesday evening the annual Conversazione of the Institution of Electrical Engineers took place at the Natural History Museum. We shall refer to it more fully next week. On the previous evening the Royal Society of Arts Conversazione was held at the same place, Sir W. H. White receiving the guests.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. A. Hamp, charge electrical engineer at the Metropolitan Railway Co.'s Neasden power station, was presented by the staff, on June 23rd, with a cabin trunk, as a token of esteem, the occasion being Mr. Hamp's departure from Neasden to Brazil, to take up the position of chief electrical engineer to the San Paulo Railway Co.

Tramway Officials.—Mr. H. E. Blain, tramways manager of West Ham, was voted an increase in salary of £100, to be followed by two subsequent annual increments of £50 each, at the meeting of the West Ham Council held on the 22nd inst.

General.—We learn that Mr. Henry W. Bowden, M.Inst.C.E., M.I.E.E., after about 18 years as managing and chief engineer of the Brompton and Kensington Electric Supply Co., Ltd., is resigning that office, and is accepting the position of consulting engineer to the company—a more or less permanent appointment. Eighteen years is a long time to look back over in connection with London electricity supply, but it is within our recollection that when Mr. Bowden took charge of this undertaking the £5 shares were being bought for a very low figure indeed by those who believed in the future of the company and in Mr. Bowden's management thereof: and since then the company has made good progress and achieved excellent results. It will, no doubt, be satisfactory to the shareholders to know that Mr. Bowden's intimate knowledge of the company's affairs is to be retained under the above arrangement. Mr. Down will take up the management (dating from July 1st), and for a time he and Mr. Bowden will act more or less in co-operation. Mr. Down will zealously devote himself to winning the new consumer by the aid of the metal-filament lamp, and in other ways. Our readers are aware that Mr. Bowden is also actively interested in the South Metropolitan Electric Light and Power Co., Ltd., and in the Woking Electric Supply Co. The South Metropolitan Co. has had an uphill fight, and although there may be a temporary fall in revenue owing to the on-coming of metal-filament lamps, the concern has a good future before it, and more particularly so if it can succeed in tapping the small consumer—a class of resident that is very largely in evidence in its area. The company has already made an interesting and enterprising beginning in this direction by taking a house in Springbank Road, close to Hither Green Railway Station and fitting it up with a model installation, wiring and furnishing it suitably for the resident paying, say, from £35 to £40 per annum rental. The South Metropolitan already claims third position among the London companies for low costs, with an output of rather less than one-fourth of that of its competitors, and if it can succeed in tapping this large source of revenue it will greatly improve upon that position. We are asked to state that all communications for Mr. Bowden should be addressed to him at 30, Craven Street, Strand, W.C.

The Worcester City Education Committee has appointed Mr. C. E. Abell as instructor in electric lighting at the Art, Science and Technical Schools; and Mr. F. W. Coomber as instructor in electric wiring.

The Watford D.C. has increased the salary of Mr. C. S. Taylor, mains superintendent, from £95 to £110, rising to a maximum of £130 by annual increments of £10; Mr. G. A. Ayre, shift engineer, has been placed on the same scale as the other two engineers, viz., £90, rising to £100 by annual increments of £5.

On Saturday last, the 26th ult., a pleasant function took place at the Victoria Hotel, Manchester. A meeting was held of the district managers of the Edison & Swan United Electric Light Co., Ltd., for the purpose of presenting a testimonial to Mr. O. H. Bishop, sales manager to the company, who has resigned after 18 years' service in order to take up other duties. The presentation took the form of an illuminated address and a service of silver subscribed for by the whole of the district managers and the heads of departments of the Northern works of the company. During the same week Mr. Bishop was presented with a gold cigarette case and an address by the sales department staff, and with a gold-fitted dispatch-case and a gold-mounted letter-case by the heads of departments at the Ponder's End works.

It is announced that in view of his advanced age, Mr. T. E. Vickers, C.B., has resigned the chairmanship and managing directorship of Vickers, Sons & Maxim, Ltd., after services to the company extending over 60 years. Mr. Albert Vickers has been elected chairman of the company, and Lieut. A. Trevor Dawson, R.N., has been appointed managing director.

The Aberdeen staff of the National Telephone Co., Ltd., presented Mr. James Kerr, electrician, with a timepiece on the occasion of his marriage. A pleasant gathering was presided over by Mr. T. Mackenzie, contract manager, and the gift was handed over by Mr. E. E. Stockens, district manager.

Mr. A. Henderson was presented with a chronograph stop-watch and chain by the staff of the electrical department of Messrs. John Brown & Co., Ltd., Clydebank, on the occasion of his leaving to take up the post of electrical engineer to Messrs. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, Scotland.

Messrs Kincaid, Waller, Manville & Dawson have removed to St. Stephen's House, Victoria Embankment, owing to the lease of 29, Great George Street, having been acquired by H.M. Office of Works. The firm's telegraphic address and telephone numbers remain unaltered.

NEW COMPANIES REGISTERED.

Power Transmission Syndicate, Ltd. (103,581).—This company was registered on June 18th, with a capital of £40,000 in 39,500 cumulative preferred participating ordinary shares of £1 each, and 10,000 deferred shares of 1s. each, to adopt an agreement with E. Hess Remanda, and to carry on the business of electricians, generators, accumulators, distributors and suppliers of electricity, engineers, proprietors of tramways and railways, omnibuses, motor-cabs, cars, carriages, vans and conveyances of all kinds, &c. The subscribers (with one share each) are:—H. P. Surtees, 43, Bedford Row, W.C., solicitor; A. A. Surtees, 43, Bedford Row, W.C., solicitor; W. Hicks, 5, Oxford Gardens, W., solicitor; F. J. Abbott, 233, Clarence Road, Kentish Town, N.W., clerk; G. L. Devisse, 17, Pembroke Street, King's Cross, N., clerk; R. B. Phillpotts, 4, Bishopsgate Street Within, E.C., solicitor; F. J. White, 481, Lea Bridge Road, Leyton, N.E., clerk. Minimum cash subscription 10 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than ten; the first are W. Scott-Scott and E. Hess Remanda; qualification, 100 shares; remuneration, £50 each per annum (chairman, £100) and 1 per cent. each of the net profits remaining after 7 per cent. has been paid on the preferred participating shares. Registered by Surtees, Phillpotts & Co., 4, Bishopsgate Street Within, E.C.

CITY NOTES.

South Metropolitan Electric Tramways Co., Ltd.

The meeting of the company was held on Monday, at the Federation Offices, Kingsway, Mr. C. G. Tegetmeier presiding. The Chairman, in proposing the adoption of the report, said that both branches of the company's business had been unfavourably affected by the trade depression which had existed for some time past. With regard to the tramway side of the business, as they were aware, the prevailing bad times had affected the majority of tramway undertakings. Their line ran principally through the open country, and was constructed with a view to the future development of the districts. That development had been retarded by the bad times, but it would come sooner or later. The effect of the trade depression was very pronounced on the company's traffic, and that had been accentuated by their having had a disproportionate number of wet week-ends. The result was that the receipts on the tramway undertaking showed an increase of only £470 over those of the previous year. They had actually carried a less number of passengers, but the small increase was due to the average distance travelled being longer. They had effected practical economies in the working where it had been possible. The power and running expenses showed a reduction of £1,392, but on the other hand, the cost of repairs and maintenance, which necessarily tended to increase rather than decline, had gone up by £832. Out of the total amount of £10,017 for power expenses, £8,545 was expended for current purchased. As the shareholders were aware, they were under an obligation to buy in bulk all their current for the working of their trams from the Croydon Corporation and the Beckenham U.D.C., and the price they paid was 2d. per unit in the case of the first-named and fractionally less to Beckenham U.D.C. A saving of many thousands of pounds would be effected if they were able to generate their current at their own power station. As to the electricity supply section of the business, it was satisfactory to find that they had added 202 new customers, representing to their mains an increase of 34 per cent. Unfortunately, that increase of 34 per cent. had only resulted in an increase of 9 per cent. in the amount of current sold. The explanation was to be found in the adoption of the metallic-filament lamp. The lessened individual consumption and the large increase in the number of customers continued to be a marked feature of the company's operation. As an instance, from the March quarter of this year, in spite of an increase of 23 per cent. in the number of their private lighting consumers, the amount of current sold only increased 2 per cent. Turning to the profit and loss account, whilst the balance from the working account of the two branches of the business was £1,192 more than in the previous year, sundry receipts and interest together showed a decrease of £1,591, and on the other side of the accounts the administration and general expenses had increased £1,104. The result was that the net profit for the year amounted to £7,777, as compared with £8,477 last year, and with the £470 brought forward from last year, they had an available balance of £8,208. The payment of the dividend on the preference shares for the first half-year absorbed £4,904, and the directors recommended £3,000 to be placed to depreciation and reserve, thus leaving £304 to be carried forward. They regretted not being able to recommend the payment of a further dividend on the preference shares, but he was sure the shareholders would fully agree with the conservative policy of the board in strengthening the position of the company.

Mr. Devonshire seconded the motion, and the report was adopted.

J. G. White & Co., Ltd.

Lord Arthur Butler presided at the offices of the company, Cloak Lane, E.C., on Monday over the tenth annual meeting, and in moving the adoption of the report (see Electrical Review, June 25th, page 1057), said the generally adverse business conditions and the very severe competition existing in the construction business had made the company's work difficult, but the figures in the balance-sheet indicated that these difficulties had been satisfactorily met, the profits for the year showing an increase over those at February 28th, 1908. The directors felt, therefore, that the shareholders were to be congratulated upon the results of the year's trading. Taking up the items in the balance-sheet, it would be seen that the item of cash in hand and loans at call against securities was very large. In fact, the cash assets of the company were practically equivalent to the whole preference capital. This was well, in so far as it proved that the assets were liquid, but unsatisfactory in so far as it indicated a reduced turnover. The profit and loss account, however, showed that the company's resources and credit were being employed in a manner which earned satisfactory returns, though not quite what they would do with better general business conditions. The actual cash and call loans of the company were equal to twice the whole indebtedness at the date of the balance-sheet. This indebtedness was entirely in connection with ordinary open accounts, the company having no moneys borrowed. The item of investments now standing at £109,429 15s. 5d. was considerably lower than the corresponding amount in last year's balance-sheet, certain securities having been disposed of in the meantime. He might mention that without exception the securities sold had realised more than the amounts at which they were taken in last year's accounts, thus showing that they had been conservatively valued. The directors believed that the present valuation of securities was equally conservative. The next item of contract retention and work in progress was self-explanatory. All doubtful items had been fully provided for, and this amount of £87,767 14s. 8d. was an asset which would be collected as the maintenance periods of their various contracts ran out, and as contract work was completed, while at the same time corresponding sums were being invested in new construction business. The valuation of plant, material in hand, &c., was nominal, having been taken at practically a scrap value basis, and not at its value to the company in carrying on its ordinary business. The item of goodwill stood at the same figure as last year, but the reserve fund of the company, if they considered favourably the recommendation made to them that day, would be more than double the amount of this item. The debit side of the balance-sheet required no comment beyond saying that the item of sundry creditors, &c., consisted of ordinary trade accounts in connection with the carrying on of the company's business, and the necessary provisions for contingencies. Regarding the future prospects of the company, he might say that business now in hand ensured satisfactory profits for the current year, and negotiations were progressing favourably for the securing of a considerable amount of new work. After deducting the dividends recommended in the report, amounting to 8 per cent. on all classes of shares for the year, the company's reserve fund would stand at £100,000, and the profits carried forward amounted to £15,460, making a total accumulated profit now in the business of £115,460. The directors believed that a conservative policy was in their interests, and that the accumulation of substantial reserves greatly added to the value of their investments.

Mr. J. B. White seconded the motion, and the report was adopted.

Indian Electric Supply and Traction Co., Ltd.

Mr. John G. B. Stone presided on Monday over the annual meeting of this company, held at Orient House, New Broad Street, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, June 25th, page 1057), expressed the disappointment of the board that better results had not been achieved. The small demand at the commencement of supply was mainly the cause. The recent growth of the business as shown by the percentage of increase expressed in number of lamps connected, was encouraging enough. A good deal of their trouble might be attributed to the compulsory laying of mains through certain areas in the city. A compulsory area might be a not unreasonable condition attaching to a right to supply electricity in this country, but events had proved that it was quite unsuitable in a city like Cawnpore. The enterprise was started with the idea that the supply of current would be readily taken by both Europeans and natives, but the results so far obtained, showed that the people had been very slow to appreciate the advantages of electrical supply, though at last they were experiencing a more rapid increase in demand. As its advantages for power purposes became better appreciated, they might look for a good business being built up among small power-users. As regards the larger power-users, they had secured a footing in two of the large mills, and hoped eventually to obtain the supply of a considerable portion of their motive power. It had been suggested that they should extend their mains to the Cantonments, where they might secure a good demand, but the price at which the military authorities would enter into a contract, did not justify the capital expenditure involved. That was to say, while they might get a return on the new capital outlay, the existing capital would not be benefited. The board had felt that in order to deal with questions arising in Cawnpore, the assistance on the board of someone thoroughly acquainted with the problems of electrical supply, and who at the same time, had some personal knowledge of Cawnpore itself would be beneficial, and he was glad to say they had been fortunate enough to secure Mr. Scott Moncrieff as a director. Mr. Scott Moncrieff had gone thoroughly into the position and prospects, and regarded the development of the supply side of the business only as a matter of time. Unfortunately it would be necessary to raise further money for the purpose of liquidating their debts and for making necessary extensions. For this purpose some proposals were being drawn up for the consideration of the creditors, and a definite scheme when agreed upon would be submitted to the shareholders. The scheme would involve considerable modification of the agreements with the agents and the secretaries, and the spirit in which it had been met was an indication of their desire to sink personal considerations and to make the company a success. The consent of the contractors would also have to be obtained. No underwriting commission was paid on the issue of capital for the company, and the interest on the construction debentures has gone into the pockets of the shareholders themselves. With regard to the tramway, on the advice of the local agents, a very low scale of fares was adopted, the idea being to teach the natives to ride and to popularise the service. The result was to encourage traffic, but the rates were unremunerative. In order to deal with this question, Mr. Pfeiffer, who was the general manager of the Calcutta Tramways for some time, was sent out to report on the situation generally, but more especially on the tramway and the question of fares. He strongly advocated raising the fares, and the board adopted his suggestion. He would like to emphasise the fact that India generally, and the United Provinces particularly, had been passing through a period of great stress, and the population had had very little money to spend. The tremendous drop in the railway earnings generally afforded ample proof of this. Things were reported to be now improving, and they might hope to benefit considerably as the depression passed away. He should add that they had received encouragement and assistance from the Local Government and the municipal authorities of Cawnpore, who were evidently anxious to see the successful development of electrical enterprise in their city. The mail received that morning give the result of the May working, which was a surplus over local costs of Rs. 2,503/14/3 on the supply side of the undertaking, and a deficit of Rs. 827/0/5 on the tramways, which compared with a surplus of Rs. 1,160/2/6 on supply and a deficiency of Rs. 1,301/10/11 on the tramways in May last year, the combined figures showing a surplus this year of Rs. 1,676/13/10, against a deficiency last year of Rs. 141/8/5. They had also received a cable which enabled him to bring down some of the figures given in the report to a later date. Up to June 19th the units delivered to consumers were 95,925 this year, against 52,701 in 1908. The number of lamps connected to the mains on June 19th was 13,700, a further 1,000 were in course of connection, and preliminary inquiries had been received for 3,900 more.

Mr. W. H. Cheetham seconded the motion, and the report was adopted.

Prospectuses.—*Tangkah Rubber Estate, Ltd.*—This company has been offering for subscription an issue of 62,500 6 per cent. preferred participating shares of £1 each. The estate consists of about 11,000 acres, situated in Johore, about 80 miles north of Singapore.

Jong-Landor Rubber Estates, Ltd.—This company is offering for subscription, the list closing to-day, 55,000 shares of £1 each. The company purchases two estates in the State of Perak, comprising 1,294 acres of rubber lands, of which 1,053 acres are under rubber.

Federated (Selangor) Rubber Co.—The report for the year ended March 31st states that the amount of rubber harvested was 59,694 lb., as compared with 23,618 lb. in the previous year, and the average gross price realised per lb. was 4s. 8¾d., against 3s. 7½d. last year. There were 34,072 trees tapped during the year, giving an average of 1¾ lb per tree. The directors recommend a final dividend of 25 per cent., making 35 per cent. for the year, carrying forward £953.

Barbados Telephone Co., Ltd.—At the half-yearly ordinary general meeting the chairman had only continued progress to report. During the current half-year the increase over the previous half-year in the supply of telephones was 35. The revenue had increased, and the available balance was $4,243, as against $3,778 previously. The dividend declared for the half-year was 4 per cent., and $1,170 was paid to the deposit account, which practically formed the reserve. There were now 705 telephones in use, producing a half-yearly rental of $9,307. Expenditure was $4,233 and maintenance cost another $1,136, leaving the surplus before stated.

Switzerland.—La Société de la Fabrique d'Accumulateurs d'Oerlikon, of Zurich, is declaring a dividend of 20 fr. per share for the last financial year.

La Société Electrique Vevey-Montreux, of Territet, is declaring a dividend of 8 fr. per share for the last financial year.

Turkey.—La Société de Tramways et Eclairage Electriques de Damas reports a profit of £637 for the last financial year.

Italy.—La Societa Italiana di Elettricita Edison, of Milan, is increasing its capital from £600,000 to £720,000.

British Electric Traction Co., Ltd.

The directors have issued their report for the year ended March 31st, 1909. As on former occasions, they submit various schedules giving particulars of the items appearing in the balance-sheet and profit and loss account, and also schedules showing the business done and dividends paid by the associated companies. In the last annual report reference was made to the formation of the British Electrical Federation for the purpose of enabling the associated companies to obtain various services on a co-operative basis; and a pamphlet setting forth further particulars concerning the companies included in the Federation, accompanies the present report. These various schedules and the particulars mentioned, give to the shareholders full information concerning the company's position and investments.

The subscribed share and debenture capital of the company remains the same as at March 31st, 1908, viz.:—

£1,333,010 in ordinary shares of £10 each.
£1,614,370 in 6 per cent. cum. pref. shares of £10 each.
£1.473,653 in 5 per cent. perp. debenture stock.
£528,936 in 4½ per cent. second debenture stock.

£4,949,969

The amount standing at the credit of reserve account is £602,420. In addition, reserves amounting to £59,162 have been made out of profits against loss or depreciation of specific assets. The various associated companies have created depreciation and reserve funds of their own, which amounted at December 31st, 1908 (including balances carried forward), to £1,015,340. The total amount due to creditors at March 31st, 1909, was £65,228, and of this £46,623 was in respect of debenture interest accrued at March 31st, 1909, which has since been paid. Investments and undertakings stand at £5,037,095, and consists of shares and debentures in associated tramway, electricity supply, manufacturing and other companies, consols, and sundry securities and undertakings set out in one of the schedules. It is made up as follows:—

Consols of the par value of £200,000. Standing in the books at ..	£196,374
Debentures in various companies of the par value of £486,147. Standing in the books at	454,942
Shares in various companies of the par value of £4,428,508. Standing in the books at	4,244,211
	£4,895,527
Capital expended at Barrow, Brighton and Mumbles, *less* reserve of £12,500	141,568
	£5.037,095

Investments standing in the books at £2,883,086 were revenue-earning during the past year, and produced an average return of 4·18 per cent. Investments standing in the books at £2,012,441 did not earn any revenue during the year. The amount of sundry debtors and debit balances stands at £473,680, and shows a reduction on the amount at March 31st, 1908. The expenditure on and in connection with the new office building which has been erected for the British Electrical Federation amounts to £36,188. There is a further sum of £3,274 in respect of other buildings and land. Expenditure on Acts of Parliament, &c., stands at £19,641, and represents expenditure on promotion of Acts of Parliament, light railway orders, and other rights and powers, surveys, negotiations, &c., in connection with various schemes, some of which may not be proceeded with. The amount is being written down annually by 20 per cent. The item stock stands at £9,876, and represents the stock of cars on hire to associated companies, electrical equipments, paving setts and general stores. Provision has been made for depreciation. Goodwill stands at £1,000, and is the balance of a larger amount. Furniture stands at £4,120.

The net profit after reserving £12,500 against depreciation of undertakings worked by the company, buildings and freehold land, stock, doubtful debts and expenditure on undertakings not proceeded with, is £130,726, to which must be added the sum of £35,394 brought forward, making a total of £166,119. After deducting the interest on the 5 per cent. debenture stock and the 4½ per cent. debenture stock for the year, amounting to £97,485, there remains a balance of £68,635, out of which a dividend has been paid on the preference shares at the rate of 3 per cent. for the year, amounting to £48,431, leaving a net balance of £20,204, which the directors propose should be carried forward. The full dividend on the 6 per cent. cumulative preference shares of the company has been paid to March 31st, 1908.

The directors regret that the dividends and interest received from the associated companies during the past year show a diminution of £33,332. The decline in profits has been general throughout the country, and is attributed by many of the companies to the severe depression in trade which has prevailed. A few of the undertakings in England and those at Bombay and Auckland, however, show increased takings per route-mile, which are sufficient to increase the average over the whole of the systems. The total number of passengers carried shows a small increase, the route-mileage of lines worked having slightly increased during the year, but the number of passengers carried per route-mile of line has fallen from 662,726 to 654,770. The effect of this decline in the number of passengers per route-mile has been somewhat counteracted by a small increase in the average fare per passenger, which was 1·23d., as against 1·21d. for the previous year. It has been pointed out in previous reports that the average fare per passenger had steadily fallen from 1·38d. in 1901, to 1·21d. in 1907, in which year the directors announced their intention of making every effort to improve the position by increasing fares, shortening fare stages, and eliminating unremunerative services. They are glad to note that their efforts have succeeded in arresting the decline, and that the present year's figure shows a small increase. The general depression in trade has been severely felt by the electrical manufacturing companies. (The annual report of the Brush Co. is quoted as evidence.)

The general charges and expenses of administration again show a material reduction, being £16,868, as compared with £24,186, the reduction on this occasion being mainly the outcome of the formation of the British Electrical Federation. In the last annual report it was stated that the directors were giving consideration to some of the proposals for electrical enterprise submitted to them from countries where the conditions for the investment of capital are more favourable than in this country, and they are glad to say that the prospects of securing such business are encouraging. The company has already secured a substantial participation in a powerful syndicate, which has been formed in association with German and other Continental banks, for the purpose of negotiating with the municipality of St. Petersburg for a concession of tramways in that city. Other negotiations are pending in regard to various enterprises abroad.

The Poole undertaking in which the company was largely interested, was purchased by the Bournemouth Corporation under an agreement which provided that the purchase price should be settled by arbitration, on the basis of fair market value as a going concern, and that in addition to such price the Corporation should pay certain liabilities of the company. In regard to the latter items litigation arose and, although the Court of Appeal had given a unanimous decision in favour of the company, the Corporation appealed to the House of Lords. The litigation has recently been concluded by the decision of the House of Lords in favour of the company on all points, and in the result the shareholders of the Poole Co. will have received a return of their capital in full, together with a premium. While it is not possible to draw from this a general conclusion applicable to the undertakings of the associated companies, the directors consider that this result affords some indication of the value of a successful tramway undertaking when sold upon an equitable basis.

The directors deeply regret the loss by death of their colleague the Right Hon. H. O. Arnold Forster, M.P. The Hon. Arthur Stanley, M.P., accepted the invitation of the directors to fill the vacancy, but immediately afterwards resigned his seat at the board, pending the determination of a business in which he has conflicting interests. The directors who retire this year are Mr. J. S. Raworth and Mr. P. Debell Tuckett, who, being eligible, offer themselves for re-election.

Birmingham and Midland Tramways, Ltd.

The report of the directors for the year ending December 31st, 1908, states that the total revenue from all sources was £97,004, compared with £83,838 for the preceding year. The expenses amounted to £45,640 compared with £38,653 for 1907. After providing for all expenses chargeable to revenue, including sums payable to corporations, repairs and maintenance, placing £1,500 to renewals account, and adding the £83 brought forward, there remained £49,948 from which must be deducted—interest on loans £10,429, interest on debenture stock £15,588, dividend for the year on 5½ per cent. preference shares £11,538, leaving a balance of £12,392, which the directors proposed to apply as follows:—Placed to debenture redemption fund £3,550, dividend on the preferred ordinary shares at the rate of 2½ per cent. for the year ended December 31st, 1908, £8,750, carrying to next account £92. The gross receipts from the tramways amounted to £45,826, compared with £44,751 in 1907. The gross receipts from the lighting and power departments amounted to £14,961, an increase of £6,658. The expenses were £9,223, an increase of £3,972. The interest and dividends received from investments produced £33,551, compared with £26,338 for 1907. The total expenditure on capital account during the year on the tramway undertaking was £1,054, and on the lighting undertaking £11,002. Generating plant, &c., valued at £1,527 was transferred from the tramway undertaking to the lighting undertaking, and electrical plant, cables, &c., in Oldbury, valued at £7,181, were sold to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

As foreshadowed in the last report, the company acquired a controlling interest in the Shropshire Power Co. at the beginning of last year, and subscribed for 57,312 shares of £5 each in that company. This subscription was made to enable the Shropshire Power Co. to comply with the provisions of its Acts of Parliament. The money will be gradually required by the Shropshire Power Co. to purchase generating stations and generally to develop its business, but pending the purchase of properties forming part of the company's electric light and power undertaking, the funds not required by the Shropshire Power Co. have been deposited at interest with the company. With the consent of the debenture trustees, the Smethwick power station has been withdrawn from the specifically mortgaged premises, and 25,152 shares of £5 each of the Shropshire Power Co. have been substituted, and the station will be sold to the power company as soon as the necessary legal preliminaries have been arranged. In accordance with the trust deed, a sum equal to 1 per cent. on the debenture stock issued, together with interest on the stock purchased and cancelled, was paid to the trustees in July last, and was applied by them in the purchase and cancellation of £4 100 of stock. The total amount of debenture stock now outstanding is £344,357. An agreement has been entered into with the Corporation of Dudley which provides for the payment of the purchase money by the Corporation, £10,631, on fixed alternative dates during the present year with interest from January 1st last to the date of payment at the rate of 4½ per cent. per annum. The terms of the lease have been agreed, and a Bill in Parliament is being promoted by the Corporation in the present session to empower the Corporation to grant a lease to the company of the tramways purchased for 30 years from January 1st, 1909.

The supply of current to power and lighting consumers has developed satisfactorily. The comparison at December 31st, 1908, in the equivalent of 8-c.p. lamps was as follows:—

	1906.	1907.	1908.
Lighting	3,940	8,437	9,821
Power	8,956	18,326	75,630
Tramways (approximate) ..	25,000	25,000	28,333
	37,896	51,763	113,784

In order to provide for the increased demand on the power station anticipated next winter, it has become necessary to order a 2,000-kw. turbine set for delivery in the autumn. The supply for the consumers in the district of Oldbury is now sold in bulk to the Shropshire Co. at the Smethwick boundary, and is distributed by that company. The introduction and extensive adoption of metallic-filament lamps has temporarily checked the rapid increase in the supply for lighting, but notwithstanding this, the actual increase is about 15 per cent. over the previous year. Unforeseen delays have occurred in completing the arrangements for the transfer to the Shropshire Power Co. of the electric light and power supply business of the company in consequence of its having been found necessary to apply to the Board of Trade for a new provisional order authorising the transfer of the Smethwick Electric Lighting Order. A new order will therefore be applied for, but cannot be granted until August of next year, before which it will not be possible to complete the proposed arrangements.

The working of the company's undertaking by the Birmingham and Midland Tramways Joint Committee continues to show satisfactory results, and the arrangements have been further continued.

The registered offices of the company have been removed to Electrical Federation Offices, Kingsway, London, W.C.

Owing to pressure of other engagements Sir Ernest Spencer resigned his seat on the board of the company, and Mr. W. G. Bond has been appointed to fill the vacancy.

The report contains extracts from the associated companies.

TRAMWAYS.

	Year ended Dec. 31st, 1907.	Year ended. Dec. 31st, 1908.
Miles open—Route miles	12·10	12·10
Single line	5·41	5·41
Double line	6·69	6·69
Passengers carried	10,732,605	11,006,985
Average receipts per passenger	·99d.	·99d.
Average expenditure per passenger (apart from rent of line, &c.)	·65d.	·69d.
Proportion of expenses to receipts..	65 %	69 %
Cars in stock	58	58

Smethwick Power Station.—The following is a statement of electricity generated, sold, &c., for 12 months ending December, 1908:—

Units generated	6,202,588
Quantity sold.—Traction section	1,492,760
Private consumers by meter	3,602,834
Total sold	5,095,594
Used on works	382,004
Total accounted for	5,477,598
Not accounted for	724 990
Total maximum supply demanded	2,000 KW.

The meeting was held on Tuesday last week at the Electrical Federation offices, Kingsway, Mr. J. A. Lycett, the managing director, presiding, in the absence of the chairman, Mr. C. S. B. Hilton, who is in Canada.

In proposing the adoption of the above report, the CHAIRMAN said the year had not been one of many changes, and little of striking interest had transpired. In the balance-sheet they would notice that a further amount of debenture stock had been redeemed and cancelled under the trust deed, so that their liabilities were steadily diminishing. Under the item of loans against securities, there was a large increase, which was accounted for in whole by the loan from the Shropshire Power Co. At the meeting last year it was explained that the directors considered it would be in the interests of the company to acquire a controlling interest in the Shropshire Power Co., and they had since bought and paid for 57,312 shares of £5 each. Owing to delays which, from various unavoidable causes, had occurred in the transfer of the Smethwick power house to that company, and in other directions, the Shropshire Co. did not require all its funds, and deposited them with their company. Meanwhile, the dividends received balanced the interest paid within a small sum; and as the Shropshire Co. gradually increased its business, that loan would be gradually reduced. Turning to the other side of the account, the item of discount in respect of debenture interest was shown separately for the first time in accordance with the provisions of the new Act, and there was also an increase under the head of investments, which was accounted for by the investment in the Shropshire Power Co. Amongst the investments to which the auditors had drawn special attention was that in the Birmingham and Midland Motor Omnibus Co., which caused continued anxiety to the directors. The motor-'bus business had been unfortunate and did not pay, especially in face of the Corporation's electric tramway system. However, it was considered best to carry on the service, particularly where there was no direct tramway competition, rather than to dispose of the assets at a disadvantage at the present time. On the whole, they might take it that the financial position of the company was sound and strong. Coming to the working accounts, the lighting section showed a very satisfactory increase of about £6,600, while the expenses had increased only by £4,000, leaving a net increase of £2,600 to transfer to profit and loss, a result on which they might fairly congratulate themselves. In the traction section the working account showed that they had rather more than held their own with an increase of £960, but the expenses owing to a fuller service and the increase of rates, taxes, &c., had increased by £2,713, the net result being that about £400 less was transferred to profit and loss—not an altogether satisfactory result, but one of which during a year of unprecedented trade depression they must not complain. Coming to profit and loss, while the balance from the working accounts showed an increase of £2,300, sundry receipts had declined by £1,780, leaving a net increase on all accounts of about £500. Their investments had increased by nearly £7,000, due to the dividends received for the first time from the Shrophire Co. That increase would have been in round figures £10,000, the full dividend on the Shropshire shares, had it not been for the lower dividends received from the following companies: The Wolverhampton tramways had only paid 1 per cent., against 1½ per cent. in the previous years, which represented a loss to the company of about £800. The Dudley, Stourbridge and District Electric Traction Co. had only paid 4 per cent., as against 5 per cent., representing a loss of about £988; the South Staffordshire (Lessee) Co. had paid no dividend on the preference shares, whereas last year it paid 3 per cent., which represented a loss to them of £1,194. Altogether the total shrinkage in their investments represented a sum of £2,982. On the other side, rates and taxes had increased by £1,200, and interest by £10,429, due to the loan from the Shropshire Co., which appeared for the first time. To sum up there was a balance of £23,846 transferred to the balance sheet, against £27,919 last year, the decrease being almost entirely due to the decreased dividends received from the subsidiary companies in which they had large interests. The directors this year could only recommend a dividend at the rate of 2½ per cent. The capital account during the past year showed only a moderate increase of £1,054 on the tramway side and £11,002 on the lighting. The accounts showed that that expenditure had been more than justified, and during the current year further development in the lighting business would demand further capital expenditure, all of which, it was expected, would be revenue-bearing at an early date. The Smethwick station sale had not yet been completed, for reasons stated in the report. Generally, although no great improvement could be expected in the near future, the outlook was not without promise of better times. The development on the lighting side was very marked, and promised well, although the difficulty of maintaining prices on which they could live was very great.

MR. S. R. BLUNDSTONE seconded the resolution, and the report was adopted.

The Paris Metropolitan Railway.

THE report of the directors of the Compagnie du Chemin de Fer Métropolitan de Paris refers, as usual, first, to the tunnel and other constructional works carried out by the city authorities on the three networks during the year 1908; and secondly, to the works executed by the company, and comprising permanent way and stations, generating station and sub-stations, distribution of power, workshops and operations on the lines already in service. After mentioning that the 10 ventilating works, which consist of bays in the station upper floors or piers, were carried out in the year, it is stated that a mechanical stairway on the Hocquart system had been established at the exchange station of Père-la-Chaise, and a vertical lift is in course of construction at the exchange station of the Place de la Republique. The experiments made with mechanical ventilating apparatus, notably near the Station des Ternes on No. 2 line, had not yielded the results which had been expected. On the other hand, the ventilation of the underground tunnels by means of bays, which give both light and air, appeared to be much more efficacious, and the company's efforts were all directed to this method. The length of line open to traffic, increased from 28 miles at the beginning of the year, to 32 miles on April 21st, when the trunk from the Porte de Clignancourt to Châtelet was started, and this mileage remained unchanged during the rest of the year. The accounts for the past two years include the following items:—

	1908.	1907.
Share capital	£3,000,000	£3,000,000
Bond capital	1,880,000	1,890 000
Total receipts	1,626,400	1 387,200
Working expenses	683,400	598,200
Municipal share in gross receipts ...	530,700	449,000
Net profits	357,500	340,000
Dividend, per cent.	8	7⅝
Number of tickets issued	229,700,519	194,822,282

The company's rolling stock at the end of 1908, comprised 488 motor-coaches and 463 trailers, as compared with 365 and 415 respectively at the close of 1907, and an additional 128 motor-coaches and 74 trailers have been ordered and are in course of construction. All grades of employés increased from 3,630 on December 31st, 1907, to 4,114 on the same date in 1908, and the system of granting bonuses to the various classes for the good management of the railway was maintained and developed during the year. The amount paid in this way was £19,600, or £3,320 in excess of that devoted to the same purpose in 1907. In addition to this, the company continued to interest itself in the building of workmen's dwellings for its employés, and at the end of 1908 the total advances reached £19,200, allowing for the erection of 76 houses. The money is lent to the staff and workmen, partly at the rate of 2½ per cent. with repayment to take place in 12 years, and partly at 3 per cent. with redemption in 20 years.

The report proceeds to state that in all probability the year 1909 will witness the completion of the second network for the putting in operation of the metropolitan transversal line from the north to the south, which is, perhaps, the most important, and certainly the most impatiently awaited of the company's lines. It is hoped to open a portion of the third network in 1910, and the whole of it before the end of 1911. The increasing success of the work jointly pursued by the company and the city of Paris had had the double effect of giving rise to local competition, and of inciting the public to demand additional lines, which had been grouped in a supplementary network. The concession had been offered to and accepted by the company, the latter agreeing in return to grant a free interchange of passengers with the network of the Chemin de Fer Electrique Souterrain Nord-Sud. The law declaring the supplementary network of public utility had not yet been passed, but legislative ratification is hoped for before next March. The agreement on the subject of the additional network has concluded the difficulties which would have arisen from the granting of the concession to a third party, and at the same time it will ensure for the public the advantages of uniformity of the system and of the fares.

The Bombay Electric Supply and Tramways Co., Ltd.

The accounts for the year 1908 record an improvement upon the operations of the company for the year 1907. The Bombay Co. is one of the subsidiaries of the British Electric Traction Co., Ltd., and, of course, is a member of the British Electrical Federation, Ltd., which is also the creation of the B.E.T.

The profit and loss account exhibits a credit balance of £42,474 for the year, after capitalising £2,407, being the proportion of debenture interest paid on unproductive outlay. With the sum of £2,889 brought into the account a total of £45,363 is provided, of which the preference dividend paid and accrued accounts for £35,977, leaving £9,385 to be carried forward to next account. There is thus not anything for the ordinary shareholders. A glance at the balance-sheet, with the terms "Dr." and "Cr.," and the somewhat ill-expressed titles of "Capital Expenditure and other Assets," and "Capital and other Liabilities," leaves an impression that in the first and second items of the former, viz., "Cost of Tramways in Bombay," &c, and "Rights and Concessions," &c., much is desired from the manner in which they are grouped and marshalled. From the present mode of exhibition little is to be learned except the large total which the expenditure has attained. £702 has been written off the suspense account, being the excess of expenses over receipts in the electricity supply department, leaving as an "Asset" or "Capital expenditure" £2,101 odd. As the working account of the electricity supply section shows a gross profit of £7,976, there is no justification for the retention of the balance of the suspense account in the balance-sheet. Of course one knows the usual argument. There is no provision for depreciation; nothing has been written off preliminary expenses, which are apparently hidden in the recesses of "Rights and Concessions," whilst similarly the item of "Cost of Underwriting and Issuing Capital" has received indifferent attention.

Presumably the board will be extinguishing the balance of the horse tramway expenditure account, which appears at a respectable amount, now that electric traction has taken the place of horse traction.

There is but little to note further save that the directors during the present year offered £150,000 5 per cent. second mortgage debentures to bearers for subscription at 94½. There is already £600,000 4½ per cent. debenture stock, so that the debenture account and the preference shares will require for their service in future a yearly sum of £70,500.

The B.E.T. have a peculiar affection for the term perpetuity. In the debenture prospectus, to which reference has been made, it is stated that, "subject to the right of the Municipal Commissioner of Bombay to determine the concession in the event of the company failing to observe certain of the terms thereof, the concession is in perpetuity, save that the municipality, or in the event of the municipality not electing to purchase, the local government, has the right to purchase the combined undertaking on the terms stated at the end of 42 years, 56 years, or 63 years from August 7th, 1905, or at the end of any subsequent period of seven years." A perpetuity means "for ever"—without qualification. Surely there is no perpetuity about the concession.

Marconi's Wireless Telegraph Co., Ltd.

The ordinary general meeting of the above company was held on Monday at River Plate House, Finsbury Circus, E.C., under the chairmanship of Commendatore G. Marconi.

The Chairman, in moving the adoption of the report (see Electrical Review, June 25th, page 1057), explained that he occupied the position owing to the resignation of Sir Charles Euan Smith, the cause of which they all regretted. Since that report was issued the position of the company had continued to rapidly improve. New important orders for stations and plant had been received from the Portuguese and Greek Governments, and the value of orders in hand that day amounted to over £100,000, with every prospect of a very substantial increase in the immediate future. As stated in the report, the trans-Atlantic station at Clifden had been completed, although, unfortunately, owing to the delay of certain manufacturers, a delay of nearly six months occurred. It was, however, a matter of satisfaction to himself to be able to say that the plant had in every way come up to his expectations in regard to efficiency. In regard to the corresponding station at Glace Bay, Canada, the machinery had already been completed, and was now nearly all delivered, and he did not expect that more than a month would be required for its efficient erection. The limited service across the Atlantic which had now been established for over 18 months had continued to give satisfaction to its principal users, but this service, although exceedingly useful to the company, had been very difficult to efficiently maintain whilst additions and alterations were being constantly carried out at the terminal stations. He had no doubt that a very great extension of the trans-Atlantic service might be anticipated as soon as the complete duplication of the station in Canada had taken place, which would enable the company to accept from 15,000 to 20,000 words per day for transmission across the Atlantic, between the stations at Clifden and Glace Bay. The board expected about the end of August to be in a position to invite the Post Office to give effect to their agreement with the Postmaster-General relative to the acceptance and delivery of the company's trans-Atlantic messages at Government telegraph offices throughout the United Kingdom. The board had had to face and overcome arduous tasks and numerous difficulties as a thorough reorganisation of the administration of the company, and of some of the associated companies, was not only desirable but imperative. This, in his opinion, had been so far as possible carried out, and although some of the changes involved a certain expenditure, nevertheless the result had been a considerable saving in current expenses. The board was glad to state that the fear it had once entertained in regard to the ratification of the Berlin Convention by His Majesty's Government being detrimental to the maritime business controlled by the company, had so far not been realised, and a considerable addition had been made to the number of ships carrying the Marconi system. This was an eloquent proof that even under what certain foreign Governments called conditions of open competition, the system controlled by the company had proved able to more than hold its own against other systems, even although these were powerfully assisted by Governments which considered their development a question of national and political importance. The assistance rendered by the company's organisation of wireless telegraphy to the ss. *Slavonia* was still fresh in the memories of all. The two assisting ships, the *Princess Irene* of the North German Lloyd, and the *Batavia* of the Hamburg American Line, were among the ships fitted with the company's system shortly after the accident which resulted in the sinking of the White Star Liner *Republic* in the North Atlantic on January 23rd, on which occasion also the efficiency of wireless telegraphy as worked by the company, was so fully and unquestionably demonstrated. It should be gratifying to the shareholders to know that wireless telegraphy was beginning to be considered every day more and more by the Press and the general public as likely to afford the most efficient and economical method of satisfactory telegraphic communication between the distant parts of the British Empire. Having quoted from an article in the *Times* of June 26th, and referred to the resolutions passed by the Imperial Press Conference, the chairman said that the stations on his system erected by the Italian Government on the Somaliland Coast of Africa had now been completed and were working satisfactorily. The location of those stations being within a few degrees of the Equator was evident proof that no serious difficulty existed in regard to the efficient working of wireless telegraphy to the tropics. Since the last meeting arrangements had been made on satisfactory terms with the Meteorological Offices in London and Hamburg for the supply of weather reports from vessels crossing the Atlantic. Their relations with H.M. Government were now on a most satisfactory basis, and the directors expected that every support would be given by the Government to the development of the company's affairs. Whilst it was an undoubted fact that the complete financial success of the company was dependent on the full working of the trans-Atlantic stations, yet it was also undoubtedly true that a very large measure of success could now be obtained by the execution of orders in hand, which were coming in from all parts of the world. When it was realised that many foreign countries and Colonial possessions were now inclined, for economical reasons, to utilise wireless telegraphy in place of the ordinary wire communication, it was easy to understand what an enormous field existed for the manufacturing branch of the company. In regard to the balance-sheet, the board had every reason to be satisfied with the position of the company, and with the amount of work which had been carried out during the time under review. The directors, after careful consideration, and with the approval of the auditors, agreed that it would be unnecessary and inadvisable, if not misleading, to present a profit and loss account with the balance-sheet for the period ending December 31st, 1908, for the reason stated by the chairman at the last annual general meeting, namely, that pending the completion of the long-distance stations it would be a matter of considerable difficulty to prepare a reliable profit and loss account, on which point there would be a considerable difference of opinion as to the amount to be capitalised. The value of the shares in associated companies should enormously appreciate when the high-power stations across the Atlantic were in full working order, and it was an undoubted fact that those shares were amongst the most valuable assets of the company. Since the issue of the report three influential gentlemen had consented to join the board, viz., Mr. Hammersley Heenan (of Messrs. Heenan & Froude, Ltd., engineers, Manchester and Worcester); Mr. Frederick Whowell (managing director of the Bleachers' Association, Manchester), and Captain H. R. Sankey, R.E. (late director of Messrs. Willans & Robinson). In conclusion, the Chairman expressed his indebtedness to his co-directors for their assistance in the work of the company.

Sir Charles Euan Smith, in seconding the motion, said that the courage, patience and consideration which the shareholders had shown to the board could not be sufficiently appreciated by them. That had enabled the board to meet them from time to time fully confident of the strength of the enterprise in which they were engaged, and to persevere with the work until it was brought to a successful conclusion. The board firmly believed, after all the consideration that had been shown them by the shareholders, that the company was at last within reach of its reward. They sincerely hoped that was the last time they would meet them without promising them a dividend. There were three extremely satisfactory features in connection with the company—the first was the constant and ceaseless expansion of the business in every quarter of the inhabitable globe; the second was the dissipation of the bogey which weighed upon them so long as to the serious results to be expected at the termination of the Berlin convention, and the third was the belief that it would not be long before the Government made it imperative and compulsory on all passenger-going ships to install wireless telegraphy of one form or another. The answer given in the House of Commons to a question put by Mr. Rees as to whether His Majesty's Government would not consider this a proper time to introduce legislation, was by no means discouraging, and it might be considered, under the circumstances, quite satisfactory. Their chairman had made considerable personal sacrifices to tide them over the worst part of the period they had gone through, and the board were extremely sensible of what he had done for the company, and they hoped he would soon meet with the reward to which his efforts were richly entitled.

Mr. Hammersley Heenan, who had just joined the board, remarked that he thought before long there would be a great fight between the telegraph companies. There were 80 millions of capital invested in cable telegraphs, and he felt perfectly certain that if they made attempts to run wireless telegrams over the world, the directors and shareholders could not take it lying down. One thing the company had to do was to preserve every patent and every secret they had got, in order to maintain their service. He had seen the station in Ireland, and he had no hesitation in saying that a better installation he had never seen. Independent of having the installation up-to-date, and twice as powerful as it need be, they had everything in duplicate. He had been assured by Mr. Marconi that the station on the other side would be as efficiently equipped. As to the cost of the stations, he put them as £50,000 each, which meant a capital outlay of £100,000 for the two stations. The price of an ordinary cable was £1,000,000, and there was a heavy item every year for wear and tear. They had, therefore, with the Marconi system, £100,000 against £1,000,000 to pay dividends on. Taking an instance of their sending 25 words a minute at 3d. a word for 360 days of 24 hours in the year, they would earn £460,000 each way, making close on a million sterling on a £100,000 capital. The profits the shareholders could work out for themselves.

Mr. F. Whowell, another new director, remarked that, when the station began to receive messages from the other side, there would be an enormous future for the company. The station in Ireland was built and fully equipped on the most sound engineering principles.

The resolution was carried unanimously, without a single comment from the shareholders.

"Harper" Electric Piano Co., Ltd.—In the report for the year ended June 1st, it is announced that Mr. C. Martin Hesse, a large shareholder, has accepted a seat on the board. The total net profit, after writing off bad debts and depreciation on fixtures, fittings and lease, and providing for debenture interest, amounts to £967, which, with £980 brought forward, makes £1,947. Interim dividends paid for the two half-years of 1908 on the preference shares at the rate of 10 per cent. per annum absorb £498, leaving £1,448. The directors recommend dividends on the preference shares for the past half-year at the rate of 10 per cent. per annum, and on the deferred shares at the rate of 5 per cent. per annum, leaving £1,149 to carry forward.

Electric and General Investment Co., Ltd.—The report (as quoted in the *Financier*) states that the gross profit on transactions of the year was £11,565. After deducting all general charges and the interim dividend already paid on the preference shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, there remained a balance of £4,095. As a further reserve to meet the depreciation in the company's investment and loan securities, the directors have carried this amount to the contingencies fund, thereby raising the amount to the credit thereof to £71,651 as at May 31st. The trustee for the ordinary shares reserve fund proposes to distribute the sum of 6d. per share out of the dividends received on the trust investments. The trustee for the founders' shares reserve fund proposes to distribute the sum of £8 per share out of the dividends received on the trust investments.

W. & T. Avery, Ltd.—A final dividend of 7½ per cent., making 10 per cent. for the year ended March 31st is recommended.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared the following dividends:—

Interim dividend to June 30th in respect of the profits for the first half of the year 1909, at the rate of 3s. per share on the 6 per cent. cumulative first preference shares, being at the rate of 6 per cent. per annum, less income-tax, payable on July 1st.

Dividend of 5s. per share on the cumulative second preference shares, being at the rate of 10 per cent. per annum, less income-tax, payable on July 1st.

Further 2s. 6d. per share on the cumulative third preference shares Nos. 1,080,008 to 1,380,007, being at the rate of 5 per cent. per annum, less tax, and at the rate of 1s. 2·63d. per share on the cumulative third preference shares Nos. 1,380,008 to 1,880,007 (being at the rate of 5 per cent. per annum from April 3rd to June 30th), less tax, payable on July 1st.

Greenwood & Batley. Ltd.—The report for the year ended March 31st last states that, after providing for interest on the debentures and expenses of management and making due provision for doubtful debts, the accounts show a profit of £7,643, which, with the balance at credit of profit and loss at March 31st, 1908, of £5,541, makes £13,094. The directors have written off £4,000 for depreciation, and they recommend that a dividend for the year ended March 31st last be declared at the rate of 7 per cent. per annum on the paid-up cumulative preference share capital, absorbing £7,028, and leaving £2,066 to be carried forward. The directors have also transferred £15,000 from reserve account in reduction of the book value of investments in subsidiary and connected companies.

Globe Telegraph and Trust Co., Ltd.

The meeting of this company was held on Thursday of last week at Electra House, Finsbury Pavement, the Marquis of Tweeddale presiding.

The Chairman, in proposing the adoption of the report, said the accounts showed a slight falling off, as compared with the previous year, but it should be remembered that those accounts were exceptionally good, and indeed were the best they had ever presented to the shareholders since the inception of the company 36 years ago. The receipts for the year, after deducting expenses, amounted to £207,347, against £201,295 last year, or a difference of £2,948. They had already paid to the ordinary shareholders the usual three quarterly dividends and the interim dividends at the fixed rate of 6 per cent. on the preference shares. Those together had absorbed £131,769, and the directors now recommended the payment of a final dividend on the ordinary shares of 5s. 6d. per share net, which, with the previous distributions, made a total dividend for the year on those shares of 5⅝ per cent., as against 5¾ per cent. last year. That, together with the final payment of 3s. per share on the preference shares, absorbed £75,479, and left £27,305 to be carried forward to the next account, being £100 more than that carried forward this time last year. Turning to the accounts, they would observe that their receipts from the different companies in which they held investments were, with the exception of four, practically the same as last year. The exceptions were the Direct United States Cable Co., the Great Northern Telegraph Co., the Telegraph Construction and Maintenance Co. and the Western Union Telegraph Co. Their receipts from the Direct United States Cable Co. had fallen off to the extent of £746, their dividend being at the rate of 4¼ per cent. this year, as against 4⅝ per cent. last year. The Great Northern Co., in which they had only a small holding, had yielded them about £50 less, their dividend being at the rate of 18 per cent., as against 20 per cent. in the previous year. The Telegraph Construction and Maintenance Co. had also reduced its dividend from 17½ per cent. to 15 per cent., which made a difference to them of £1,094. The receipts from their shares in the Western Union Co. showed a diminution of about £257, their dividend being £2 15s. 10d. per cent., as against £3 8s. 10d. per cent. in the previous year. The losses which the Western Union had suffered were not only due to the general depression in business, but still more to a prolonged and costly strike. That strike was now over, and the prospects of the company had undoubtedly improved, and they might expect better results from that investment during the current year. Having referred to a grant of £250 which the board had made to the widow of the late Registrar, who had been in the service of the company for nearly 40 years, the chairman said that by a rearrangement of the staff a reduction had been made in the yearly charges. The present value of the investments, he stated in conclusion, showed an increase over the original cost of £230,000.

Sir James Pender seconded the motion, and the report was adopted.

Acknowledging a vote of thanks, the Chairman said that no doubt proposals would be made in regard to cheapening rates, but no definite proposition had yet reached the directors. When it did he had no doubt it would receive the consideration which was due to it, and they might rely upon it that the interests, both of the shareholders and the public, would be thoroughly well considered.

Stock Exchange Notices.—The Committee have ordered the following securities to be quoted in the Official List :—

Central Electric Supply Co., Ltd.—Further issue of £63,124 4 per cent. guaranteed debenture stock.

Highlands and Lowlands Para Rubber Co., Ltd.—123,546 shares of £1 each, 15s. paid, Nos. 1 to 7 and 181,462 to 305,000; and 182,952 shares of £1 each, fully paid, Nos. 8 to 181,461 and 305,001 to 306,498.

Bukit Rajah Rubber Co.—For the year ending March 31st the net amount at credit of profit and loss account is £39,278. A final dividend of 31 per cent. is to be paid on the ordinary shares, making 55 per cent. There is to be placed to reserve fund £500, to depreciation £500, and carried forward £1,593.

Vulcan Boiler and General Insurance Co.—The directors have declared an interim dividend of 4s. per share.

Sao Paulo Tramway, Light and Power Co.—The warrants in respect of the quarterly dividend of 2½ per cent. were to be posted on Wednesday.

Eastern Telegraph Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending 30th ult., and a first quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax, in respect of profits for the year ending December 31st, 1909.

Turbinia German Parsons' Marine.—The report for the past year showed a profit of 241,031 marks. General expenses amounted to 79,278 marks. A dividend of 10 per cent. is recommended on the ordinary, and 8 per cent. on the priority shares. The total number of ships afloat and under construction fitted with turbines of the company's system at the end of April amounted to 273, with 3½ millions horse-power. In conjunction with the firm of Brown, Boveri & Co., the company has acquired an interest in a large German shipbuilding yard.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	June 23	2,840	— 15	3	4,787	— 43	..	..
†Ayr	„ 26	663	— 66	6	1,786	— 124	8	..
Bath	„ 23	1,533	— 23	25	17,503	+ 550	..	..
Belfast	„ 25	7,602	+ 134	12	47,339	+ 1,459	37	..
Birkenhead.. ..	„ 27	2,063	— 102	12	13,294	— 453	18·52	..
Birmingham Corp.	„ 19	12,207	—1,375	12	75,405	+ 254	..	..
Blackburn	„ 23	2,189	— 62	13	14,910	— 261	13·97	..
Blackpool-Fleetw'd	„ 26	1,323	— 285	25	10,711	+ 807	..	..
Bolton	„ 27	4,528	— 426	13	30,209	— 553	26	..
Bournemouth ..	„ 23	3,061	— 57	12	20,132	+ 286	21·96	..
Bradford	„ 12	9,784	— 560	11	57,003	+ 1,353	54·9	..
Brighton	„ 27	1,829	— 27	13	11,855	+ 697	9·5	..
Bristol	„ 25	10,756	+ 763	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 18	444	— 1	24	5,202	— 87	3·65	..
Barnsley	„ 18	303	— 83	„	3,993	— 143	..	..
Barrow	„ 18	488	— 97	„	5,154	— 350	5·37	..
Cavehill	„ 18	227	+ 23	„	1,815	— 151	..	..
Devonport ..	„ 18	714	— 288	„	8,828	— 1,725	8·85	..
Gateshead ..	„ 18	1,915	— 137	„	23,578	— 48	11·25	..
Gravesend ..	„ 18	405	— 111	„	4,617	— 167	6·5	..
Greenock	„ 18	1,259	+ 173	„	12,180	+ 235	7·25	..
Hartlepool ..	„ 18	476	— 86	„	5,140	— 116	6·72	..
Kidderminster ..	„ 18	191	— 199	„	2,242	— 137	..	..
Leamington ..	„ 18	333	— 151	„	3,769	+ 154	..	..
Merthyr	„ 18	440	— 60	„	5,024	+ 19	2·9	..
Metropolitan ..	„ 18	12,318	—1,869	„	140,596	+12,692	22	..
Middleton ..	„ 18	814	— 189	„	7,8[illegible]0	— 446	8·5	..
Mid. Joint Com'tee	„ 18	11,107	—2,789	„	132,386	— 3,725	..	..
Oldham—Ashton	„ 18	1,150	— 156	„	13,210	— 898	9·18	..
Peterborough ..	„ 18	218	— 79	„	2,577	— 198	5·31	..
Potteries	„ 18	3,330	— 419	„	42,168	— 1241	29	..
Rothesay	„ 18	605	+ 127	„	2,585	+ 82	2·75	..
Southport.. ..	„ 18	634	— 279	„	6,239	— 126	8·17	..
S. Metropolitan ..	„ 18	1,564	— 543	„	17,879	— 74	..	..
Swansea	„ 18	1,822	— 845	„	21,894	+ 546	12·5	..
Tynemouth ..	„ 18	558	— 126	„	4,171	— 38	3·75	..
Weston-s-Mare ..	„ 18	338	— 218	„	1,863	+ 224	3	..
‡Worcester ..	„ 18	553	— 167	„	6,157	— 56	5·75	..
Wrexham ..	„ 18	188	— 47	„	2,264	— 90	..	..
Yorks. Wool. Dist.	„ 18	1,770	— 221	„	21,058	— 425	17	..
Miscellaneous ..	„ 18	413	— 46	„	4,646	— 45	..	..
Burnley	„ 26	2,449	— 29	..	..	..	..	..
Burton-on-Trent ..	„ 27	545	— 2	13	3,366	— 66	6·62	..
Bury	„ 27	2,215	— 378	$12\frac{4}{7}$	15,205	— 448	22·5	..
‡Cardiff	„ 19	4,233	— 826	12	25,100	— 439	..	..
Carlisle	„ 26	354	— 26	25	8,929	— 110		..
Chatham and Dist.	„ 24	1,532	— 70	25	19,118	+ 1,157	14·98	·61
Cork	„ 24	1,029	— 14	25	9,967	— 937	..	..
Croydon	„ 18	2,804	— 631	..	17,210	+ 214	11·25	4·75
Darlington	„ 26	370	— 9	13	2,412	— 150	..	..
Darwen	„ 25	501	— 6	12	3,154	— 105	4·36	..
Dover..	„ 19	385	— 77	12	2,301	— 139	4·75	..
Dublin	„ 25	11,273	— 412	..	128,541	+ 395	54·25	..
Dundee	„ 23	2,374	— 57	$5\frac{4}{7}$	6,644	— 276	15	..
East Ham	„ 26	2,008	+ 240	$12\frac{1}{2}$	12,758	+ 1,955	8·43	·68
Exeter	„ 25	634	— 28	13	4,504	+ 583	5·5	..
Glasgow	„ 26	35,376	—1,939	..	66,783	+ 319	90·5	1·5
Hastings	„ 24	1,976	— 142	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	„ 26	4,805	+ 48	12	30,843	+ 162	13	..
Ilkeston	„ 23	264	+ 4	12	1,591	— 137	..	..
Ipswich	„ 26	793	— 12	13	4,841	+ 15	10·5	..
Kilmarnock.. ..	„ 19	292	— 2	5	747	— 56	4·25	..
Lan'kshire Trm. Co.	„ 24	2 613	— 106	25	30,379	— 1,856	17 62	1·18
Lancashire United	„ 23	2,614	— 252	25	31,6[illegible]7	— 194	..	..
Leeds	„ 19	13,635	— 558	12	78,204	+ 2,956	96·75	·25
Leicester	„ 26	4,501	— 42	..	..	..	..	..
Leith	„ 19	1,202	+ 143	5	3,117	+ 324	6	..
Liverpool	„ 19	21,257	—1,451	$24\frac{2}{7}$	255,312	— 2,949	104	
‡L.C.C.	„ 12	74,358	—1,728	..	376 657	+19,392	121	4·25
London United ..	„ 26	13,201	—2,148		144,559	—13,0[illegible]5	..	..
Lowestoft	„ 26	352	— 58	39	5,707	— 633	3·5	..
Manchester.. ..	„ 26	29,618	—1,548	13	188,994	— 862	90·5	6
Newcastle	„ 26	9,755	— 223	12	50,566	+ 264	..	..
Newport	„ 19	1,280	— 322	12	7,914	— 145	14·5	..
Oldham	„ 26	3,523	— 634	$15\frac{4}{7}$	25.792	— 1,676	23·75	..
Pontypridd	„ 26	775	+ 121	$12\frac{1}{2}$	5,051	— 586	5·5	1·75
Portsmouth ..	..	..	..	..	..	..	14·5	..
Preston	„ 23	1,425	— 59	..	..	..	..	..
Rotherham	„ 24	1,184	+ 24	12	7,459	— 170	10	·66
Salford	„ 21	8,822	—2,115	$11\frac{5}{7}$	54,561	— 1,435	..	..
Sheffield	„ 27	11,202	— 78	$13\frac{3}{7}$	75,838	— 1,250	87	1·25
Southampton ..	„ 23	2,086	— 28	12	12,617	— 353	..	..
†Southend-on-Sea ..	„ 23	939	+ 101	12	5,627	+ 888	..	..
South Shields ..	„ 26	1,180	— 132	..	6,985	+ 70	..	..
Swindon	..	..	..	..	..	..	..	..
Tyneside	„ 23	1,698	+ 124	25	11,072	+ 843	..	..
Wallasey	„ 12	2,018	+ 87	$10\frac{1}{2}$	9,826	+ 426	..	·22
Walthamstow ..	„ 26	1,449	— 50	13	8,651	+ 264	9	..
West Ham	„ 17	4,417	— 585	11	26,593	+ 1,766	15	·8
Wolverhampton ..	„ 24	1,527	— 70	13	9,856	— 598	12·5	..
Baker St.-Waterloo	„ 26	6,760	+ 685	25	83,850	+ 7,470	4·25	..
Cen. London Rly...	„ 26	11,610	—3,226	25	139,113	—17,196	6·32	·55
Char. +, Eus. Hamp.	„ 26	7,900	+1,210	25	97,240	+15,950	7.75	..
City & S. Lon. Rly.	„ 27	6,459	+ 295	25	81,345	+ 1,359	7·8	..
Dublin-Lucan Rly.	„ 25	805	+ 16	25	3,165	+ 253	7	..
G.N. and City Rly.	„ 26	2,703	— 274	25	37,365	— 4,459	8·5	..
G.N., P'y, & Brmtn.	„ 26	11,880	+ 690	25	145,115	+ 9,375	9·25	..
L'pool Overh'd Rly.	„ 27	2,839	— 95	25	34,287	— 2,854	6·8	4·3
†Llandudno-Col. Bay	„ 18	688	— 228	29	4,856	+ 1,640	..	..
Mersey Railway ..	„ 26	3,805	+ 14	25	49,260	+ 1,454	4·5	..
Metropolitan Rly...	„ 27	34,858	+1,327	25	402,202	+18,512	24·5	..
Met. District Rly...	„ 26	21,895	+2,706	25	248,235	+28,911	24	..
Anglo-Argentine ..	„ 24	77,018	+7,484	25	982,502	+56,595	..	..
§Auckland	„ 18	14,218	+3,180	24	83,101	+11,794	22·3	8·1
Bombay (B.E.T.) ..	May 27	4,895	+ 204	20	58,704	+ 8,440	..	..
§Brisbane	May	16,551	+1,008	..	..	..	..	..
Calcutta	June 26	6,622	+1,615	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	May	3,745	..	..	18,621	..	20·5	..
Madras	June 15	1,140	— 16	23	13,879	— 95	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	„ 25	2,725	+ 188	..	86,087	+ 204	28	2·4

* Compared with the corresponding period of 1908. † One week only. ‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE sails of the Stock Exchange ship flap idly, there being barely a breath of breeze to stir them. Only in rubber shares can it be said that anything approaching animation obtains. After being intensely busy for a few weeks, brokers and jobbers chafe at the sudden alteration, and are at some loss to know where to lay the blame. Speculation in mining shares has come to well nigh a full stop, and the consequent fall in prices led to failures. As for investment stocks, prices ought to be good, judging from the condition of the money market; but, in point of fact, Consols are weak, and the general range of better-class stocks—Home Railways excepted—are depressed in sympathy.

Mexico Tramways slumped from 137 to $123\frac{1}{2}$, following upon a drop of 8 points in the week before. The 5 per cent. gold bonds lost $1\frac{1}{2}$. Mexican Light and Power Common shed no more than half a point, but the Preference fell $3\frac{1}{2}$, making 6 in the fortnight. Rio Trams are flat at 83, and Sao Paulo fell to $146\frac{1}{2}$ *ex* dividend.

This further slump in quotations is attributable to financial difficulties of weak holders who were forced to realise. With nothing cheerful in surrounding markets to make the outlook hopeful for the immediate present, prices simply tumbled of their own weight, and were at times marked down without stock changing hands. Whether the time has come for buying Mexican-Canadians yet, we are not in the least disposed to prophesy, but it is in the nature of Stock Exchange prices to rally after any severe and protracted fall. The market in these issues, however, is so nervous and timid now that there might be another swoop down before recovery set in.

Home Railway stocks, as we write, are in a condition of exceedingly subdued hopefulness. The Coal Conference on the Wednesday in this week may alter the complexion of affairs for the worse, but at the moment anticipation leans to the view that an amicable arrangement will be reached, and fears of a strike once more averted. Hence prices are fairly firm, and the only section where this tendency fails to permeate is the luckless "tube" market. Central Londons are distinctly weak, for the Exhibition reason recorded here last week. City and South London also receded, and East London fell back to $3\frac{3}{8}$. On the other hand, Metropolitan Consolidated has moved up a little, and Districts keep very firm at $17\frac{1}{2}$, the disreputable weather being humorously hailed as a bull-point. The 4 per cent. Debenture stocks of the Underground Railways group are strong in tone, and the higher figure of the quotation for Bakerloo Debenture is par. London United Tramways Preference continue flat, and the 6 per cent Income bonds of the Underground Electric Railway are a point lower, although the Prior Lien bonds have regained their slight decline.

The *ex* dividend markings of last account-day included London United Trams 4 per cent. Debenture, the price being put down to 66, British Westinghouse 4 per cent. Debenture, where the quotation was lowered to 40, and Brush Electrical $4\frac{1}{2}$ per cent. Second Debenture, now standing at 29. Upon all of these the interest has been regularly met, so far.

Telegraph and Telephone issues are, on the whole, inclined to dulness. The alterations are small, however, and there is no movement of importance to record. Marconi's regained $\frac{1}{16}$ after the meeting of the company. American Telephone and Telegraph recovered half the dividend deducted from the price. National Telephones are not affected by the failure of a Stock Exchange member who used to deal largely in the stocks.

City of London Ordinary and Preference shares show small rises, and Bromptons fell $\frac{1}{4}$; except for these, the English electricity supply list is featureless. The only other changes are those produced by *ex* dividend markings.

Manufacturing shares show some irregularity. Babcock & Wilcox fell $\frac{3}{32}$. British Aluminium Ordinary and 6 per cent. Preference weakened, while the 7 per cent. Preference advanced, only to recede again. Electric Construction Preference rose another 2s. 6d., bringing the price to $1\frac{1}{16}$. Willans & Robinson Preference are $\frac{1}{16}$ lower. Rubber shares provide the Industrial market with its main attraction at the present time. The Vallambrosa Company has declared a dividend making 80 per cent. for the year, and the continued strength of rubber itself, has led to lively hopes of bumper dividends on other companies' shares. As already observed, the rubber share department is one of the strongest in the Stock Exchange, and stands out with peculiar cheeriness against the background of general drabness colouring most of the other markets.

British Electric Traction Ordinary and Preference fell after the issue of the report. Tramway and Traction shares are quiet, with the exception of the issues already mentioned.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations June 22nd.	Closing Quotations June 29th.	Business done week ended June 29th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾— 3¼	2¾— 3¼	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —145	143 —144 xd	..	..	..	5 11 1
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98½—100½	98½—100½	..	..	..	3 19 7
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	56 — 58	56 — 58	..	..	..	5 10 1
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —100	99 —100	99⅞	99¼	..	5 19 8
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	15⅜— 15⅝	15⅜— 15⅝	16 1/16	15 7/16	..	2 5 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100½ —102½	102 —104	..	..	+1½	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8⅛	..	..	4 15 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90½ — 92½	89 — 91 xd	90½	89	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛ — 8⅞	8⅛ — 8⅞	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¾ — 9	8⅝ — 8⅞	8⅜	..	— ⅛	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	3 15 4
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	12⅝ — 13⅛	12⅝ — 13⅛	12 13/16	12¾	..	6 10 0
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	132 —135	130 —133	135	131	—2	5 5 3
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85½ — 87	85 — 87	86¼	85¼	— ¼	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 — 105	104 —106	105½	104	+1	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅞ — 12⅜	11¾ — 12¼	12 1/16	11⅞	..	5 13 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103¼	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¾ — 11¼	10¼ — 10¾xd	10 9/16	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13 — 13½	12⅞ — 13⅜xd	13 3/16	..	..	4 9 9
160,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	27 — 28	27 — 28	27¼	..	..	6 8 7
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	18 %	13 %	18 %	13 %	51½ — 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	9/16 — 11/16	11/16 — 13/16	15/9	12/9	+ ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	13/16 — 15/16	13/16 — 15/16	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	108	107	..	5 10 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	119½—121½	119½—121½	120⅞	119¾	..	4 18 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼ — 11	10¼ — 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10 — 10¾	10 — 10¾	..	..	..	5 11 7
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 7/16 — 5 11/16	..	..	..	4 7 2
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	97 — 99 xd	..	..	..	3 12 2
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100½—102½	99 —101 xd	99½	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 0 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	86 — 88	..	..	—2	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	7⅝	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	98½ —100½	..	..	—2	4 9 7
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 13/16 — 7 1/16	6 13/16 — 7 1/16	6 15/16	..	..	5 18 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	4⅞ — 5¼xd	5 5/32	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½ — 14	13⅜ — 13⅞xd	13½	13⅜	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	101 —102	103½	100	— 1½	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	13/1½	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼ — 8¾	8¼ — 8¾	..	..	..	6 17 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	..
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102½—104½	102½—104½	..	..	..	4 15

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9½ — 9¾	9½ — 9½ xd	9⅝	..	..	5 5 3
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5¾%	6 %	6⅛ — 6⅜	6 — 6¼ xd	6 1/16	..	..	4 16 0
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	94 — 96	91 — 92 xd	94½	91½	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102½—104½	100 —102 xd	102	..	..	4 18 0
[illegible]	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 13/32 — 4 17/32	4 5/16 — 4 7/16	87/6	..	— 3/32	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1⅛ — 1⅝	1 — 1½	25/-	22/6	— ⅛	23 5 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅜ — 2⅞	2¼ — 2¾	55/-	50/-	— ⅛	15 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½ — 4	3⅜ — 3⅞	61/3	51/3	— 1/16	7 14 10
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4¼	3¾ — 4¼	75/-	68/9	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	143 —147	145½	144¼	..	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	122 —125	121 —124	123	122	—1	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	110 —113	110½	..	+1	4 8 6
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	8 %	Nil	Nil	..	15/16 — 1 3/16	⅝ — 1	18/9	16/3	— ¼	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	..	2⅞ — 3⅜	2½ — 3	57/6	53/9	— ⅜	10 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	92 — 95	92 — 95	92½	..	..	5 5 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	68 — 72	..	..	..	6 5 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ — 7¾	7⅜ — 7¾	7⅝	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6¾	6⅜ — 6¾	..	..	..	4 7 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	105 —108	103 —106 xd	..	..	..	4 4 11
804,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	6/-	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 44	38 — 42 xd	..	..	..	9 10 6
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 6
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	29 — 33	27 — 31 xd	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜ — 4¾	4⅜ — 4¾	..	..	..	6 6 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4⅞ — 5⅛	4¾ — 5 xd	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —103	97½ —100½ xd	..	..	..	4 9 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9⅝ — 10⅜	9⅝ — 10⅜	10¼	..	..	7 4 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5¼ — 5⅝	5⅛ — 5½ xd	..	..	..	4 15 3
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	103 —105 xd	106½	..	..	4 5 9
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅞ — 2	1⅞ — 2	40/-	38/9	..	6 0 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	102 —106	..	..	..	4 4 11
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	64 — 66	63 — 65	64	63	—1	5 0 0
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	84 — 86	..	..	—1	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	49 — 51	47 — 49	..	..	—2	5 2 0
[illegible]	City and South London Railway	Stock	1¾%	2⅛%	2⅜%	1½%	31½ — 32½	31 — 32	31¾	31	— ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	1 — 1¼	1 — 1¼	..	..	..	9 7 6
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	94 — 97	..	..	..	5 3

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued).

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908	Closing Quotations June 22nd.	Closing Quotations June 29th.	Business done week ended June 29th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16— 1¼	1 1/16— 1¼	..	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 3/32— 1 7/32	1 3/32— 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	99 —102 xd	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13— 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	¼— ½	¼— ½	..	..	..	15 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	..	1½— 2½	1½— 2½	..	..	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	70 — 75	68 — 73 xd	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	10/-	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390..	2	7 %	7 %	7 %	7 %	1 5/16— 1 9/16	1 7/16— 1 11/16	..	..	+ ⅛	8 7 2
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7⅜— 7¾	7⅛— 7½xd	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	.	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	18/9	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅝— 12⅜	11⅝— 12⅜	12⅛	11¾	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 7/32	5	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104½—106½	106	105½	+ ½	4 4 6
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %		14½— 15½	14½— 15¼	14⅞	..	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞— 15/16	15/16— 1	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	3 %	Nil	1½— 2½	2 — 3	..	..	..	4 8 11
899,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	3 — 4	3½— 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1¾— 2½	1¾— 2½	..	..	..	15 0 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	69 — 73	64 — 78 xd	..	..	..	5 17 8
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38½— 39	38½— 39	39⅛	38⅜	..	1 5 9
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	69 — 71	68 — 70	69½	69¼	—1	5 18 7
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	17¼— 17¾	17¼— 17¾	17 5/16	17¼	..	Nil
391,837	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝— ¾	⅝— ¾	..	..	..	...
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	23/32— 27/32	23/32— 27/32	..	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	99 —101	96½— 98½xd	98⅜	..	..	4 11 5
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	146 —148	121 —124	134¾	122	—24½	.
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93 — 95	92 — 94	92¾	91½	—1	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/16— 7/16	3/16— 7/16	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	33 — 34½	33 — 34½	34	..	..	5 19 0
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	..	101 —102	101½—102½	102½	102	..	.
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	89 — 91	89 — 91	..	..	..	4 18 11
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	38 — 40	37 — 39	..	..	—1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝— ⅞	⅝— ⅞	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 13/16— 3 5/16	2¾— 3¼	..	..	— 1/16	7 7 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 78	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908	Closing Quotations June 22nd.	Closing Quotations June 29th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4¼— 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8½— 9	8¼— 8¾	8¾	8⅜	— ¼	5 14 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅞— 4⅜	3⅞— 4⅜	83/9	80/-	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3⅝— 4⅛xd	..	..	..	5 9 1
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99 xd	96 — 99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 4⅛	3⅝— 4⅛	..	..	..	5 9 1
175,000*l*	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	102 —105	100 —103 xd	102½	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12½	11⅞— 12⅝	12 7/16	..	+ ⅛	4 14 1
400,000*l*	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	119 —122 xd	..	..	..	4 2 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	99 —102 xd	101	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾— 3¼	2¾— 3¼	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3¼— 3¾	3¼— 3¾	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	93½— 95½xd	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅛— 8⅝	8⅛— 8⅝	..	..	..	5 14 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	11	10⅞	..	5 6 8
400,000*l*	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	104 —107 xd	105½	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	13/9	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	87 — 89	85½— 88½xd	88½	88	..	5 13 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½— 5	4½— 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	7⅛— 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	100 —101	100—101	100¾	100⅝	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅞— 7⅜	6⅞— 7⅜	..	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 19 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞— 2¼	1⅞— 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	5 11 8
882,255	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	90 — 94 xd	90 — 94	..	..	..	4 3 4
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜— 4¾	4⅜— 4¾	91/3	89/4½	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4¾— 5⅛	4⅞— 5 xd	96/3	..	..	4 10 0
285,000*l*	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	107 —110	105 —108 xd	..	..	..	4 3 4
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	83½— 86½xd	..	..	..	4 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82½— 84½	83 — 85	84¼	83¾	..	5 18 4
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	68 — 71	67 — 70	69	67	—1	5 0 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —107	100 —104	106	103½	—3½	6 14 7
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	85½— 87½	85½— 87½	86¾	85	..	5 14 3
450,000	Midland Electric Corporation, 4½ % 1st Mort. Deb,	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 87,500..	5	8 %	8 %	8 %	2½%	4¾— 5¼	4¾— 5¼	..	..	..	2 7 8
137,000	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½— 12½	11½— 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1⅜— 1½	1⅜— 1½	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/32— 1 5/32	1 1/32— 1 5/32	20/6	..	..	5 15 8
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —107	102 —105 xd	104½	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8¾— 9¼	8¾— 9¼	..	..	..	6 13 4
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
150,000*l*	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	86 — 90	84 — 88 xd	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16— 13/16	9/16— 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2¾— 3⅛	2¾— 3⅛	..	..	..	6 9 0
122,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—103	100 —103	101½	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— 1	⅜— 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅞— 2⅜	1⅞— 2⅜	..	..	..	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	25/32— 27/32	25/32— 27/32	16/10½	..	..	5 19 5
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅞— 9⅜	8⅞— 9⅜	..	..	..	5 6 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅜— 5⅝	5⅜— 5⅝	5 3/16	5⅛	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1909.

While this month's export returns do not come up to the high level of the April figures, they still attain very satisfactory proportions. Thus, during the month of May the exports amounted in value to £269,341, which compares with £297,690 in the preceding month. Included in the former amount is £49,192 worth of telegraphic exports, leaving £220,149 as the value of general business, which is comparable with previous years' returns, when the telegraphic section was not included. The imports also dropped off considerably, the total amounting to £122,736, as compared with £138 762 in the previous month; and the re-exports declined by £3,000 to £10,023.

On the whole, the first five months' export business has been quite as good as in the closing months of 1908, the position is, however, quite otherwise as regards the imports.

During the month some £93,000 worth of electrical machinery was exported, the telegraphic and cable items were also well represented; the import section shows an improvement in the machinery total, and a large decrease in value of lamps imported. The more prominent purchasers were Japan, India, Brazil, and the Argentine in the order named.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	151	230	49	42	216	3,593	98	...	25	1,030	3,462	8,896
Germany	367	1,671	...	86	94	846	76	26	57	84	626	3,933
Netherlands	441	1,682	30	10	10	202	...	17	6	199	101	2,698
Belgium	272	148	36	38	241	1,183	70	165	...	915	236	3,304
France	12	...	212	580	...	3,872	125	...	...	...	31	4,832
Switzerland	3	...	...	...	13	...	...	...	...	...	...	16
Portugal, Madeira, Portuguese Africa & India	190	371	142	65	...	455	20	39	...	25	12,412	13,719
Spain, Canary Isles and Spanish Africa ...	40	...	75	227	...	2,020	...	8	11	27	42	2,450
taly and Austria-Hungary	296	...	93	60	291	4,950	...	...	...	21	1,535	7,246
Greece and Turkey	72	...	...	40	..	746	...	160	...	4	384	1,406
Channel Isles, Gibraltar, Malta and Cyprus ...	156	374	40	...	317	1,248	354	2	...	17	337	2,845
U.S.A., Cuba and Philippines	8	...	500	38	95	377	...	4	93	...	368	1,483
Canada and Newfoundland	7	5,220	327	198	563	785	277	304	..	584	843	9,108
British West Indies and British Guiana ...	...	15	...	38	...	68	..	73	18	19	...	231
Mexico, San Salvador and Colombia	17	195	9	...	...	220	...	...	...	1,753	...	2,194
Peru and Uruguay	54	14	260	47	...	...	...	51	11	..	...	437
Chile	198	175	66	576	...	613	3,804	21	104	94	350	6,001
Brazil	298	841	550	230	352	4,231	522	151	...	568	17,413	25,156
rgentine	2,593	1,882	685	674	267	5,969	145	3,749	94	1,536	1,005	18,599
gypt	96	391	55	118	43	177	...	53	...	873	134	1,940
ritish West Africa and St. Helena	8	60	73	130	107	235	...	34	...	239	321	1,207
ape of Good Hope	230	539	318	66	85	4,995	103	1,088	...	61	51	7,536
atal	635	3,864	45	256	5	1,418	...	23	...	43	57	6,346
hodesia, Orange River Colony and Transvaal	795	3,444	240	852	...	1,163	...	...	25	267	530	7,316
anzibar, Brit. East Africa, Mauritius and Aden	77	144	51	90	6	231	7	55	...	35	25	721
hina and Siam	695	4,174	756	925	17	792	1,331	130	197	...	240	9,257
apan	44	6,170	2,404	53	335	22,154	1,380	...	...	508	3,148	36,196
ndia	1,278	8,419	1,660	1,329	368	8,496	1,867	1,288	182	1,353	355	26,595
eylon	33	15	7	166	...	1,167	80	...	...	32	...	1,500
raits Settlements and Fed. Malay States	38	910	154	...	138	1,785	...	25	40	57	58	3,205
ong Kong	246	224	2,896	125	...	1,051	...	16	15	4	...	4,579
est Australia	230	363	...	59	...	561	...	5	12	...	2,000	3,230
outh Australia	134	535	24	132	...	626	...	29	...	713	...	2,193
ictoria	1,061	674	25	695	82	859	...	59	...	10,761	144	14,360
ew South Wales	783	1,087	323	1,163	723	3,696	335	295	...	40	2,612	11,047
ueensland	75	201	59	...	8	2,568	...	...	...	31	45	2,987
asmania	160	...	35	...	...	...	...	..	...	...	49	244
ew Zealand and Fiji Islands...	296	2,196	266	501	372	9,098	240	49	...	34	278	13,330
Total, £	12,089	46,228	12,465	9,599	4,748	93,450	10,834	7,919	890	21,927	49,192	269,341

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£		£
orway, Sweden and Denmark	11	...	...	39	...	605	...	317	...	4,098		5,070
ermany	908	7,609	1,191	24,884	1,644	22,948	...	537	4,139	8,983		72,843
olland	120	189	...	2,014	20	19	...	...	141	...		2,503
lgium	550	2,018	352	173	132	1,618	58	66	275	7,402		12,644
ance	8	152	1,648	1,865	739	215	...	1,627	2,316	851		9,421
itzerland	41	219	...	4	225	359	...	...	212	4		1,064
aly	160	694	35	...	...	140	...	...	...	...		1,029
stria-Hungary...	3	364	...	785	8	36	...	...	1,591	533		3,320
ited States	2,283	75	688	838	292	7,209	1,391	285	41	1,740		14,842
Total, £	4,084	11,320	3,914	30,602	3,060	33,149	1,449	2,832	8,715	23,611		122,736

Additional imports: Spain, carbons, £26.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£		
rious countries, mainly as above	1,885	138	...	1,765	...	3,338	...	527	528	1,842		....

Total Exports: £269,341. Total Re-Exports: £10,023. Total Imports: £122,762.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

REVIEWS.

The Life-Story of Sir Charles Tilston Bright, Civil Engineer. Revised and Abridged Edition. By Charles Bright, F.R.S.E. London: Archibald Constable & Co., Ltd. 1908.

The author in his Preface describes this work as an abridgment of the original biography under the same title by the joint authors, Edward Brailsford Bright and Charles Bright, having been specially prepared in view of the fiftieth anniversary of the Atlantic Cable celebrated last year.

After some details of genealogy and boyhood in the first two chapters, we are given in the third an interesting account of Bright's start in life as a telegraph clerk at the Harrow Station of the L. & N.W. Railway, and his early work laying landlines in the service of the old Electric, the British and the Magnetic Companies from 1847 to 1860. His career so far marked unmistakably the man of action and resource, and after laying a network of landlines over the kingdom and devising instruments and improvements in apparatus for working them, it is not surprising to find that he took up the construction and laying of submarine lines, at that time just demonstrated practicable. He saw the Atlantic from afar, and prepared himself for it by experiments in signalling over long lengths of underground landlines and by laying the first cable to Ireland.

In Chapter V the story of his crowning achievement—the Atlantic Cable—is related in 15 sections, covering the period from the first attempt in 1857 and the successful but short-lived cable of 1858, to the 1865 and 1866 successes.

One of the most remarkable events in the 1858 Expedition related in this work was in connection with the arrangement that the two vessels, after splicing in mid-ocean and paying-out, were to return to the rendezvous and start again in the event of the cable parting. After three attempts the fourth start was made on the agreement that if the cable parted before the ships had gone 100 miles they were to return and start again, but if the 100 miles were exceeded the ships were to proceed homewards. The cable actually parted after the *Agamemnon* had gone 114 miles, and the excess over 100 being so little she elected to put back, assuming that the *Niagara* would do the same, but after beating up to the rendezvous against a heavy gale and cruising around in a fog she was obliged to turn homewards, the *Niagara* having acted strictly on the agreed distance and gone home.

Other points standing out in historical interest are related. For instance, the failure to use Lord Kelvin's (then Prof. Thomson's) reflecting mirror on the completed 1858 cable, and the fatal mistake made of using high-tension induction apparatus for signalling, gradually killing the cable thereby. Also the fact that the smallness of the core of the first Atlantic was approved on scientific grounds by such great names as Faraday and Morse, while Bright had correctly counselled a heavier core. It is, indeed, striking reading from the point of view of scientific expert opinion as advanced from time to time; some right, others hopelessly wrong. Many such proved to their own satisfaction the impracticability of laying an Atlantic cable. Others, among whom Lord Kelvin was greatest, showed that the scheme was practicable. Of the many interesting features of this part of the work the side lights thrown from time to time upon the early life and sayings of this most distinguished and beloved scientist are of especial interest.

There is very little of Sir Charles's own writings given us in connection with the Irish and Atlantic Cables, and it is somewhat surprising that no references by Atlantic shipmates appear except the short and graceful notes by Lord Kelvin, who, though himself never self-assertive, was ever ready to encourage and notice the best points in others.

Chapter VI contains the story of the first Mediterranean Cables laid in three sections from Malta to Alexandria, and the Spanish Cables in 1860.

In Chapter VII Sir Charles Bright's improvements in cable making appear, particularly his patent for the outer serving, and the process of application of preservative compound which rendered so lucrative a return to himself and his partner, Mr. Latimer Clark.

Chapter VIII, under the title of the "Telegraph to India," contains the account of the Persian Gulf Cable Expedition. In describing the segmental conductor then tried, it is of interest to note that copper for cables was of 76 per cent. purity, and that in cables previous to this, the conductivity was as low as 30 and 40.

Chapter IX treats of Sir Charles's election as Member of Parliament for Greenwich, and some interesting glimpses of his Parliamentary experiences.

In Chapter X we have notice of the introduction in 1859 of Mr. William Hooper's vulcanising process for india-rubber, as used for submarine cables of that time, and so much in vogue to-day for electric light cables.

The active part taken by Sir Charles in the cables to India, China and Australia is related fully in this chapter. Most people when going through the biography of a great man, are chiefly attracted by those portions revealing the secrets of his start in life, and those of his own writings, throwing light on the more human side of his career. The great achievements of such men are known to all the world; the fame of them has been sounded far and near, and for years the works connected principally with their name have been known, talked of, read of, and in some cases impregnated within us almost to the verge of super-saturation. While it is true that excellent and refined music can be drawn from the trumpet, such as will command the highest appreciation from those who hear it, there is, nevertheless, the possibility that the appreciation may not continue at so high a pitch if the same tune is played over and over again on the same instrument for an indefinite period of time. The biography must of necessity contain these great events, but what we look for, more than anything else, is the pourtrayal of the man himself. We want to know him as he lived, his aims, his attitude in difficulties and triumphs, his strong points, his weaknesses, his pleasures and his struggles. It is always of interest to learn of the early days and start in life of such a man, and how he rose to success.

Of official reports, speeches and newspaper accounts of expeditions in which Sir Charles took part, the author provides enough to satisfy the most rapacious instincts, the story of the first Atlantic expeditions being almost entirely compiled from the *Times* correspondent's articles. These articles, let us say in passing, are exceptionally good, and show evidence of considerable study of the nautical and technical matters handled. Moreover, in reading them one is not bored by any hard labouring to say smart things, so frequently the cause of an otherwise fair effort being rendered commonplace.

In default of so little written by Sir Charles himself, we should have expected to see more accounts by those who worked in co-operation with him, such, for instance, as the very entertaining reminiscences on page 262 by Mr. F. C. Webb, his chief engineering assistant. Such details could not, of course, be supplied from the author's own experience, as his birth (chronicled on page 240) occurred only seven years before Sir Charles entirely discontinued taking an active part in the laying of cables.

As to Sir Charles's rise to the position of influence and success which he very justly won, it may be said that a successful career is always a useful one, and is founded upon, first, attaining the necessary qualifications to be of use to the community in one particular line; and, secondly, the occurrence of opportunities at the right time when those qualifications are most needed by the community. To some the opportunities come too late or too early. To others they simply follow each other in succession exactly at the right moments of time. Some seize them, while others fail to do so.

In the biography of Sir Charles Bright before us, we cannot fail to perceive that those qualifications which he earned for himself were just those for which opportunities occurred at the right time for their fullest exercise. His landline experience fitted him to embark on cable laying just when cable laying was commencing to be in demand. His experience on the Irish cables fitted him for the Atlantic expeditions just when these enterprises were taken in hand. His Atlantic experience fitted him for the services he rendered to Parliament and the Government, and for the laying of the Persian Gulf and other cables. This must not be misunderstood in any way to suggest detraction from his abilities and perseverance, but rather to enhance these qualities as their development was stimulated.

The author has evidently deemed it unnecessary to trouble much about his descriptions of early cable-laying machines; otherwise the illustrations and explanations, with a little care expended upon them, might have been made intelligible and interesting. In the first Atlantic paying-out gear, for instance, on page 79, the rods connecting the brakes with the self-releasing levers in the elevation might have been shown in the plan, or the fact pointed out that each brake wheel had a separate attachment. The illustration on page 76, although entitled "the self-releasing brake," does not show the self-releasing action, and that on page 77, although entitled "the principle of the brake," shows no connection between the weights and brake band, the latter being shown as continuous instead of in two parts, with the proper articulated motion for applying and releasing. It would be more to the point if the titles of these two illustrations were interchanged, or the illustrations themselves modified so as to make their purpose clear.

There appears to be a slip in the foot-note on page 78, where it is stated that the drum is carried round by the weight of the axle as the ship moves onwards. This ought to read, "by the weight of the cable."

Chapter XI, on Sir Charles Bright's cable-laying expeditions in the West Indies, is full of human interest, great difficulties having been met with and surmounted. The climate during those five years worked death amongst his most experienced foremen and jointers, and he himself was down often enough. Shore-ends had to be negotiated by wading through pestiferous mud; yellow fever, cholera and small-pox were raging in the towns. Nevertheless, there were bright times, and the diary here given shows that there was no lack of fêtes, banquets, picnics and general exchange of courtesies between enthusiastic colonists and the cable staff as the various islands became linked up.

After this we have, in Chapter XIV, an interesting side-light upon a part of Sir Charles's life, in which he and his brother occupied themselves in mining. The work concludes with a digest of Sir Charles Bright's 130 inventions, comprised in 20 patents, several of which related to electrical generators and lighting.

Altogether, the work is a well-written record of a distinguished life, and in a style which can be appreciated by the non-technical as well as the technical reader.

THE PREVENTION OF SMOKE.

By WILFRED YORKE, A.M.I.E.E.

In the technical Press recently the case of an electric lighting company being fined for the production of smoke was cited, the defence being that the emission of smoke at times was unavoidable, although the company had spent upwards of £2,000 in their efforts to mitigate the offence.

In the face of up-to-date practice, which has proved that such a nuisance can be absolutely avoided, such pleading is rather remarkable, and seems to show that the results of the empirical methods of burning coal in a boiler furnace that became standard (?) practice in the early days of steam engineering, and which, together with the poor condition steam plant deteriorated to generally, induced Fairbairn to found the Manchester Steam Users' Association, still have a faint echo in many parts of the country, with the accompanying plea that the production of smoke cannot be avoided at times.

The writer, therefore, hopes that the following remarks embodying the essentials of modern practice, together with particulars of the success attending the serious application of these methods, will prove interesting to the readers of this journal.

Most electric lighting and power undertakings in this country favour the use of bituminous coal, since it is much cheaper than smokeless coal (anthracite or semi-anthracite), and when handled scientifically is quite as efficient and as smokeless.

It is particularly interesting to note at this point that James Watt's ideas for burning bituminous coal are in the main quite as efficient and sound as any of the present-day methods. Watt enunciated the principle that bituminous coal should be burnt on the coking system, the green fuel being placed in front of the fire on the dead-plate to allow the hydrocarbon gases to be volatilised and burnt; the partly coked coal was then pushed back on to the grate, and its place filled with a further charge of fuel. He also realised the importance of supplying air *above* the fire to burn these volatile gases efficiently. The latter point will be referred to in detail later.

The writer is convinced that the coking system, as outlined above, is the correct method of burning bituminous coal, the advantages gained more than outweighing the drawbacks when compared with the sprinkling system, and he therefore proposes to deal more particularly with the coking method, though the general principles expounded are, of course, applicable to both systems. Further, since mechanical stoking is now practically universal in all generating stations that have any pretensions to size, this article will deal with chain-grate stokers, this being the type of coking stoker most commonly met with, especially when installed under a water-tube boiler.

Now, the coal classed as bituminous is that which contains up to about 35 per cent. of volatile matter, above which percentage the fuel ranks as "cannel," and is used chiefly for gas-making purposes. The combustion of a substance containing such a relatively high proportion of volatile matter becomes a very complex problem, since it may be considered to involve two totally different processes, namely, burning (*a*) the gaseous constituents, and (*b*) the solid or carbon portion.

The gases will burn in a very much shorter time than the carbon, and require to be intimately mixed with air to ensure complete combustion whilst passing under the fire arch and over the incandescent bed of fuel, and the emission of smoke will be solely due to the ineffectual combustion of the hydrocarbon gases evolved.

The two main essentials for achieving this combustion perfectly are temperature and air supply, and if either is deficient the production of smoke will ensue.

In the chain-grate stoker the hot zone is provided by the fire arch, which is often far too small to fulfil successfully its purpose, and might be lengthened considerably, the additional area being installed at the front of the arch and the stoker brought away from the boiler to suit. The combustion chamber would be thereby increased, and this would nullify the possibility of the gases striking the water tubes and being cooled below the point of ignition before complete combustion is effected. Such premature cooling will cause the hydrocarbons to be condensed, resulting in the liberation of carbon in a finely divided state, and smoke will be inevitable.

The air supply for the gases should be admitted at the front of the boiler in such a manner as to be drawn over the fire and intermixed with the volatile gases at the moment of their liberation. The mixture will then pass through the hot zone, and should be perfectly consumed, producing an intense heat-giving flame, carbon dioxide and steam being formed. Whereas with a deficient air supply above the fire, smoke will be formed, even though the requisite temperature is attained, due to the dissociation of the gases by the high temperature into carbon and hydrogen, which pass to the flue unburnt.

The chain-grate stoker, however, is sadly deficient as regards this supplementary supply of air, though in the usual designs of such stokers in use, it is presumed that the requisite air for the gases finds its way through the thinner portions of the fire at the back of the grate, and also as leakage between the stoker front and the side jambs. But the admission of air at the bridge of the ordinary chain grate must be regarded as a very crude method, as it not only deprives the air of the heating effect of the arch and fire, but also of the better mixing effect to be derived from admission at the front. The volume of air that finds its way through the various small openings at the front of the stoker (such as ill-fitting fire doors, joints in the stoker casing, &c.) will rarely exceed a fraction of 1 per cent. of the total volume necessary, and must, therefore, be regarded as negligible.

Hence it becomes necessary from a theoretical point of view to make some proper provision in the front of the stoker for the admission of air over the fire for the purpose of consuming the volatile constituents of the coal, and until such an allowance is made the writer feels convinced that the present designs of chain grates will continue to be offenders by producing smoke. It is obvious that such an opening should be controlled by a damper or register to regulate the volume of air admitted in proportion to the hydrocarbons in the various classes of coal; and in cases where the draught at the boiler damper is less than ½ in. of water, it will be necessary to use a small high-pressure steam jet in the air opening to ensure the satisfactory admission above the fire.

It might be mentioned here that poor draught, due usually to an overloaded chimney, is in many cases the fundamental cause of smoke, since to ensure proper combustion the pull at the boiler damper should be at least ¾ in. of water.

The table given was deduced from some six experiments carried out on a water-tube boiler fitted with the usual type of chain-grate stoker, and these fully prove the soundness of the assertions made.

In the first test the stoker was left in its usual position, and all openings in front were plugged with lagging composition. The latter was afterwards removed for the second test, the opening round the front of the stoker being equivalent to ¼ in., or an area of ⅓ sq. ft. This opening was then increased for each successive test by drawing the stoker away from the boiler bodily until, on the final test, it was 2 in. distant from the boiler front, leaving an opening equal to 2⅓ sq. ft. This latter figure agrees closely with Rankine, who gives a consumption of 24-27 lb. of coal per sq. ft. of grate surface per hour with natural draught, and *air holes in the fire doors equal to $\frac{1}{38}$ of the grate surface.*

Test No.	Conditions.	Area of opening at stoker front.	* % of opening to grate surface.	CO_2	Velocity of air.		Cubic feet of air per hour over fires.	Per cent. to that necessary for combustion.*	Smoke.
					Under grate. Ft. per min.	Over doors. Ft. per min.			
1	Stoker in usual position, all openings stopped.	—	—	12·6	230	—	—	—	dark brown
2	Cement removed, leaving an opening of ¼ in.	·307 sq. ft.	·35	12·0	230	82	1,510	0·25	brown
3	Stoker drawn ½ in. away from boiler.	·62 „	·7	11·55	223	160	5,940	0·98	light brown
4	Stoker drawn 1 in. away from boiler.	1·24 „	1·4	11·0	225	305	22,600	3·74	very light brown
5	Stoker drawn 1½ in. away from boiler.	1·86 „	2·1	10·5	220	464	54,430	8·5	very slight haze
6	Stoker drawn 2 in. away from boiler.	2·37 „	2·7	10·0	220	614	87,100	14·4	none

Draught—at boiler damper ¾-in. water. Draught—over fire damper ·85-in. water.

* Air necessary for combustion assumed to be 22 lb. per lb. of coal with a consumption of 25½ lb. of coal per sq. ft. of grate surface per hour.

The thickness of the fire was regulated so as to keep the bars covered right to the back, and the speed of the drive was adjusted to suit.

The density of the smoke was accurately gauged by inserting an ordinary electric glow lamp in the boiler setting at the rear on the far side. An aperture was then made on the near side in such a position that the products of combustion crossed the line of sight, the presence of smoke therein causing a dimming effect on the light.

Needless to add, all leakages, not only in the boiler brickwork, but also in the economiser settings and main flue, were eliminated as far as possible.

That the emission of smoke can be absolutely prevented by the exercise of scientific control is therefore patent, and as two of the largest generating stations in London are using the principles outlined above on their mechanical stokers with complete success, the writer hopes that the information given will prove useful in a small degree to those engineers suffering from the too earnest attentions of the local smoke inspector.

A GERMAN ELECTRICALLY-OPERATED WAGON-TILTING PLANT.

[BY OUR BERLIN CORRESPONDENT.]

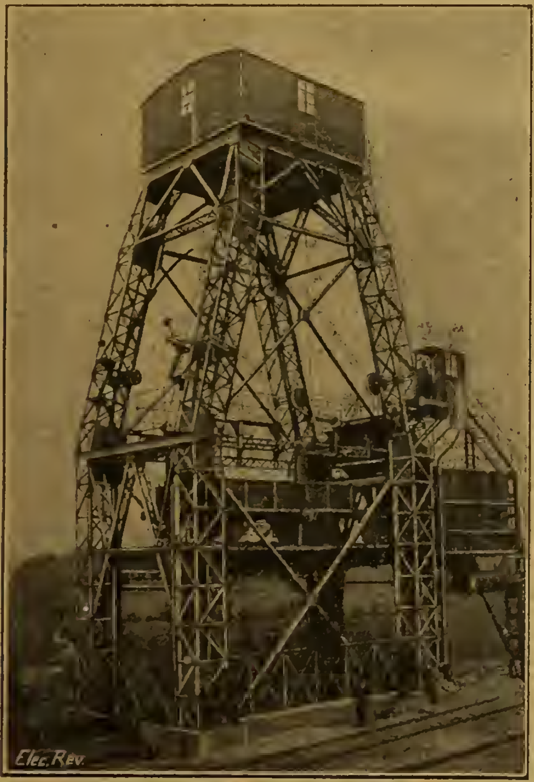
A marked tendency can be noted towards reducing as far as possible hand labour, and using machinery in connection with the transfer of large amounts of staple matters—such as ore and coal. The plant described in the following has been recently constructed by the Benrather Machinenfabrik for a German mine, and can be considered as typical of the best Continental practice in this connection. In fact, it is the first German plant in which a single platform is used both for lifting and tilting.

The plant in question is designed to transfer ore and blast-furnace materials on their arrival in ordinary open goods wagons into self-tilting Talbot cars, and mainly consists of two parts—viz., devices for raising the full car and tilting it on to the hopper of 120 tons capacity placed beside the latter, into which the cars are unloaded. The materials are thence discharged through a movable chute into the self-tilting cars. The chute and locking valve are operated by a common electric winch. Four wire ropes supporting the platform, 34⅔ ft. in length and 77½ ft. in width, and leading over guiding rollers towards the four drums on which they are wound up, are used as lifting gear for the wagons to be unloaded. The drums are operated in pairs by one motor each, for the fore and back ends respectively of the platform. However, the two driving gears are connected together during the lifting at a height of 36⅔ ft. by a friction clutch mounted on the continuous worm shaft. The output of each motor is 45 h.p., with a lifting speed of 5·5 metres per minute. In order to avoid any loss in time by the arranging and shifting of the cars to be discharged, the tilting device has been constructed with its longitudinal axis coincident with that of a railway track interrupted by the platform.

The loaded cars are brought to one side of the plant, and after being discharged leave it from the other side of the hopper. The discharging of a car is carried out as follows:—

The platform, in its lowest position, rests on the foundation with its sliding doors opened, being carried on felt buffers, thus turning down the track locks fitted into the feeding tracks and into the platform. The filled car is drawn on to the platform by means of capstans, its speed being reduced, whenever required, by the rail brake actuated through a spindle device on the platform, which acts on the wheel rims. On coming down, the car itself actuates two substantial clamps embracing the fore axle. The operator, who is located in a cabin above the hopper, then sets the driving gear working by means of a controller and two self-acting reversing starters. On lifting the platform a track-lock, which prevents the car from moving, is erected behind the last axle of the car, while the feeding tracks at the same moment are locked and the pit doors closed. After a lift of 35⅝ ft., the current is cut off automatically, and by means of a pedal the operator then causes a support, consisting of two props at the back end and two bearings for the tilting pivots at the fore end of the platform, to advance, thus opening two rotary framework doors which prevent any access from the operator's cabin to the pit. The platform is then lowered on to the support and the driving gear stopped automatically, after which the operator proceeds to the cabin in order there to disengage the locking bolts of the front wall of the car. One of the motors is now thrown out of circuit and the clutch connecting the two motors disengaged; if now the reversing starters be actuated, only the motor lifting the back part of the platform will receive current, while the platform with the car turns on two circular guiding rails round the tilting pivots until it reaches an angle of 45° with the horizontal. During the tilting operation, the platform swings above the rope winches, after the safety device for preventing the ropes from gliding off the winches has been removed. The current is cut off automatically with an inclination of less than 45°.

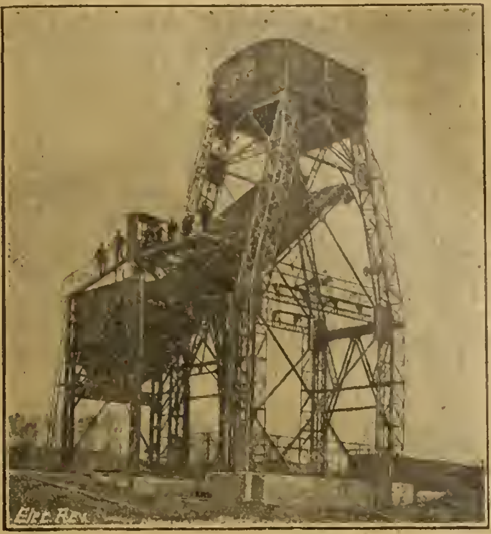
As soon as the platform has commenced tilting, the hand lever actuating the clutch and commutator is again locked, and on the platform returning to a horizontal position, the rope guard is again turned round by the platform, and current cut off automatically on its arrival in that position.



Wagon-Tilting Plant.

The second motor can now be brought into use and connected by the clutch with the other one.

The operator now lifts the platform up to its uppermost horizontal position, thus causing the framework doors to close, the props to be withdrawn and the actuating levers to be closed, while the current is cut off automatically at the end. The platform being now lowered, the sliding doors are opened and the controller lever moves automatically into its central position. As the platform arrives at its lowermost position, the clamps carrying the car and the three track-locks are turned down, when the car can be taken out beneath the hopper. On leaving the platform, the car also disengages the clamps so as to allow all the axles of the empty car to pass over the platform, and the first axle of the next full car is again seized by the clamps. Any possibility of accident due to carelessness of the operator is entirely excluded, the current being interrupted automatically after each motion of the platform, both in lifting, tilting, and lowering, the operator being able only to start the motion corresponding to each operation by closing the circuit.



Wagon in Position for Discharge.

The Fixation of Nitrogen.—It was recently reported that the Baden Aniline and Soda Works, of Ludwigshaven, whose works for the winning of nitrate from the nitrogen of the atmosphere are still in course of construction in Norway, proposed to erect similar works in Italy. The report stated that the company were in negotiation with the Marquis Cornaggia, of Milan, on the subject, that preliminary studies had been in progress for some time past, that an engineer sent to Italy was satisfied with the investigation of the water power available, and that a contract would soon be signed in Milan. It was then intended to form the Societa Anonima per la Fabricazione di Nitrato. with a capital of £480,000 and the co-operation of German and Italian banks, and then proceed, in the first place, with the erection of plant of 30,000 h.p. It was added that with the participation of the Societa Generale per la Cianamide of Rome, it was intended to erect nitrate works for the utilisation of water-power in Dalmatia, the plant to be arranged according to the patents of the Ludwigshaven company. The latter, on being asked as to the accuracy of the report, states that it is correct that the company is negotiating in regard to the grant of a licence for its nitrate process to the Advocate Cornaggia, of Milan, that preliminary investigations are in hand, and that an engineer has been dispatched to examine the source of water-power concerned, but all the other statements in the report are declared to have no foundation in fact.

Company and Municipal Tramway Co-operation.—A further instance of co-operation in the industrial district of Rhenish-Westphalia is recorded by the transfer to an Essen group of the majority of the shares in the South German Railway Co., which in addition to other lines carries on the Essen tramways, of a total length of 37 miles. These other lines proceed to Horst in the north, Bredeney in the south, Gelsenkirchen in the north-east, Steele in the east, and Oberhausen in the west. These ramifications, which are to be amplified by a number of shorter lines, bring the Essen network into touch with various other tramway systems, particularly those of the Bochum-Gelsenkirchen Co., and those of Oberhausen and Mulheim on the Ruhr. The Essen group, already mentioned, consists of the town of Essen, the Essen circuit, and the Rhenish-Westphalian Electricity Works Co., which is a pit-mouth supply undertaking, and as it owns the majority of the shares in the Bochum-Gelsenkirchen tramways, it is assumed that the latter will be brought into connection with the other lines mentioned by means of junctions and through traffic. The group proposed to form a limited company with a capital of £85,000 to take over the shares, of which the town of Essen would subscribe 48 per cent., the Essen circuit 27 per cent, and the electricity company the balance of 25 per cent., whilst the company would assume a debt of £850,000, which is to be guaranteed by the town and circuit of Essen. The acquisition by the group or the company of the majority of the shares in the Southern Railway Co. will also give the former a controlling influence over, among others, the tramways of Wiesbaden and district, up to Mayence, and over the full-gauge and narrow-gauge lines in Hessen, Baden and Thuringia, and it is thought possible that the various towns concerned will also participate in the new company.

A Non-Magnetic Yacht.—A non-magnetic survey yacht, built for the Carnegie Institution, Washington, was launched at Brooklyn recently. The vessel will be used for ocean research in terrestrial magnetism, and contains no magnetic material in its structure; it is 155 ft. long with 33 ft. beam and 12 ft. draught, and has a displacement of 568 tons.—*Electrical World*, N.Y.

THE FIXATION OF ATMOSPHERIC NITROGEN BY THE BADISCHE ANILIN UND SODAFABRIK PROCESS.

A DETAILED account of this process was recently given by Dr. Schönherr in a paper read before the Elektrotechnischer Verein (*E.T.Z.*, April 22nd and 29th, 1909), from which we take the ollowing particulars:—

After a historical survey of the subject, the writer points out that the production of nitric oxide in the electric arc is a thermal effect, but that the concentration attained depends not only on the high temperature reached, but also on the rapidity with which subsequent cooling occurs, and so limits the re-combination of the products. It is chiefly because of the greater ease with which this subsequent rapid cooling can be effected that the electric arc, when suitably arranged, has proved superior to the many purely thermal processes which have been devised.

At the present time the only industrially operated processes are the Birkeland-Eyde process and the Badische Anilin und Sodafabrik process. The former, patented in 1903, makes use of the deflecting power of a magnet on the arc. The arc is fed with alternating current, whilst the magnet is a direct-current one of constant polarity, so that the arc is alternately deflected upwards and downwards in rapid succession in its narrow chamber between water-cooled copper electrodes. The arc, consequently, appears to the eye as a great disk of light. In this way without the aid of any complicated machinery large amounts of power could be brought into action, and at the present time a factory employing ,000 H.P. is operating this process at Notodden, in Norway.

The Badische A. & S. commenced experimenting at the end of the nineties at their works at Ludwigshafen a. Rh., and in 1905 the author was able to bring forward a still simpler form of apparatus than the magnetic arc arrangement. In place of the intermittent or vibrating flame which had previously been considered essential, the Badische A. & S. apparatus employs a stable, steady arc. In order to bring a large mass of air into contact with the flame a long arc is employed; and, in order to avoid extinguishing or disturbing this extremely sensitive form of flexible conductor, the air is introduced with a circular motion, so that it passes over the arc with a screw-like motion. In this way the arc is kept steady in the centre of the eddying air stream, and the whole can be conveniently enclosed in a metal tube without fear of the arc jumping to the sides. In its simplest form, therefore, this apparatus consists of the metal tube and an insulated electrode at one end. The arc is started in any convenient way—for instance, by making the distance between the electrode and the tube small enough at one point to enable the H.T. supply to jump across the gap; the revolving air-blast then carries the arc before it to the end of the tube, and finally a steady arc is burning in the centre of the tube. No further arcs will occur at the gap, because an inductive resistance is always in series, and the voltage drop in this due to the current of the first arc lowers the voltage over the gap below the striking value. Should the arc be blown out from any cause, it would, however, automatically start again at the narrow gap.

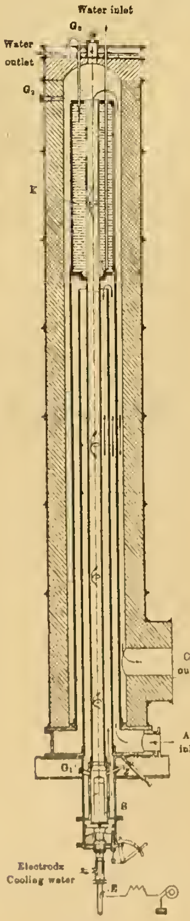


FIG. 1.

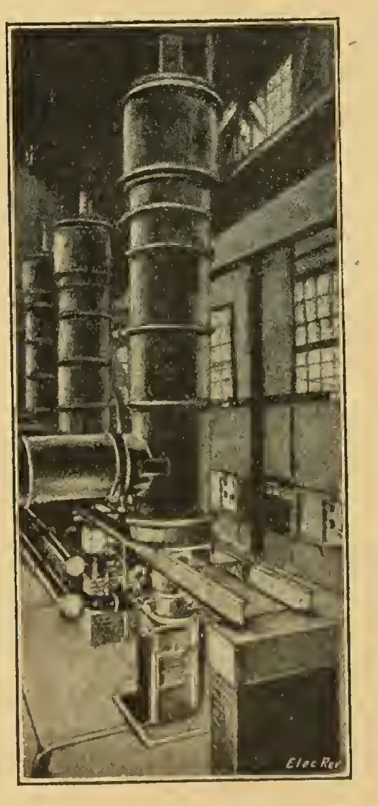


FIG. 2.

The construction of the actual furnace now employed is shown in fig. 1. It consists of an insulated electrode E of iron, which becomes coated with oxide and consumes away very slowly, and is usually fed in from time to time by hand. A single electrode lasts about 2,000 hours, and the cost is only a few pence per KW.-year. The electrode is surrounded by a water-cooled copper vessel. The arc is struck between this electrode and the innermost tube (also of iron) by means of the rod Z operated by hand. This rod, together with the whole of the rest of the furnace except the electrode E, is earthed, so that there is no danger to the operators. The restriking of the arc, besides, is very seldom necessary. When the arc is struck it travels, under the action of the air-blast entering tangentially by eight openings at S, up the inner tube, and comes to rest on the upper end of the tube. The correct length of arc is adjusted by means of an air controller surrounding the openings at S, and the position of the top of the arc is inspected through the glasses G_2 and G_3. By looking through G_3 the arc is inspected axially, and is seen to rotate steadily and so change its position continually. The upper part of the iron tube is also water-cooled by a copper jacket, and therefore practically no wear occurs at this electrode.

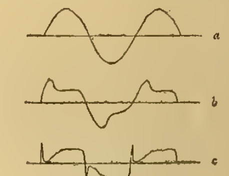


FIG. 3.

In the 600-H.P. furnaces (fig. 2) using 4,000-5,000 volts the length of arc is about 5 metres. In the 1,000-H.P. ones using a higher voltage, the length is about 7 metres. Still larger furnaces, absorbing 2,000 H.P. each, are in contemplation. The supply is usually a three-phase one—the furnaces being used with star connection. After passing the arc and the upper cooler the hot gases pass downwards between the central part of the furnace and the outer concentric case, and from here into a steam boiler which serves as a further cooler, and whose steam serves to concentrate the products of the process.

It will be seen that the fresh air as it enters the furnace passes first upwards in the chamber immediately within the outermost chamber, and becomes partly heated here. Just below the upper cooler the air is reversed, and travels downwards in a third compartment, becoming further heated through the walls of the inner chamber by the arc, and finally entering the arc chamber in a well-warmed condition by the openings S. The vertical arrangement of the furnace is not essential, as horizontal ones have been tried, and the arc is still found to burn steadily in the centre of the tube. Even bent tubes, conical tubes, &c., have been used successfully. It is also unnecessary to admit all the air at one set of openings S, as it can be admitted at successive points along the tube, and in this way any desired length of arc can be attained. The stability of the arc is so great that nothing but the most serious disturbances, such as short-circuits of the supply line, or sudden and excessive changes in the air admission, put it out.

The steadiness of the arc is well brought out by the voltage curve. In fig. 3 curve *a* shows an oscillogram of the voltage across the arc, curve *b* shows the same for an ordinary arc lamp, and curve *c* for the Birkeland-Eyde arc. It will be seen that the sudden peak of voltage at the re-striking of the arc shown in *b* and *c* is absent in curve *a*.

The power factor of these arcs is, therefore, also good—ranging from ·92 to ·96. The explanation of the difference from the ordinary arc seems to be that in these long arcs practically the same gas particles serve as current carriers for a number of successive periods, and so the resistance variations from instant to instant are minimised. New air particles, of course, constantly enter at one end, and gas particles leave at the other, but their numbers are small compared with the total number of particles forming the arc at any one instant.

The potential in the arc has been investigated by means of an auxiliary electrode, and it is found to be fairly uniformly distributed along the whole length. Measurements of the nitric acid concentration along the arc are not so easy to carry out, but, as would be expected, the concentration increases towards the centre and the top of the furnace.

Coming next to the question of the utilisation of the energy, it is found that the energy actually used in the formation of the nitric oxide amounts to only some 3 per cent. of the total energy. Over and above this, however, a large quantity of highly heated air results as a by-product, although only a small fraction of the energy in this has hitherto been made use of. An investigation of the Badische A. & S. furnace shows that about 40 per cent. of the heat conveyed to the arc is obtained in the form of hot water, 17 per cent. is lost by radiation, 30 per cent. is used in the steam boiler, and a further 10 per cent. has to be removed from the hot gases by water cooling after they have passed the boiler. The remaining 3 per cent. alone is used in the formation of the nitric oxide. It is to be expected that more of this waste heat will be employed in time.

At Notodden the weak nitric acid solution is allowed to act on carbonaceous lime directly. This weak lime solution is dried in vacuum chambers by means of heat from the arc gases, and when crystallised, the cake is broken up into small pieces in mills and is packed in 100-kg. casks. The material so produced has now been on sale for several years. It is of uniform quality with a content of 13 per cent. of nitrogen, whilst Chile saltpetre has about 15 per cent. Besides the experimental works at Ludwigshafen and at Kristianssand, and large extensions to the factory at Notodden, in which the Badische A. & S. process will be employed, a still larger installation is being erected at Rjukan, in Telemarken (Norway). Here a waterfall of 560 m. is available, with a flow of 47 $m.^3$ per second, so that a total of 250,000 E.H.P. can be obtained. The fall is to be used in two stages of 280 m. each; the first stage is to be equipped with ten 14,000-H.P. turbines, and is to be ready for the production of saltpetre by 1910.

Negotiations are also in hand in connection with a 50,000-H.P. water supply at Salzach, in Southern Germany, and for two waterfalls at Matre and Tyn, in Western Norway. These will all be under the combined control of the Badische Anilin und Sodafabrik and the Hydro-Electrische Stickstoffgesellschaft, which works the Birkeland-Eyde patents.

PROCEEDINGS OF INSTITUTIONS.

Faraday Society.

At the meeting of the Society held on June 10th, subjects so apparently diverse as the conservation of water for power and electric steel smelting were discussed by a well-attended meeting, which seemed, on account of the presence of some well-known American electrochemists, something like an echo of the recent International Congress of Applied Chemistry. The subjects are, of course, in reality very closely connected; the more amply and generously is power placed at the disposal of the electrochemist, the more chance have his methods of becoming generally applied.

The National and International Conservation of Water for Power.

This was the subject of an address given by Mr. E. R. Taylor, of Penn Yann, N.Y., who is well known as the inventor of the electric furnace method of manufacturing carbon bisulphide, but who is now devoting his energies and enthusiasm to teaching the people of America and Europe the folly of allowing to run to waste vast stores of natural power and natural sources of agricultural wealth whose very existence at present seems to pass unnoticed. Mr. Taylor's plea, in a word, is for the civilised nations of the world to impound, as far as possible, the flood-waters which fall in such abundance—often executing great damage—on the uplands of the earth, and to utilise the water so impounded for irrigation purposes in the lowlands and as a source of power, vast in the aggregate, in its fall from higher to lower levels. Again, in many parts of the world, the flood waters carry down with them the soil, entirely denuding the uplands until they become useless wastes. Mr. Taylor showed on the screen a view of some arid Chinese uplands which 200 years ago were covered with timber. By impounding the rainfall in such regions, not only is one conserving water and conserving power, but forests will be created, which are in every way a source of wealth (and a source of beauty) to the regions in which they have sprung up. As an example of what can be done on a small scale, but which could probably be repeated by countless individuals all over the world, Mr. Taylor showed some views of a small brook on a farm in America, from which the enterprising owner, by making a simple dam of stones, has developed 25 H.P., which is utilised on his farm. From this little brook 2,225 H.P. could be developed—equivalent to 30,000 tons of coal a year. The water-power capacity of the whole of the United States is not less than 150 million H.P.; of the annual stream flow of the country from 85 to 95 per cent. is wasted in flood. No doubt conservation cannot be carried out in countries like England, where land is extremely valuable, to the extent possible in America, but America has now led the way, inspired by the action of the late President, to a serious national consideration of this great problem, and it is to be hoped that the Governments of Europe will not lag behind. Mr. Taylor strongly urged the necessity for the problem to be considered internationally, and he pointed out that a beginning is to be made in 1910, when a conference will be held at the Hague. It is gratifying to be able to report, what was stated at the meeting by Mr. Walter Reid—that the President of the Local Government Board has recently promised to take definite action in at least one direction, namely, with regard to the conservation of our English rivers, each of which is to be placed under the control of one central authority, subject to the supreme direction of the Local Government Board. This is a step in the right direction, and it may, at least it is to be hoped it will, have the effect of bringing into utilisation the many small waterfalls existing in this country, to say nothing of the general downward flow of our large rivers, which, if small individually, are by no means negligible in the aggregate.

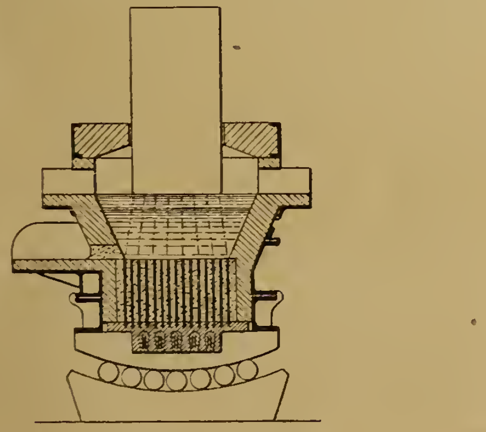


Fig. 1.—Keller Furnace.

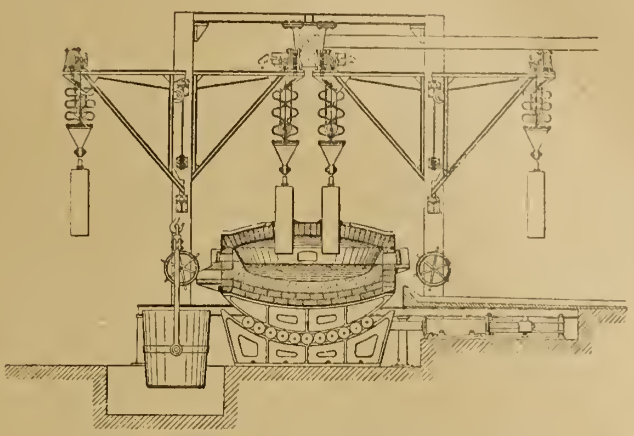


Fig. 2.—Keller 10-ton Furnace at Unieux

Electric Steel Smelting.

Under the title "A Contribution to the Study of Electric Furnaces," M. Keller, the distinguished French electrometallurgist, made a communication to the Society of considerable interest, in which he advocates the extended use of the type of furnace in which a conducting hearth—which must be non-carbonising—forms one of the electrodes. This was the method used by Siemens in his original furnace (1880), but the type mostly employed at the present day is that perfected, among others, by Héroult (and by M. Keller himself), in which two, or more, electrodes dip into the bath suspended from above, the current entering by one, or one pair, usually through the medium of an arc, and leaving by the other. Of course the construction of this type of furnace is very simple, and only half the current density is necessary for the same output as is employed in the other type, thus economising electrical connections; but these furnaces have the disadvantage of not allowing the current to flow uniformly through the whole mass of molten metal, and the product is consequently not likely to be so homogeneous as where it flows from one upper electrode, through the bath, to a lower electrode. M. Keller, in this paper, advocates the extended use of the "conducting-hearth" furnace, and he describes a type which ensures a uniform current density over the whole base of the furnace. Previous forms of conducting hearth consist either of metal only on one or more metallic poles embedded in a non-carbonising masonry (Siemens, Borchers and Girod), or else of refractory material, such as magnesia or silica, rendered conducting by a carboniferous substance (the new Firminy type). M. Keller,

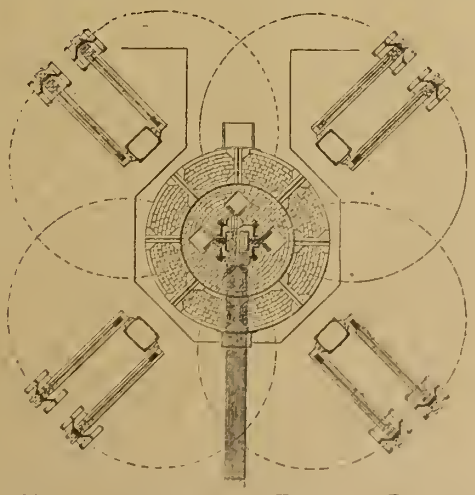


Fig. 3.—Keller 10-ton Furnace: Plan.

however, uses a hearth consisting of a "reinforced clay," made up of iron bars 25 to 30 mm. in diameter, placed vertically 25 to 30 mm. apart and packed solid with magnesia, by preference (see fig. 1, p. 37). When cold, only the bars are conducting, but when in operation, the hearth is conductive over its whole section, and the electrical resistance is very small. The mechanical resistance of such a hearth to the subsidence of the metallic bath is very considerable, and the author states that the bottom of the furnace is absolutely indeformable. The hearth of a 1,500-kg. furnace, examined after many months' service, was in exactly the same condition as when it started. The grave objection to this furnace is the fact that the bottom electrode will have to be water-cooled, and a bath of steel on a foundation of water in any shape may lead to exciting incidents, to say the least. Many of those who took part in the discussion, Mr. Morrison, Mr. Ristori and Mr. Cobb, among others, considered the water-cooled electrode an insuperable objection to this type of furnace; it is probably a question that experience will ultimately have to decide. The 10-ton Keller steel furnace used at the Holtzer works at Unieux—probably the most important of its kind in actual operation—for finishing the manufacture of a steel already molten in a Martin furnace, is of the vertical electrode type, with, however, four instead of two electrodes, each pair of which is capable of independent regulation, so that the operation of the furnace is under complete control (figs. 2 and 3). This method of central distribution of current into the furnace results in very small self-induction; the power factor is as high as 0·97, when a great current like 12,000 amperes is passing. This furnace purifies the steel until the phosphorus and sulphur together only total 0·01 per cent. The type is particularly adaptable for three-phase current, the electrodes being connected either in mesh—one of the three electrodes to each phase—or in star, in which case the armoured clay hearth of the furnace is connected to the middle point of the three-phase system. In the opinion of M. Keller there is no reason why a 20-ton three-phase furnace, of about 1,800 KW. capacity, should not now be constructed. Such a furnace could purify 250 to 300 tons of steel per day, obtained from a converter, at an operating cost of 12s. to 16s. per ton, with electricity at 0·15d. per unit, such as would be obtainable by utilising blast-furnace gas.

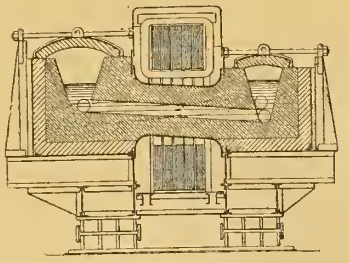


Fig. 4.—Gin Induction Furnace.

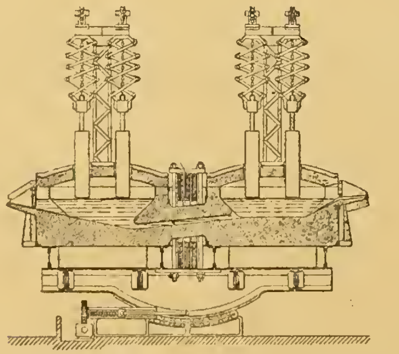


Fig. 5.—Combined Electrode and Induction Furnace.

A paper by M. Gustave Gin described a suggested improved form of induction furnace (fig. 4), also for steel refining, in which the molten material is in continual circulation, so as to ensure homogeneity of treatment and of product. The two crucibles which form the main part of the furnace are connected together by inclined channels, the whole arrangement forming the closed secondary circuit, in which general circulation is caused by the higher temperature generated in the cross channels. It is claimed that with this type of furnace the ohmic resistance of the circuit can be increased without correspondingly altering its self-induction, thus allowing furnaces with a high power factor to be constructed, and generators and transformers of normal frequency and size to be employed.

The same principle of cross-connections to facilitate circulation can obviously be applied to ordinary electrode furnaces, or to combined electrode and induction furnaces (fig. 5), which are now coming into use, although whether practical difficulties are likely to arise with the use of these channels, whose resistance will be high, and in which a good deal of local heat will be generated, is a question which only experience can decide.

Physical Society of London.

At the meeting held June 11th, 1909, a paper by Dr. Russell and Mr. Arthur Wright on "The Arthur Wright Electrical Device for evaluating Formulæ and solving Equations" was read by Dr. Russell. In this device special slide resistances are used. If R be the resistance of one of these and a metallic finger make contact with it at a point where the scale-reading is x, the resistance between this finger and the terminal of the slide is R/x. The scales of the slides are graduated logarithmically as in the ordinary slide-rule; hence the processes of multiplication and division can be done mechanically by sliding them against exactly similar fixed scales. If one connects a number of these slide resistances in parallel, since the current is inversely proportional to the resistance, the sum of the currents through them will be proportional to the sum of the readings of the contact fingers. One can easily balance by a null method this current against the current going through a single slide resistance X by means of a Wheatstone-bridge arrangement; in this case the reading on X when there is a balance gives the sum of the readings on all the other slides. Similarly one can subtract numbers by putting slides representing these numbers in parallel with X, and then obtaining a balance by altering the reading on X. The variable arms of the bridge can be usefully employed in making the calculations.

A model of this device for solving an equation of any degree consisting of not more than four terms was shown. The inaccuracy of the results found by means of this model is of the order of one per cent. Approximate values of the imaginary roots of numerical equations can be found by the device, and it can be employed to solve very complicated equations.

A paper entitled "The Proposed International Unit of Candle-Power" was read by Mr. C. C. Paterson. The paper discusses the units of candle-power at present officially accepted in Great Britain, France, the United States of America and Germany. The numerous intercomparisons which have taken place during the past five years between these units show that the candle, as interpreted in France, Great Britain and the United States respectively, has practically the same value in the three countries. The authorities in the gas and electric interests in the United States are prepared to adjust their units of candle-power to bring them to a single value, which is to be the same as the British and French units. The paper gives the results of comparisons showing that within the limits of experimental error the British and French units are identical. The change involved in the unit at present maintained at the Bureau of Standards, Washington, is shown to be 1·6 per cent. The proposal to call the common unit of light to be maintained jointly by the National Standardising Laboratories of America, France and Great Britain the "International Candle" has been submitted to the International Electrotechnical Commission, and through it to all the countries of the world which are represented on that Commission. The Hefner unit is shown to be almost exactly $\frac{9}{10}$ths of the new unit. The comparisons between the units have been made by two methods:—(1) Direct comparisons of the flame standards in France, Germany and Great Britain. (2) Through the medium of electric sub-standards which have had values assigned to them in the National Laboratories of the four countries.

The agreement between the ratio values by the two methods is very close, and is shown by a table giving the results of the various comparisons which have been made.

Dr. Fleming said that he greatly regretted that the National Physical Laboratory authorities had acquiesced in the adoption of a flame standard of light, with all its difficulties and variabilities. Influenced as they are by atmospheric pressure, moisture, CO_2, height of flame, composition of fuel and number of persons in the photometric room, these flame standards could not possibly be considered as a final solution of the problem of obtaining a primary standard of light. What was really required was the concrete realisation of a permanent primary standard, which would be the standard of reference for secondary standards like the Fleming-Ediswan large-bulb glow-lamp standards, which he had introduced seven years ago. Prof. Petavel had shown that with suitable precautions the unit of illumination could be reproduced within 1 per cent. by means of the Violle molten platinum standard.

Dr. Russell said that the *bougie décimale* was the unit adopted by the International Congress of Electricians in 1889, and was defined to be the twentieth part of the Violle standard. He was not prepared to accept that it was equal to 1·11 Hefner units. Waidner and Burgess had proposed to adopt as the unit of intensity the radiation from a square centimetre of a black body maintained at the temperature of fusion of platinum.

Mr. Dow said the pentane lamp as a standard was not very inferior to the Violle standard. He did not think they could as yet accept as a standard an area of a black body at a high temperature.

Dr. Drysdale thought the international agreement was simply an attempt to obtain agreement between present existing units rather than standards, and left the matter of the best form of standard perfectly open. Every one having experience with flame standards would thoroughly agree with Prof. Fleming's condemnation of them, and there could be no doubt that the primary standard should be an incandescence one. He, however, did not agree with Dr. Fleming's suggestion of reviving the Violle standard. It seemed decidedly preferable to suggest a unit area of a black body at a definite temperature. Mr. Jolley and he had come to the conclusion that a square cm. of a black body at a temperature of 2,000° absolute would perhaps be a good unit and would be probably of the order of 100 candle-power. This temperature was probably pretty close to that of the ordinary carbon-filament glow-lamp, so that there should be no colour difficulty and it should not be exceptionally difficult to maintain constant. A point in favour of the black body was the perfectly definite character of its spectrum, which made it a standard of colour as well as intensity and suitable for spectro-photometric comparison. As the surface would be that of a solid, it would be unnecessary to maintain it in a horizontal position, as with the Violle standard, and the amount of light could be easily varied by a diaphragm.

Prof. C. H Lees said that Prof. Petavel's recent work on the radiation from heated platinum strips suggested that he was not altogether satisfied with the Violle standard.

Mr. Paterson thought that Dr. Fleming had probably misunderstood the object of the paper, which dealt with the relations existing between the various units now in use. He did not think it would be possible to keep the temperature of a black body sufficiently constant to enable it to be used as a standard.

A paper on "Inductance and Resistance in Telephone and Other Circuits" was read by **Dr. J. W. Nicholson.** A general formula for the effective inductance of a circuit consisting of two long parallel wires has been given by the author, and is suitable for cases in which the current distribution in either wire is greatly affected by the frequency of alternation. In the present paper certain important cases are examined in detail, and formulæ are obtained capable of immediate use. A calculation of the effective resistance is also made in each case. Attention has been mainly directed to that of the simple telephone circuit, in which the leads are not twisted round each other in order to annul the inductive effects of the earth and of neighbouring circuits. To all metals used in practice, except iron, the formulæ developed for copper wires may be applied with a nearly identical order of accuracy.

THE ROYAL SOCIETY CONVERSAZIONE.

The second conversazione of the Royal Society was held at Burlington House on June 24th. There were few exhibits of striking novelty that would interest the physicist or the electrical engineer. We notice below the more important exhibits which we have not already described in connection with the last conversazione.

The "Panflen" spring wheel for motor vehicles exhibited by the Hon. R. C. Parsons is an ingenious contrivance to replace the pneumatic tire. The outer rim of the wheel which runs on the road is completely detached from the inner wheel; this is furnished with radiating spiral springs running on the inner surface of the outer rim, which plays the part of an endless track laid down by the vehicle as it advances. A series of curves drawn by a seismographic apparatus carried on the car appeared to demonstrate that there was less vibration with the "Paufleu" wheels than with the pneumatic tire.

The Linolite Co. exhibited "Tnbolite" lamps fitted with a metallic filament which is held at each end by a zigzag spring to take up the expansion, and is supported by anchors at two intermediate points. The lamp may be placed in any position, and can be run on an alternating or direct-current circuit. Every point of the filament is in the same position with regard to the reflector (and there is a larger reflecting surface than can be used with a bulb lamp), which ensures uniformity and efficiency in the distribution of the light.

Mr. W. M. Mordey demonstrated the effect of electrostatic condensers in preventing or extinguishing arcs. A suitable condenser placed in shunt to an arc or in shunt to a resistance in series with an arc will instantly extinguish the arc. If connected in shunt to the contacts before they are separated, it will prevent the formation of an arc even in a circuit having considerable electromotive force. The condenser is effective whether, when applied, it is in the discharged condition or charged to the full E.M.F. of the circuit. In the latter case the charge may be in either direction of polarity.

The Hon. C. A. Parsons exhibited a model of a leakage path device for regulating the voltage of alternators. The apparatus depends on the principle that, while an alternating current cannot directly produce a uni-directional field, it can have a strong action in diminishing magnetic flux. When it is applied to an alternator, the field magnets of the exciter are provided with a leakage path around which windings carrying alternating current are placed. It will be seen that when the current is passing in one direction it cannot appreciably increase the "leakage flux" through the core owing to this being already saturated; but when it reverses and flows in the other direction it will reduce the leakage flux. The model shown consisted of a direct-current motor driving a three-phase alternator with its exciter. Bridging the poles of the exciter was a laminated iron construction having three cores or leakage paths. Each of these cores carried a winding which was in series with one of the phases of the alternator. An artificial load of resistance wire was provided, and by means of a two-way switch the load could be put on with or without the leakage-path coils in circuit, so that the regulation of the alternator could be compared with and without the compounding. When there is no load on the alternator, the coils on the leakage paths are inactive, and the diversion of flux from the exciter armature keeps the exciter voltage, and thus the alternator field, low. When the load is put on the alternator, with the current flowing through the leakage-path coils, these coils choke back the leakage flux. The result is to increase the flux through the exciter armature, raise its voltage, and so automatically increase the alternator excitation and keep its voltage constant. The action is practically instantaneous, since the load current of the alternator is used directly to effect the regulation, without the intervention of any mechanical apparatus.

Mr. C. E. S. Phillips exhibited a permanently luminous watch dial and military night compass. The watch dial is transparent (glass), and the figures are painted on its upper surface. The dial is backed with a compound containing a minute quantity of radium bromide, which renders it luminous, so that the time may be easily read in the dark. The compass is arranged on the same principle. By means of a luminous disk and strip, direction may be determined at night.

Mr. S. Cowper-Coles exhibited specimens of metallic parabolic reflectors made by electro-deposition. The specimens of parabolic glass mirrors were coated with gold, copper and palladium. Specimens were also shown coated with gold and silver bands so as to give greater penetration in foggy weather, and yet retain the dazzling effect required for military purposes.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

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Lamps not required for gas or electric light ...	10 % ad val.
Glass and glassware of all kinds	10 „
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Iron in bars, pieces, rods or sheets, rails, conduct pipes, gas pipes, axles, boxes, wheels, cast or wrought, frames of iron buildings, sheds or warehouses, iron bridges and parts thereof, iron roofing and gutters, whether galvanised or not, bolts and nails, iron wire, wire for telegraph and telephone purposes and cables	free
Ironwork, cast, wrought, flattened or forged, not specially mentioned	10 %, ad val.
Leadware not specially mentioned	10 „
Leather and leatherwork	10 „
Petroleum, per hectolitre	·25 florin
Pitch	free
Resin	free
Steel in bars, sheets and plates, steel ropes, axles, and rails, steel joints and junction plates for railways	free
Steelware not specially mentioned	10 % ad val.
Goods not specially mentioned in the Tariff ...	6 „

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

13,887. "Improvements in the enumeration of telephone calls." S. D. Williams. June 14th.

13,892. "Improvements in the construction of sparking plugs for internal combustion engines." R. F. Drury. (Société l'Oleo, France.) June 14th. (Complete.)

13,897. "Improvements in electrical relays." R. M. Abraham and British Pneumatic Railway Signal Co., Ltd. June 14th.

13,908. "Improvements in or connected with means for giving an initia impulse to magneto-electric sparking machines used in connection with internal combustion engines." G. Braud. June 14th.

13,911. "Automatic fire-alarm electric bell push." J. Laxton. June 14th.

13,919. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 14th. (Complete.)

13,922. "Improved microphone for currents of high intensity." A. Steinacker and A. Plisnier. (Date applied for under Sec. 91 of the Act, January 16th, 1909, being date of application in Austria.) June 14th. (Complete.)

13,961. "Improvements in and relating to electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 14th.

13,962. "Improvements in and relating to electric meters." British Thomson-Houston Co., Ltd. (Date applied for under Rule 13, May 29th, 1909. An invention comprised in Application No. 12,689/09. June 14th.

13,989. "Improvements in the manufacture of electric incandescent lamps." M. Milch. June 15th.

14,012. "Improvements in and relating to antiseptic devices for telephones." E. A. Pickering. June 15th.

14,019. "Improvements in electrical motors and the like." S. Pinkus. June 15th.

14,034. "Improvements in mechanical telegraphs, particularly applicable to vehicles and the like." J. D. Owen. June 15th.

14,052. "Improvements in electric time switches." J. G. Mehne. June 15th. Complete.)

14,062. "Improvements in and relating to metal boxes for switches and wall plugs." C. A. Backman. June 15th. (Complete.)

14,091. "Arrangement for uniform and rapid electro-plating of flat or other sectional shaped articles." Langbein-Pfanhauser-Werke Akt.-Ges. (Date applied for under Sec. 91 of the Act, June 22nd, 1908, being date of application in Germany.) June 16th. (Complete.)

14,093. "Improvements in electrically-operated point-actuating mechanism for tramway or the like tracks." A. P. Williams. June 16th.

14,097. "Improvements in or connected with electrical switches." I. V. Zealander and P. Conway. June 16th.

14,117. "Improvements in electric contact breakers particularly applicable for induction or sparking coils." R. W. Grant. June 16th.

14,120. "Improvements in electrical contact apparatus actuated by the passage of trains to control railway points and signals." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 16th. (Complete.)

14,126. "Improvements in magneto-electric apparatus for firing electric igniters." W. E. Lake. (Fabrik Elektrischer Zünder G.m.b.H., Germany.) June 16th. (Complete.)

14,128. "Improvements in or relating to arc lamps." A. J. Boult. (Voigt and Haeffner Akt. Ges., Germany.) June 16th. (Complete.)

14,153. "Improvements in and relating to magneto-electric machines." E. Troike. June 16th. (Complete.)

14,164. "Improvements in and relating to electric locks." J. Xabski. June 16th.

14,165. "Improvements in electric arc lamps." O. Millauro. June 16th. (Complete.)

14,168. "Improved variable-speed dynamo." A. G. Inrig. June 16th.

14,209. "Improvements in and relating to telephonic transmitter and the like." J. K. Pickford. June 17th.

14,212. "Improvements in methods of charging and discharging secondary batteries or electric accumulators on three-wire systems." A. M. Taylor. June 17th.

14,239. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 17th. (Complete.)

14,240. "Improvements in signalling apparatus operated from a distance." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 17th. (Complete.)

14,244. "Telephone system." D. W. May. June 17th. (Complete.)

14,288. "Improvements in electrolytic apparatus having a liquid anode." O. Schott and C. Z. Stiftung (trading as Schott & Gen). (Date applied for under Sec. 91 of the Act, June 26th, 1908, being date of application in Germany.) June 18th. (Complete.)

14,330. "Improvements in and relating to the electrical operation of gun mechanism and the like." H. C. Leake. June 18th.

14,352. "Improvements relating to the fault protection of cables in electrical current distribution systems." W. C. H. M. Georgi and A. Reyrolle & Co., Ltd. June 18th.

14,363. "Improvements in direct-working telephones for intercommunication purposes." E. A. Davis. June 19th.

14,391. "Improvements in dynamos or electrical motors." J. H. Garty. June 19th. (Complete.)

14,398. "Improvements in electric switches and switch fuses." H. H. Berry and W. J. Markham. June 19th.

14,431. "New or improved method of and means for preventing the pulsation of electric currents generated by small dynamos and rotary converters." A. Schulzer. June 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electrolyte for Use in Electric Batteries. New Ignition Syndicate and W. J. L. Sandy. 10,520. May 14th.

Electric Power Hammers. R. Berry. 10,589. May 15th.

Electrical Driving Devices for Clocks. A. Anders. 10,626. May 15th. (Date applied for under International Convention, September 11th, 1907.)

Electrical Driving Devices for Clocks. A. Anders. 10,627. May 15th. (Date applied for under International Convention, March 28th, 1908.) (Application for Patent of Addition to No. 10,626/08.)

Manufacture of Filaments for Electric Incandescent Lamps. Wolfram Lampen Akt Ges. 10,891. May 19th. (Date applied for under International Convention, October 7th, 1907.)

Induction Coils. J. B. Brooks and F. H. Alston. 11,170. May 22nd.

Dynamo-Electric Machines. Siemens Bros. Dynamo Works and M. Kloss. 14,049. July 2nd.

Electric Regulating Devices. British Thomson-Houston Co. (General Electric Co., United States.) 14,701. July 10th.

Accumulator Electrodes. C. Vogel. 14,814. July 13th.

Retransmitting and Reinforcing Telephone Currents. J. E. Kingsbury. (Western Electric Co.) 17,047. August 13th. (Application for Patent of Addition to No. 11,6.5/05).

Current-Collecting Rings for Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 17,380. August 18th.

Manufacture of Refractory Electric Conductors. W. P. Coolidge. 17,621. August 21st. (Date applied for under International Convention, August 24th, 1907.)

System of Fitting Incandescent Electric Lamps. G. Weissmann. 18,233. August 31st. (Date applied for under International Convention, January 10th, 1908.)

Regulation of Alternating-Current Electric Generators Working in Parallel. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 18,715. September 7th.

Suspension of Trolley Wires for Electric Tramways and Railways. J. G. Scott. 19,621. September 18th.

Safety Device for Portable Electric Hand Lamps. J. Lightfoot. 19,679. September 19th.

Emergency Brake for Electric Tramcars and other Vehicles. T. Jones and L. J. Evans. 21,766. November 18th.

Process for Production of Pure and Thin Filaments of any Length for Illuminating Purposes. A. Kroll and B. Saklatwalla. 27,144. December 14th. (Date applied for under International Convention, October 16th, 1908.)

Third-Rail Insulators. P. M. Justice. (Essex Co.) 27,477. December 17th.

Magneto-Electric Sparking Apparatus. W. P. Thompson. (E. Eisemann and Co., Ges.) 27,999. December 23rd.

Electric Treatment for Curative and other Purposes. H. Wartmann. 27,512. December 18th.

Electrical Advertising Devices. W. K. L. Dickson. 28,135. December 24th.

Processes for Producing Metallic Articles by Electrodeposition, and Articles so Produced. F. I. Gibbs. 4,410. February 27th.

Apparatus for Reinforcing the Insulation of Electrical Apparatus with Lacquer or Varnish. J. F. Simpson and A. W. Brown. 9,090. April 27th.

Telephony and Telegraphy. Brown. 11,135. May 22nd.

Electrical Circuit Breakers. B. Thomas and E. Thomas. 11,183. May 23rd.

Measurement of Intensity and Tension of Electric Currents Delivered by an Induction Coil. F. Klingelfuss. 11,299. May 25th.

Dynamo-Electrical Machinery Subject to Fluctuation of Load. Electric Construction Co. and W. Buchanan. 11,336. May 25th.

Control of Electric Circuits and Apparatus. British Thomson-Houston Co. (General Electric Co., United States.) 11,345. May 25th.

Electric Light Reflector and Shade. Mygatt. 11,539. May 27th.

Electric Lighting of Roundabouts and the like. H. M. Darrah and L. A. Hackett. 11,758. May 30th.

Commutators for Dynamo-Electric Machines. C. A. Parsons and A. H. Law. 11,871. June 1st.

Motor-Controlled Switches. A. J. Barlow. 12,508. June 10th. (Post-dated December 7th, 1908.)

Galvanic Element of the Bunsen Type. K. Heintz. 13,671. June 27th.

Reinforced Wooden Support for Electric Insulators. C. Graham. 15,342. July 20th.

Dynamo-Electric Machines. Burleigh. 15,487. July 21st.

Means of Connection between Electrical Conductors. E. Rayner and Chillington Tool Co. 16,060. July 29th.

Electro-Therapeutic Apparatus. J. Purthner, F. Zimmerl and J. Böck. 16,772. August 10th.

Electric Fuses. W. White. 17,170. August 15th.

Locomotive Electric Alarm Systems. A. Cummings and G. Noreau. 27,923. December 23rd.

Control of Alternating Electric Current Motors of the Commutator Type. British Thomson-Houston Co. (General Electric Co., United States.) 6,963. March 28th.

Alternating-Current Dynamo-Electric Machines of the Commutator Type. Allgemeine Elektricitäts Ges. 11,633. May 28th. (Date applied for under International Convention, May 29th, 1907.)

Apparatus of the Resonance Type Applicable for Use in Indicating or Measuring the Frequency of Electrical or Magnetic Alternations. R. Hartmann-Kempf. 11,870. June 1st. (Date applied for under International Convention, May 31st, 1907.)

1909.

Electric Condensers. R. Schiessler. 4,028. February 18th. (Date applied for under Rule 13, March 30th, 1908.)

Magnetic Brakes. J. N. Mahoney and O. S. McCurdy. 8,521. April 8th. (Date applied for under International Convention, April 20th, 1908.)

Metal Filaments for Electric Lamps and the Process of Manufacturing the same. H. Kuzel. 1,332. January 19th. (Date applied for under International Convention, February 22nd, 1908.)

Antiseptic Attachments for Telephones. F. C. Tabler. 1,493. January 21st. (Date applied for under International Convention, January 24th, 1908.)

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 5,904. March 11th.

Means for Preventing the Corrosion of the Internal Parts of Boilers due to Electro-Chemical Action. P. E. G. Cumberland. 8,068. April 3rd.

Apparatus for Electroplating. R. E. Philips. (Meaker Co.) 5,087. March 2nd.

Device for Identifying an Electric Lead with its Terminal. C. Isaac. 7,298. March 26th.

Electric Furnaces for the Treatment of Gases or Gas Mixtures. Salpetersaure Industrie Ges. 8,443. April 7th. (Date applied for under International Convention, May 22nd, 1908.)

Trolleys or Collectors for Electrically-Driven Vehicles. S. Bryan. 747. January 12th.

Ignition Device for Internal-Combustion Engines. P. R. J. Willis. (W. H. R. Mildobrath.) 868. January 13th.

Apparatus for Use in Connection with Electric Cables. Beaver and Claremont. 2,076. January 28th. (Date applied for under Rule 13, March 23rd, 1908.)

Electric Fuses Fitted with Indicating Devices. C. C. Hatry. 2,838. February 1st.

Sewing Machine Guides for Hat Sweats. W. Fairweather. (Singer Manufacturing Co.) 4,941. March 1st.

Safety Device for the Dissipation of Excess Voltage in Electrical Systems. G. Giles. 4,997. March 1st. (Date applied for under International Convention. March 2nd, 1908.)

Telephones. A. H. Nicholson. 6,523. March 18th.

Electrical Rail Bond. W. Leder. 7,635. March 30th. (Date applied for under International Convention, June 6th, 1908.)

Electric Fuse Fittings. Siemens Bros. Dynamo Works. (Siemens & Halske Akt.-Ges.) 8,269. April 6th.

THE
ELECTRICAL REVIEW.

VOL. LXV. JULY 9, 1909. No. 1,650.

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THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.
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The "Electrical Review" is the recognised medium of the Electrical Trades, and has
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READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1909 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

INCREASED OUTPUT OF BOILERS.

WE referred some time ago to the statements of Prof. Nicholson regarding the increased efficiency of heating surface in boilers due to the rapid movement of the gases. This is not a novelty, for it has long been known that rapidly moving gases give up heat most quickly, and we are under the impression that Mr. Rowan, in his book "The Physics of the Steam Boiler," uses this fact in explanation of why an excess of air in the furnace gases does not seriously diminish efficiency, since if the volume of the gas is increased its velocity for a given coal consumption must be so much greater, and this greater velocity more or less counterbalances the reduced temperature head due to dilution.

The United States Geological Survey Department has been experimenting upon the subject, and its recent bulletin states that the experiments so far made seem to indicate that it is possible to double or treble the capacity of a boiler without making any radical change in the furnaces or boiler. To effect such improvements requires double or treble the quantity of air to be put through the fuel bed. It also seems probable that rebaffling of the gases will permit double or treble capacity to be attained while still getting more steam per pound of fuel for purposes outside the boiler room, that is to say, net steam for external power production. Thus far at least this in itself does not appear to be much more than a statement that by means of forced draught the capacity of a boiler may be very much increased, and that not very much power will be absorbed in producing the additional draught for the stated ratio of increase. Now we do know of forced-draught trials with a boiler particularly suited to show the effects of rapid gas movement; with every care, the evaporation per pound of fuel certainly became less, and the indications were that the chimney temperature was so high that at the top rate of fuel combustion an extension of the heating surface would have been of advantage to economy.

It is, therefore, just as well to be cautious in accepting the recent promulgations both of Dr. Nicholson and of the U.S. Geological Survey. The experiments, however, of the Survey Department are interesting. Most of them were made with a special apparatus consisting of an air-measuring vessel connected with a tube in which were two layers of lead shot to represent fuel beds and boiler resistance. That representing the boiler was maintained constant. The "fuel bed" was changed in respect of both size of shot and depth. Air was passed through these two beds, and careful observations made of temperatures and pressures above each bed, and from these the conditions of draught about a boiler are deduced. Three laws are stated: (*a*) If the resistance to the flow of gas remains constant, the pressure drop through any portion of the path will bear a constant ratio to the total drop from the ashpit to the uptake. That is to say, if the pressure drop due to the fuel bed is 0·5 in. for a total drop of 1 in., then it will be 1 in. when the total drop is 2 in., in each case retaining the ratio of one-half. (*b*) If the total pressure drop from ashpit to uptake remains constant the pressure drop through any portion of the gas path will vary in the same direction as does resistance to the flow of gases, though the magnitude of the variations may not be in simple proportion.

Thus, with a total drop of 1 in. the fuel bed accounts, say, for 0·5 in. Now, double the fuel bed thickness while keeping the same total drop, and the fuel bed resistance will rise to 0·65 in.; or quadruple the fuel bed thickness, and, for the same total drop of 1 in., that due to the fuel bed will now be 0·8 in. of water. (*c*) When the resistance along any portion of the gas path remains constant, the weight of gas that will pass this portion varies with some power of the pressure drop. Since the resistance between fuel bed and uptake remains nearly constant, the weight of gas passing through the furnace and boiler varies as some power of the pressure drop between these points. Approximately the weight of gas passing through a boiler is directly proportional to the square root of the pressure drop through the boiler or through any portion of a gas path having constant resistance. Therefore, to double the weight of gas passing, there must be fourfold pressure drop. To treble it the pressure drop must be made ninefold. Now, roughly, the steam output should vary with the weight of gas put through, for gas represents fuel burned, and to get this double or treble weight of steam the fan power must obviously be increased eight times or 27 times, or 2^3 and 3^3, and very soon a limit will be reached beyond which no further increase is possible.

Thus, if 2 per cent. of the steam made by a boiler will drive its draught fan at 100 H.P. output, there will be required 8 per cent., or 8 times as much when the horsepower is 200. At 300 H.P. the fan will require 18 per cent., or 27 times as much steam, and at 700 H.P. the fan will absorb 98 per cent. of the steam output. Beyond sevenfold the boiler would not be able, therefore, to find steam enough to drive the fan. The report says "doubling, trebling or with larger grates even quadrupling the rate of working a boiler, seems to be sound commercial practice." This may be so, but we think the reference to the larger grates very wise. The increase of a grate means that the main resistance is kept the same for a larger rate of combustion. It is the higher rate of combustion per sq. ft. of grate that demands so much power to overcome the increased resistance. But so far the report is by no means on all fours with Prof. Nicholson's. His idea, we take it, is largely to increase the velocity of the gases past the heating surface, thus augmenting the resistance all along the path of the gases, and demanding such a serious amount of fan power as to put a very early limit on the increase, for the net available steam would very soon become nil.

London County Council Stores.

The business agenda prepared for a recent meeting of the L.C.C. contained an important recommendation—which, we understand, was agreed to at the meeting—in reference to the reorganisation of the Council's stores. The matter has been under the consideration of a committee, of which Mr. Isidore Salmon is the chairman, and with this gentleman's mature commercial experience the scheme proposed must no doubt be of considerable merit. There is, however, a point of irony in the suggestions put forward by some of our daily contemporaries as to the reorganisation reducing the rates and enabling the Council to purchase at lower prices, when we remember that firms doing business with the L.C.C. find their contracts not infrequently result in loss; rather is there reason to hope that the reorganised scheme may offer some benefit to manufacturers and merchants as well as to the ratepayers. This no doubt will be the case, as a chief officer appointed to control the whole supply of stores will have a right to insist on the schedules of quantities and description of articles being prepared, not in an approximate fashion, but on the basis of more definite information than has hitherto been the case; it is admitted that the technical officers must still select and approve their own material. As previously pointed out, we think they have proved to be rather too keen buyers, and the change of system from this aspect is hopeful.

It is stated that the value of the stores dealt with amounts to upwards of £350,000 per annum. This is such a large figure that it must be apparent on the face of it that the whole energy of a capable commercial man can be advantageously utilised in what the chairman of the committee calls "the commercial co-ordination of the undertaking." Many of the stores must be purchased in wholesale quantities, held in stock in suitable quantities, and supplied in retail quantities, and this sort of handling of merchandise, when running into six figures annually, is deserving of skilful and intelligent direction.

As to saving the ratepayers' money, this may perhaps be effected, but the more important matter of reducing the rates will certainly not; we have seen a comment that the new scheme will give manufacturers and merchants the opportunity of dealing with a chief official of the Council instead of with juniors, with this statement we join issue, as in all official matters of this description the bulk of the work must be carried through on what may be termed red tape lines by the numerous members of the staff who report their efforts through well worn channels to the official head, and by this system, mistakes which may be made by the junior can be corrected by his superior, whereas when this arrangement is reversed, it is possible that the head of the department makes a mistake, and it is more difficult to save the situation.

We shall watch with interest the issue of the annual schedules in November next, and, under the present capable chairman, we think the scheme will be generally advantageous. When working as the present tramway scheme works, there is little doubt that it will be of general benefit, and there is no reason why stores should not be organised even as a tramway scheme or a main drainage scheme has been organised.

"The New Telegraphy."

Under this title the *Daily Telegraph* booms the Pollak-Virag system, under the ægis of Mr. Henniker Heaton. We have no wish to depreciate the merits of this beautiful and exceedingly clever invention (which, by the way, has been well known to the electrical world for some nine years); but, in view of the continued efforts of Mr. Henniker Heaton to thrust it down the public throat, we are compelled once more to emphasise the truth about this matter.

The Pollak-Virag system cannot be used over long submarine cables.

The Pollak-Virag system requires two wires; therefore its maximum speed per wire is (half 46,000 =) 23,000 words an hour, = 384 words per minute.

The Wheatstone automatic system, which has been used in the British postal service for 35 years, requires only one wire, and sends 400 words a minute, or 24,000 an hour, on one wire; it has been run at 36,000 words an hour.

The Pollak-Virag system, therefore, is slower than the well-known and well-tried system in general use on the British lines. It cannot be used where there is only one wire; and even where there are two it is put out of action whenever one of them is broken.

Both systems can be used with a type-writer at the sending end. The only point in favour of the Pollak-Virag is that at the receiving end the message is "written" by the apparatus, while the Wheatstone has to be transcribed or put through a type-writing mechanism.

We have said enough to show that the Pollak-Virag system has no bearing whatever upon the question of Imperial intercommunication. It serves Mr. Henniker Heaton, however, as an admirable device for tickling the imagination and imposing upon the credulity of his supporters and the lay Press.

THE I.M.E.A. CONVENTION.

Steam Turbines.

By Alfred S. Blackman, Borough Electrical Engineer and Manager, Sunderland.

(*Abstract.*)

The present situation of the steam turbine industry is a battle for supremacy between the impulse and reaction types, and the following statements are put forward as representing the point of view of a user who has studied the problem from all sides:—

1. All turbines must fulfil a certain law of combination of blade speed, and number of running rows.
2. Steam expanding between boiler pressure and condenser, must generate a certain velocity, and this velocity must be imparted to the revolving mass in small increments as in the Parsons machine, entailing many rows of blades, or in larger increments as in the Zoelly or Curtis machines, or in one increment as in the Laval.
3. The fewer the rows of running blades, the higher must be the speed at which the blades run, and consequently the higher the speed of the steam impinging on the blades.
4. The impulse type turbine runs at a much higher speed at blading than the reaction type, and necessitates particular attention being given to the design of the wheels and blades, owing to the greater stresses that prevail.
5. The impulse type turbine lends itself to a more mechanical looking construction than the reaction type.
6. The reaction type, as illustrated by the best Parsons type, is more economical than the impulse type.
7. For speeds of 3,000 R.P.M. and below 1,000 KW. the impulse type is better than the reaction.
8. For speeds of 1,500 R.P.M. and up to 3,000 KW. the reaction type has, up to the present, proved most satisfactory.
9. For speeds of 1,000 and 750 R.P.M., and up to the largest sizes likely to be used, there is absolutely no evidence that the impulse type can compete in reliability or economy with the Parsons type.

A review of the progress of the last two years shows that while trouble with the reaction type has shown a marked diminution, due to the defects of the earlier designs having had time to come to light, thus showing the necessity of more mechanical construction, and notably of stiffer shafts, the impulse type has not made the headway many people looked for, and may still be said to have its infantile complaints ahead.

Too little attention is given nowadays to selecting an efficient combination of power and speed, although the latter is such an important point. The periodicity being, say, 50, only two speeds can be considered—viz., 3,000 R.P.M. with a two-pole machine, or 1,500 R.P.M. with four poles. Many engineers have selected the lower speed, but the high-speed set will be more economical by about 10 per cent., take up less floor space, and be about 15 per cent. cheaper in first cost. The higher the speed at which the set is run, the greater the benefits which will be obtained from a turbine installation.

At Sunderland, we have a 1,500 R.P.M. Willans-Dick, Kerr combination, installed to carry a load of 2,000 KW. continuously and 2,500 KW. for two hours, and the economies effected by this plant have been most pronounced. With the present normal day load, amounting to about 2,300 KW., two boilers will easily steam the turbine; but upon changing over to three modern high-speed reciprocating engines of about 700 KW. capacity each, it is impossible to hold the steam without substantial assistance from a third boiler.

For direct-current sets, the merits of the tandem machine must not be lost sight of. By putting in tandem generators, the speed of the set can be increased by about 75 per cent. with all the attendant advantages already pointed out; and the electrical portion being divided into two, there is only half the machine out of commission should troubles of any sort arise.

It is often a subject of some concern to decide at what size of unit it becomes advisable to adopt turbines in preference to reciprocating engines; a general statement which has been made very frequently is: above 750 KW. as a unit, use turbines; below 750 KW., use engines. It is, however, impossible to draw any definite line of demarcation, as so much depends upon the conditions. With the higher speeds at which it is now possible to run turbo-generators, the proposition of turbines *v.* engines will soon disappear, and it will be a case of turbines only.

The Brush Co., who have made a speciality of small turbo-generator sets, give the following typical figures for a 300-KW. plant:—

Steam consumption in pounds of steam per KW.-hour, with steam at 160 lb. per sq. inch:

	Dry steam.	With 100° superheat.]
Reciprocating engine, 26 in. vacuum ...	24	20½
Turbines, 28 in. vacuum...	22	19¾

while the capital cost of the two plants complete, with condensers, is practically the same.

Taking into consideration the undeniable advantages the turbine has in cost of oil and general upkeep, it does indeed appear that the reciprocating plant has only a small field left, except where the facilities for obtaining cooling water are exceptionally bad.

The conditions for turbine installations are:—150 lb. per sq. inch steam pressure; 150° superheat; highest possible speed, and best vacuum possible.

The condensing plant is the most important detail of the plant; a vacuum should be selected with an equivalent temperature about 25° above the available temperature of circulating water; having once obtained this, see that it is always maintained. If a vacuum of 28½ in. can be obtained, never let it drop to 27½ in., which it will easily do with a little neglect. An inch down in vacuum will mean a 5 per cent. rise in the coal bill. The writer has found a vacuum recorder kept under lock and key, worth considerably more than its weight in gold.

The field for improvement in condensing plant is even greater than in turbines.

The Parsons augmenter surface condenser allows smaller cooling surface, and less circulating water to be employed. Further, the hotwell temperature is higher. This is, in the writer's opinion, undoubtedly the best form of surface condensing plant.

As a rule, the capital cost of surface condensing plant will be rather higher than that of either jet or barometric condensers.

Barometric condensers are a very satisfactory form of plant, provided every precaution is taken to prevent air leakage, and ample passage way is given to steam and water. A uniform vacuum can be maintained, owing to the absence of cooling surfaces which become dirty and therefore inefficient. In some cases, no air pump is installed, but where a high vacuum is essential a really powerful dry air pump is necessary. Barometric condensing plants are certainly more easy to maintain at their best than surface condensers.

Sunderland experience has shown the Willans-Parsons turbine to be absolutely trustworthy. For over sixteen months the bulk of the work has been done by the 2,000-KW. turbine plant of this make, running at 1,500 R.P.M., and during the year ending March 31st, last the total units generated in the works were 9,207,227, of which no less than 8,009,000, or 87 per cent. of the whole output, was generated by the one turbine plant.

This turbine has, with very few exceptions, been put on load every Sunday at noon, and has run through without any stop until the following Sunday, at about 1 a.m. During the night, the load drops, as a rule, to about 400 KW., and the day peaks have been about 2,300 KW.; when this has been exceeded, one or more 700-KW. reciprocating sets have been paralleled. Throughout the day, the work has consisted of about three quarters shipyard, and one quarter tramway load, and it is of a very fluctuating character.

During the whole of this time, any sudden mishap to the turbine would have shut the whole system down, because in no case has there been sufficient plant in parallel with the turbine to take the load up temporarily, but in no instance has there been a hitch in any way attributable to the turbine; it runs through week after week with an entire absence of incident.

It will be realised that these are severe and exacting conditions, and such dependence upon a single unit calls for the utmost reliability; after fairly lengthy experience of both high-speed piston valve and low-speed Corliss valve reciprocating engines, the writer trusts the turbine with equal confidence to either of these alternatives.

The writer is of the opinion that maintenance costs on steam turbine plant (consisting of turbine, alternator and condensing plant) complete, should not exceed, say, £100 per annum per 10,000,000 units generated, and if careful record were taken in some of the larger turbine works, and fair maintenance debits were allocated against units generated, it would be found in many cases less than this amount. The maintenance of the Sunderland 2,000-KW. plant for the year ending March 31st last, including opening the turbine twice to measure clearances, came to less than £35; while it is true that the set was under the contractor's maintenance, a detailed and careful check was taken of all that was done to the plant, including the renewal of exciter brushes, &c., and the figure given is a liberal allowance of what it would cost the Corporation to do the same work.

The turbine exhausts into a barometric condenser, and it is probable that the maintenance costs would be greater upon a surface condensing plant. As regards wear upon the turbine itself, it appears to be negligible, and most careful examination has failed to reveal any signs of blade erosion.

The advantages of the application of the exhaust steam turbine do not appear to be fully appreciated, even at the present time. Many present-day condensing engine plants, with a good supply of cold water for circulating, could be increased in output by 25 per cent. without any appreciable extra expense, save the capital cost of the exhaust turbine installation.

Sunderland experience shows the cost of working with turbine plant to be much lower than with reciprocating engines.

The 2,000-KW. Willans-Parsons set installed at Hylton Road was tested on setting to work, and again on the expiration of one year and two months' work, during which time the plant ran over 9,000 hours, and generated over nine million units. The steam consumption on a 27½-in. vacuum was 17·07 lb. of steam per unit on one test, and 17·1 lb. of steam per unit on the other.

As regards oil, which was logged separately from the other plant, the total cost for the year ending March last, was, for the turbine £13 8s., and for the turbine auxiliaries £18 8s. 6d., a total of £31 16s. 6d., equivalent to ·000953 of a penny per unit generated.

It would be difficult to claim such a record of maintained economy for any prime mover other than the steam turbine.

Mr. J. H. Bolam (Weymouth), in opening the discussion, said that he had had to consider the question of installing either a turbine or reciprocating set of 300 KW., and had decided on the former. With 160 lb. steam pressure and 28 in. vacuum, this set required 21 lb. steam on full load and 25½ lb. on half load. These figures were good, but he had no doubt a reciprocating plant could beat them. However, as they obtained an overload capacity up to

420 kw., and the set gave no trouble, either from sparking or otherwise, and the capital cost for turbine and condenser was barely £10 per kw., he thought a good case could be made out for this plant. Since it was brought into use, one boiler only was required instead of two as formerly.

Mr. D. B. Morison (Richardsons, Westgarth) said that despite his near interest in the Parsons turbine, he considered the author's *résumé* of the position quite fair. Turbines were generally reliable now; his firm were constructing a 7,000-9,000-kw. turbine set for Mr. Merz's company, which would run alongside an A.E.G. turbine of the same size, and should therefore enable some interesting comparisons to be made. He understood that Messrs. Brown, Boveri were proposing to build a 15,000-kw. turbine; and on the Continent 10,000 kw. appeared to be a favoured size. Touching on the behaviour of air in the condenser, this had only recently been understood, thanks to the work of Prof. Weightman. If there was a large difference of temperature between the top and bottom of a condenser, there was certain to be an excess of air, and this interfered seriously with efficiency. The vacuum augmenter was really an auxiliary air-pump, and was very effective in withdrawing air; it, however, used steam, and this was often neglected when making comparisons. There was always a difficulty in withdrawing hot water from condensers, and he was coming to the conclusion that a direct-acting steam-driven pump was the best for the purpose. The exhaust steam turbine was only just being appreciated. He understood that the exhaust (l.p.) turbine fitted to the White Star ship *Laurentic* had proved very successful, and that the two new 50,000-h.p. White Star boats would be similarly equipped. The usual arrangement for atomising the water in cooling towers was very ineffective, and his firm had recently perfected an arrangement which was giving much satisfaction.

Mr. T. P. Wilmshurst (Derby) said it had been stated that makers of impulse turbines could not guarantee the efficiency over many years owing to attrition of the blades. He would like to know what prospect there was of obtaining d.c. turbo-generators of over 1,000 kw. capacity, as the tandem arrangement of generators required too much space. His six years' use of d.c. turbo-generators had shown them to be quite satisfactory, and free from flashing round the commutators. He did not think the author's figures for maintenance could be accepted as an average, as an accident was generally a costly matter.

Mr. J. P. Gregory (B.T.-H. Co.) said the impulse turbine *was* more mechanical than the reaction type, and he had no record of a blade stripping. Moreover, the impulse type was making more headway than the author appeared to think. In machines of over 1,000 kw. size, the B.T.-H. Co., of Rugby, had over 50,000 kw. running and 25,000 kw. in course of construction; of all sizes, there were 31,900 kw. (25 machines) in hand at Rugby. The General Electric Co. in America had supplied over a million h.p. in machines of over 1,000 h.p. including many of 14,000, 9,000 and 6,000 kw. size. There were also a number of machines made by Continental makers. As showing some results obtained with the Curtis turbine, a 9,000-kw. Chicago set operated over 5,000-13,900 kw. load on approximately 13 lb. steam per kw.; an A.E.G. 4,000 kw. set showed a consumption of 11·9 lb. of steam per kw. and 2,500 and 1,000 kw. machines, built by the B.T.-H. Co., took 16·06 and 15·8 lb. steam per kw., on full load. He considered that for exhaust steam use the Curtis impulse type was more suitable than the reaction type of turbine as it was much better able to deal with water.

Mr. Seaton (Willans & Robinson) said it was the very first time the maker had received credit for good results obtained; the station engineer generally claimed them. He thought the impulse turbine makers would, as that type became more general, take a share in the troubles. The impulse turbine had shown a great steam economy in one or two cases, but this was with an independently fired superheater, which meant a large coal bill.

Mr. W. B. Woodhouse (Yorkshire Power Co.), said, as a user of both types of turbine, they were both good. The oil bill on each of two Curtis turbines was less than £5 per annum; one of these machines was opened up after five years' use, and there were no signs of erosion. He found that the difference in temperature between water and steam with a clean condenser tube was about 6°, but if dirty it might be 30°. It was well known that a high speed of circulating water had the effect of cleaning tube surfaces and improving efficiency, and he thought possibly something might be gained by doing the same thing on the steam side.

Mr. F. Newington (Edinburgh) said he was using two exhaust turbines of 1,200 kw. capacity driving direct-current machines, and he had had some temporary trouble with the commutation, due possibly to couplings. With exhaust turbines the atmospheric valve had but little pressure on it, and he found it was liable to chatter. In Edinburgh they had been looking for water for many years, and had at last impounded the Water of Leith sewer, and although straining was required, they found it satisfactory for condenser use.

Mr. Crawford (Belliss & Morcom) was understood to advocate the exhaust turbine in conjunction with reciprocating plant.

Mr. Cooper (Colne) said good barometric conditions were not usual in this country, and so evaporative condensers were not much use here. He advocated water-packed glands for centrifrugal pumps and multi-jet condensers, the latter being practically as good as surface condensers, but requiring a little more water.

Mr. H. Faraday Proctor (Bristol) said continuous running was, in his opinion, the most favourable condition for a turbine. At Bristol a 1,000-kw. three-phase Parsons machine ran continuously for two months, although the blading was known to be loose. He wanted to know whether a turbine shaft which had been straightened two or three times was likely to be reliable, and would it require annealing? He had been in the happy position of the author, but thought the latter would probably experience trouble with whipping shafts before long.

Mr. F. W. Purse (Watford) advocated reciprocating plant for anything up to 1,000 kw. size as being more reliable and efficient. From the average cost of small turbine and reciprocating stations, he thought this could be proved. (We also gathered that he instanced the Park Royal and Greenwich (L.C.C.) station results recently given before the I.E.E. as a further proof of his case, but we may remind him that the Greenwich results were for slow-speed Corliss engines, working under dissimilar conditions.—Eds. E.R.).

Mr. V. Robinson (Richardsons, Westgarth) said that at high speeds the impulse turbine might be as efficient as the reaction type. He found the author's figures for turbine maintenance were about double those given by Mr. Fox recently as an average amount.

Mr. H. Richardson (Dundee) suggested that more discussion might be given to questions of suitable pressure and superheat in turbine working.

Mr. S. J. Watson (Bury) said it was possible to obtain economical steam-driven auxiliaries for condensers if the units were large enough. At Bury he used steam-driven pumps with his 25,000-lb. condensers, and they took some 350 lb. of steam per hour, or about 17 lb. per h.p.-hour. When it came to large units quite an appreciable portion of the capacity was taken by the auxiliaries, and he considered it better to sell energy than to use it in the works. The exhaust from such auxiliaries could be used in the lower stages of a turbine.

Mr. S. E. Fedden (Sheffield) said his experience of turbine maintenance was in agreement with the author's—*i.e.*, about £109 per annum for 9½ million units—and he had had no trouble, although he used steam at 200 lb. pressure. Tests on his 5,000-kw. turbine showed an efficiency of over 70 per cent., and he did not think the impulse men would beat that. The steam consumption at Neepsend averaged 20 lb. per kw. over the 24 hours.

Mr. T. W. Bloxham (Belfast) said the steam consumption of both reciprocating and turbine plant at Belfast was about the same, but repairs to the former were very heavy, and there had been no repairs, so far (12 months), on the turbines. As regards reliability, owing to the presence of water in a cylinder he had had a reciprocating plant laid off for weeks.

Mr. S. L. Pearce (the President) commented on the fact that no reference to the price of the turbine plant had been made; the reaction type was much the cheaper. He would have adopted a 5,000-kw. impulse turbine at Manchester some years ago, but the makers would not guarantee it. From what he had seen he thought the Parsons type was losing ground on the Continent, and at Manchester they hoped soon to be able to compare the two types. He thought the figures quoted for the Curtis turbine were not guaranteed by the makers; at any rate, their guarantees for Manchester were not so good as for other types.

Mr. Blackman, in replying, said that blade erosion did occur in the impulse type of turbine, and flashing round of commutators had not disappeared. He did not think the American Curtis figures could be substantiated, and asked whether auxiliaries were included. If one had good reciprocating plant, it was better to add exhaust-steam turbines. The comparisons made by Mr. Purse were scarcely fair, and included stations using low-speed Corliss engines. The Bradford engines were very expensive, being of the low-speed Corliss type, and, although economical, he did not think, taking everything into account, that it would pay to use such plant now. He considered that nine-tenths of turbine troubles were caused by going beyond 150 lb. pressure and 150° superheat.

Steam Turbines.

Mr. Blackman's paper on "Steam Turbines" is essentially a challenge to those who hold different views on the subject, to come forth and do battle with him. Whether the opinions expressed in the paper are indicative of the real situation of the steam turbine industry, is to be proved, but even the author's severest critics will appreciate the earnestness of the statements which he has made.

Mr. Blackman quite naturally supports the reaction type as represented by the Willans-Parsons turbine, principally because he has apparently found a good thing; like a true sportsman he sticks to it, and backs his fancy to the bitter end, and the records which he gives in the paper of the behaviour of the turbine he has installed fully and amply justify many of his statements.

Clause 1 on the first page of the paper seems to want some explanation for its insertion. We are rather inclined to believe that it is a veiled hint to those who advocate the impulse type, but who do not know really why the "impulse" principle does not allow of something being done which the Parsons type cannot do, and if this is so, it would be interesting to compare relative designs of a Parsons turbine and a Zoelly turbine for a 6,000-kw. unit at 750 r.p.m. The last three clauses of the nine opinions expressed by the author point rather to the fact that the lower the speed of the unit, the greater becomes the advantage of the Parsons type.

Of one thing we are certain—namely, that the impulse turbine has a stiffer problem to face in competing with the big Parsons type in this country than abroad. British trading is free, Continental and foreign trading is very largely controlled, and if the impulse type of turbine is to flourish in this country it can only do so on sheer merit.

The author is very decided in his opinions on the question of outputs and speeds, and if his figures are correct (and we have no reason to doubt their accuracy), the selection of size and speed of a turbine prime mover is quite a serious matter. The limiting factor in the speed of a turbine is the electrical end of the unit, as the steam end possesses no difficulties; while electrical firms in this country have been rather diffident in going to the higher speeds, we believe that experience and experiment are now telling their tales, and as larger outputs for a given speed can now be obtained, the steam turbine will further justify its selection as the best kind of prime mover.

It seems to us incumbent on every engineer to obtain the advice and co-operation of both the turbine and the electrical manufacturers when laying out his station, in order that his selection of size and speed of unit may be the best possible to meet his particular requirements.

The steam consumption figures of the author's turbine, taken after an interval of 14 months, are very interesting, proving as they do that a turbine of the reaction type can maintain its economy over a long period of hard work *without requiring any renewals or adjustment*. We believe that this—though not emphasised by Mr. Blackman—is one of the strongest arguments in favour of the Parsons type of turbine.

Another very strong feature revealed by the paper is that of reliability. Not all turbine users perhaps are as fortunate as Mr. Blackman has been in the handling of his turbine, but the fact remains that nothing can be much better than no trouble at all; that absolute reliance has been placed on a single unit with such satisfactory results, points to the earlier troubles of the steam turbine having been successfully remedied. Turbine troubles are not varied, although they may have been many; they seem to us to be summed up in one word, at least so far the Parsons type is concerned, and that is "blading." Stripped blades has usually been the cry, but apparently this is the only real trouble met with, and even this is rapidly disappearing with the experience engineers are obtaining as to exactly how fine to cut the clearances to obtain the best combination of reliability and economy. Mr. Rider referred to this question in his paper before the I.E.E. lately, and we hope to see later a statement from him giving clearances and economy, as he has apparently contrived to hit the happy medium, with, we trust, satisfactory results.

This question of clearances is one that is urged as unimportant by the devotees of the impulse type, but is it not a fact that *all* multi-stage turbines must have fine clearances somewhere that will constitute a danger if contact takes place between the fixed and moving elements? In the Parsons type it is over the tips of the blading, in the multi-wheel impulse type it is necessary (to obtain good economy) to keep the clearances small at that part of the fixed or stator disk which is round the shaft.

There are, no doubt, many arguments for and against each type, and we want to have the opinion of those who, like Mr. Blackman, speak from actual experience; an ounce of practice is worth a ton of theory in cases like this.

The author has only touched lightly on steam consumptions; published results are absolutely useless for comparison unless they are reduced to the common basis of efficiency ratio, the importance of which was first made plain by the Institution of Civil Engineers, and since utilised to the full by *Engineering* when considering steam turbine consumption figures.

The condensing plant problem is one that is not sufficiently considered. Mr. Blackman, in his reference to the 5 per cent. loss incurred by allowing the vacuum to drop from 28½ to 27½ in., hits the nail right on the head. It pays handsomely to maintain the condensing equipment at its very highest efficiency, but this is, we believe, now being realised by the majority of engineers using steam turbine plant.

As regards exhaust steam turbines and their application, it seems strange—as the author points out—that they are not more widely used. In those stations where there is an ample supply of cold water for condensing purposes, a most remarkable gain in economy can be obtained, and it would well pay every engineer to go thoroughly into the proposition.

Mr. Blackman's paper is certainly one of the most interesting of those contributed to the I.M.E.A. at the Convention, and even his bitterest critics will not grudge admiration to an engineer who holds definite opinions and states them so openly and freely.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Chichester Electrified.

I have read "Not Too Cheap's" criticism of the Chichester Co.'s works with interest, because some of the points he raises have occurred to me.

While one actually does not care to criticise the work of one's professional brethren without being in full possession of the circumstances of each individual case, it would be interesting, in view of the novel character of these works and the radical departure made from the beaten track, if Mr. H. Boot would kindly give for the information and instruction of your readers his reasons for dispensing with the aid of a secondary battery and the adoption of double-pressure generators in lieu of two single-pressure machines on each engine.

The economic value of the use of storage batteries in small steam-driven stations is, of course, well known, but it would appear that similar advantages should accrue in oil-driven stations. The fuel consumption of a Diesel engine per B.H.P. is some 50 per cent. greater at quarter load than at full load, and therefore the use of a battery of suitable capacity should result in a considerable reduction of fuel per unit generated, besides which there should also be a substantial saving in wages for generation and maintenance.

I agree with your correspondent that, should the balancer installed misbehave itself at any time, the consequences would probably be serious. Small three-wire systems suffer at times from considerable out-of-balance currents, and if the balancer happened to break down at such a time, it would result in a serious disorganisation of the running of the station.

Regarding "Not Too Cheap's" comments on the distributing system, I am inclined to think that a 100-volt three-wire would have been better than a two-wire system at, say, 200 volts, as fitting in better with modern conditions. One feeder cable as a commencement is, in my opinion, perfectly safe. Accidents to a good modern cable properly laid and protected are of such rare occurrence that the contingency may be regarded as negligible.

Wm. J. U. Sowter.

Bray, *July 3rd*, 1909.

Temperature Errors in Shunted Ammeters.

With reference to Mr. Fennell's article on page 1061 in your last issue, the writer appears to have just missed the point with regard to the actual cause of the heating of the shunt at one end which he describes. The material used for the resistance strips in the shunt was evidently unsuitable for the purpose, and formed a thermal couple with the terminal blocks at both ends, and consequently set up a very small P.D. also at both ends of the shunt, *but in opposite directions*. It will be found that the end which heated most was that at which the small thermal P.D. opposed the direction of the main current, while the end at which the poles of the thermal couple were arranged so as to assist the flow of the main current remained cool. With unsuitable resistance material a shunt will always heat at one end without regard to its sectional area, the amount of heating being, of course, a matter of degree.

At first sight it would appear that the heating at one end of the shunt must be due to bad contact, but I have no doubt that if the writer of the article can arrange to reverse the direction of the current in the shunt he experimented with, without in any way altering the main connections, he will find that the opposite end will heat.

Of course, the false reading on the ammeter after the current was cut off was due to the difference between the P.D. of the thermal couple at the cold end of the shunt, and the P.D. of the thermal couple at the hot end of the shunt. Directly the two ends reach an equal temperature, the P.D.'s of the junctions oppose each other. The fact that a higher false reading was obtained when heating one end of the shunt with a blow lamp, simply shows that a higher temperature was reached than when it was heated by the current.

I met with exactly the same experience some years ago, and in consequence made a number of experiments with different resistance alloys for use as ammeter shunts. In the end I adopted the material known as manganin, which does not form a thermal couple with brass or gun-metal, and which is quite suitable for the purpose in every other respect, more particularly for its low temperature coefficient of resistance.

I believe manganin was originally made only on the Continent, but it can now be obtained made in this country, and I shall be pleased to give interested parties further particulars.

The material used in the shunt Mr. Fennell experimented with was probably one of the nickel copper alloys (usually about 40 per cent. nickel, 60 per cent. copper), which are sold under a number of fancy names.

Ernest F. Moy.

London, N.W., *June 30th*, 1909.

Lightning Phenomena.

Noticing the correspondence *re* the above in your columns, the experience I had some five weeks ago may be of interest. On May 25th last we had a very violent thunderstorm between 10 and 11 p.m.; before it subsided the exchange rang me up on the telephone, informing me that my line was badly earthed and that he would have to cut me off. It rained heavily, and a ceiling of a bay window began to leak; the drops of water forming through the leaks in the plaster assumed a pear-shape and jumped a distance of 9 in. through the air almost horizontally to the curtain rings at the top of the window. The rings (metallic) were almost in contact with the lightning arrester of the telephone. I short-circuited the point of formation of the drops and the rings, when the former fell plumb, but immediately after removing the short circuit they again jumped as before. I concluded that the ceiling had become electrically charged by the surrounding atmosphere, the lead of the roof acting as a condenser, then silently discharging from the ceiling through the rings to the lightning arresters and thence to earth.

So much interested was I that I communicated with Sir Oliver Lodge, and further suggested to him that the above might explain the unaccountable ringing of ordinary (not electric) house bells such as has occurred in the writer's and also in a friend's house. In his reply he is of the same opinion.

Alex. Sinclair.

Swansea, *June 29th*, 1909.

Discourtesy to a Selected Candidate.

I read with great interest the article by "A. G. M." in your issue of June 18th on "Is Foreign Competition Overrated?" I had received at the same time an invitation from a Continental firm to discuss in London with two of their heads the question of their representation in England. This was following my replying to their advertisement in your REVIEW a few weeks previously.

After having been kept waiting for an hour, and thus missing my last train back, I was told very abruptly that the advertisement and subsequent letters were all a mistake; that the firm never intended engaging a representative—in fact, were resolved upon closing their London office. This appears to me very strange treatment; and, moreover, in addition to being very discourteous during the short interview, these gentlemen never apologised for having unnecessarily caused me so great a discomfort, namely, a journey of many hundreds of miles and a loss of two days' work. I may add that only after very strong representations did I succeed in having my outlay partly recuperated.

I understand that other gentlemen, out of the batch of applicants, received a similar invitation; I should very much like to hear how these gentlemen were treated. Perhaps one of these had been successful in securing the position before my own interview took place. If such is the case, I think it would have been more straightforward dealing if I had been told so.

C. I. E.

Comparative Steam Consumption Results.

No one will quarrel with your correspondent "E. J. F." in his protest against comparing steam consumption test results on the basis of lb. per KW.-hour pure and simple; but his suggestion of making the thermo-dynamic efficiency the basis of comparison does not entirely eliminate the question of varying conditions as to steam and vacuum, for the efficiency of a given type of turbine varies, of course, with these conditions.

Then, again, the effect of overload capacity cannot be neglected; for the most economical load of a turbine is its maximum output without the use of a by-pass, whereas most published figures refer to full, half-load steam consumptions, &c. Would not the maximum output give a fairer figure for judging the merits of the type?

K. J. K.

The Ethics of Advertising.

I am sending you herewith a neostyled circular which a large firm of lampmakers is enclosing with statements, &c., to their customers and others. As you will observe, this circular gives the alleged cost of current at various prices per unit of the metal-filament lamp made by the firm in question, in comparison with carbon-filament lamps and with another metal-filament lamp, which is specifically mentioned. The authors of this circular do not subscribe their names to it.

I believe that there is a certain code of ethics, even in electrical manufacturing circles, which precludes a manufacturer from depreciating in his advertisements a competitive article, at any rate by name. The offence is all the greater when the authors do this under the cloak of anonymity. You have laid it down that the state of the home electrical industry is due, in part, to the methods of some of our manufacturers, and I should be glad to know whether you think this is a fair method of trading. What confidence can other manufacturers have in Electrical Leagues or Associations, if it is possible for the managing director of a firm that sends out a circular of this description to sit on the committee?

Electricity at per unit.	Cost of current per 1,000 hours.			Hours' lighting of one 16-C.P. Osram at a cost of 1d.
	16 C.P. carbon.	16 C.P. tantalum.	16 C.P. Osram.	
d.	s. d.	s. d.	s. d.	
5	23 4	11 3	7 1	12
4½	21 0	10 1	6 4	13⅓
4	18 8	9 0	5 8	15
3½	16 4	7 10	4 11	17
3	14 0	6 9	4 3	20
2½	11 8	5 7	3 6	24
2	9 4	4 6	2 10	30

Assuming—Carbon, 16 C.P., 56 watts; tantalum, 16 C.P., 27 watts; Osram, 16 C.P., 17 watts.

Fair Play.

[Dealing first with the circular, in the interests of truth we are obliged to point out that the efficiencies of all these lamps have been rated a little too generously. If, for 16 c.p., we read 14 c.p. in each case, the figures will be more nearly in accordance with the facts. Nothing can be gained in the long run by exaggeration, but a good case may be spoilt.

As regards the ethical point raised by our correspondent, we question whether the anonymity objected to by him is so impenetrable as he implies—he seems to have formed his own conclusions as to the source of the circular—and, indeed, such circulars are not usually issued without very clear indications of their origin. Comparisons, however, are generally objectionable, especially when they emanate from a source which may, whether justly or unjustly, be regarded as not entirely free from bias. The question will, perhaps, form a fit subject for consideration by the Committee of the I.E.E., which is engaged in drawing up a code of etiquette not only for consulting, but also for manufacturing engineers and contractors.—Eds. E.R.]

The New Home Office Regulations.

In connection with the new Home Office Regulations for the generation, transformation, distribution and use of electrical energy in premises under the Factory and Workshop Act of 1901 and 1907, which come into force to-day and on January 1st, 1910, there is a sentence in Regulation No. 13 which seems to require a little explanation. This Regulation reads as follows :—

> 13. Every flexible wire for portable apparatus, for alternating current or for pressure above 150 volts direct current, shall be connected to the system either by efficient permanent joints or connections, or by a properly constructed connector.
>
> In all cases when the person handling portable apparatus or pendant lamps with switches, for alternating current or pressure above 150 volts direct current, would be liable to get a shock through a conducting floor or conducting work or otherwise, if the metal work of the portable apparatus became charged, the metal work must be efficiently earthed, and shall not itself be the only earth connection for the metal of the apparatus. *And a lamp-holder shall not be in a metallic connection with the guard or other metal work of a portable lamp.*
>
> In such places, and in any place where the pressure exceeds low pressure, the portable apparatus and its flexible wire shall be controlled by efficient means suitably located and capable of cutting off the pressure, and the metal work shall be efficiently earthed independently of any flexible metallic cover of the conductors, and any such flexible covering shall itself be independently earthed.

It is the last sentence of the second paragraph of the Regulation, which I have underlined, that seems to me to call for comment. If the rest of the metal work of the fitting is earthed, it would also seem to be advisable to earth the holder. If the holder is insulated it is liable to become charged, and anyone turning on or off the switch, if the holder is of the switch type, putting in new lamp or tightening up barrel while holding metal stem of fitting, or while making contact in some other way with earth, would be liable to get a shock. I can only conclude that a printers' error must have occurred here, and that the word "not" should be deleted. It seems a little late in the day to be writing in reference to this matter, seeing that we have all had so much time in which to give these excellent Regulations our consideration, and it is possible that I have not interpreted the sentence correctly in its relation to the rest of the Regulation. If so, I should like to be put right.

F. Johnston.

Holywood, *July 1st*, 1909.

Allocation of Profits.

Your leading article on Municipal Trading gives me an opportunity of airing an idea which I have held for a good many years, but, unfortunately, have not been in a position to get carried into practice. It is with reference to the manner of dealing with a profit obtained from a municipal electricity supply. Leaving aside the question of a depreciation fund, or supposing that to have been satisfactorily dealt with, an electricity committee finds itself with a balance on the right side. It generally, without omitting to advertise the fact, at once hands it over to the general fund. Now this may be good tactics if an election is at hand, but it seems to me very short-sighted, not to say unjust. From whom is this surplus obtained ? The consumers of electricity. And who gets the bulk of the money ? The consumers of gas and other illuminants. You see, the ratepayers are actually subsidised to keep off the electricity supply, as they get a benefit free to which otherwise they would have to contribute. The way I should treat the matter would be thus : Hold the balance over for twelve months, call it a reserve fund or suspense account, or what you will, and reduce the price per unit either to dead cost or slightly below, but not so much below but that the loss, if any, for the succeeding year would be covered by the balance in hand. Then advertise well the substantial reduction in price, with the result of a large increase in the number of consumers, whose additional consumption should again result in a profit. At the worst, that is, if the increase in consumption were small, the suspended balance would be swallowed up ; but the people who reaped the benefit of the reduction would be the same ones who produced the surplus. By the usual method the price remains unduly high to the present consumers, and the profits taken from them are distributed among their competitors. The objection that I see will be raised is that the general body of ratepayers have covered the deficiency in the years of loss, and should be the first to gain when a profit is made. But if my suggestion were adopted their time would come, for it would not be long before the majority of light and power users were on the electricity supply, when the price would be at a very low figure, and any profit made would be more equitably than at present allocated to reduction of rates.

C. F. Haswell Bayly.

Slades Green, *June 28th*, 1909.

Municipal Trading and the Electric Lighting Acts (Amendment) Bill.

I suppose it is necessary to reply to "Contractor's" second letter, because he has now wilfully perverted my statements, and may mislead casual readers.

In the first place, I am not in the least anxious to strengthen either my own position or that of municipal wiring ; I am not anxious to gain a victory at any price ; but I wish to see the matter discussed fairly. In the House of Lords there were representatives of one class only. The municipalities had no chance of stating their case ; this will come in the Commons. "Contractor" now suggests that private traders have a monopoly of trade, and that a local authority has no moral right to do wiring, simply because there are contractors. I did not discuss this larger question —I simply contended (and no one has even attempted to refute this point) that a municipality should have the power to do everything which a company might do in carrying out a provisional order. If it is advisable under certain conditions for a company undertaker to wire houses in the interests of the undertaking, then it is equally advisable for a municipality to do likewise under the same conditions.

I am pleased to hear that "Contractor" had no wish to be abusive, but the first paragraph of his first letter was quite unnecessary.

With regard to "Contractor's" 1-dollar grievance, he is rather too quick in seizing upon my "admission" that a contractor must do less work if he has more competitors. I can make him a present of that "admission," but I would point out that it applies chiefly to his fellow contractors ; "Contractor" will benefit his competitors very much if he closes his business. If he carries it on in the same way as that adopted by him in this discussion, I am sure his fellow traders would be pleased to hear he had closed. There are limits to legitimate controversy, just as there are to fair competition. I mention this because I have to charge "Contractor" with deliberately misquoting my article to bolster up his arguments.

He alleges that I stated that the wiring contractor's grievance "is at the outside a matter of 4s. 2d. per annum." As a matter of fact, my exact words are, "we can, therefore, say that this poor wiring contractor's grievance, *as a ratepayer*, *is usually nil*, and is, at the outside, a matter of 4s. 2d. per annum."

Now "Contractor" has deliberately left out the part in italics. The italicised words make all the difference and sweep away all ground for his attack. I suppose that is why he has left them out in quoting me. To make matters clear, I say definitely that where the municipal wiring pays, as it usually does, the contractor, as a ratepayer, gets a dividend, and has no grievance *as a ratepayer*, where it makes a loss, his grievance as a ratepayer cannot, in practice, exceed $1 per annum. As a contractor, he has as much grievance against a new private contractor opening up as he has against a municipal wiring department opening, no more and no less.

Coming to "Contractor's" unjustified assumptions, he says he assumed the likelihood of loss being equal to a 1d. rate, and attempts to suggest that this is taken from my article. My statement was as follows:—"Now the wiring department usually pays, but it cannot very well cost more than a 1d. rate (if it did the general body of ratepayers would be up in arms)." Can any fair man read into this a suggestion of likelihood of loss? Surely it suggests a likelihood of profit, and suggests a very remote possibility of loss; and that loss a very small matter to any individual ratepayer. His second assumption he states as follows:—"The average loss made by a municipal wiring department does not exceed 10 per cent." This was characterised by me as absurd, and rightly so, because there is no evidence of any average loss. "Contractor" pretends to imagine that I thought it should exceed 10 per cent., this again, because it "suited his book." My words, as quoted above, indicate the reverse of his assumption.

His conclusions, 1, 2 and 3, falsely alleged to be based on this correspondence, are outrageous prevarications.

I need hardly say, after the exposure I have given of his deliberate misquotations and perversions, that I entirely deny his statements.

Regarding his last paragraph, I maintain that it is probable that no municipal wiring department has ever been started, except there have been many cases locally of jerry wiring by contractors. It may be an unpalatable truth to "Contractor," but I am sorry to say that a great deal of the work done by many contractors is similar to "Contractor's" quotations and assumptions in this controversy—unsound and often deliberately counterfeit. The many genuine contractors must suffer until they can find means to deal with those who disgrace their name.

"Contractor's" point about London companies is amusing. If, as he says, London companies don't wire, and that is the best argument against municipal wiring, I beg to point out that provincial companies nearly all do wiring; therefore, this is the best argument for municipal wiring.

Borough Electrical Engineer.

Mining Switchgear.

Commenting upon the letters appearing in your issues dated the 18th and 25th ult., I do not agree with Mr. Burge that it would be safe to fix gauze windows in the back plates of switch covers in order to protect them from mechanical injury. They would thus be out of sight, and coal-dust would accumulate on the gauze which would practically never be wiped off.

As the heavy metal-to-metal "flame and explosion proof" boxes can be made to meet all requirements, and the additional thickness of the case is a convenience because of the rough handling the boxes may get, why should we resort to a design that is weaker mechanically, and if not kept clean may be absolutely dangerous electrically, when by this change we gain nothing, and introduce only elements of danger?

Incidentally, in conversation with a colliery engineer today, this question was discussed, and he suggested that coal-dust settling on the gauze would, in his opinion, actually conduct a flame from inside to outside the cover in the event of an internal explosion. This seems probable.

The heavier gear which I have advocated in your columns, lends itself for A.C., as well as D.C. work, up to the maximum of medium pressure, *i.e.*, 650 volts, and owing to its perfect safety, and the fact that it requires no attention, is in some instances preferable to oil switchgear for A.C. Mr. Nelson appears in favour of oil switches throughout for A.C., but where a large number of oil switches are installed, it must be borne in mind that a large amount of care is required to ensure that the oil level is right, and that the oil is changed at intervals depending upon the amount of use the switches get.

The "flame and explosion proof" gear requires no such attention, and is, therefore, in many cases preferable to oil gear. It only remains for me to add that exhaustive experiments should be carried out for any design on these lines which has not already been tested, and that the workmanship and material must be beyond doubt or criticism.

P. N. Rand.

Manchester, *July 5th*, 1909.

We have been much interested in the discussion appearing in your "Correspondence" columns under the above heading, particularly in view of the fact that we have been manufacturing "flame and explosion proof" switchgear for several years on the lines referred to. Our experience points to the heavy cast boxes with carefully machined surfaces being most suitable for colliery work, and the demand for this gear proves that our opinion is shared by numerous colliery and other engineers.

We should be glad to send full particulars to any mining engineers interested upon receipt of request.

We would also apologise for resorting to your "Correspondence" columns, as we have no wish to use the same for business purposes, but identify ourselves with the "flame and explosion proof" gear in this way because the correspondence centres around apparatus designed on the lines adopted by us for years with complete success.

The British Westinghouse Electric and Mfg. Co., Ltd.

Manchester, *July 5th*, 1909.

Engineer's Department v. Accountant's Department.

In reply to "Accountant" in your last issue, I still maintain that I am right with regard to the method of dealing with invoices certified for payment in connection with the system described by "Interested." Further, because the works department keep a creditors' ledger, it does not follow by any means that the accountant's department do not also keep a creditors' ledger, and in this case, of course, there is no need for an entry to be made on the Dr. side of *Accountant's* creditors' account, until the account is paid; but that is not the question, the point is simply this: In order to show that an invoice has been certified for payment, the works department make an entry on the Dr. side of creditors' account before sending certified invoice to the accountant's department.

I note that "Accountant" is not a municipal man, and on going over his letters again, I can only express surprise. No doubt others who have read this correspondence will perhaps agree that there is an excuse for the great assumption of

Quid Nunc.

[This correspondence is now closed.—Eds. E.R.]

Irresponsible Comparisons.

In your issue of the 2nd inst. I find a report of the general meeting of Marconi's Wireless Telegraph Co., Ltd., at which Mr. Heenan stated that "sending 25 words a minute at 3d. a word for 360 days of 24 hours in the year, they would earn £460,000 each way," &c.

It would be interesting to know how Mr. Heenan arrives at these figures of £460,000 each way. By *ordinary* calculation, you arrive at quite different figures, and perhaps you could help the shareholders to "work out the profits for themselves."

F. C. C. Nielsen.

[We make it £162,000; but, of course, the conditions are purely imaginary, and unattainable in practice. Duplexing wireless is still a pious aspiration, and Mr. Heenan's figure of one million sterling of revenue per pair of wireless stations must be divided by 10 at least, while the system is still far from being capable of giving any such service as this. As regards the cable, it costs less than half as much as Mr. Heenan stated, and being duplexed it can transmit at least 100 words per minute. The cost of the cable, therefore, on the basis of *equal traffic capacity*, is only £120,000, as compared with £100,000 for the two wireless stations.—Eds. E.R.]

Flexible Wire and Dust.

I should be obliged if any of your readers would give any explanation, scientific or otherwise, as to the reason why dust collects on the flexible wire which is sometimes used for surface flexible wiring.

This wire has, of course, to be supported from the wall or ceiling by means of insulators or other device, and I have noticed that in addition to the dust collecting on the flexible wire, it also forms a black mark on the wall behind.

Wiring.

[This is an old question, but as it crops up again regularly, a few remarks on the matter may be acceptable. It was fully dealt with in the Electrical Review, Vol. 46, pages 840 and 876, and Vol. 52, page 984. The action is mainly electrostatic; if the wire is electrically charged, it attracts floating dust particles, retaining some and projecting others against adjacent surfaces, where they stick. The effect may be minimised, where the circuit is supplied from a three-wire system with the neutral earthed, by connecting the switch in the lead not connected to the earthed pole, so that the flexible is only charged whilst the lamp is in use. Prof. Schwartz has pointed out (Electrical Review, Vol. 60, page 905) that there is also a slight tendency for any obstruction to air currents, such as a pipe or wire near a wall, to cause a deposit of dirt on the surface of the wall.—Eds. E.R.]

Cheap Units.

I was much interested in the article on the above subject in your issue of the 25th ult., and quite agree with your suggestion that the author's Tables A and B should consist respectively of a running cost per unit and a fixed charge which would consist of *all* items of cost beyond those which are strictly proportional to the number of units turned out, for a given maximum demand. I note that you suggest 0·3d. per unit as the running cost, and think this not unreasonable, except that it would, in many cases, cover as much as 50 per cent. profit. The practice of taking the total works costs as being the running costs is, in my opinion, quite unfair, and includes items which are distinctly of the nature of a standing charge.

I agree with the sentence in your article which reads as follows: "But surely, if it is proper to charge a power consumer with the standing charges entailed by a demand of 130 KW. at the time when the majority of the lighting consumers are making their maximum call (notwithstanding that the said power consumer may have made a demand of 200 to 250 KW. in another part of the same day), it may be assumed that a consumer who does not make any demand whatever at the time of the maximum should pay no standing charges at all." It was to this class of consumer that I was suggesting a 100 per cent. discount should be given *off all fixed charges*. It is merely another way of saying that his diversity factor is infinity (or its reciprocal).

It seems to me that there is no objection to allowing a consumer who runs right on into the day to have as good a discount as one who only comes on in the dead of night, provided he keeps clear of the station peak. The essence of my proposal was not so much the giving of the discount (though I think in the amount of the discount I am suggesting something unusual), as in the conditions under which the discount would be given, viz., that the period of "keep-off" should be revised every year. It seems to me that this would effectually avoid the creation of spurious peaks, which has been the real difficulty in applying the restricted-hour system to such an extent as to really induce a heavy load, and we may trust the battery people to educate any large power consumers as to how they are to get over the break in their supply provided that it is offered to them at low enough terms at other parts of the day. I quite agree with you that the extent and importance of the overlap of the power and lighting loads has been considerably under-estimated by Councillor Sinclair, probably because he was thinking only of his summer peak.

A. M. Taylor.

King's Heath, *June 30th*, 1909.

There are one or two points in connection with the discussion on the above subject at the I.M.E.A. Convention to which, with your permission, I should like to make reference.

I was very glad that one or two engineers emphasised the desirability of avoiding all difficulties about the consumer's load factor, by the method of making a fixed charge per annum per KW. of maximum demand coupled with a low price per unit, and I should like particularly to call attention to the importance of taking account of the diversity factor in a systematic way in making the fixed charge.

With your permission I shall give you my views as to how the diversity factor should be applied in reducing the fixed charge. The effect of the diversity factor may be taken account of in two ways: (1) It may be expressed as the new ratio of the sum of the maximum demands of the various consumers (including the new consumer under consideration) to the new maximum demand at the station; or (2) it may be expressed as the *increment* of the sum of the existing maximum demands of the various consumers to the *increment* of the maximum demand at the station. The corresponding analogy in the matter of load factor would be that (1) a consumer would only get the benefit due to the percentage improvement that he conferred upon the load factor of the station; or (2) he would get the whole benefit due to his own load factor. I contend that in the matter of diversity factor, the consumer ought to be treated under the second method.

In the case which I cited at Manchester, the ratio obtained under the first method (assuming for the sake of argument that the existing maximum demand at the station was 20,000 KW., and that the sum of all the maximum demands of the power consumers amounted to, say, 40,000 KW.), would be—

$$\frac{40,000 + 4,000}{20,000} = 2\cdot2.$$

Whereas in the second case it is

$$\frac{4,000}{0} = \text{infinity}.$$

In other words, in the first case the consumer is only given a 10 per cent. betterment upon what he would get if he came on at the time of peak the same as the other consumers, whereas in the second case he would be *entirely* relieved of his capital and other fixed charges, owing to his only coming on in the small hours of the morning, as in the case considered by me at Manchester.

If this principle be granted, and I cannot help feeling that it is the right one, then the allocation of the fixed charges becomes an easy matter, and it is only necessary to add a percentage of profit on to the true running cost to cover all cases. My point is that a consumer coming on in this way in the dead of night is just as profitable to the station, if he is charged in the above manner, as the ordinary consumer would be, and in some cases even more so. In the one case the station incurs a very big expenditure for the sake of getting a consumer; it has to pay heavy charges on account of that expenditure, and my contention is that there is no advantage to the municipality in the mere spending of greater capital sums of money and paying interest on these sums, but that the real advantage comes in the question of what is the *net profit* after all the other expenses have been met. It is this which goes to relieve the rates, or to reduce the cost of energy to future consumers. I do not, therefore, agree with the suggestion that has been made by some speakers that a consumer with a maximum demand occurring between midnight and 6 a.m. should contribute something towards *capital* charges, but suggest that it is quite sufficient that he contributes towards *net profit* charges.

It also appears to me that in the desire to be scrupulously fair towards the old consumers, some of our friends are overshooting the mark, and are grossly unjust towards the new consumers. Really, we are hardly to expect that the old consumers started supporting the station from purely philanthropic motives any more than we are to expect that the new consumers are going to be enormously more generous in *their* philanthropic motives. Anyway, the existing consumer has his remedy; he, too, can become a "restricted-hour" man if he chooses! Lastly, I am not at all sure that if the restricted-hour system could be applied in the way I suggest, and carried up till reasonably late in the afternoon, a considerable amount of business might not be done in heating and cooking, as well as in power. Surely there can be no harm in offering the terms, if the station is properly protected against spurious peaks? There is at least the *chance* of capturing some new consumers, and that is worth something.

A. M. Taylor.

King's Heath, *July 6th*, 1909.

LEGAL.

Roche v. London Electrobus Co., Ltd.

In the City of London Court on Thursday last week, before Judge Rentoul, K.C., a claim was made by Mr. J. J. Roche, trading as J. J. Roche & Co., 83, Queen Victoria Street, E.C., electrical engineers, to recover the sum of £3 6s. 6d. against the London Electrobus Co., Ltd., Whitehall House, Charing Cross, for electrical engineering work done.

Mr. Aldis, plaintiff's solicitor, said that the claim was for the difference between ordinary time and overtime. In October the plaintiff was instructed by an insurance company to do certain work to the defendants' motor-generator. While that was being done the defendants' manager, Trehern, saw plaintiff's workmen and instructed them to work overtime, as he was anxious to get the work done immediately. The ordinary time had been paid by the insurance company, and the plaintiff now claimed for the overtime.

Plaintiff said that the defendants were afraid that some of their omnibuses would be stopped if the work was not done at once. They worked all day Sunday and all night to do it. No date of finishing the work was agreed to. From 6 p.m. to 10 p.m. they paid their men time and a quarter, and from 10 p.m. during the night time and a half. Part of the claim was for work involving the employment of a sub-contractor.

Mr. S. G. Trehern, defendants' manager, said that the plaintiffs were employed originally by the British Engine, Boiler and Electrical Insurance Co., Ltd. He had only agreed to pay the plaintiffs overtime if the work was finished by a particular Monday, and that was not done.

Judge Rentoul, K.C., found for the plaintiff for the amount claimed, with costs.

Crewe Corporation v. Timperley.

At Crewe County Court on June 30th, before Judge R. Brown, K.C., the Crewe Town Council sued Wm. Geo. Timperley for £5 10s., for electricity supplied to two houses owned by him.

It appeared that the property of the defendant was just outside the borough, and when the Corporation decided to extend the area of supply, defendant undertook to be responsible for the payment for energy used by his tenants. The Corporation, however, did not serve the demand notes upon the defendant, but upon the tenants, who paid in the ordinary way. One of the tenants left without paying the account which was due, and this, which formed the present action, the defendant refused to pay, on the ground that the Corporation had novated the agreement by not having always applied to him for the money. It came out that in another agreement the tenants had indemnified the defendant against any sum he might be called upon to pay, and the defendant further contended that the Corporation ought not to have allowed the tenant to get into arrears for two quarters.

For the Corporation, it was shown that on one occasion when there was a change of tenancy, defendant applied for the light to be re-connected, and the work was done.

The Judge said the defendant had not a ray of defence, and he entered judgment against him, with costs.

W. F. Jackson v. F. Bailey and F. H. Jackson.

The Lord Chief Justice, sitting in the King's Bench Division on Thursday, July 1st, heard an action brought by the plaintiff, of Beechwood Avenue, Weybridge, against defendants, of 64, Bankside, London, electrical engineers, for breach of contract. The action had to do with an invention of a clutch for use in wheeled vehicles and for the transmission of power.

Mr. Rufus Isaacs, K.C., appearing for the plaintiff, who is a member of the Stock Exchange, said an agreement was entered into between the parties in September, 1906, by which the defendants, who were then in the employ of the City of London Electric Supply Co. as chief and second engineer respectively, agreed to grant to the plaintiff the full and exclusive licence and authority to construct and vend a clutch, which, it was contended, would be of considerable value for use in machinery for the transmission of power. Defendants agreed to let the plaintiff have this privilege for £1,000, and to supply a specimen clutch for use on a 25-h.p. motor. The clutch supplied failed when put on trial, and plaintiff claimed for the return of his £1,000 and asked for other damages. The defendants denied any breach of warranty.

Mr. D. Haviland, an expert, exhibited a model of the clutch, and explained that the principal portion of the invention was an oil cushion constructed inside the fly-wheel. Owing to a leakage of oil the clutch would not work, but he thought that upon reconstruction it would be improved and made useful.

Mr. Simon, K.C. (for defendants), contended that he had no case to answer. There was no breach of warranty, because the clutch was constructed according to a workable invention.

Mr. Isaacs said it was not a defect in an invention that the plaintiff complained about; it was because the particular sample which was provided was of no use and was unworkable because of a defect which the defendants would not or could not remedy.

Mr. Simon said he would call no witnesses, and his Lordship reserved judgment.

On Monday, his Lordship said the action of the plaintiff would fail. The proceedings were based on the ground that the defendants did not supply a workable sample of their patent, for after the clutch had been fixed to the motor it broke down. Plaintiff paid the £1,000 before the invention was tried, to obtain certain rights. The patent was an ingenious device which failed through one defect, which the inventor could not foresee, but which it was said could be remedied. He entered judgment for the defendants, with costs.

Johnson & Phillips, Ltd., v. Palmer.

By this action, which came before the Lord Chief Justice in the King's Bench Division on Tuesday, the plaintiff company sought to recover from the defendant £300 paid to him by them upon conditions, which it was alleged had not been fulfilled.

Mr. Norman Craig, on behalf of the plaintiff, said the defence raised was that the payment of the £300 was an out and out payment; secondly, that even if the money was repayable by the contract defendant was entitled to detain it in consequence of the acts of the plaintiffs; and thirdly, the plaintiffs were indebted to the defendant in respect of another matter. Plaintiffs were the well-known firm of electrical engineers, and the defendant was solicitor to the West Surrey Light Railway Co., which was registered on October 19th, 1903, its object being to construct light railways in Surrey. Subsequently they obtained two provisional orders—one for the Guildford Light Railway and the other for the Woking and Bagshot Light Railway, and the present inquiry was practically limited to the last railway. A Mr. England was the intermediary between the plaintiffs and the defendant, and the directors of the company, which was ultimately formed for the Woking and Bagshot Light Railway, were Mr. Collinson Hall, Mr. Gardner and Mr. Harrop. Plaintiffs were approached by the defendant with the view to their being the contractors who should build the light railways; plaintiffs were invited to help in the financing of the matter, and as a matter of business plaintiffs were prepared to help in the financing if they got the contract. The length the plaintiffs were prepared to go in financing was that they were to apply 27½ per cent. of the contract price in both the Guildford contract and the Woking and Bagshot contract in subscribing for ordinary shares of the Light Railway Co. formed by the West Surrey Co. Plaintiffs were also to pay the necessary deposits to the Board of Trade—£1,000 and £4,000—and also £4,000 to the expenses of the promoters in framing the Woking and Bagshot Provisional Orders, and finally plaintiffs were to pay £500 to the defendant towards his expenses of negotiation, and that was the basis of the claim in the present case. That £500 was divided into £200 for the Guildford expenses and £300 with reference to the Woking and Bagshot expenses. The £500 was to be paid on the plaintiffs obtaining the contract, the time being fixed for the payment; but the defendant made application for the money before it was payable, and plaintiffs paid it on the express condition that, if the plaintiffs did not get the contract, defendant would repay it. That was in writing, and the real issue was whether the plaintiffs were entitled to get the £300 back, having regard to the terms of the letters. Plaintiffs, through their managing director, always made it clear that they were not going to be employed to build railways without money, and that any contracts entered into must be settled by their solicitors. Counsel then read correspondence which had passed between the parties, and in reply to his Lordship, he said that the plaintiffs did not get the contract in question because, as the defendant said, they would not consent to immaterial alteration.

Mr. John Macgregor, the managing director of the plaintiff company, gave evidence to the effect that no provisional contract was come to with regard to the Woking and Bagshot railway, and his company never got the contract.

Cross-examined, he always insisted that the payment of the £4,000 to the promoters was contingent upon the money being raised and the contract being signed. From the very first Mr. Palmer or the West Surrey Co. undertook to find the money to carry on the contract.

Mr. George Wale, the plaintiffs' solicitor, examined, said that from first to last the matter never passed out of the region of negotiation.

Mr. F. E. Proctor, electrical engineer in the employ of the plaintiffs, examined, said he took part in the negotiations between the parties. No final agreement was ever come to so far as he knew.

Mr. Johnson Edwards then addressed his Lordship on behalf of the defendant, contending that if there was a condition as to the repayment of the £300, plaintiffs had waived it. He further submitted that the financial arrangements had nothing whatever to do with the contract between the defendant and the plaintiffs.

Supposing he (counsel) was wrong on both these contentions, he submitted that on September 14th, 1906, there was a sufficient agreement arrived at which enabled the defendant to keep the £300 to satisfy his fees.

Defendant was examined, and at the conclusion of the arguments judgment was reserved.

The Lord Chief Justice, in delivering his reserved judgment on Wednesday, said that it was clear that a great deal of money had been spent in obtaining the Provisional Orders, and that the plaintiff firm was approached for the purpose of assisting financially in carrying out the scheme. The plaintiffs' only interest in the matter was obtaining the contract, and they were not liable for preliminary expenses. The plaintiffs sent the cheque on the clear understanding that if the contract was not given to them the money would be returned. As the contract was not given to them, through no fault of their own, the £300 must be paid to the plaintiffs, and there must be judgment for them for that amount, with costs.

Stay of execution was granted on the money being paid into Court within a fortnight.

North-Western Electricity and Power Gas Co., Ltd.

In the Companies' Winding-up Court on Tuesday last, petitions for the compulsory winding-up of this company were before Mr Justice Neville. The petitioners were Harper Bros. & Co., of London, and D. Balfour & Son, St. Nicholas Buildings, Newcastle.

Counsel, for the company, asked for a week's adjournment, which was assented to by Mr. Mansell, who represented the petitioners. His Lordship accordingly directed the hearing to stand over until Tuesday next.

Platinum Corporation.

In the Companies' Winding-up Court on Tuesday last, Mr. Justice Neville, on the petition of H. B. Gill and others, made an order for the compulsory winding-up of the Platinum Corporation, Ltd.

It was stated that the company was doing no business except holding shares in other companies, and such business as was done through those companies. Under those circumstances the directors did not oppose the petition, which was based on the allegation that the sub stratum of the company was gone.

The Amalgamated Radio-Telegraph Co., Ltd.

Mr. Justice Neville, on Tuesday, heard a court summons in the matter of the liquidation of this company, by which Mr. Ashby claimed remuneration and costs in respect of the sale of the company's assets.

Mr. Ashby, a gentleman largely interested in radio-telegraphy, was a shareholder in and creditor of the company, and was its managing director before it went into liquidation. At his suggestion, the liquidator suspended the sale of the company's assets, as he thought he would be able to obtain a better price than that at which this was first offered. A better price was ultimately obtained, and in respect of the sale Mr. Ashby claimed remuneration, and also his costs, for attending the proceedings in Court for the purpose of carrying the sale through.

The summons was opposed by the liquidator.

His Lordship, after consulting with the Master, said he was told that Mr. Ashby was not authorised to act on behalf of the Court, and, therefore, he could not give him any remuneration. Mr. Ashby's attendance, however, no doubt facilitated the carrying-through of the sale, and he would, therefore, allow him the costs of such attendance. The liquidator was given his costs of the present summons.

L.G.B. INQUIRY AT WEST HAM.

The Local Government Board inquiry into the application by the Corporation of West Ham for borrowing powers to a total of £74,600, as detailed in our issue on the 18th ult., was resumed at Stratford Town Hall on Monday last, the 5th inst.

Mr. H. Ross Hooper, M.Inst.C.E., presided. Mr. R. Elvy Robb appeared for the India-Rubber and Gutta-Percha Works Co., Ltd., who opposed the application, and Mr. Drucker (instructed by Mr. Tweedy Smith) for several local wiring contractors, who considered that the wiring department of the Council's undertaking unfairly interfered with their business. The Council was represented by its chief officials, and Mr. Edward Morten, K.C., the Recorder for the borough.

It will be remembered that the inquiry was opened a year ago, and adjourned on the Council refusing to disclose details of the contracts they had entered into for the sale of power. It has since transpired that a very large contract entered into for five years was at the rate of 0·37d. per unit, and that the whole of the supply to the Silvertown area—some 5½ million units per annum—was sold at an average price of 0·43d. per unit.

On the resumption of the inquiry, Mr. A. H. Seabrook, the late electrical engineer to the Council, was cross-examined by Mr. Robb as to certain evidence given before a Parliamentary Committee in 1906, when opposing a power Bill promoted by the London County Council, that he could buy additional plant at a capitalised value of a little over 10s. per kilowatt per annum, or a capital value of between £7 and £8 per kilowatt. In the discussion on Mr. Snell's paper on the "Cost of Electrical Energy" at the Institution of Electrical Engineers 18 months ago, he had stated it would cost at least £12 per kilowatt.

Mr. Seabrook was asked if, in fixing the rates to be charged, the consumer had been debited with his proportion of the capital charges. The answer was yes, and a long discussion took place as to the meaning of the phrase "his proportion of the capital charge," Mr. Seabrook maintaining that it meant the proportion of the capital charge incurred in giving the supply to that particular consumer, and Mr. Robb arguing that it ought to mean the proportion of the total capital charge of the undertaking, calculated by comparing his share of the total maximum load on the station.

Mr. Seabrook was pressed to give definite figures as to how the proportion of the capital charges allocated to the 0·37d. customer was calculated, but he declined to do so. He, however, said that the amount was determined by the maximum load, and that the only effect of load factor was to reduce the sum thus allocated per unit and the price of energy.

Asked as to whether he considered the price of 0·37d. per unit a profitable one, Mr. Seabrook said he did, and would be glad to get others requiring a similar supply on the same terms. He did not, however, feel justified in giving the full details as to the costs on which this selling price was based. It was, however, clear that while they provided for the share of capital charges incurred in giving the power supply, they did not provide for a proportional part of the capital outlay on the whole of the undertaking.

Mr. Robb then discussed the question of the price of 1·53d. per unit charged for the public lighting supply, and asked for an explanation. Mr. Seabrook stated that a number of charges, such as carbons, attendance, &c., were included, and would not accept Mr. Robb's contention that ·98d. per unit would be a fairer charge which, after allowing £500 per annum for capital charges, still showed an overcharge of £1,252 per annum.

The question was then raised that the 1908 accounts apparently showed that over a million units had been sold at an average price of ·336d. per unit. It was explained that though this was the price paid, it was not the price charged, as a sum of £727 10s. 10d. had been paid to one customer as damages for interrupted supply. Mr. Robb then said, as this had happened once, and the sum then paid was in excess of the Corporation's statutory liability of 40s. per day, it might happen again, and due provision should be made for this contingency.

The large number of units lost during 1909 in distribution were alluded to, and Mr. Seabrook explained it was largely due to the increased number of tramway units generated by the turbine plant and then transformed to direct current.

In reply to Mr. Morten, Mr. Seabrook stated that no lighting was carried out in the Silvertown area, and that if the average capital charge on the whole undertaking had been used in determining the rate of charge, not a single power unit would have been sold. They had been able to give this cheap power supply without detriment to their lighting customers, and without any increase in price per unit to them. If it had not been for the power supply they would have had to increase the price per unit on account of the diminished output due to the use of metallic-filament lamps.

The provision of cheap electric power had been a great benefit to the borough, and had increased considerably the rateable value, as well as provided a large amount of employment.

The Inspector drew Mr. Seabrook's attention to the small reserve fund, which, with the £3,800 just added, was under £6,000, while the sum contributed in past years from the rates towards deficits in the undertaking was about £25,000. Mr. Seabrook replied that as £93,599, out of £438,558, was either repaid or in the sinking fund, he did not think a large reserve fund necessary.

Mr. Robb pointed out to the Inspector that his clients did not ask for the entire refusal of the loan, but for its definite allocation in such a way that no renewals of existing contracts or new contracts should be entered into on similar terms, and that all future contracts should contain proper safeguards to cover the risks to the Corporation of variations in the price of coal and the liability of the Council in case of failure of the supply. He said that his clients considered that the undertaking had been run on reckless and improvident lines, and they objected as ratepayers to be liable for the errors committed through the optimism of the two extremely able and ambitious young men, Alderman Littler, the Mayor of West Ham, and Mr. Seabrook, who had been the guiding spirits of the undertaking.

They considered that to obtain a true idea of the financial position of the undertaking, it should be debited with the following items:—

Overcharge for public lighting	£1,252
Undercharge for capital charges on motor purchases	408
Undercharge on rates due to low assessment ...	4,000
Further allowances for reserve fund, approximately 2 per cent. on total capital expenditure of £438,558	8,000
Contingency against liability in case of breakdown of supply	2,000
	£15,660
Less surplus as shown by 1909 account ...	3,853
Estimated deficit on year's working	£11,807

Mr. Robb closed by asking whether the sinking fund was being used to finance the undertaking, but was refused a reply on the ground that the matter was involved in an impending law suit.

Mr. Stuart Russell, M.I.E.E., electrical engineer to the India-Rubber and Gutta-Percha Works Co., was then called. He said he had examined the reports of the undertaking, and was of opinion that the price of ·37d. per unit was unremunerative. The present output of the station was about 15½ million units per annum, but taking the present maximum demand of 6,100 KW., and assuming the ideal load-factor of 100 per cent., which would give an output of 53 million units per annum, he could not reduce the cost of production below ·412d. per unit made up as follows:—

Coal	·200d.
Oil, waste, &c.	·003d.
Wages	·035d.
Repairs	·013d.
Rent, rates and establishment charges ...	·028d.
Capital charges	·133d.
	·412d.

The capital charges were obtained by dividing the whole of the capital charge *pro rata* over the output.

If the maximum demand rose to 8,000 KW. and the output to 70,000,000 units, on a load factor of 100 per cent. the figure would be reduced to ·401d. per unit These figures did not include any provision for reserve fund or profit, and from the large number of units concerned they showed that sales at the prices agreed on could only be made at a considerable loss.

Mr. Russell was closely cross-examined by Mr. Morten as to the effect on his costs of the allocation of the whole of the capital charges over the entire output, and admitted that if this were not done it might be possible to supply without loss at the quoted prices.

Mr. Morten contended that the position of the lighting consumers was not prejudiced by the new contracts for cheap power, but that, on the contrary, they had a "prospective benefit" in the increased output which at present had prevented an increase in the price charged per unit.

Mr. Russell, however, persisted in maintaining his opinion that the capital charges should be distributed over the whole output irrespective of use, but having regard to maximum loads.

Asked to account for the improved results shown in the last account, Mr. Russell attributed it largely to improvements in methods of working and lower coal contracts.

Mr. W. H. Patchell, M.Inst.C.E., was in general agreement with Mr. Stuart Russell's figures. He had independently estimated the cost of production on the basis of an output of 70 million units from the present plant, viz, 8 000 KW. with a load factor of 100 per cent., and found it to be ·39d. per unit, as compared with Mr. Russell's ·401d. He agreed with Mr. Russell's contention as to the allocation of capital charges, but admitted that a difference might be made in favour of a large long-hour consumer near the station, as against a small short-hour consumer some distance away and involving expenditure on mains.

On the resumption of the inquiry on Tuesday, the question of the management of the sales department was again considered.

Mr. Huddleston, Messrs. Siemens's representative, again repudiated the manufacture of the cable sold to Messrs. Troup, Curtis & Co., and reputed to be of their make, and Mr. Coxell, clerk to Messrs. Troup, Curtis & Co., repeated his evidence as to the prices charged by the Corporation for cable being lower than trade prices of non-Association cables of British make.

It was then explained by the Corporation that the cable was of German make, and that owing to a label being misplaced a mistake had been made in stating it was of Siemens's make. As to price, this showed a profit of 15 per cent.; samples had been tested, and several insurance companies had agreed to accept it. It was claimed that the mistake was an isolated one, and afforded no ground for the charges of selling goods under false trade names which had been imputed to the department.

The profit and loss account of the sales department for the year 1909 which had been promised by Mr. Patterson, the borough treasurer, was handed in.

A number of questions were asked by the Inspector, who pointed out there was no sinking fund provision for the £14,000 worth of motors which had been purchased in connection with the motor-hiring scheme. This should amount to £1,750, a sum which far outweighed the £250 1s. 5d. shown as profit on this item.

It was explained that, as the money was not yet borrowed, no sinking fund charges actually had to be paid, and that a sum of £759 had been allowed for depreciation. The Inspector, however, insisted that the fact that the money had not been borrowed, but provided temporarily from other sources, did not exonerate the Council from the duty of providing the necessary sinking fund for the redemption of the loan.

Mr. Drucker complained that the rent, rates and taxes charge of £20 was insufficient; that no part of the advertising charges of the whole undertaking were allocated to it, and that the item of hire of arc lamps, on which a loss was acknowledged, had been omitted.

If due allowance were made for these items, the department would show a heavy loss, and he contended it was unjust to his clients for such unfair competition to be subsidised by the rates.

Mr. Fines, on behalf of the Ratepayers' Defence Association, Mr. Duke and Mr. Bishop, on behalf of the ratepayers, asked the Inspector to advise the Board, in granting the loan, to impose stringent regulations as to the way in which the accounts of the undertaking should be kept, and to insist on their being audited by one of their own auditors.

Mr. Morten then replied on behalf of the Corporation. He claimed that in reality the whole of the opposition was interested, and had in it an element of trade competition. He defended the management of the sales department, denied that it had unfairly competed with local contractors, and held that it was a valuable asset which, by its indirect effects, helped the general prosperity of the undertaking. The Corporation were satisfied with its results.

Dealing with Mr. Robb's opposition on behalf of the India-Rubber Co., he said that when on the previous day Mr. Robb had agreed to the necessity for the loan being granted, and limited his demands to the conditions on which it should be allowed, he had considerably modified his attitude.

As to the claim that the loan, if granted, should be used for the specified purposes, the Inspector had carefully examined the application, and it was unnecessary to specify such an instruction, it was implied in the permission.

Mr. Morten then dealt with the absence of any sliding scale for variations in the price of coal from the low priced long term contracts. He considered this a fair business risk, it was quite as likely to go down in price, when the Council would get the advantage, as to increase in cost which would be a disadvantage to the Council.

He then considered the question of the allocation of capital charges, which, he said, was the real point at issue. The opposition claimed that consumers should be treated alike, consideration only being given to their relative maximum demand, while the Corporation insisted that only that proportion of the total capital charges which were directly connected with the supply to that particular consumer or class of consumer should be considered. The undertaking had commenced as a purely lighting system, and the power supply had been commenced at a much later date. It would obviously be unfair to make the power consumers responsible for capital charges incurred in the early days of the lighting undertaking. Again, it had been admitted by Mr. Patchell that some difference must be made between the long-hour large consumer who built a factory close to the generating station and the small consumer in a distant part of the borough. The fairness of discrimination once allowed—the policy of the Corporation was not merely the logical, but the only sound commercial one.

He contended that the lighting consumer was in no way prejudiced by the addition of the low-price, long-hour power users, and that it was only the enlightened policy of the Council in taking steps to encourage the power demand which had caused the great improvement in the accounts of 1909 as compared with 1908. This improvement would, in his opinion, be maintained, and the undertaking would in future years be able to bear all charges which could fairly be allocated to it. The advent of cheap power had been such a benefit to the borough, that even a loss on the undertaking would have been justified.

The Inspector then closed the inquiry, intimating that he would report to the Board in due course.

BUSINESS NOTES.

Consular Notes.—German East Africa.—The British Vice-Consul at Dar-es-Salaam reports that that town is supplied with electric light by the Central Railway Co. at a cost equivalent to about 10d. per unit. The electric lighting of the streets, both in the European and native quarters, of which the estimated cost was £6,000, was expected to be completed by the end of March, 1909. The cables are underground in the European, and overhead in the native quarters. German East Africa is connected with the international cable system by a cable from Dar-es-Salaam to Zanzibar *via* Bagamogo. There are telegraph stations at the post offices of Amani, Bagamogo, Bismarckberg, Dar-es-Salaam, Kilimantende, Kilossa, Kilwa, Korogwe, Lindi, Mikendani, Mohoro, Mombo, Morogoro, Moschi, Mpapua, Muanza, Muhesa, Pangani, Sadani, Tabora, Tanga, Ujiji, Wilhelmstal and Wrigiri. Dar-es-Salaam, Tanga, Bagamogo and Pangani possess local telephone systems.

Later in his report the Vice-Consul states that the development of the cultivation of Ceara rubber in German East Africa has been remarkable. It is estimated that in the next two or three years the total number of trees in the Colony will have increased to some 6,000,000. The chief districts in which this rubber is grown are Wilhelmstal—which alone is expected to possess 4,000,000 trees by the end of 1921—Lindi, Kilwa and the lowlands of Moschi, while plantations are springing up at many points along the two railways. No separate statistics are available of the exports of Ceara rubber as compared with the native varieties, but as the trees are not tapped as a rule until they are three years old, the amount can scarcely be very large at present, and, in any case, statistics would give little indication of the great future which is believed to await the cultivation of this rubber in German East Africa. Whether this belief is fully justified remains to be proved by the results achieved in the next few years Some uncertainty would still appear to exist as to the best method of tapping the trees, and experiments made in this direction by the Biological Institute at Amani are likely to lead to the production of a purer and more remarkable rubber. Meanwhile, results at present attained have led to the belief that, so long as the price of rubber is maintained at its present level, nothing short of the invention of an efficient substitute can prevent rubber-growing in German East Africa from becoming a successful and profitable undertaking. The sudden preference shown by rubber planters for this rubber has led to a great neglect of other valuable qualities. Considerable success is said to have been achieved by an experimental plantation of a native liana belonging to the Landolphia family, and known scientifically as Landolphia Stolzu Busse.

Java.—The British Consul at Java reports that the area under rubber cultivation there has been further increased during 1908. Exports are still, as for some years they must continue to be, on a limited scale, but the small quantities of Ceara, Castilloa and Ficus elastica which have been shipped have sold at high prices. Hevea has so far only gone forward in sample lots, but these have been sufficient to prove that Java Para rubber is as good as either the Federated Malay States or Ceylon rubber.

United States.—The British Consul at San Francisco reports that the Southern Pacific Railroad Co. has begun work on a large power house at Frentvale, Alameda County, to supply the current for operating the extensive electric system intended to supplant the present steam system in use in the cities on the east side of the Bay of San Francisco. The power house will contain two large dynamos of 5,000 H.P. each, and will furnish sufficient current to operate all the lines running in Oakland, Alameda and Berkeley. A new licence has been granted by the city of Alameda, and the work of electrifying the lines running through the town has already begun. The work begun by the Great Western Power Co. in 1906 to drive a tunnel through the bank of the Feather River where it forms a horseshoe about 20 miles north of Oroville, in Bulte county, was completed in December last. The neck of the bend is about 15,000 ft. across where the horseshoe begins, but the channel of the river is more than 500 ft. lower than at the upper point. The tunnel which will carry the entire contents of the river to the generating machinery has been cut three miles through a mountain. In that distance it has a drop of 75 ft., but from the lower end of the tunnel to the power house there is a plunge equivalent in all to a drop of 540 ft. The tunnel is solidly lined with concrete and finished smoothly inside to prevent friction. The plant is to have eight electric generating machines of 18,000 H.P. each, and four of them were put in operation at the opening. Already £2,000,000 has been expended upon the electric plant at Las Plumas, on the Feather River. It is said that this will be the largest electric generating station in the world, being capable of producing 144,000 H.P., which exceeds even the plant at Niagara. Power is being furnished by this company to the new Cowell Cement Works in Contra Costa County, by an overhead wire, supported by steel masts, some 150 miles long.

Experiments are still being carried on with an electric iron smelter on the Pitt River, Shasta County, California. The small furnace with which the early experiments were made is being replaced with a plant which will use 2,000 H.P. of electric energy, and will turn out a large quantity of iron. The new furnace is practically complete, and was to be ready to begin operations in the early part of 1909. If this plant solves the problem of producing pig-iron without fuel a new industry of great importance will be added to the list of Californian enterprises. Some attempts have been made to produce pig-iron with oil as fuel, but these experiments have not met with much success, and all the plants have been abandoned.

The British Vice-Consul at Los Angeles reports that the three principal electrical companies there, state in their reports, that the total amount of electricity in KW.-hours furnished and supplied during the year 1908 was 184,370,000. They further report the total cost of their properties to be £3,900,000.

There are nearly 700 miles of electric tramway in Los Angeles and connecting Los Angeles with neighbouring towns. The longest of the suburban lines is to Santa Ana, a distance of 30 miles. These trams run at the very high speed of from 40 to 60 miles an hour on the suburban lines.

Greece.—The British Consul in the Piræus reports that the electrification of the local tramway system has been pushed forward, and now some 26 miles are in use. The number of cars already imported amounts to 120, and 40 more are expected; these and most of the plant are of Belgian origin. The total number of employés is 750. A further 12½ miles will be undertaken during 1909.

Holidays.—We have before us a booklet published by the Paris-Orleans Railway Co., with views of, and a good deal of matter relating to, the various places of historic and general interest served by the company's system. Intending tourists can obtain a copy of the brochure from the Art Publishing Co., 34, Norfolk Street, Strand, W.C.

Catalogues and Lists.—Messrs. Simplex Conduits Ltd, Birmingham and London.—A number of new leaflets giving illustrated particulars and prices of their Simplex-Isaria electricity meters, watt-hour meters for A.C., and ampere-hour meters for continuous-current; curves of accuracy, diagrams of connections, and notes of dimensions, are given. The company is laying down at its premises, 116, Charing Cross Road, W.C., a completely equipped testing and calibrating plant in connection with its meter business. Large stocks of various types are carried at that address.

Messrs. Fyfe, Wilson & Co., 145, Bath Street, Glasgow.—Four-page illustrated list relating to their paraffin and petrol engine sets, switchboards, batteries, &c., for country house, shooting lodge and other small electric lighting installations.

Tudor Accumulator Co., Ltd., 119, Victoria Street, S.W.—Two leaflets, one giving a list of their complete batteries of 14 and 27 cells for 25 and 40-volt installations, with prices arranged in tabular form; the other indicates the approximate rates for carriage of acids to the principal stations in the United Kingdom.

Messrs. Donovan & Co., 12, Barwick Street, Birmingham.—Various loose lists dealing respectively with "Danco" single-enclosure arc lamps, "Barwick" motor-starters, metal-filament lamps, replacement fuses and main switches.

Messrs. Wm. Geipel & Co., 72A, St. Thomas Street, S.E.—Revised price list of Henrion carbons for open and enclosed arc and flame lamps.

Messrs. Jaeger Bros., 47, Victoria Street, S.W.—Catalogue (80 odd pages) containing illustrations of a variety of electric lighting and bell devices and fittings. Prices are indicated in red.

Messrs. Tetley & Co, Falcon Electrical Works, Salford.—Illustrated price leaflets of "Rex" push and pull switch fuses, ironclad switches, door switches, &c.

The General Electric Co., Ltd., Queen Victoria Street, E.C.—32-page booklet (pocket size) giving fully illustrated particulars and prices of various types of "Freezor" electric fans (A.C. and C.C. for desk, bracket and ceiling service in the house, offices, hotels, ships, railway carriages, &c.), "Bandy" electric punkahs, small power motors, electric bench drills, polishing and buffing machines, &c. The title of the booklet—"A Good Breeze"—indicates at once the nature of the greater part of the contents. A second larger publication of 8 pp. enters more fully into the description of the "G.E.C." "Bandy" electric punkah, and discusses the advantages of the electrical punkah over the mechanical punkah and the ceiling fan.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—Several new lists. One deals with some modern electric light fittings—"Majolica" fittings, solar brackets, tantalum arcs, water-tight fittings for tantalum lamps, adaptors and glass shades; a second is devoted to tantalum lamps and fittings specially designed for ship and harbour lighting, and a third gives prices of small motors of from $\frac{1}{100}$ H.P. to 3 H.P.

Clarke's Crank and Forge Co., Ltd., Lincoln.—Pamphlet, as issued at the recent Royal Show, showing neat illustrations of all classes of their cranks as supplied for steam and gas engines, motor-cars, &c., in Siemens-Martin acid process, nickel, nickel-chrome, vanadium and other steels.

Witton-Kramer Electric Tool and Hoist Co., Witton, Birmingham, and 71, Queen Victoria Street, E.C.—Various lists of electric suspension and mono-rail trolley hoists, transportable electric tool equipments, A.C. and D.C. electric brake magnets, ordinary and magnetic drill posts, and tube scrapers. The company has recently acquired the goodwill of the business of Kramos, Ltd., of Bath, including patterns, designs, patents and trade marks, and is carrying on the manufacture of the above lines.

Pope's Electric Lamp Co., Ltd., Willesden, N.W.—Illustrated price list of their "Y R" metal-filament lamps, showing different shapes of bulbs, and giving prices for lamps of various voltages and candle-powers.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, S.W.—Several new pamphlets as follows:—No. 146 describing the "Quartz" system of electric heating (Bastian patents); No. 145 detailing, and giving prices of the "Phœnix" lantern ("Streetlite" patent), the ventilating system of which is claimed to prevent blackening of lamp bulbs; also No. 144, containing 8 pp. of illustrations, tabulated voltages, current consumptions and prices, of Osram lamps, and giving notes of instructions for ordering and handling the lamps.

Century Electric Co, St. Louis, U.S.A.—40-page well-illustrated bulletin (No. 12), in which their single-phase self-starting motors are described, and some of their applications are shown, dimensional and other drawings being included.

Trade Announcements.—The book departments of the McGraw Publishing Co. and the Hill Publishing Co. have consolidated under the corporate name of the McGraw-Hill Book Co., with offices after July 1st, at 239, West 39th Street, New York. This consolidation brings together two of the most active publishers of technical books in America. The Hill Publishing Co, which controls the *American Machinist*, the *Engineering and Mining Journal*, and *Power and the Engineer*. The McGraw Publishing Co., which issues the *Electrical World*, *Electric Railway Journal* and the *Engineering Record*.

Messrs. Laidler, Ritchie & Co., Ltd, of Manchester, announce that their representation of Messrs. J. & H. Grevener terminated on June 30th.

Messrs. George McCartney & Co., engineers, Burnside Works, Cumnock, N.B., have appointed the E.M.F. Manufacturing Co., 10, Ironmonger Lane, E.C., as their representatives for London and the Southern Counties, and Messrs. C. E. Lugard & Co., Fields Buildings, Middlesbrough, as their representatives for the North-East Coast District.

As was announced on p. 1013 of our issue of June 18th, the business formerly carried on by Vaughan & Cook will in future be conducted by the Vaughan Engineering Installations, Ltd. Mr. T. W. Vaughan remains on the board, and all work will be carried on under his personal supervision as before.

Book Notices.—*Spon's Workshop Receipts.* Vol. I. Acetylene Lighting—Drying. London: E. & F. N. Spon. Price 3s. net.—"Workshop Receipts" is one of those works that everybody knows, and without which no library is complete. It is the product of many years' painstaking compilation from innumerable sources, and naturally it has suffered in the past from the defects to which all such encyclopædic works are liable: it has become overgrown and unwieldy, and the maintenance of logical and systematic order has been impossible. To remedy these defects the publishers have wisely—though, perhaps, somewhat tardily—decided to reorganise the whole work with the aid of expert editors, who have thoroughly revised the accumulation of receipts, and have reduced them to alphabetical order. That the scope of the work and its magnitude have not also been reduced is clear from the fact that the first volume only reaches "Drying"; we may, therefore, look for some half-dozen volumes in all to complete the set. To review in detail a collection of independent articles of this description is a Herculean task, calling also for an omniscience which is not ours; we can only mention briefly a few items of special interest to electrical engineers, though we by no means suggest that the many other subjects dealt with are not likely to be useful to them on occasion. Passing by Anemometers, Belting and Bitters, we find several pages devoted to the Corrosion, Incrustation and Covering of Boilers, which include detailed analyses of several classes of water and of the resulting boiler scales, with a series of receipts for boiler compositions and processes of purification. Briquette-making is the subject of an interesting article. Cements and Lutes naturally occupy a very lengthy section, though a number of important adhesives, such as glue, are deferred to later volumes. Concrete is dealt with at fair length, and a variety of subjects of minor importance with which the engineer is called upon to deal from time to time. We feel sure that the revised volumes will enter upon a new era of usefulness and will enjoy at least equal popularity with their forerunners.

Journal of the I.E.E., June, 1909. Vol. 42. No. 195.—This part contains "The 'G.B.' System," by S. Clegg; "Parallel Operation of Alternators," by Dr. E. Rosenberg; "Electrical Distribution Systems," by J. W. Beauchamp; "Improvement of Power Factor in A.C. Systems," by M. Walker; "Early Experiments in Electric Traction," by W. W. Lackie; "Electro-Hydraulic Pumping Plant at the Bristol Docks," by W. A. Clatworthy; and "Researches on the Magnetic Properties of a Series of Carbon Tungsten Steels," by T. Swinden. London: E. & F. N. Spon, Ltd. 1909. Price 5s.

"Kapazität und Induktivität." By Dr. E. Orlich. Brunswick: Friedr. Vieweg & Sohn. 1909. Price M. 14.

"Atlas der Elektropathologie." By Dr. S. Jellinek. Berlin: Urban & Schwarzenberg. 1909. Price M 35.

"Science Abstracts." Sections A. and B. Vol. 12. Part 6. No. 138. London: E. & F. N. Spon. 1909. Price 2s. 6d. per number.

"Stroboscopic Measurements of Alternating-Current Frequency with Electric Lamps"; and "The Influence of Frequency on the Equivalent Circuits of Alternating-Current Transmission Lines." By A. E. Kennelly. Reprinted from the *Electrical World*. New York: From the Author.

"The Post Office Electrical Engineers' Journal." July, 1909. Vol. 2. Part 2. London: H. Alabaster, Gatehouse & Co. 1s. net.

"Electricity for Everybody; a Popular Handbook." By R. Borlase Matthews, Wh. Ex. London: The Electrical Press, Ltd., 1909. Price 5s. net, post free.

Bankruptcy Proceedings.—Charles and Gustave Markt, lately trading under the style of Markt Bros. & Co., at Curtain Road, E.C.—The debtors attended at the London Bankruptcy Court on July 2nd, for public examination, before Mr. Registrar Brougham. The statement of affairs lodged by the debtors, shows total liabilities £18,313 (unsecured £16,155); assets valued at £417; and a deficiency estimated at £15,737. The estate is being administered in bankruptcy by Mr. S. P. Child, C.A., acting as trustee, with the assistance of a Committee of Inspection. According to the observations of Mr. G. W. Chapman, Official Receiver, and the statements of the debtors, they attributed their insolvency to the failure of the Auto-Claw Co., Ltd., in which their money was locked up, to depression in trade, and to the loss of their principal agency. The particulars have already been reported in the Electrical Review (June 25th, p. 1042). The examination of both debtors was concluded.

A receiving order was made on June 30th in the case of W. T. Harris, electrical engineer, Commercial Road and Emanuel Street, Portsmouth, on his own petition.

Annual Outings.—The Armorduct Co.'s head office staff, accompanied by some of the branch managers and agents—a company about 40 strong—assembled at Windsor on Saturday morning, boarded the *Diamond Queen*, and proceeded up river to Bourne End, luncheon being taken *en route*. On arrival the company's cricket team played a game, whilst other members of the party indulged in punting and other pursuits. Tea was served on the return journey. The company assembled at the White Hart Hotel at Windsor, where dinner was served, after which songs and music concluded a pleasant day. The managing director, in congratulating the staff on the success of the outing, pointed out that it was only in harmony with the successful development of the company in general, which, in spite of the trade depression, continued to be strongly progressive.

On Saturday, July 3rd, the employés of the British Electric Calibrated Fuse Co., Harpenden, went for their fourth annual outing to Brighton. After the dinner in the evening at the Clifton Hotel, the usual toasts were proposed, and Mr. Weekes, the general manager, in his speech stated, that the progress of the firm during the last year had been entirely satisfactory. Although the electrical trade was supposed to be in a bad way, they had beaten, by a very big margin, the turnover of the previous year.

Storage Batteries in Hot Climates.—We understand that cells supplied to the Indian Government some six years ago by the D.P. Battery Co., of Bakewell, are still working well and giving no trouble, in spite of the hot climate—sometimes a troublesome factor. No renewals of either positive or negative plates have been required, nor, we are informed, are there signs of deterioration, according to the latest accounts.

High-Voltage Metallic-Filament Lamps.—The Electrical Co., Ltd., of 121-125, Charing Cross Road, referring to the paper on the "Influence of Metallic-Filament Lamps on the Electrical Industry and on Street Lighting," read by Mr. E. E. Hoadley at Manchester, write to point out that a high-voltage Aegma metallic-filament lamp is obtainable, giving 25 C.P., and consuming 30 watts only, at 4s. 3d. This, they say, is a considerable advance on the 50-C.P. presumably 60-watt lamp mentioned by Mr. Hoadley, and they are of opinion that it is as small a wattage lamp as is required. The public, once having been educated up to the higher standard of light, are now no longer satisfied with a 16-C.P. lamp, as formerly.

For Sale.—On July 21st, Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction the entire stock of electrical goods at Fittings, Ltd., 112, Victoria Street, S.W. Particulars appear among our advertisements to-day.

The Brighouse Corporation is offering a 55-B.H.P. gas engine and 40-KW. multipolar dynamo, and other smaller sets and parts of an installation, for sale.

Dissolutions and Liquidations.—British Aluminium Co., Ltd.—A petition presented by Dick, Kerr & Co., Ltd., creditors, for the winding up of this company is to be heard in London on July 13th.

Rex Electric & General Supplies, Ltd.—This company is winding up voluntarily, with Mr. W. M. Whyte, 11, Queen Victoria Street, E.C., as liquidator. Creditors must send the usual particulars by July 31st.

Conduit & Insulation Co., Ltd.—A meeting is to be held on August 4th, at 23, Queen Victoria Street, E.C., to hear an account of the winding up.

Mountain & Gibson, Ltd.—A meeting of the creditors of this company will be held at the Chartered Accountants' Hall, 60, Spring Gardens, Manchester, on Monday, July 19th, 1909, at 11.30 o'clock.

Auto-Controllers, Ltd., electrical engineers, &c., 4 and 5, Town Hall Chambers, Bournemouth.—The winding-up order in this matter was made on the petition of a contributory on 14th ult., and the accounts filed show a small surplus as regards creditors, while as regards contributories, there is a total deficiency of £319. The failure is ascribed to want of capital.

India-Rubber Estates, Ltd.—A meeting is to be held at 52, Queen Victoria Street, E.C., to hear an account of the winding up from Mr. H. S. Murphy, the liquidator.

Christian & Phipps (1907), Ltd.—At a meeting held at Hampton Wick, on July 1st, it was resolved to wind up voluntarily, with Mr. W. A. Pearce, 16, Finsbury Circus, E.C., as liquidator. A meeting of creditors is called for July 19th.

Electric Lorry.—The Metropolitan Asylums Board last January purchased a 5-cwt. electric lorry from the Electric Vehicles Co., at £300, and the necessary charging apparatus was provided at the Infirmary by the B.T.-H. Co., for £70. They are now buying a second of the same type from the company, for carrying 25 cwt., at £480.

Installation Contracts.—The Bridge House Estates Committee have placed a contract with Messrs. C. Larkins & Co., Ltd., of Bush Lane, E.C., for the maintenance of the telephones on the Tower Bridge for one year from June 24th, 1909. Amongst other contracts which this firm have in hand are:—The installation of electric bells and lighting for 51 flats in Stamford Street, S.E., the electric light installation of licensed premises at Finsbury Park, N., and alterations and additions to the electric light installation of large city warehouse.

Theft.—At Lancaster Quarter Sessions on Monday, Matthew Wilson, 31, labourer in the electrical department of Messrs. Vickers, Son & Maxim, at Barrow-in-Furness, was sentenced to six months' hard labour for feloniously receiving brass and copper wire, &c.

German Electrical Motor Vehicles in England.—Messrs. F. A. Wilkinson & Partners, Ltd., of 19-20, York Place, Baker Street, London, W., have secured the British Agency for the electrical motor vehicles built by the Siemens-Schuckert Co., of Berlin. The firm are at present running a 15-cwt. van, which has been hired by Messrs. Peter Robinson, Ltd.; the vehicle is fitted with a 4 2-H.P. motor; the battery, which has a capacity of 30 miles on one charge, is carried under a bonnet at the front of the chassis.

LIGHTING and POWER NOTES.

Ashford (Kent).—Mr. Mark Parker, of Dover, has informed the U.D.C. that he intends applying for an E.L. prov. order.

Bath.—The adjourned L.G.B. inquiry into the application of the T.C. for a loan of £11,700 for E.L. purposes was held on Friday. Mr. H. R. Hooper, the inspector, suggested that certain items should be charged to revenue account, with the result that the loan applied for was reduced to £9,500. There was no opposition.

Beaconsfield (Bucks.).—The U.D.C. has decided to take no action in the matter of compelling the Uxbridge E.L. and Power Co. to extend the mains to the district under the prov. order which expires in November next.

Birmingham.—Last week a L.G.B. inquiry was held by Mr. H. R. Hooper, at the Council House, into an application by the city council for sanction to borrow, among other sums, £149,350 for purposes of the electric supply. Mr. Prideaux, who appeared for the Corporation, said that £100,000 of the £149,530 loan was required for an extension of the underground mains, which had been rendered necessary by the rapid increase in the demand for electrical energy in the city. That demand was shown by the fact that there was an increase in the sale, during the year terminating March 31st last, of about 4,000,000 units, as compared with the previous year, and for the first time in the history of the undertaking the Electric Supply Committee was able to recommend the council to pay £10,000 in relief of the rates. A sum of £15 000 was needed for H.T. switchgear; £2,000 was required to supply transformers to consumers' premises in cases in which consumers desired L.T. current in districts where there were at present only high-tension mains available, and the balance of the loan was for the installation of new plant at Dale End and Summer Lane stations. Evidence was given in support of the application, which then closed.

Birkenhead.—The gross profit for the year 1908-9 on electric lighting was £11,114 and the net profit £2,249. From this, £1,000 was transferred to the district rate and £1,249 added to the reserve fund.

Bridlington.—The report of the last year's working of the electricity department shows that matters are steadily improving, the deficit being £188, as compared with £275 in the previous year. For the first time the private supply exceeded the public lighting supply, and some 34,000 additional units were sold.

Cambuslang.—For the year ending May last, 102,871 units were sold, producing a total revenue of £1,375; the total costs were £795, and gross profit £580. The works cost came out at 1·11d. per unit (including ·06d. for fuel), and total costs 1·85d., while the average price obtained was 2·71d.

Continental Notes. — Hungary. — The municipal authorities of Budapest have decided in connection with the establishment of a large electricity generating station for the electric lighting of the city, to utilise the water power of the River Soroksar, a tributary of the Danube, for the purposes of the scheme.

Belgium.—Luxemburg.—An electricity generating plant for lighting and power purposes, comprising two 1,200-H.P. steam engines and dynamos and one set of 300 H.P., has recently been installed at the new steel works at Saint-Ingbert, Luxemburg, by the Société des Hauts-Fourneaux et Acieries de Rumelange-Saint-Ingbert.

Italy.—H.M. Consul at Naples reports, with regard to a project for the employment of the Volturno river for developing electrical energy, that further consideration has induced the civic authorities of Naples, to whom the administration of the concession belongs, to entertain a scheme for having two works instead of one, as originally proposed. The works are expected to produce normally about 25,500 H.P., and at low water season about 21,500 H.P. The first station is to be at the meeting of the Rochetta and Vandra streams; the second, some 9½ km. lower down the stream.—*Board of Trade Journal.*

Croydon.—At the B.C. meeting on Monday, the Lighting and Electricity Committee reported an application for the supply to a house just outside the borough at Upper Norwood, the premises being within the area of the South London Electric Supply Corporation, Ltd. The latter had agreed to the Croydon Council giving the supply, subject to a nominal rent of 1s. per annum and an undertaking to remove the cables on a month's notice. The recommendation was adopted.

Cuckfield (Sussex).—The Haywards Heath Electric Supply Co. has informed the U.D.C. that it intends applying for a prov. order for E.L.

Darlington.—The T.C. has decided to extend the mains to the West Lodge Estate, and to the works of Messrs. G. Denham and Son.

A loan of £700 for meters has been applied for.

Derby.—The T.C. has decided to apply for a provisional order for E.L. for the following parishes:—Littleover, Markeaton, Darley Abbey, Breadsall, Chaddesden, Ulvaston and Boulton, Normanton and Sinfin Moor.

The mains are to be extended to the works of Messrs. E. J. Axe & Co., Bridge Street, and Haslam's Foundry Co., Ltd., City Road.

Devonport.—The T.C. has applied for a loan of £6,329 for mains extensions.

Dover.—The T.C. has decided to increase the price of electricity as follows:—Public lighting, 6d. per unit; private lighting, 6½d. per unit with ½d discount, instead of 6d. and ½d. discount, and for free lights 7d. net. instead of 6½d. net. These increases will produce an additional revenue of £2,168 for the three quarters of the year.

The B. of T. has informed the T.C. that it is not at present prepared to sanction a loan for the extension of the cables to St. Margaret's-at-Cliff, as the Board is not satisfied that the proposed expenditure would prove sufficiently remunerative.

Dublin.—Mr. P. C. Cowen, chief engineering inspector of the L.G.B., concluded the inquiry into the application for certain loans, including one of some £70,000 for the extension of electric lighting, made by the Corporation. Mr. Mark Ruddle, city electrical engineer, stated that the expenditure since 1905, was £71,000, and the estimated amount necessary to complete the work now in progress was £57,000, made up as follows:—Boiler plant, £7,100; Dame Street area, £3,600; Fleet St. switchgear, &c., £1,800; house services and meters, £2,500; and North and South Circular Roads, £42,000. The loans already applied for amount to £127,000, and the estimated cost of further extensions, for which application was being made, was £69,705.

Mr. P. C. Cowen also sat last week at the Richmond Asylum for the purpose of inquiring with regard to the desirability of sanctioning an application made by the Joint Committee of Management for a loan of £3,800, to be applied in lighting the institution by electricity; the inquiry was adjourned till the 21st inst.

Eastbourne.—The electric auditors in their half-yearly report say that they are of opinion that the electric light balance in hand on the reserve and depreciation fund is somewhat large, viz., £11,487, and that some of it should go to relieve the rates; but after an explanation they desired to leave the matter in the hands of the Council.

Glasgow.—The T.C. electricity department has paid £30,625 to the city committee on finance on account of sinking fund for the year ending March 31st, 1910, while the treasurer has reported that he has borrowed £20,000 for capital purposes from the Corporation Loans Fund, making the total amount borrowed up to June 29th, £1,890,000.

The Committee has had under consideration an application by the Clyde Valley Electrical Power Co. for permission to lay about 550 yards of the cable, with which they propose linking up Rutherglen and Cathcart, within the city boundaries. The Committee has recommended to the Corporation that, so far as the electricity department is interested, no objections be taken to the foregoing proposal, provided (1) that the company undertake not to supply any energy off said main within the city boundary, and (2) that the company do not use the permission now granted as an argument for getting authority to lay down additional cables or to supply electrical energy within the city boundaries.

Greystones.—At the adjourned meeting of the Rathdown (No. 2) Rural District Council, last week, a resolution was adopted granting permission to the Electric Lighting Co., to lay cables in Greystones and district after the summer season, the company undertaking to make good any damage done to the roads.

Handsworth.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £4,400 for E.L. purposes, the sum including £1,000 for free wiring. The Inspector, Mr. H. R. Hooper, referring to this part of the application, remarked that in many towns free wiring was deceased. Any form of free wiring involved a liability, and was speculative. Work carried out with public funds should be properly secured, not speculative. Mr. Nixon, electrical engineer, explained that they were anxious to open up a new field of supply.

Hanley.—The T.C. has decided to supply current to theatres, music halls, and places of amusement taking 400 units per week throughout the year, at 3d. per unit for the first 400 units per week, and 1½d. per unit beyond.

The Collieries Electric Power Development Syndicate Co., Ltd., has informed the T.C. that it is associated with the North-Western Electricity and Power Gas Co. in the erection of a power station for supplying electric power in and around the Potteries, and suggesting that the Council might consider a proposal for the purchase of current in bulk. The Council has decided to confer with a representative of the company on the subject.

Haslingden.—At the Haslingden Guardians' meeting on June 30th, a letter was read from the Rawtenstall Corporation stating that it was prepared to supply the board with electricity for lighting purposes at a flat rate of 3d. per unit subject to five years' agreements. It was also prepared to supply electricity for power purposes at 1d. per unit subject to a similar agreement, the Corporation to lay and maintain the necessary cables to the workhouse and new infirmary at its own expense. The offer was unanimously accepted.

Hastings.—The Electricity Committee, as a result of being approached by certain large consumers, has recommended the T.C. to amend clauses (*a*) and (*b*) of its revised scale of charges, so that consumers with bills in excess of £100 shall obtain a discount of 25 per cent. on the whole amount payable, subject to payment of account being made within one month of its rendering.

Keighley.—The L.G.B. has communicated with the T.C. in regard to the recent application for power to borrow £12,800 for electrical extensions. The Board is willing to sanction £2,950 for mains, services, meters, &c., and has consented to the allocation of the balance (£1,200) of previous loans. The Board will also entertain the proposal to install H.T. plant for power supply, providing evidence of demand from prospective consumers is brought forward. It is stated that the ultimate scheme may raise the total from £12,800 to about £20,000.

Little Lever.—The U.D.C. has unanimously decided to transfer its E.L. order to the Lancashire Electric Power Co., suitable terms having been arranged.

London.—Paddington.—The General Purposes Committee of the B.C has decided to forward to the L.C.C. a statement of the negotiations which have taken place with the Metropolitan Electric Supply Co., relative to the transferring of the company's generating station from Amberley Road to Willesden; and to the failure of the effort to induce the company to reduce the price charged for energy. The Spring Garden authority is to be asked if it can assist in any way to obtain the reduction sought for.

Southwark.—Newington Town Hall is to be re-wired by the Electric Light Department at an estimated cost of £41. Superheaters are to be installed to four boilers at an estimated cost of £570. The accounts of the electricity undertaking for the 12 months ended March 31st last show a gross profit of £5,939. After deducting interest and instalments of loans, there is a surplus of £849. In regard to the wiring of consumers' premises, it is shown that after charging one-third of the outlay, and allowing for lamp renewals and interest on the capital outlay, a substantial profit has been secured. The report winds up as follows:—"During the past year the undertaking has had to contend with competition of the most active description, notwithstanding which your Committee are glad to be able to report that the present financial position of the undertaking is stronger than it has ever been, and they have every reason to hope for a continuance of the results accomplished during the past year. Your Committee have, therefore, expressed their appreciation of the electrical engineer's services, which have been mainly instrumental in bringing about the successful results shown by the accounts for the past year."

Loughborough.—At the recent meeting of the T.C. reference was made to Mr. J. F. C. Snell's report on the gas and electricity undertaking. From this it appeared that the primary difficulties were insufficient demand for the output, low prices for power output, and excessive coal consumption. He did not recommend an increase in power prices, but thought that some improvement should be made in the price of public lighting. It appeared that many of the recommendations had been carried out; they had saved more than £300 on coal, and were trying to obtain an increased price for lighting; moreover, the output for June last was more than double that of the previous June, although that was mainly due to power load.

The report of the Gas and Electricity Committee for last year's working showed a profit of £547 carried to revenue account, as against a loss for the previous year of £314.

Lytham.—The E.L. and Power Co., Ltd., has informed the U.D.C. that it is hoped to commence the necessary works for electricity supply forthwith.

Middlesbrough.—The T.C. has secured in the Bill of the Durham County Electric Power Co. the necessary clauses fully protecting the interests of the Corporation.

Rugby.—The U.D.C. has applied to the L.G.B. for a loan of £5,500, for the following purposes:—150-kw. alternator, £1,316; switchboard, &c., £144; feeder and distributing mains, £2,492; transformers, £214; transformer chambers, £109; consumers' connections and meters, £880; contingencies, £344.

Spennymoor.—The U.D.C. has accepted the tender of the Northern Counties Electricity Supply Co. for public lighting at £2 10s. per lamp per annum.

Tasmania.—At a meeting of ratepayers in Zechan a proposal of the Municipal Council to borrow £6,000 for doubling the electric light plant, and £1,000 for credit installations for consumers, was approved.

Transvaal.—In evidence before the Power Commission, the local Coal-Owners' Association opposed the proposal to allow a corporation or syndicate to obtain a monopoly of the water power, and at the same time obtain a controlling interest in certain coal mines, as being injurious to the country. The proposal meant the substitution of hydraulic power for coal for generating electrical energy, and would practically destroy the Transvaal coal industry as it at present exists.

Walton-on-the-Naze.—The B. of T. has decided to dispense with the consent of the local Council, and grant the prov. order asked for by the Coast Development Corporation, which is already supplying the area with the concurrence of the Council. Consent is given, however, allowing a maximum price of 8d. per unit, subject to the insertion of provisions requiring the removal of overhead wires in five years, and giving the Council powers of purchase.

Wharfedale.—Another electric supply project is on foot, with a view to lighting, &c., in Horsforth, Yeadon, Rawdon, Menston, Burley, Ilkley and Otley; this time a Leeds syndicate is understood to be trying to secure a prov. order and form a company. Several of the townships have opposed previous schemes by securing the necessary powers themselves, but these powers have lapsed.

Willesden.—The Council has resolved to renew its agreement with the North Metropolitan Power Supply Co. for seven years, a reduction of price having been arranged.

Wood Green.—Not dismayed with the reverse of five years ago, when the L.G.B. refused to sanction an electricity scheme involving an outlay of £40,000 or £50,000, the U.D.C. has now decided to embark on a bulk supply scheme, at a cost of £30,000, and application has been made for the necessary permission to raise the loan. The Council proposes to take the supply from the North Metropolitan Electrical Power Co., and to distribute same itself. The engineers are Messrs. May & Hawes. Their scheme provides for only 400 customers throughout 10 miles of streets, and they estimate that 330 of the 1,900 houses would be connected up, 100 out of the 600 shops, and five of the 25 public buildings along the line of route. The consulting engineers report that under the Wood Green Act, of 1903, the Council has the power to carry out the installation of wires, lamps, fittings and other electrical apparatus on consumers' premises for the use of electrical energy. Some 51 arc lamps will be provided for public lighting. The buildings, supply mains and house transformers will, it is reckoned, cost £27,000; house wiring, £2,500; and the public lamps, £1,750; bringing the total outlay to £31,250. The revenue is based on the following tariff of charges:—Private dwelling houses, 4½d. per unit; shops, licensed premises, public buildings, places of worship, and schools, 4d.; for power, 1¾d. The estimated total working expenses connected with the delivery of 397,000 units to the private consumers and the public lamps would, it is calculated, work out at 2·25d. per unit. The private lighting and power supply should yield £5,180; public lighting, £612; and rentals and house meters and transformers, £300. These items total £6,092, and with £3,722 (397,000 units at 2·25d. per unit) deducted, would leave a gross profit of £2,370. The loan charges (interest and repayment of principal) would amount to £1,870, leaving a surplus of £500. The Council agreed to go on with this scheme, subject, of course, to the sanction of the L.G.B.

York.—The T.C. has applied to the L.G.B. for a loan of £2,510 for mains extensions, which will be carried out in conjunction with the new tramways.

TRAMWAY and RAILWAY NOTES.

Bacup.—Progress is reported in the electrification of the Bacup tramways, the section comprising the 2½ miles to Waterfoot. It is expected that with a continuance of fine weather the new track and equipment will be completed in the course of two or three weeks.

Birkenhead.—The tramways show a gross profit of £20,638. Interest and sinking fund absorbed £21,344, and £200 was reserved for income-tax on profits, leaving a deficit on the account of £905, to be contributed by the borough fund; £5,068 was expended on capital account during the year.

Burnley.—The T.C. has refused an offer of £800 per year for advertisements on the electric tramcars.

Continental Notes.—Switzerland.—An 80 years' concession for the construction and working of a single-track metre-gauge electric tramway, from Massagno to Ostarietta through Cadempino, has been granted.

Italy.—A contract has been entered into between the Ministry of Public Works and the communal authorities of Civitanova Marche, for the construction of an electric tramway to run from Civitanova Marche to the docks. The contract carries with it a Government subsidy of about £57 per km. per annum for 50 years.

Edinburgh.—The Tramways Committee of the T.C. has had before it a proposal for connecting South Queensferry with the city by an electric tramway, which would have a terminus in the west end, near the existing cable tramways. It appears that the dust created by the motor traffic on the Queensferry route has converted some of the objectors to tramways, and the building interests are disposed to look favourably at the scheme.

Glasgow.—The Tramways Committee of the Glasgow T.C. has now submitted the annual report, which shows that the ordinary income amounted to £892,751, and the working expenses to £505,618, thus leaving a gross surplus of £387,133. The gross balance of £416,924, which includes interest on surplus revenue and rent of lines let to Dumbarton Burgh and County Tramways Co., Ltd., has been applied in meeting rental of Govan and Ibrox Tramways, payment to Paisley District Tramways Co., interest on capital, sinking fund, income-tax, depreciation and permanent way renewals, and annual payment to the common good, these payments amounting in all to £400,649. The net balance amounting to £16,275 has been added to the general reserve fund. The principal items are interest on capital, £63,349, compared with £53 152 last year; sinking fund, £71,323, against £68,804; depreciation fund, £105,536, against £100,415; permanent way renewals fund, £90,261, against £88,187; payment to common good, £50,000, against £35,000. The gross revenue for the year shows a decrease of £17,567, compared with that of the previous year, and the average traffic revenue per car-mile has been reduced from 10·488d. to 10·262d. The working expenses show a decrease per car-mile of ·06d. The decrease in revenue is mainly attributed to trade depression. A considerable reduction is shown on the expense of maintaining the electrical equipment, and the total working expenses amount to £505,617, against £509,894. The net amount of borrowing powers at May 31st was £2,454,355, and the amount borrowed was £2,434,478, leaving an unexhausted sum of £19,876. Additional borrowing powers to the extent of £309,625 are being asked for under the Glasgow Corporation Bill of 1909. Credit of the depreciation fund is now £1,383,289. The amount at the credit of the general reserve is £87,313. From this fund there has been deducted £15,000, being an additional payment to common good for the year. The number of passengers carried amounted to 221,744 569; the traffic receipts totalled £889,530, the .1d. fares forming a percentage of 61 96.

By an overwhelming majority, the T.C. has rejected the proposal of the Committee to let part of the inside of each tramway car for advertising purposes.

Leeds.—The T.C. has applied to the B. of T. for an extension of time until August 11th, 1911, for completing the works under the Pudsey Corporation Tramways Order, which has been transferred to Leeds T.C.

Leith.—The section from Granton Square to Goldenacre of the Leith and Granton tramway extension was recently inspected by Col. von Donop, of the B. of T.

London.—Mr. A. P. Trotter, of the B. of T., has issued a report on the fire which occurred at the Charing Cross Station of the District Railway on May 24th last. From this it appears that the fire was started by a spark—possibly from a brake block, but not of electrical origin—which ignited the dust in a chamber containing feeder cables below a platform. The chamber apparently formed a ventilating intake to the sub-station, and the powerful draught is supposed to have fanned the flames, burning the plank cover and cables. Mr. Trotter recommends that a Jarrah cover be used instead of ordinary wood; he says that no danger was involved, and the delay in traffic was chiefly due to the unfortunate stoppage of a train with a motor immediately over a cable which could otherwise have been disconnected.

Nottingham.—The T.C. has decided to seek powers to extend the tramways to the Swinton district of the city.

Rhondda.—As the result of an appeal, the assessment of the Rhondda Tramways Co.'s undertaking has been reduced from £24,866 gross to £13,000, and from £5,680 rateable to £5,500.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—Reuter reports that the Senate has adopted the proposal of the Western Union Telegraph Co. for the construction of a direct cable between Europe and the Argentine Republic *via* Ascension Island.

Australia.—As a result of communications with the Imperial authorities, the Commonwealth Government (says Reuter) will shortly introduce a Bill enabling the Commonwealth to seize and control in time of war or emergency the shore ends of ocean cables touching Australia.

Cape Colony.—In his annual report for 1908, the Postmaster-General for Cape Colony gives the following particulars relating to the working of the Telegraph Department:—

	1908.	1907.
Telegrams forwarded and received ...	4,631,538	5,132,350
Words forwarded and received ...	101,740,777	110,183,554
Miles of line worked	8,221	8,221
Miles of wire worked	31,836	31,804

The revenue of the cable companies from the whole of the telegraphic traffic exchanged with South Africa was £234,985. This was again below the standard revenue (£300,000) required by the companies under the cable agreement before any refund of the annual subsidy becomes due to the contributing Governments.

4.460 telephones were in use in 1908, a decrease of 200 as compared with the previous year. The total length of wire in service was 70 miles less than in 1907, and amounted to 5,751 miles, of which 2,631 miles were in underground cables. The calls made numbered 9,117,453. The revenue, after paying working expenses and interest, left a balance of £4,655, but as, owing to the general financial condition of the country, depreciation was not provided for, the expenditure of £9,517, which should have been debited under this heading, is not included. Instead, therefore, of a surplus of £4,655, an actual deficit of £4,862 exists.

The adoption of a message rate, under which each renter will pay proportionately to his use, must be regarded as only a question of time.

India.—Arrangements have been made by which messages can be forwarded to India going by telegraph to London, by post between London and Bombay, and by telegraph from Bombay to their destination in India. The charge is calculated at the ordinary inland rate in this country in addition to 1d. for postage and the equivalent of the ordinary rate for transmission in India, viz., ½d. a word, with a minimum of 6d.

Telegraph Charges.—In the *London Gazette* of July 6th, a lengthy list of the revised charges for telegrams to all parts of the world is published.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Dakar-Conakry	May 13, 1909	
Tangier-Cadiz	May 19, 1909	
Cayenne-Salinas	June 7, 1909	
Trinidad-Demerara	June 19, 1909	
Martinique-Paramaribo	June 28, 1909	July 2, 1909

Sweden.—During 1907 the system of telegraphs in Sweden increased by 1,639·8 km. to 31,099·8 km., of which 1,027·33 km. consisted of cable. Railway and private companies owned 8,601 km. of line and 23,796 km. of wire. Telephone companies owned 88,000 km. of wire in 1906, which in 1907 increased to 96,000. The number of offices increased from 2,519 in 1906 to 2,632 in 1907, while the number of telephone offices increased from 1,497 to 1,625, and call and subscribers' offices from 2,436 to 2,797. The inland traffic amounted to 1,655,231 telegrams; 586,160 telegrams were sent to, and 675,687 were received from, foreign countries, and 593,072 telegrams passed in transit. International traffic increased from 1,750,252 to 1,854,919 telegrams. The telephonic traffic also showed a considerable increase, the number of conversations rising from 269,917,280 in 1906 to 299,977,568 in 1907. Net revenue from telegraphs, both inland and international, amounted to 2,872,351 fr., while the revenue derived from telephones was 11,595,730 fr., and the total revenue from all sources was 14,640,146 fr. in 1907, as against 12,951,807 fr. in 1906. The total expenditure was 14.515,003 fr., leaving a surplus for the year of 125,143 fr.—*Journal Télégraphique.*

Wireless Telegraphy.—A system of wireless telegraphy is to be installed from the Canary Islands to Europe, Cape Colony and South America. Santa Cruz de Tenerife is to be the main station in the islands, and communication is to be established with all the adjacent islands; with Cadiz, and thence to Paris; with Casa Blanca, and thence to Paris direct; with Pernambuco, and thence to Buenos Ayres; and with a station in Senegambia, probably Dakar, and thence to Capetown. The work is to be undertaken by two companies, one of them being registered in Paris, with a capital of £50,000, and the other in Madrid with a capital of £40,000.

CONTRACTS OPEN and CLOSED.

OPEN.

Acton.—July 12th. Lead-covered paper-insulated cables for the U.D C. See "Official Notices" June 18th.

Altrincham.—July 30th. Electrical installation at the new Higher Elementary Schools, Hale (deposit, £1 1s.). J. Howarth, Clerk, Education Department, Altrincham, Cheshire.

Australia.—MELBOURNE.—July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 KW., for the Council. See "Official Notices" May 14th.

MELBOURNE.—August 4th. Overhead travelling crane, for the Electricity Supply Committee. See "Official Notices" June 4th.

MELBOURNE.—August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

MELBOURNE.—July 23rd. Insulated copper cables for the Council. See "Official Notices" July 2nd.

Austria.—July 14th. The Austrian State Railway authorities in Prague are inviting tenders for the contract for an installation of electric lighting at the railway station at Wiesa-Oberleutensdorf.

Belgium.—July 14th. Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science). Transformer sub-station plant (continuous to alternating current) in connection with the Spa-Verviers electric railway.

Bradford.—July 30th. Eight automatic point controllers for the Tramways Department. See "Official Notices" to-day.

British Colonies.—The *Glasgow Daily Herald* says:—"Information has been received by the Glasgow Chamber of Commerce that tenders are invited for the supply of 25 tons galvanised iron wire, 2,500 iron telegraph poles, hydraulic and electrical machinery for generating station, and for a 25-ton quarry crane, for certain British Colonies. Further particulars may be obtained by British firms interested on application at the Chamber."

Canada.—WINNIPEG.—August 2nd and 16th. The city of Winnipeg is advertising for tenders for the hydraulic and electric equipment of the generating station now under construction on the Winnipeg River, at Thirty-foot Falls. Some particulars were given in this column last week.

Denmark.—COPENHAGEN.—July 19th and 17th. The Corporation wants tenders for (1) a quantity of cable; and (2) 800 electric meters for alternating current. The period of delivery, in both cases, is to extend from August 1st, 1909, to August 1st, 1910. Tenders, marked "Tilbud paa Jaevnstroms Kabler" in the case of (1), and "Tilbud paa Vekselstromsmaalere" in the case of (2), to be sent to Directoren for Belysningsvaesenet, Raadhuset, Copenhagen. Copies of the specifications, &c., may be seen by British makers interested on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Croydon.—The B.C. on Monday decided to construct a new repair shop at the electricity works, equipped with machine tools (estimated cost, £895). Tenders are to be invited.

Derby.—July 17th. The Corporation is inviting offers for the advertisement rights on its electric cars. Town Clerk.

France.—July 21st. The Paris municipal authorities are inviting tenders for a 60-H.P. steam engine and a 40-KW. continuous-current dynamo at the Paris Municipal School of Physics and Industrial Chemistry.

PARIS.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

Hellingly (Sussex).—July 20th. Storage battery for the County Asylum. See "Official Notices" to-day.

Holland.—July 16th. The Dutch Post and Telegraph authorities at The Hague are inviting tenders for the establishment of a wireless telegraph station at Scheveningen.

Hull.—July 29th. Electric lighting mains extensions for the year for the E.L. Committee. See "Official Notices" to-day.

Italy.—August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as home makers for the supply of 100,000 metres of telegraph cable.

London.—ST. PANCRAS.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

July 12th. The Port of London Authority is inviting tenders for materials and stores, including carbons for electric lights and electric (incandescent) lamps. Specifications, &c., at the Authority's Stores Department, 106, Fenchurch Street, E.C.

L.C.C.—July 21st. Electric lighting and fan installation at the extension of the Paddington Technical Institute. See "Official Notices" to-day.

Luton.—July 19th. 500-KW. steam-driven generator and condensing plant for the Electricity Department. See "Official Notices" July 2nd.

Manchester.—July 13th. Special permanent-way tramway trackwork for the T.C. (deposit £2 2s.). J. M. M'Elroy, General Manager, 55, Piccadilly, Manchester.

Pontypridd.—July 12th. Condensing plant, circulating pump, air pumps, pipe work, &c., for the U.D.C. electricity department. See "Official Notices" June 25th.

Rotherham.—July 13th. Meters for the Electricity Department. See "Official Notices" June 18th.

Russia.—July 14th. The municipal authorities of Koslow (Government of Tambov) are inviting tenders for the establishment of a central electric lighting station in the town.

Salford.—July 12th. Re-wiring at the Royal Technical Institute for the Electricity Committee. See "Official Notices" July 2nd.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

CASA DE ESCALONA (PROVINCE OF TOLEDO).—Tenders have just been invited by the municipal authorities for the concession for the electric lighting of the town during a period of six years.

Swansea.—July 14th. Arc lamp pillars, brackets and gear, arc lamp feeder pillars, joint boxes, &c., for the Corporation Electricity Department. See "Official Notices" June 25th.

Wallasey.—July 12th. Battery, reversible booster and switchboard for the U.D.C. See "Official Notices" June 25th.

Whitehaven.—July 20th. Lighting the Harbour Quays for five years, by electricity, gas, or other means, for the Harbour Commissioners. See "Official Notices" June 11th.

CLOSED.

Burnley.—Mr. B. G. Smith, of Halifax, has been given the contract for the electrification of the lift at the Workhouse Infirmary.

Bury (Lancs.).—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., of Hollinwood, for a main high-tension switchboard.

Darlington.—The T.C. has accepted the tender of Messrs. W. E. Dove & Co., of Darlington, for a motor-generator set, switchboard, &c.

Derby.—The T.C. has accepted the tender of the Chloride Electrical Storage Co., for the renewal of the tramway battery, and maintenance for 10 years on the following terms:—The Council to pay £100 down, and £100 per annum for six years, and £70 per annum during each of the 10 years.

Dewsbury.—For the electrical installation and fittings at the Foundry Street Hippodrome, the tender of Messrs. Hirst and Co., Dewsbury, has been accepted.

Leyton.—The D.C. has accepted the following tenders for the annual supply of meters:—

Venner & Co.—Motor-type ordinary meters: 1½ amperes, £1 13s.; 3 amps., £1 16s.; 5 amps., £2; 10 amps., £2 5s.; 25 amps., £2 10s.; 50 amps., £2 14s.; 100 amps., £3 3s. Motor-type slot meters: 1½ amps., £2 15s.; 3 amps., £2 17s. 6d.; 5 amps., £3.

Reason Manufacturing Co., Ltd.—Electrolytic-type ordinary meters: 10 amps. 10s. 6d.; 25 amps., £2; 50 amps., £2 10s.; 100 amps., £3 (less 5 per cent.).

Mordey, Fricker & Co.—Electrolytic-type slot meters: 1½ amps. £1 13s; 3 amps., £2 2s.

London.—HACKNEY.—The Council has accepted the tender of Messrs. Sykes & Sugden for three-core service boxes, at 9s. per box.

L.C.C.—The Highways Committee received the following tenders for road-work and platelaying, exclusive of supply of rails and special track-work, in connection with the conduit lines on the Embankment east of John Carpenter Street, Blackfriars Road, and Southwark Street:—

R. C. Brebner & Co.		£11,420
Dick, Kerr & Co., Ltd.	(recommended)	12,055
A. N. Coles		12,945
W. Manders		13,599
J. Mowlem & Co., Ltd.		14,707

Engineer's estimate, £11,953.

Messrs. Dick, Kerr & Co., Ltd., are authorised to sub-let portions of the work to Anderston Foundry Co. or Wilsons, Pease & Co., Ltd. (yokes); Doulton & Co., Ltd., or Bullers (insulators); Bayliss, Jones & Bayliss, Ltd., or Guest, Keen & Nettlefold (tie-bars, bolts, &c.); Associated Portland Cement Manufacturers, Ltd. (cement); Harrison & Co. (Lincoln), Ltd., or Hadfield's Steel Foundry Co., Ltd. (plough and drain boxes); Forest City Electric Co., Ltd. (bonds).

For the supply of steam, &c., piping and valves, water tanks, &c., for the final portion of the Greenwich generating station, the tenders were:—

Staveley Coal and Iron Co., Ltd.	(recommended)	£7,066
Railway and General Engineering Co., Ltd.		7,343
Staveley Coal and Iron Co., Ltd.		7,566
Shelby Manufacturing Co.		7,734
S. Russell & Sons		7,954
James Oakes & Co.		8,003
Foster Bros., Ltd.		8,169
Stewarts & Lloyds, Ltd.		8,232
John Spencer, Ltd., Wednesbury		8,291
Babcock & Wilcox, Ltd.		8,400
Edward le Bas & Co.		8,495

Estimate of the chief officer, £9,000.

The tenders for condenser water piping, valves, &c., for the same portion of the station, were:—

Foster Bros., Ltd.		£2,617
Railway and General Engineering Co., Ltd.	(recommended)	2,987
Staveley Coal and Iron Co.		3,025
John Spencer, Ltd., Wednesbury		3,064
James Oakes & Co.		3,093
John Wilson & Co.		3,184
S. Russell & Sons		3,287

Estimate of chief officer, £3,500.

For the construction of the junction line from Junction Road to the Holloway car-shed, a contract has been given to Messrs. J. Mowlem & Co. and Hadfield's Steel Foundry Co., Ltd., the cost of the work being approximately £4,650.

The tenders submitted for 362 moulded plough bases for electric cars and stores vehicles were as follows:—

J. G. Ingram & Son (recommended), 45s. each.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 47s. 6d. each, less 2½ per cent. discount.
Avon India-Rubber Co., Ltd., 55s. each.
Dermatine Co., Ltd., 59s. 6d. each.

The contract for (1) 150 outside stringers, (2) 150 inside stringers and 1,200 galvanised risers for electric cars, has been given to Messrs. G. A. Harvey, Ltd., the tenders being as follows:—

G. A. Harvey, Ltd., (1) 3s. 4d., (2) 3s. 1d., (3) 7d. each, less 2½ per cent. dis.
Ed. le Bas & Co., (1) 6s. 6d., (2) 6s. 6d., (3) 8½d. each.
F. Braby & Co., (1) 7s. 3d., (2) 7s., (3) 10½d. each, less 2½ per cent. dis.

The tender of R. Bridger & Co. for electric lighting at the enlargement of the Oliver Goldsmith School, Peckham, at £135, is recommended for acceptance.

The following tenders were received for electric wiring and fittings at the Great Marlborough Street Fire Station:—

G. E. Taylor & Co.	(recommended)	£169	0	0
Pinching & Walton		169	7	6
Tredegar & Co.		182	0	0
W. J. Fryer & Co.		194	0	0
A. Hawkins & Sons		210	0	0

METROPOLITAN ASYLUMS BOARD.—The Board has accepted the tender of Messrs. W. J. Fryer & Co. for changing over to metallic-filament lamps, including lamps, transformers, and wiring alterations, at a number of its institutions. The matter is alluded to in our "Notes" columns to-day.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for the supply and erection of a battery, booster and switchgear, with fittings, cables, connections and accessories, for £8,810.

Continued on page 64.)

THE UNDERTAKING OF THE MELBOURNE ELECTRIC SUPPLY CO., LTD.

By J. H. DAVIES.

The above company was known as the "Electric Lighting and Traction Co., of Australia, Ltd.," until about six months ago, when it was decided to change that somewhat unwieldly title for the one by which it is now known.

The company owns electricity works in Melbourne and in Geelong, both in the State of Victoria. This article will deal only with the Melbourne undertaking.

In 1900 the electric supply of the city of Melbourne was in the hands of four undertakings, as follows:—

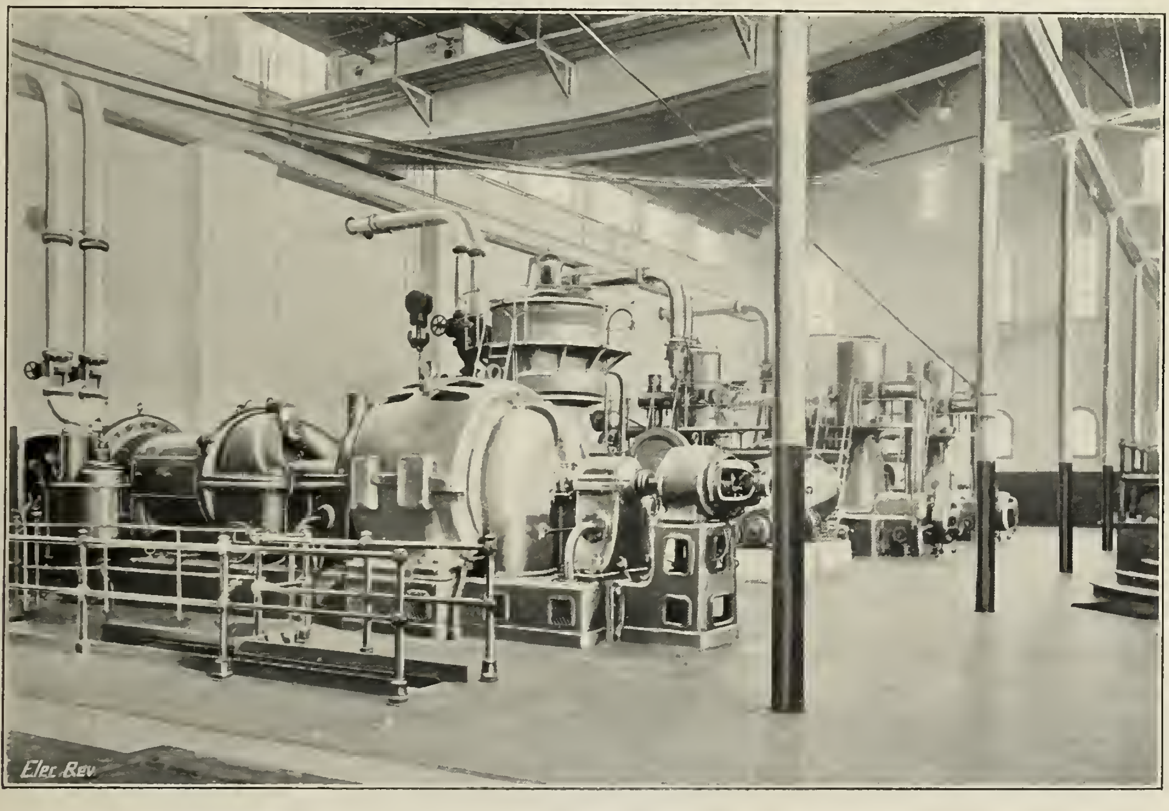
(*a*) The Melbourne City Corporation, which was carrying out the whole of the public lighting of its area by electricity, but did not seriously attempt private lighting.

(*b*) The New Australian Electric Supply Co., with its main generating station on the banks of the Yarra in the suburb of Richmond, supplied electricity for public and private purposes to a number of the eastern and southern suburbs of Melbourne, and gave a supply, for private purposes only, within the area of the Melbourne City Corporation. This company also possessed a small subsidiary station within the city area proper.

(*c*) The A.U. Alcock Electric Light and Motive Power Co., Ltd., likewise with a supply station situated in Richmond, supplied some of the northern and north-eastern suburbs with electricity for public and private purposes, and also electricity, for private purposes only, within the Melbourne city area, where, like the New Australian Co., it did the larger part of its business.

(*d*) There was also a small electric supply, for private purposes only, given by a privately owned undertaking, situated within the city area proper.

The Melbourne City Corporation being desirous of taking over the whole of the electricity supply in its own municipal area, agreed to purchase from the existing companies so much of their undertakings as was situated within that area. At the same time, however, the New Australian Co. and the A.U. Alcock Co. were in negotiation for the sale of their undertakings to the Electric Lighting and Traction Co. of Australia, Ltd., which acquired the whole of their business, the City Corporation simultaneously acquiring from it the small generating station of the New Australian Co., as well as the mains and other apparatus of the two companies situated within the city area, the new company retaining all the suburban areas within which to carry on its business.



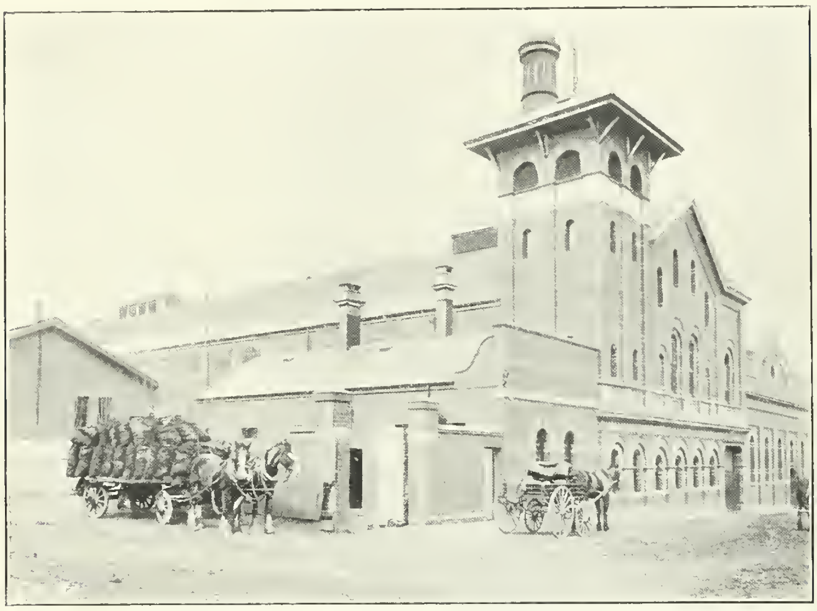
General View of the Generating Plant, Melbourne Electric Supply Co.

The consequence of the above arrangement was that in 1901, the new company proceeded to remodel the whole of the existing supply arrangements on modern lines. The Alcock Co.'s power station was as soon as possible permanently closed down, and the New Australian Co.'s power house, favourably situated as regards condensing water on the banks of the River Yarra, was largely altered and rebuilt. Further, the two existing systems of single-phase high-tension, overhead, alternating-current distribution were taken down, and a very complete and thoroughly modern distributing network substituted.

The present generating station consists of an engine room about 180 ft. long × 60 ft. wide, with a 25-ton overhead crane, running the whole length of the building. The system of supply is, as stated above, an alternating-current one, generation being effected at 4,000-4,400 volts pressure.

The total full-load generator capacity is 3 925 KW.

Describing the various sets in the order of their installation—we have, first, the only one remaining of those which were in the station when it was purchased by the present owners. This is a 300-H.P. cross-compound horizontal Robey engine, fitted with Richardson & Rowland's valve gear, and running at 94 R.P.M. It exhausts to an ejector condenser, which was also supplied by the engine makers.



Exterior of the Melbourne Electric Supply Co.'s Station at Richmond.

By means of ropes this engine drives a 175-KW. 4,000-volt 50-cycle single-phase Mordey inductor alternator, at a speed of 300 R.P.M. Its field is excited by a Mordey patent bi-pole dynamo, mounted on an extension of the alternator shaft.

Next in seniority, though at the other end of the building, are two identical Brush Universal engines, running at 250 R.P.M., direct-coupled to 500 KW. 4,000-volt 50-cycle single-phase inductor alternators. These each have on their own shaft a 5·5 KW. exciter. Each engine exhausts to its own surface condenser, with three-throw Edwards air pumps, driven direct off the engine shaft. A single cylinder hot-well pump is also worked off the same shaft by an eccentric.

A Pulsometer filter is used with the oil-cooling apparatus required for these reciprocating engines.

Nearly three years ago a Curtis turbo-alternator was put in. This is a 1,000-KW., 4 000-volt, 50-cycle, single-phase set, running at 1,500 R.P.M. The complete set, including the condenser, was built by the British Thomson-Houston Co., of Rugby. The turbine is of the familiar vertical type, and has recently been fitted with the maker's latest design of hydraulic governing gear. The footstep bearing is water-lubricated, water being maintained in it at a pressure of 253 lb. per sq. in.; two motor-driven plunger pumps, working in conjunction with a hydraulic accumulator maintain this pressure. The motors are each $2\frac{1}{2}$ H.P., one being a single-phase and the other a direct-current machine.

The turbine exhausts to a sub-base surface condenser which can deal with 30,000 lb. of steam per hour. The air-pump is of the Allen-Edwards pattern, combined with a hot-well pump, and driven by a 10-H.P. induction motor.

The generator of this set is of the B.T.-H. standard design, having a 4-pole field, excited alternatively from the storage battery, or from the motor-generator exciter sets, which will be referred to later on.

The latest addition to the generating plant was made early in this year. It is a turbo-alternator of 1,500-KW. capacity, running at 1,500 R.P.M., supplied complete by the Brush Co. The turbine is of that company's standard Brush-Parsons type, exhausting to a surface condenser situated immediately under it in the basement. The condenser is capable of condensing 40,000 lb. of steam per hour, and is fitted with a three-thrown Edwards air-pump and single cylinder hotwell pump, driven by a single-phase induction motor.

The stator is provided with a definite air circulation by means of fans fitted to the revolving field, which draw air into the bottom of the stator casing through the bedplate, and after circulation through the windings, &c., expel it through the holes in the sides and top of the machine. An 18-KW. exciter is mounted on an extension of the bedplate.

Provision is also made for exciting the alternator from the motor-generator exciters or from the storage battery.

The separate exciting plant consists of two 36-KW. motor-generator sets. The motors are of the induction type, having wound rotors, slip-rings and rotor starting resistances. The motors are supplied with current transformed down to 400 volts. The D.C. dynamos generate at 100/150 volts, and either supply direct to the fields of the alternators, charge the battery, or both.

Circulating water is obtained from the River Yarra by means of two Belliss steam-driven centrifugal pumps and one motor-driven centrifugal pump, the Belliss engines being each fitted with Körting ejector condensers taking a supply from the delivery side of the pumps and discharging into the suction side.

During the early days good work was done by the switchboard of the well-known original Ferranti cellular type.

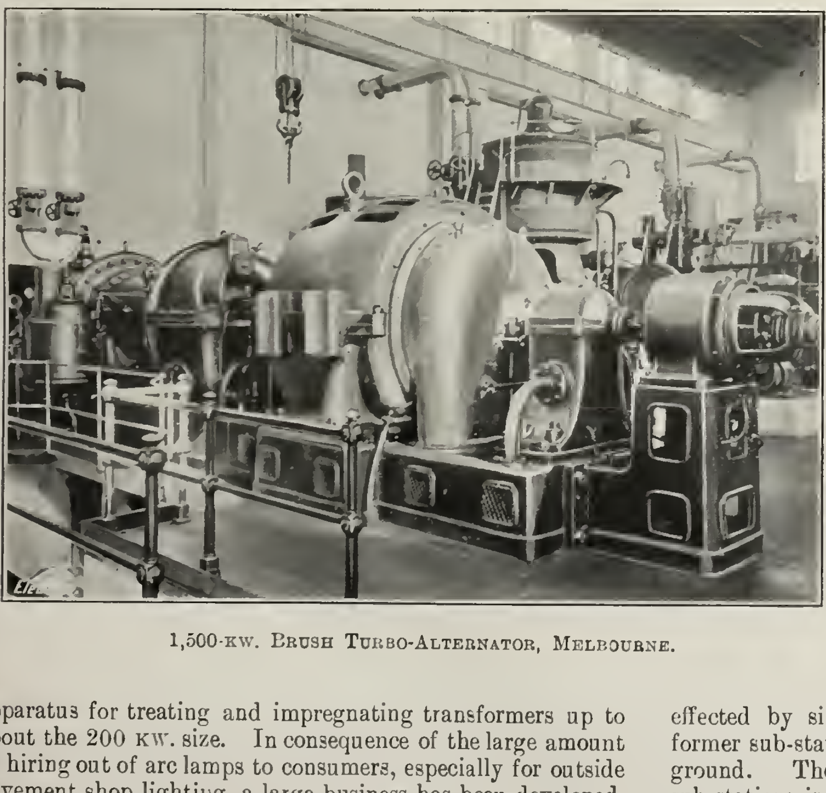
Interior of the Boiler House.

Owing to the great increase in the size of the generators, however, the switching arrangements are at present undergoing alteration, and as regards the generator portion of the board, modern oil-break switches in connection with reverse-current relays, and in built up concrete cells, are being substituted. A Reavell motor-driven air compressor is provided for cleaning the boiler tubes, also the generators and other electrical apparatus.

The boiler house contains eight boilers of Babcock and Wilcox make, each with a heating surface of 2,823 sq. ft. At present only hand-firing is in use, but it is proposed shortly to introduce automatic stoking. There is sufficient room provided for 12 boilers in all.

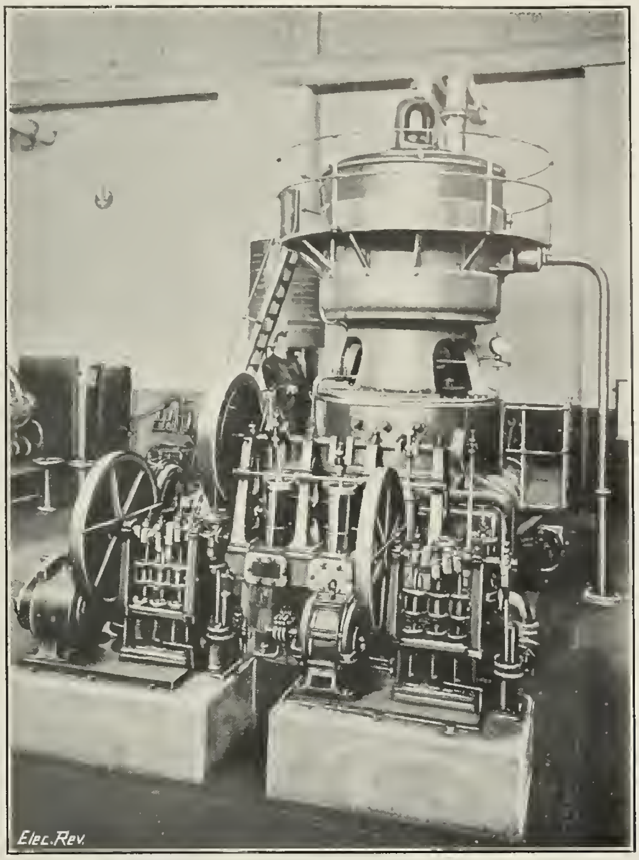
The flues are underground, and are carried through a Green economiser of 512 tubes, situated in the centre of the boiler house, so that the boilers are arranged symmetrically on each side; the flues discharge into a brick stack, 150 ft. high. The steam piping having originally been laid out on the duplicate system, is continued on that system when extensions are made; all valves on boilers, steam engines and in the steam pipes are of the Hopkinson "Triad" type. Underneath the floor in front of the boilers is situated the usual ash tunnel. At cleaning times plates in front of the boiler ash-pits are raised, and the ash and clinker removed from the furnaces are dropped directly into a cast-iron worm conveyor, which removes them to the outside of the building. The coaling arrangements are in one respect unusual. A row of coal bunkers runs the whole length of the boiler house. The bottoms of these bunkers are ridged and sloped, so as to discharge through specially constructed guillotine doors, fitted with friction rollers. On the boiler side of the coal bunker wall, a small travelling jib runs the whole length of the boiler house on rails, supported against the wall. From this crane jib a tilting hopper is suspended through a spring balance. With this arrangement it is, therefore, possible to take coal from any bunker, to traverse it down the boiler house to its proper position before any boiler, and at the same time to record its weight. The arrangement is much more handy than trolleys, running on rails, or without rails, on the floor, and it is out of the way, and being constructed with roller bearings, there is no difficulty whatever in operating it. Coal is elevated into the bunkers by means of an elevator fitted with a crusher and by a conveyor of the push-plate type.

The above is a description of the plant in use, and it is hardly necessary to say that the usual winding shops, repair shops, stores, &c., are provided. Owing to the very great distance at which Melbourne is situated from the large manufacturing centres of Europe and America, it is absolutely necessary to do a large amount of small manufacturing work in the electrical line, and also to be prepared for the rewinding of generators, transformers, and electrical apparatus generally. For instance, the transformer winding shop contains a large vacuum drying apparatus and also an oil-treating apparatus for treating and impregnating transformers up to about the 200 KW. size. In consequence of the large amount of hiring out of arc lamps to consumers, especially for outside pavement shop lighting, a large business has been developed, and the arrangements for storing and repairing arc lamps are also necessarily on a somewhat larger scale than would be usual in an English station of the same size.



1,500-KW. Brush Turbo-Alternator, Melbourne.

Although, no doubt, the power house itself is much the same as other undertakings of similar size in England, yet the system of distribution is very different to that obtaining generally in Europe. In consequence of the enormous area covered by the suburbs of Australian cities (nearly every house—and even the workman's house—has its garden, and two-storey houses are the exception) the problem of distribution is very different to that in the more crowded English cities and the very much cramped Continental cities, in the latter of which an enormous population lives in a very small area in large buildings let out on the flat system. The area supplied by the Melbourne Electric Supply Co. covers 41 square miles, and this large area contains the comparatively small population of 250,000 inhabitants. The area is principally residential, but there is a large amount of power to be obtained, in consequence of certain suburbs being manufacturing centres.



1,000-KW. Curtis Turbo-Alternator, Melbourne Electric Supply Co.

When re-modelling the distributing network the company decided that the alternating current, single-phase system was the simplest and best under the conditions obtaining. The old distributing systems were, by means of alternating current at 2,000 volts, conveyed overhead to transformers supported in the American fashion on poles. The whole of this system was removed and distribution effected to feeder centres, situated in the various suburbs, by means of lead-covered, paper-insulated concentric cables, laid on the solid system, at 4,000 volts; the H.T. distribution is also effected by similar underground cables to about 80 transformer sub-stations, built, some underground and some over ground. The secondary distributing network from these sub-stations is carried out generally on the overhead system by means of bare, hard-drawn, copper conductors, supported on jarrah or ironbark poles of octagonal shape, the system being a three-wire one with 200 volts between each outer and the neutral. The outer of the H.T. underground primary system is earthed at the generating station, and the secondary distributing system is earthed at the neutral point at each transformer sub-station. All feeders are looped into the nearest transformer sub-station which they pass, so as to enable easy location of faults in case of breakdown, and the principle is being extended by the provision of H.T. street pillars at suitable quarter or one-third mile intervals along the lines of mains. In the transformer sub-stations the primaries of the transformers, as well as the underground H.T. distributors, are controlled by means of switch fuses, so interlocked that the outer disconnecting switch cannot be opened without first removing the inner switch fuse. The transformers are all fitted with earth shields, and are principally of the oil-cooled type.

The size and scattered nature of the area supplied can be gauged from the following figures :—

In order to supply 1,696 consumers at present connected, there are in use 46·7 miles of H.T. underground mains and 240 miles of overhead bare copper cable. The supply is available in 80 miles of streets. These figures are already very large for the number of consumers supplied, but large extensions of the overhead distributing mains are still required every year to cope with the increasing applications. However, the overhead method of distribution is comparatively cheap, and it is quite certain that it would have been impossible to do the amount of work that has already been done with commercial success, if the distributing mains had been underground. This is recognised all over Australia, and whether the electric supply undertakings are in the hands of municipalities or companies, the universal practice, except in the dense business portions of the city areas, is to distribute overhead. At the present time the equivalent of 157,934 8-C.P. lamps is connected to the mains, of which 2,174 H.P. is represented in motors. The output for the past year has been 2,300,000 units, and this is increasing rapidly from year to year. The number of arc lamps which is daily attended to by the company, either under its public lighting contracts or under its above mentioned system of hiring out, is 860. Almost without exception these lamps are of the flame type, supplied through small pressure-reducing transformers. The prices at which electricity is supplied are :—

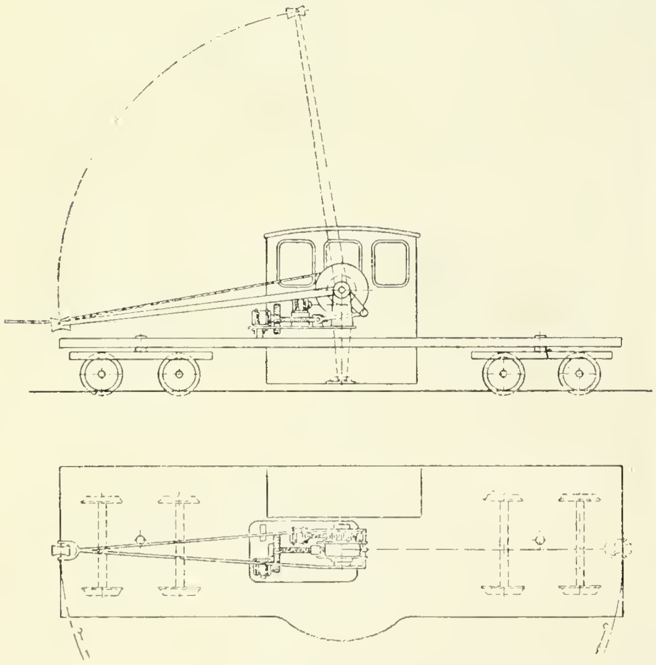


Fig. 1.—Electric Towing Locomotive: Teltow Canal.

For lighting, a flat rate of 5½d. per unit, or an alternative tariff on the maximum demand system of 7d. per unit for the first 450 hours' use per annum of the maximum demand, and 3d. for each unit consumed beyond this amount.

For power, a flat rate of 2d. per unit, with an alternative system, allowing of the unit being sold to consumers of large amounts at about 1d. per unit.

The above prices certainly cannot be considered high when it is remembered that the whole of the apparatus required for generating electricity has to be carried 12,000 miles, is subject in part to a 20 per cent. duty, and that labour and also fuel cost 35 per cent. to 50 per cent. more than in England.

In conclusion, the writer would express his indebtedness to Mr. F. W. Clements, the engineer and manager, for the facilities afforded him ; he would also acknowledge the assistance of Mr. Buckingham, the superintendent of the power house.

ELECTRICAL HAULAGE ON CANALS.

Dr. G. Meyer, in a long article in *Elektrische Kraftbetriebe und Bahnen*, deals exhaustively with the problem of mechanical and electric traction on canals from the time of the earliest experiments up to the present day. The subject has been repeatedly dealt with in these columns, so that only the portion of the article covering the recent developments need be referred to here.

Although at first sight the simplest solution of the problem might seem to be obtained by the use of steam or electrically-driven tug-boats, experience has shown that the most convenient and economical results are, on the contrary, obtained by haulage from the bank.

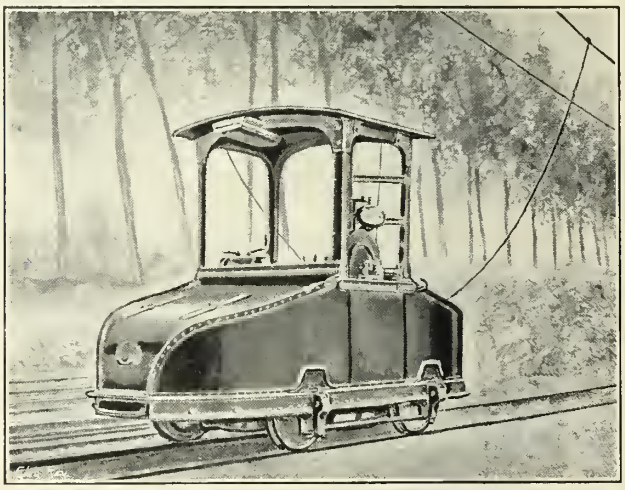


Fig. 2.—French Electric Towing Locomotive.

There are several reasons for this result. In the first place, the waves set up by screw steamers in the confined waters of a canal cause a serious loss and lower the haulage efficiency. The absence of waves with haulage from the bank also adds greatly to the length of life of the canal bottom and sides.

Secondly, experience with bank haulage on the Teltow Canal has shown that no reduction of speed is necessary when barges are passing one another, whilst, with tug-boat haulage, satisfactory steering is rendered impossible by the waves set up unless the speed is reduced to a very low value whenever two barges meet. This leads to a considerable reduction in average speed, especially where the traffic is dense. Thus, supposing the traffic is so dense that a meeting between two barges occurs every half-hour, and that the normal speed is 4·5 km. (2·8 miles) per hour, and it has to be reduced to 2·5 km. (1·55 miles) per hour at each meeting. This means that the average speed becomes 2·48 M.P.H., or about 11 per cent. lower than the normal speed.

Particulars of the operation of the Teltow Canal from a financial point of view over any considerable period are not yet available. The installation is arranged to deal with a yearly traffic of about 2 million tons, but it is not fully in use at present—averaging only some 70,000 tons a month.

The conditions on this canal are especially advantageous because of its closeness to Berlin.

The latest Siemens-Schuckert locomotives are of the type shown in fig. 1. They are symmetrical from both ends, have two bogies, or, in some cases, two fixed driving axles, and are provided with a 3·5-metre swivelling arm for adjusting the height of the haulage rope, and a drum for winding the surplus rope upon and so adjusting the distance between the locomotive and the barge as required. The swivelling arm and the drum are driven by separate small motors.

Ordinary Vignoles rails are used, but the greater part of the weight of the locomotive is arranged on the landward side, so as to minimise the risk of damage to the canal bank. These locomotives can drag a load of 1,200 tons at a speed of 5 km. (3·1 miles) per hour. Their overall efficiency averages 76 per cent., and little improvement in this respect can be expected.

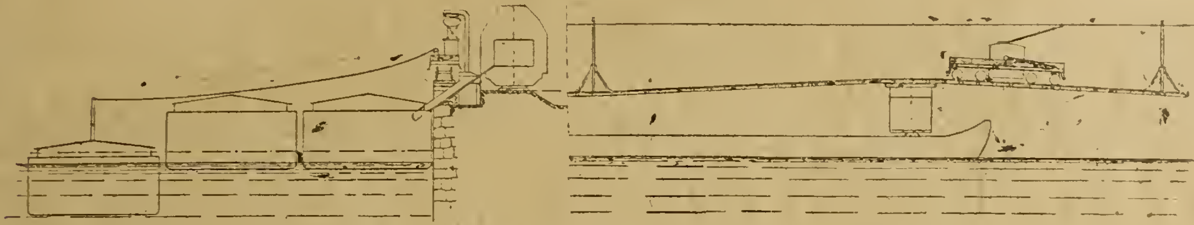


Fig. 3.—Diversion of Towing Track to Allow of Barge Loading.

Such a locomotive is equally fitted for travelling in both directions, although on the Teltow Canal reversed travelling is only required occasionally—at curves and loading docks—because rails are laid on both sides of the canal, and all the traffic one way is carried out from one bank, and that in the other direction by the returning locomotives on the other bank. The reversible locomotive is, however, more generally useful than the older single-ended locomotive when only a single line of rails exists, and the traffic in both directions is carried out from one bank by the so-called "pendulum" method, in which the haulage ropes are transferred and the locomotives reversed every time two barges meet. In this way a given locomotive travels constantly backwards and forwards over about the same stretch of canal bank.

The Teltow Canal installation has been found to work perfectly satisfactorily, in spite of the low order of intelligence of the average bargeman. One man only is required on each locomotive, and no trouble has been found in raising the haulage rope sufficiently to clear stationary barges, &c., without slackening the speed. This form of canal haulage, by means of an electric locomotive running on ordinary rails on the bank, has established itself as the best all-round solution of the problem in a number of independent cases in recent years.

Thus, since 1904 the Société d'Electricité du Nord, of Douai, have installed some 55 km. (35 miles) of single line on various canals in the North of France. These are worked on the "pendulum" system, using a light and simple double-ended locomotive (fig. 2) weighing 8 tons, and running on two ordinary 41-lb. per yard rails. Each of the two axles is provided with a 20-H.P. 550-volt motor. The haulage rope is fixed so as always to exert its pull through the centre of gravity of the locomotive at a height of about 1·4 m. over the rails. The other end of the rope is attached to a 7-m. mast on the barge, and the height thus attained is found sufficient to clear all ordinary obstructions. No height adjustment or coiling drum is, therefore, provided as in the Teltow locomotives. This simplification is possible, because the canal banks are much clearer than on the Teltow Canal, as the loading and unloading of the barges is chiefly carried out in special private docks branching out of the canal.

Each locomotive can drag two or three barges of 300 tons capacity at a speed of nearly 3 km. (1·9 miles) per hour. Some 72 locomotives are now in use, and they are able to handle a yearly load of 3 to 4 million tons; when this capacity is exceeded a second set of rails will be laid on the other bank of the canal. The price chargeable for haulage is fixed by the Government at ·35 to ·4 centimes per ton km. (·054d. to ·061d. per ton mile). In spite of this low figure the scheme is said to be a financial success. Simultaneous horse haulage can be employed, but it is not so cheap or speedy as electric haulage, and is gradually being suppressed by the latter.

In America, too, standard electric locomotives on plain rails have proved most satisfactory. On the Miami-Erie Canal, locomotives weighing 25 tons and provided with two 80-H.P. three-phase motors, are used to draw 10 barges carrying 80 tons each at a speed of 16 km. (10 miles) per hour.

The only valid objection which can be brought against this form of haulage is that of interference with the loading and unloading of barges on the bank of the canal. This difficulty can, however, be got over by the use of private docks or, if these are not possible, by some arrangement such as is shown in figs. 3 and 4.

In conclusion, the author quotes the results of a complete series of tests carried out in 1907, under the direction of the Prussian Ministry of Public Works. These tests were all carried out on the same stretch of the Rhein-Hanover canal at present under construction. This stretch is 267 km. (167 miles) long, and contains three locks. The five systems of haulage investigated under exactly similar conditions, were:—(1) Steam-driven barges; (2) barges driven by suction gas engines; (3) electrically-driven barges; (4) tug boat traction of two barges by a steam tug; and, finally, (5) haulage from the bank by electric locomotive on the Siemens-Schuckert system.

The tests were carried out at two speeds, viz., 5 and 7 km. per hour (3·1 and 4·4 miles per hour), and with various lengths of time assumed for loading and unloading. The latter point naturally had much less effect on the working cost of the last two systems than on the first three. The tests show, first, that the freight cost in this particular case is considerably greater with the first three systems (self-driving) than with the last two systems (haulage by tug-boat or by loco. from the bank); and secondly, that the cost in the first three systems is much more dependent on the time required for loading and unloading than on the system used or on the speed. The electric locomotive system works out the cheapest of all by a small percentage, with the existing loading and unloading times, whilst even with greatly reduced times, it is still almost the cheapest.

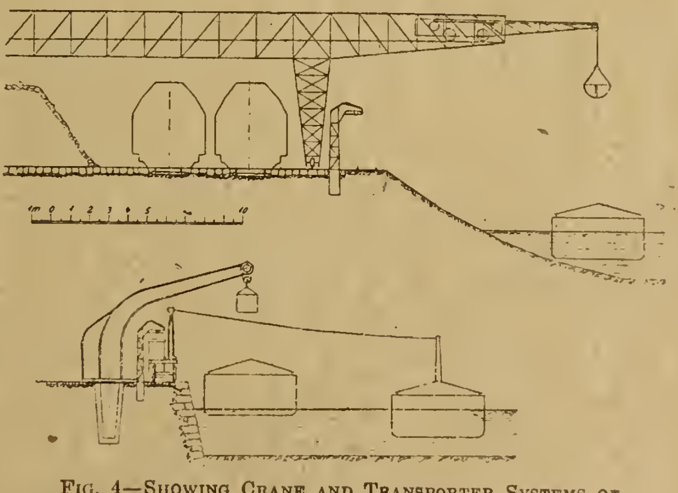


Fig. 4—Showing Crane and Transporter Systems of Loading Barges.

The figures are based on the assumption that the whole of the haulage on the canal is under the control of a single authority.

Such uniformity of control—subject to Government regulations—seems essential from the point of view of quick and reliable service.

CONTRACTS CLOSED.

(*Concluded from page* 58.)

Cape Town.—Tenders have been accepted by the Corporation in connection with the electric lighting of Sea Point as under:—

Siemens, Ltd., for 450 steel poles, for £1,326, subject to the poles being capable of taking a strain of 300 lb. without permanent deflection, in accordance with the terms of the specification; also for 700 cross-arms, for £134.

The Clyde Engineering Works, for eight transformer pillars, &c., including two spare 5-kw. transformers and two 10-kw. transformers, for £1,134, provided the design is amended to satisfy the electrical engineer, and subject to the reduction of the base of the pillar.

Chester.—The T.C. has accepted the tender of Messrs. Crompton & Co. for a switchboard, at £785.

Glasgow.—The T.C. Electricity Committee on Works has recommended acceptance of the offer, at £426, by the British Thomson-Houston Co., Ltd., for three motors for driving fans for cooling towers at St. Andrew's Cross Station. The Committee has also placed contracts amounting in all to £15,104 for the erection of a store and extension of boiler house, &c., at Port Dundas generating station. The accepted offers include that of Messrs. Austin & Co. for an electric goods elevator costing £215.

Grimsby.—The T.C. has accepted the following tenders in connection with the electricity works:—

John Wilson & Co.—Exhaust pipe, £145.
Hebb & Co.—Renewal of the cooling stack, £140.
McPhail & Simpson.—Two steam superheaters, £255.

Hartlepool.—Durham Education Committee has accepted the tender of Messrs. Cox-Walker, Ltd., of Darlington, for the E.L. installation at Henry Smith Schools, at £192 10s.

Leamington.—The D.P. Battery Co., of Bakewell, have received an order from the Midland Electric Light and Power Co. to install and maintain for 10 years a storage battery of their LS. 17 type in replacement of two batteries of another make.

Rochdale.—The Rochdale Electric Co., Ltd., have secured the contract for the electric lighting of the new St. Mary's Church.

Rugby.—The U.D.C has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., for service cable, at £78.

Wigan.—The following tenders were received by the T.C. in connection with the proposed extensions at the electricity works:—

CONSTRUCTIONAL STEEL WORK.

Lambourne & Co.		£695
William Park & Co.	(provisionally accepted)	720
British Thomson-Houston Co.		756
Edward Wood & Co.		778
J. Booth & Son		784
Redpath, Brown & Co.		839
Tickle Bros.		876
Dorman, Long & Co.		880
Gibbons Bros.		907
Gilbert Little & Co.		922
Graham, Morton & Co.		931
Heenan & Froude, Ltd.		1,010

CABLES.

Siemens Bros.	(brick pits not included)	£8,947
Electrical Co., Ltd.	(brick pits not included)	9,106
Lahmeyer Electric Co.	(brick pits not included)	9,194
W. T. Glover & Co., Ltd.	(provisionally accepted)	9,297
British Insulated and Helsby Cables, Ltd.		9,416
Callender's Cable Co.		9,426
Johnson & Phillips Ltd.		9,462
Western Electrical Co.		9,494
W. T. Henley's Telegraph Works Co.		9,596
Aubert, Grenier & Co.	(not to specification)	3,919

BOILERS (TWO).

Water-Tube Boiler Co.	(Patent Water-tube)		£2,525
Hawksley, Wild & Co.	(Suckling)	(not to specification)	2,719
Stirling Boiler Co.	(Stirling)	(not to specification)	3,034
Babcock & Wilcox, Ltd.	(Babcock)	(provisionally accepted)	3,066
J. Thompson	(Durr Water-tube)		3,100
British Thomson-Houston Co.	(Babcock)		3,219
Musgrave & Sons	(Woodeson)		3,307
Clark, Chapman & Co.	(Woodeson)		3,472
George Sinclair	(Sinclair Patent)		3,669

PIPEWORK AND CONDENSERS.

Browett, Lindley & Co.		£1,602
Worthington Pump Co.		1,645
British Thomson-Houston Co.		1,647
Tickle Bros.	(provisionally accepted)	1,689
Crompton & Co.		1,711
Korting Bros.		1,725
Johnson Bros.		1,823
Willans & Robinson, Ltd.		1,825
Musgrave & Sons, Ltd.		1,998
Parsons & Co.		2,010
F. J. Mitchell	(not to specification)	1,290
Tinsley & Sons	(not to specification)	1,463

It was resolved that the consideration of the tenders for pipework and economisers be deferred. The tenders for coal-conveying plant, engine, generator and switchboard were also deferred until a sub-committee had visited works where turbine engines and modern coal conveying plants are in operation.

Winchester.—The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for an installation of electric fire-alarms at an annual charge for 12 years of £33, and £17 per year for maintenance.

Wishaw.—The following firms have obtained contracts from the Burgh Electricity Department:—

British Westinghouse Co.—A 100-kw. rotary converter.
Oliver & Co.—Twelve 9-ampere magazine flame lamps.
London Electric Firm.—Twelve sets of raising and lowering gears.

Woolwich.—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, at £70, for repairs to a boiler at the electricity works. The tender of the British Insulated and Helsby Cables, Ltd., has been accepted for two tons of compound, at £25 13s. 4d. per ton, delivered in 7-lb. tins.

Worcester.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Heenan & Froude for a steel storage bunker, and coal elevator and conveyor, at £656.

York.—The Corporation of York has decided to weld the whole of the rails in connection with the electrification of the tramways, by means of the "Thermit" processs.

FORTHCOMING EVENTS.

Institution of Mining Electrical Engineers.—Saturday, July 10th. At 7 p.m. At the Grand Hotel, Manchester. Meeting. The meeting held at Glasgow was adjourned.

Junior Institution of Engineers.—Saturday, July 17th. At 10 a.m. Visit to the ordnance engineering works of Messrs. Vickers Sons & Maxim, Erith.

NOTES.

Erratum.—In our article on the Royal Society conversazione last week (page 39) for "Paufleu" read "Panflex."

Parliamentary.—SECOND READING.—In the House of Commons on Friday last, the Telegraph (Arbitration) Bill was read a second time, as well as the Electric Lighting Acts (Amendment) Bill.

On Tuesday in the Commons the Gateshead and District Tramways Bill was read a second time.

THIRD READING.—In the House of Commons on July 1st, the Durham (County) Electric Power Supply Bill was read a third time.

Another "Wireless" Torpedo.—The *Standard* announces:—"A new type of torpedo, in which the principle of wireless telegraphy is utilised, and for which the inventor claims remarkable powers. . . . The inventor is a young man. . . . He claims for the machine that it would destroy any vessel at a range of 10 miles, or an even greater distance. It can be started, steered and fired without any mechanical connection between it and its operator, who controls its action by an apparatus which can be carried if necessary in the pocket." Comment is needless.

National Electrical Manufacturers' Association (Inc.).—We are informed that on Thursday, July 1st, this Association called together at the Hotel Cecil a general meeting of electrical manufacturers of the United Kingdom to consider certain proposals which had been suggested by the Electrical Contractors' Association, and which had appeared in their official journal. We understand that the meeting was largely attended, and it was unanimously resolved that the action of the National Electrical Manufacturers' Association in their negotiations with the Electrical Contractors' Association regarding the proposed agreement to give special terms to the members of that Association should be endorsed, and that the terms set out in the official journal of the Electrical Contractors' Association, April, 1909, could not be entertained. The meeting was not confined to members of the Manufacturers' Association, manufacturers being invited regardless of whether they were members or not.

Ironmongery Exhibition.—The Ironmongery and Hardware Exhibition opens on July 13th, at the Royal Agricultural Hall, Islington, and remains open until the 23rd inst.

Canadian Water-Powers.—Mr. R. E. Young, superintendent of the Dominion railway lands, in a recent statement to a legislative Committee, estimated the total horse-power known to be available in Canada at 25,682,907, distributed as follows: 17,075,939 in Quebec; 3,129,168 in Ontario, exclusive of Niagara Falls; 2,000,000 in British Columbia; 1,000,000 in Alberta; 600,000 in North-West Territories; 504,000 in Manitoba; 500,000 in Saskatchewan; 54,700 in Yukon; 150,000 in New Brunswick, and 54,000 in Nova Scotia. Mr. Young endorses a prediction that owing to their great water-powers Ontario and Quebec will in time become the manufacturing centres of North America.—*Electrical World*, N.Y.

Metal-Filament Lamp Economies.—As mentioned in our "Contracts Closed" to-day, the Metropolitan Asylums Board, acting on the advice of its engineer-in-chief, is about to proceed with the change over from carbon to metallic-filament lamps at the North-Western, Western, South-Western and South-Eastern Hospitals, also at its ambulance stations, and at the central stores. The engineer in March last reported upon the considerable saving that was to be expected, as a result of a three months' test that he had made at the South-Western Hospital. In his report he submitted the following estimates as to economies, cost of the work, &c. :—

In the case of the South-Eastern Hospital, the engineer-in-chief has since reported that it is only intended to do a portion of the work at this hospital at the present time, and that he estimates the cost of such work at £200, and the annual saving at from £200 to £250.

Name of Institution.	Number of lamps installed.	Present cost of electricity per annum.	Estimated cost per annum with low voltage metallic-filament lamps installed.	Estimated annual saving.	Estimated approx. cost of change over to met.-fil. lamps, incldg. lamps, trns. frmrs & slight alterations to wiring.
N.W. Hospital ...	1,060	£516	£266	£250	£250
Western Hospital ...	1,4-0	677	327	350	360
S.W. Hospital ...	1,350	*	300	250	200
S.E. Hospital... ...	1,250	817	417	400	280
Children's Infirmary...	2,050	*	—	—	480
The Downs School ...	940	127	87	40	180
Western Amb. Station	130	37	20	17	30
S.W. Amb. Station ...	130	*	—	—	26
Mead Amb. Station ...	30	*	—	—	15
S E. Amb. Station ...	170	41	23	18	40
Central Stores ...	225	*	—	—	60

* No figures obtainable.

Late Legal.—J. T. Williams & Sons *v.* Beckenham Urban District Council.—In the City of London Court, on Wednesday, before his Honour Judge Lumley Smith, K.C., and a jury, plaintiffs, a South Bermondsey firm, claimed to recover £74 odd for work done in repairing a burnt-out armature and supplying a new governor valve and spindle in respect of certain electrical machinery. Mr. Warren appeared for the plaintiffs, and Mr. Richards for the defendants.

Plaintiffs' case was that a contract was made between the parties for the hire of a Siemens generating set used for supplying electrical power. It had been used by the Underground Railway Co. for generating electrical power. They only wanted it for temporary purposes, and the plaintiffs bought one of two sets which were sold. On October 16th, 1906, defendants agreed to hire the set from the plaintiffs at the rate of £60 a month for six months certain, and if the defendants wanted to purchase the price was fixed at £1,430. If the defendants decided not to purchase the hire was to be increased to £125 a month. At the expiration of the hire defendants were to return the machinery in the same good condition as when they received it, fair wear and tear only excepted. The Court would not be concerned about the purchase. Plaintiffs' case was that the defendants did not return the machinery as they received it. An armature became burnt out in the course of using it; hence plaintiffs' claim for necessary repairs. As to the governor valve, when the machinery left defendants' hands it was discovered that there was a flange that had been cracked or broken. The plant was afterwards disposed of to the Southampton Corporation.

Mr. Richards, for the defendants, said that they only ran the generating set for 109 hours during the six months that they had it. Therefore, they could not have caused the repairs sued for to be necessary. They refused to pay because they did not get what was bargained for. Legal proceedings were brought by the plaintiffs, and any possible claim that could now be made was, he urged, settled in a previous action under the head of "damages for breach of contract," when plaintiffs received £500. The case would never have been settled if it had not included everything in dispute between the parties.

Mr. Warren contended that there was no settlement of the present cause of action.

The defects complained of were only discovered after the £500 was paid.

Judge Lumley Smith, K.C., held that the plaintiffs could not recover after the previous action, and he found for the defendants, with costs.

Liverpool Cart-Owners' Association *v.* National Telephone Co.—In the King's Bench Division on Wednesday, before Mr. Justice Pickford, this case was heard, the question being whether the Telephone Co. could enforce a certain agreement made by the Finance Committee of the Liverpool Corporation. Mr. Leslie Scott, K.C., and Mr. Ross Brown were for the plaintiffs, and Mr. M. Shearman, K.C., with Mr. H. T. Waddy, for the defendants.

Mr. Scott said that the question was one of construction of an agreement which was ordered to be tried without pleading, but the defendants had since raised a separate issue of fact which would have to be taken to Liverpool if tried, as there would be a large number of witnesses to be called. The question was whether the plaintiffs were entitled to be treated as flat-rate subscribers to the telephone system, or whether the defendants were entitled to call upon them to enter into contracts for the telephone service at the measured rate—that was the penny-in-the-slot system. Flat-rate subscribers paid a lump sum annually, and could take as many calls as they liked. The plaintiffs were an association of cart-owners, who do practically all the dock work, and had a large number of depôts in the docks, in connection with which they had 22 different telephones. In 1896 the Corporation of Liverpool entered into an agreement with the Telephone Co., which, the plaintiffs said, was made on behalf of all the ratepayers who were then, or might become, subscribers to the telephone, and the question was whether they ought to be compelled to carry out that agreement. That agreement was revised in 1908, and the defendants gave notice to the plaintiffs to terminate all the existing agreements at the expiration of six months, with the intimation that they could only in the future have the telephone service upon the measured-rate basis. The plaintiffs contended that the defendants had no right to give the notice to terminate the agreement, because, under an arrangement made with the Corporation, they had undertaken not to terminate any flat-rate agreement with existing flat-rate subscribers. Evidence was called in support of the plaintiffs' case.

Mr. Shearman, K.C., for the defendants, contended that the ratepayers had no right individually to bring an action to enforce the agreement. Some subscribers might want one system, and some the other, and if the plaintiffs were right in their contentions, anyone could bring an individual action against the Telephone Co. on a contract made to confer a benefit upon him, as well as 500,000 other people.

His Lordship, in giving judgment, referred to the circumstances under which the Telephone Co. had entered into an agreement with the Corporation in the first instance, when certain charges for the service were arranged. That was in 1906, at which time the action was taken by the Corporation in their capacity of governing body of Liverpool. In 1908 it was desired to substitute the measured for the flat rate. An interview took place between the Corporation and the company, the result of which was the second agreement, an important part of which was that the company agreed not to interfere with the arrangements with the existing flat-rate subscribers where agreements existed. It was said that there was an understanding as to hotels and clubs, and the plaintiffs claimed that they came within that exception. The plaintiffs could only be entitled to sue if the Corporation, in making the contract, purported to make it for the plaintiffs either by themselves or with a number of other persons. If they did that, then the plaintiffs and other individuals would be entitled to sue under the agreement. Upon the whole of the evidence it did not appear that the Finance Committee were contracting as agents for the existing flat-rate subscribers so as to make each one a principal. The plaintiffs had not established their right to sue, and the action would be dismissed. Dismissed with costs accordingly.

Finsbury Technical College Engineering Society.—The annual dinner of this Society took place at the Holborn Restaurant on Tuesday last, and was well attended. Amongst the guests were Prof. S. P. Thompson, Messrs. P. V. McMahon, R. J. Wallis-Jones, W. B. Esson, A. T. Turney, R. Borlase Matthews, and other well-known engineers. After "The King," Mr. Malan proposed "The President" (Dr. Coker), who, unfortunately, was not able to be present. Mr. Scohle replied on his behalf. The annual report of the Committee was read, showing that the Society was in a flourishing condition, with a substantial balance. Numerous works had been visited, and a successful smoking concert had been held. Mr. Brodribb toasted "The Guests," and Dr. Thompson replied, remarking that the College had been in existence for a quarter of a century. Amongst other successes of old students, Prof. W. J. Pope had been appointed Professor of Chemistry at Cambridge, and for three years in succession the Chairman of the Manchester Section of the I.E.E. had been an old Finsbury man. He emphasised the importance of mathematics as a tool, while pointing out the danger of its becoming a master. Mr. P. V. McMahon also replied, urging the students to join the Old Students' Association. The elders could often help the younger students if they could get hold of them at the right time, but there was a wide gap in the membership between the very early and the present-day students, and to prevent this in future they should join at once. Mr. Darling proposed "The Engineering Society," to which Mr. Betts responded; and finally Mr. Neill toasted "The Chairman and Secretaries." The proceedings were enlivened by a musical programme contributed by the members, with an extra turn of Chinese conjuring by Mr. Yaou.

Only 582.—The Rochdale Board of Guardians, who require the services of an electrical engineer for the plant at the workhouse, have received no fewer than 582 applications from all parts of the country. The salary offered is 50s. a week with a house. Among the letters are some from men holding good positions. The Committee has spent two days in making a preliminary examination of the applications.

Resuscitation of the Aluminium Syndicate.—A remarkable report has just emanated from Paris in reference to a proposal to revive the International Aluminium Syndicate which was dissolved in the Autumn of 1908. It is remarkable from the circumstance that the collapse of the combination was due to the attitude assumed towards it by one of the French constituents, and from the fact that a suggestion for the reconstitution of the organisation should now also come from the circles of French producers. Apparently the severe rivalry which has prevailed during the past nine months—cut-throat competition, as it would be termed in some quarters, having regard to statements that sale prices are below the cost of production—has begun to influence the situation in the direction of the desire for a fresh understanding among manufacturers. When the French company concerned gave notice of intention to withdraw from the syndicate, the question was referred to a court of arbitration, but notwithstanding the most determined opposition of the German controlled Neuhausen Aluminium Co., which for several years had largely dominated the position, the Court decided in favour of the French company, and the syndicate ceased to exist. Now the French makers have just met in conference in Paris to discuss the situation, and the primary result is the decision not only not to proceed with sales for 1910, but also to hold back in regard to the acceptance of further contracts for the remainder of the present year at current prices, which are declared to involve a loss. A secondary result is the determination to again enter into relations with the other former constituents of the International Syndicate with the object of concluding a fresh understanding. It remains to be seen whether success will attend these efforts, although an important part will probably be played by the productive capacity of the extensions of plant, and the new works erected by outsiders during the past two or three years. The stocks of aluminium must also be taken into consideration, as unless the consumption has enormously increased owing to the low prices prevailing in the current year, the accumulation of the metal represents a very large tonnage. The statistics recently issued by the Metal Co., of Frankfort-on-Main, show that the production amounted to 18,100 tons in 1908, as compared with 19,800 tons in 1907, but as contrasted with this reduction, the consumption is recorded as having advanced from 14,200 tons in 1907, to 14,500 tons last year. If it is possible to secure the adhesion of most of the new producers, the scheme for the resuscitation of the International Syndicate may be brought to a successful issue, but failing their support, it seems somewhat doubtful whether the combination, if reconstituted, will be able to accomplish the object of securing a large advance in prices.

Appointment Vacant.—Improver for switchboard work for the Cleckheaton U.D.C.

Institution and Lecture Notes.—JUNIOR INSTITUTION OF ENGINEERS.—A large number of members visited the Menpes Printing Co.'s colour-printing works at Watford recently.

CANADIAN ELECTRICAL ASSOCIATION.—The nineteenth annual convention of the Association, recently held at Quebec, was one of the most successful meetings the Association has ever held. Over two hundred delegates were in attendance, from all over the Dominion.

INSTITUTION OF MUNICIPAL ENGINEERS.—The roll of the Institution now numbers 653. The new Council will be elected at the first annual general meeting, at Durham, on August 7th.

New Anglo-French Telephone Cable.—We understand that a contract has been placed with Messrs. Siemens Bros. and Co. for a new Anglo-French telephone cable with Pupin coils.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Friday, 2nd inst., at the West Ham generating station, Mr. Lloyd-Jones, resident engineer, presented to MR. A. H. SEABROOK, on behalf of the generating department staff, a gold watch chain, on the occasion of his leaving to take up the position of general manager to the Marylebone undertaking.

MR. H. F. FOSTER has resigned the position of resident engineer of the Epsom electrical undertaking, and he is to be appointed as consulting engineer for 12 months from August next, at a salary of £100 per annum.

The Leek U.D.C. has increased the salary of MR. R. M. CARR, electrical engineer, from £175 to £200 per annum.

The salary of MR. W. FENNELL, electrical engineer to the Wednesbury Corporation, has been increased from £200 to £225 per annum. After the results of the current year's working have been ascertained, the salary will be further considered.

Tramway Officials.—MR. JOSHUA SOUTHALL, tramway inspector at Stockport, has been appointed chief inspector of the Ilkeston Municipal Tramways.

General.—The Croydon Education Committee have appointed MR. A. BLOK as chief lecturer in electrical engineering at the Central Polytechnic, at a salary of £110 per session.

MR. J. R. S. BARKSHIRE, late station supervisor at H.M. Dockyard, Devonport, has been appointed resident supervisor-in-charge of the electric light and power installation at the Royal Naval Ordnance Depôt, Bull Point.

Obituary. — EDWIN TRENAM, I.S.O.—We regret to record that Mr. Edwin Trenam passed away at Upper Norwood on July 4th, at the age of 65 years, some 3½ years after his retirement from the controllership of the Central Telegraph Office. The deceased gentleman entered the service of the Electric and International Telegraph and the Magnetic Telegraph Companies in 1857 and 1862 respectively, while his connection with the Postal Telegraph Service dates back to 1870. The positions occupied by him subsequently were those of Superintendent of Telegraphs at Leeds and chief Superintendent of Telegraphs at Manchester, also Traffic Manager of Telegraphs and Deputy-Controller and Controller of the Central Telegraph Office. On the occasion of the retirement of Mr. Trenam, his many friends at the latter office presented him with a gold watch and chain, and, in making the presentation, Sir John Lamb spoke very highly of the efficient work he had achieved while at Leeds and Manchester, and also in London, in improving the telegraphic communication between London and the provinces. His long experience was also of great assistance in 1898, when he, with others, was appointed by the then Postmaster-General to solve the problem of congestion at the C.T.O. He visited Belgium with Mr. (now Sir) John Gavey, and, as a result, intercommunication was introduced for facilitating the disposal of local telegrams.

NEW COMPANIES REGISTERED.

British Vitrite Works (Swan's Patents), Ltd. (103,549).—This company was registered on June 17th, with a capital of £80,000 in £1 shares, to adopt an agreement with Swan's Patents, Ltd., and to carry on the business of manufacturers of, and dealers in, vitrite and other caps or bases for incandescent electric lamps, electric lamps and fittings, apparatus and accessories, &c. The subscribers are:—B. M. Drake, M.I.E.E., 66, Victoria Street, S.W., electrical engineer, 250 shares; W. A. Turquand, Milton Lodge, Horton, Bucks, electrical engineer, 250 shares; H. T. Perkins, Kingston Hill Road, Norbiton, barrister, 25 shares; C. R. Dewhirst, Pine Ridge, Broadstone, Dorset, electrical engineer, 1 share; W. T. Smythe, Fairmead, Maidstone, gentleman, 1 share; W. H. Disney, 7, Arlington Gardens, Ilford, gentleman, 1 share; C. H. Brookes, 48, Brooklebank Road, Wandsworth Common, S.W., clerk, 1 share. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are B. M. Drake and W. A. Turquand. Swan's Patents, Ltd., have the right to nominate two directors; qualification, £250; remuneration (except managing directors) £100 per annum (chairman, £150), and a share in the profits. Registered office, Broad Street House, New Broad Street, E.C.

Maxwell's (Dundee), Ltd. (7,161).—This company was registered in Edinburgh on June 14th, with a capital of £25,000 in £1 shares, to purchase the lands, properties, electrical plant and goodwill of the business of Maxwell, Son & Co., electrical, mechanical and motor engineers and brassfounders, of 26, St. Andrew's Street, Dundee. The subscribers (with 100 shares each) are:—D. Maxwell, Kenmore Place, Broughty Ferry, electrical engineer; J. Lockhart, Lammerton Terrace, Dundee, electrical engineer; J. Forrester, Duneaves, Broughty Ferry, jute spinner; (?) Druce, 22A, Strathmartine Road, Dundee, electrician; G. Brodie Paul, Dundee, solicitor. Private company. The number of directors is not to be less than three or more than seven; the first are D. Maxwell, J. Lockhart and J. Forrester; qualification, 50 shares; remuneration as fixed by the company. Registered office, 28, St. Andrew Street, Dundee.

Charlestown Electric Light and Power Co., Ltd. (3,440).—This company was registered in Dublin on June 16th, with a capital of £1,500 in £1 shares, with objects as indicated by the title. The subscribers (with one share each) are:—Rev. Michael Keveney, Charlestown; P. Doherty, Charlestown, merchant. Private company. The Rev. M. Keveney is the sole director until the election by shareholders. Registered office, Charlestown, co. Mayo.

Electric Ordnance Co., Ltd. (103,690).—This company was registered on June 24th, with a capital of £10,000 in 8,000 cumulative participating 10 per cent. preference shares of £1 each, and 40,000 ordinary shares of 1s. each, with objects as indicated by the title. The subscribers (each with one cumulative participating preference share) are:—G. W. Heard, 16 and 17, Devonshire Square, E.C., director; A. Wilson, 66, Offord Road, Barnsbury, N., secretary; T. J. Woolls, 58A, Second Avenue, Mortlake; M. Hibbard, 90, Cannon Street, E.C., land surveyor; W. J. Sadler, 43, Connaught Road, Stroud Green, N., photographic goods dealer; A. Marchant, 16 and 17, Devonshire Square, E.C., solicitor; A. F. Benning, 31, Liverpool Street, E.C., accountant. Minimum cash subscription, £7. The number of directors is not to be less than one or more than seven; the first are H. F. Spencer, A. Blackman and Dr. Woltereck. Registered office, Ingram Court, Fenchurch Street, E.C.

Adnil Electric Co., Ltd. (103,763).—This company was registered on June 29th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, electrical and general engineers, ironmongers, makers of and dealers in electric tramcars, motor-cars, flying machines, aeroplanes, cycles, carriages, and other vehicles, manufacturers of and dealers in dynamos, motors, telephones, electroliers, arc and other lamps, electric light fittings, &c. The subscribers (with one share each) are:—Dr. H. Rossner, Berlin, 21 Waftstrasse, solicitor; A. Tagg, Hawthorn, Southville Road, Thames Ditton, clerk. Private company. The number of directors is not to be less than three or more than five; the first are to be appointed by the subscribers; remuneration as fixed by the company. Registered office, Adnil Building, Artillery Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd. (31,964.)—A memorandum of satisfaction in full on May 15th, 1909, of debenture dated January 6th, 1903, securing £600, has been filed. Also particulars of £30,000 debentures created August 9th, 1901, and secured by trust deed dated August 21st, 1901, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital and premises in Arbroath, Farringdon Avenue, Holborn Place, Upper Holloway and Holloway Road. Trustees: W. K. Macdonald and H. G. Anderson.

Institution of Electrical Engineers (18,393).—Mortgage and charge, dated June 1st, to secure £26,000, charged on leasehold premises known as the Examination Hall, Thames Embankment, W.C. Holders: Economic Life Assurance Society.

Typewriting Telegraph Corporation, Ltd. (66,332).—Particulars of £3,000 debentures created November 4th, 1904, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £440. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Johnson & Phillips, Ltd. (84,968).—Particulars of £50,000 debentures created June 10th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £37,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Direct Spanish Telegraph Co., Ltd. (6,732).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: 1st mortgage debentures dated May 5th, 1894, securing £30,000.

Coatbridge and Airdrie Electric Supply Co., Ltd. (89,178).—Further charge dated June 10th, 1909, to secure £7,020, charged on the company's undertaking and property, present and future, including the Coatbridge and Airdrie undertakings, benefit of orders and contracts, and uncalled capital. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, E.C.

Eastern Extension, Australasia and China Telegraph Co., Ltd. (7,221).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First charge on the company's undertaking and revenue, dated November 19th, 1890, securing £320,000.

Electric Laudaulet Co., Ltd. (72,890).—First mortgage debenture dated June 2nd, 1909, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: London Joint Stock Bank, Ltd.

Mather & Platt, Ltd. (60,387).—This company's annual return was filed on March 30th, when 40,000 preference and 40,000 ordinary shares had been taken up out of a nominal capital of £1,000,000 in 50,000 preference and 50,000 ordinary shares of £10 each; £10 per share has been called up on 29,200 preference and 2,500 ordinary shares, resulting in the receipt of £317 000; £483,000 is considered as paid on 10,800 preference and 37,500 ordinary. Mortgages and charges: Nil.

New Ignition Syndicate, Ltd. (91,175).—Issue on June 3rd of £500 debentures, part of series created November 12th, 1908, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £3,500.

British and Colonial Insulating Co., Ltd. (Liverpool) (72,876).—Particulars of £10,000 debentures created by resolutions of November 17th, 1908, and January 19th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future. No trustees.

Eastern Telegraph Co., Ltd. (6,338).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Charges dated 1883-1896, securing in all £1,432,268.

Eastern and South African Telegraph Co., Ltd. (13 306).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First charge on Government subsidies of £28,000 for 20 years in respect of Zanzibar-Seychelles-Mauritius cables, and on the net receipts of such cables, dated May 18th, 1893, securing £200,000.

This company's annual return was filed on June 3rd, when the entire capital of £600,000 in £10 shares had been taken up and paid for in full. Mortgages and charges: £199,500.

South London Electric Supply Corporation, Ltd. (50,392).—This company's annual return was filed on May 3rd, when the entire capital of £260,000 in £4 shares had been taken up. £260,000 paid. Mortgages and charges: £100,000.

Marsh, Son & Co., Ltd. (74,746).—This company's annual return was filed on April 19th, when 18,608 shares had been taken out of a nominal capital of £20,000 in £1 shares. £6,608 paid; 12,000 considered as paid. Mortgages and charges: £9,200. (Originally registered as "Vandam, Marsh & Co., Ltd.")

Windermere and District Electricity Supply Co., Ltd. (41,461).—This company's annual return was made up to April 10th, when 5,000 preference and 3,000 ordinary shares had been taken up out of a nominal capital of £50,000 in 5,000 preference and 5,000 ordinary shares of £5 each. £5 per share called up on 3,040 preference and 1,730 ordinary. £23,850 paid; £16,150 considered as paid on 1,960 preference and 1,270 ordinary. Mortgages and charges: £16,800.

Laurence, Scott & Co., Ltd. (50,656).—This company's annual return was made up to April 13th, 1909, when 45 £1 and 4,181 £10 shares had been taken up out of a nominal capital of £50,000 in 50 shares of £1 each and 4,995 shares of £10 each. £1 per share called up on 45 shares and £10 per share on 2,798. £28,025 paid; £13,830 considered as paid on 1,383 shares. Mortgages and charges: £22,200.

Cleveland and Durham Electric Power, Ltd. (89,539).—Issues on June 5th of £6,500 and on June 7th of £31,000 debentures, parts of series of which particulars have already been filed.

Gent & Co., Ltd. (78,797).—A memorandum of satisfaction, to the extent of £7,000 by various instalments, up to June 25th, 1909, of debentures dated December 14th, 1903, securing £17,000, has been filed.

Bournemouth and Poole Electric Supply Co., Ltd. (55,189).—This company's annual return was filed on May 12th, when 15,000 ordinary, 7,500 4½ per cent. preference, and 15,000 6 per cent. second preference shares had been taken up out of a nominal capital of £500,000 in 25,000 ordinary, 7,500 4½ per cent. cumulative preference, and 17,500 6 per cent. second preference shares of £10 each. £875,000 has been received. Mortgages and charges: £187,500.

Woking Electric Supply Co., Ltd. (46,175).—This company's annual return was filed on May 18th, when 34,098 preference and 20,552 ordinary shares had been taken up out of a nominal capital of £100,000 in 50,000 preference and 50,000 ordinary shares of £1 each. £54,650 has been received. Mortgages and charges: £16,175.

Southern Electric Free Wiring Co., Ltd. (64,550).—This company's annual return, made up to May 3rd, 1909, has been filed. 1,510 shares have been taken up out of a nominal capital of £5,000 in £1 shares, and £1,510 has been received. Mortgages and charges: Nil.

Raworth's Traction Patents, Ltd.—Particulars of £1,500 debentures created April 7th, and secured by trust deed dated May 19th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, and all inventions and improvements connected with regenerative control on electric cars. Trustees: C. Shirreff, B. Hilton and J. S. Raworth.

Calmont, King & Co, Ltd. (97,616).—Issue on June 7th of £500 debentures, part of series created August 7th, 1908, to secure £2,000 charged on the company's undertaking and property, present and future including uncalled capital. No trustees.

West Coast of America Telegraph Co., Ltd. (52,114).—This company's annual return was filed on May 28th, when 45,008 shares had been taken up out of a nominal capital of £132,520 in 53,008 shares of £2 10s. each £20 has been received on 8, and £112,500 is considered as paid on 45,000 Mortgages and charges: £170,000.

Western Telegraph Co., Ltd. (6,886).—This company's annua return was filed on June 2nd, when 207,930 shares had been taken up out of nominal capital of £2,500,000 in £10 shares. £1,300,000 has been received, an £779,300 is considered as paid. Mortgages and charges: £800,000.

Crompton & Co., Ltd. (27,200).—Particulars of £100,000 debentures (the issue of £75,000 of which was authorised by board resolution o February 15th, 1909), filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £9,275. Property charged The company's undertaking and property, present and future, subject to first mortgage debentures. No trustees.

La Plata Electric Tramways Co., Ltd. (101,431).—Trust deed dated May 26th, 1909, to secure £30,000 5 per cent. debenture stock (th company reserving power, on executing a further trust deed or deeds, to create and issue further debenture stock not exceeding in the aggregate £170,000, ranking *pari passu* with this £30,000), charged on a concession, certain lands, tramways, buildings and hereditaments, and the company's undertaking and general assets, present and future, Trustees: River Plate Trust, Loan and Agency Co., Ltd.

Works Construction Co., Ltd. (85,014).—Charge dated June 16th, 1909, to secure all moneys advanced up to £42,000, charged on the company's uncalled capital and 4,500 preference and 15,493 ordinary shares of £5 each in the Para Electric Railways and Lighting Co., Ltd. Holders: Anglo-American Debenture Corporation, Ltd., 20, Birchin Lane, E C.; R. Fleming, 2, Princes Street, E.C.; and J. G. White & Co., Ltd., 9, Cloak Lane, E.C.

Keswick Electric Light Co., Ltd. (28,820).—This company's annual return was filed on May 6th, when 3,420 ordinary shares had been taken up out of a nominal capital of £20,000 in £1 shares (15,000 preference and 5,000 ordinary). £3,420 has been received. Mortgages and charges: £10,100.

Rhymney Valley and General Electric Supply Co., Ltd. (89,413).—Particulars of £1,250 debentures created January 1st, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

F. Hutchins & Co., Ltd. (88,132).—Particulars of £5,000 debentures created June 21st, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ogmore Valley Electric Light and Power Supply Co., Ltd. (34,191).—Particulars of £3,000 debentures, created June 16th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

The B.E.T. Report.

A DIMINUTION of £33,331 from dividends and interest being reported for the past year, which we regret to notice, a perusal of the report and a cursory examination of the accounts of the B.E.T. for the year ending March 31st, 1909, are not calculated to inspire the preference and ordinary shareholders with much hope for the future of that company, whilst the shares of the associated companies, with possibly one or two exceptions, do not appear to offer any attraction to the investing public. The B.E.T. is practically, of course, a finance company. The preference shares (£10) are quoted "wide" at about 50s., as also are the ordinaries (£10) at something like 10s.

Mention is made of the company having secured a substantial participation in a powerful syndicate, which has been formed for the purpose of negotiating with the municipality of St. Petersburg for a concession of tramways in that city. This is somewhat opportune, as the B.E.T. is sadly in need of promotion profits.

We find a reference to the litigation which took place between the Bournemouth Corporation and the Poole Electric Traction Co. (which was the creation of the B.E.T., and in which, of course, it was largely interested), when the Corporation purchased the undertaking of the Poole Co. The following is an excerpt from the report:—"While it is not possible to draw from this a general conclusion applicable to the undertakings of the associated companies, the directors consider that this result affords some indication of the value of a successful tramway undertaking when sold upon an equitable basis." It would probably have been interesting to the B.E.T. shareholders if the directors had incorporated in their report *in extenso* the observations of the Lord Chancellor in the appeal, from which we make the following extracts:—"Part at all events of the moneys so borrowed and spent is represented by existing assets, which the Corporation took over, and I cannot doubt paid value for in the valuation of the undertaking which it bought"; "it seems at first sight unreasonable that the Corporation should pay the company for those assets, and also pay off the debts incurred in order to create them. That is like paying twice over for the same thing"; and finally, "having regard to the way in which this contract has worked out in making the Corporation pay heavy debts due by the company, I can understand and share a desire to give to the Corporation the benefit of debts due to the company or of moneys owned by it, which owe their origin to the Poole undertaking. But the language of the contract does not, in my opinion, admit of these claims."

The nature of the agreement is pretty closely followed from these observations, and the case affords material for an interesting study.

Turning to the accounts, there is a credit balance on profit and loss of £130,725, which the draftsman of the report has been pleased to call net profit, and which is carried to what is erroneously termed net revenue account. These figures are augmented by the sum of £35,393, brought into the account from the previous year, making a total of £166,119. After providing for debenture interest and for the preference share dividend paid to March 31st, 1908, there is a balance of some £20,000, which is carried forward, and which is some £15,000 less than the sum brought into the account from the previous period. The result is that the shareholders may, if they choose to do so, thank the board for what they have not received.

Except in two particulars, there is no necessity to deal with the itemised credits of the profit and loss account. Do each of the undertakings of Barrow, Brighton, and Mumbles, show a profit? Whether they do, or do not, a working or profit and loss account should be included among the schedules showing the trading result of each concern. As we are treated to some small items *per contra*, we are surely entitled to some disintegration of the £16,359 which is exhibited opposite "profit on contracts," &c. For example, it should be shown somewhat as follows:—Rents from subsidiary companies; profit on engineering and other services rendered to subsidiary companies; transfer fees; and so forth. In noticing the usual stereotyped delineations of the debits of the profit and loss account, we need only refer to that of management expenses which responds to £16,868, which is a reduction of some £7,000, compared with the sum for the previous year. The report attributes the saving mainly to the result of the formation of the British Electrical Federation. It would be interesting to know whether the management and general expenses of the subsidiaries have increased since the intervention of the Electrical Federation, Ltd. Looking at the balance-sheet, which again appears with the superfluous terms of Dr. and Cr., we need only notice some of the salient features of that statement. An exceedingly vulnerable point is that of the investments which stand in the books at £4,895,526, of which over two millions did not yield any return for the year; moreover, there are uncalled liabilities on the investments amounting to £70,000. It is remarkable that investments of the par value only of £984,000 are officially quoted in the London Stock Exchange, and are included in the above figures at £977,054; their value at middle published prices being £548,814. No valuation of the remainder has been made, some of which are quoted occasionally on provincial stock exchanges. Sundry debtors and debit balances represent £473,680, after providing for a reserve of £37,162. As we have stated on previous occasions, this indebtedness is much too large. If the B.E.T. have faith in their own creations why not take payment in shares? Perhaps they would prefer the public to take the paper and they the cash. We have a new item of £36,188 in respect of Electrical Federation offices. Presumably the B.E.T. charge head office rentals to the associated companies. If so, what is the profit on the investment? The balance of expenditure on Acts of Parliament is probably a valueless item, and it stands even now at a written-down sum of £19,640. The reserve, which stands at £602,420, is only of theoretical importance. It is a singular fact, however, that only £55,000 of this sum has been contributed out of profit and loss. Before arriving at the existing amount of reserves, *inter alia*, some £18,000 and £6,000 have respectively been written off on account of Wellingborough and South Shields. What days those were, to be sure. Additional reserves against specific assets total over £59,000! Is any portion of the latter sum likely to find its way back to exhilarate disposable balances, or has any part of it been lost?

Some of the schedules accompanying the accounts are rendered almost valueless by the manner in which they are framed, inasmuch as the information which they should afford is lost in the highly-cultivated art of aggregation practised by the B.E.T. As examples, Schedule 5 contains a list of the amounts set aside by each associated company for "depreciation and reserve funds, including balance of profit carried forward." The statement, as drawn, is of no value owing to useless grouping. In any case, for so many companies the total only reaches a miserable sum of £1,015,340. Schedule 1 should show separately the ordinary and preference shares and debentures, if any, held in each company. Schedule 6 sets forth the amounts due by associated companies; but it is silent upon the details of the consideration for the indebtedness of the companies named, and the information which it conveys is only useful in the books of the B.E T.

Eliminating the profitless ordinary shares a 5 per cent. upon which would be but a poor return upon such a speculative and reactionary variety, it may be noted that £194,346 is required annually for the service of the debentures and the preference shares. Contrast this requirement with the miserable achievement of the year. It would seem that if there is no one in the B.E.T management capable of stemming the apparently swelling tide of retrogression, some action on the part of the shareholders may be desirable with a view to putting the finances of the company on a proper basis.

Edmundsons' Electricity Corporation, Ltd.

The directors' report for the year ended March 31st, 1909, states that the net profit, after payment of interest on the debenture and prior lien debenture stocks, amounts to £597. Adding to this amount the balance of £20,417 brought forward from the previous year, less the expenses of the issue of prior lien debenture stock, there remains £14,809, which the directors recommend should be carried forward to the next account. The dividends and interest received have increased by £2,871, the loss on working the local authorities' undertakings is reduced by £997, and the urban company guarantee is less by £387. In view of the conditions which have adversely affected almost all electric supply undertakings during the past year, the directors consider that these results are not unsatisfactory. The reduced net profit is attributable to the diminution in the trading profits consequent upon a reduced capital outlay by the subsidiary companies, but as it is the avowed policy of the board to restrict capital expenditure as far as is reasonably possible, this feature of the accounts need from this point of view occasion no regret. The following schedule shows capital expenditure and gross profits of subsidiary companies for the years 1907 and 1908:—

Name.	Capital expended. Dec. 31, 1908.	Capital expended. Dec. 31, 1907.	Gross profit (before providing for capital charges and depreciation). 1908.	Gross profit (before providing for capital charges and depreciation). 1907.	Lamps connected (equiv. 33-watt). 1908.	Lamps connected (equiv. 33-watt). 1907.
	£	£	£	£		
Alderley	46,315	46,065	1,745	1,452	17,725	16,269
Bromley	157,492	155,150	12,746	12,163	84,052	77,802
Folkestone ..	200,445	193,591	12,919	12,782	103,990	96,300
Guernsey	133,149	127,836	5,242	4,423	85,730	80,851
Isle of Wight ..	259,469	258,430	11,201	10,731	94,805	89,300
Ilfracombe ..	32,629	32,484	327	234	17,000	15,823
Lymington ..	36,348	36,211	1,440	1,396	17,238	16,787
Melton Mowbray..	40,003	39,993	1,864	1,777	18,015	17,528
Newmarket ..	41,957	39,336	2,377	2,588	23,664	22,713
North of Scotland	106,616	104,688	2,878	1,543	55,473	50,362
Ramsgate	40,196	37,164	1,715	1,842	23,254	16,147
Scarboro' Trams	99,580	99,580	8	— 23	—	—
Salisbury	69,826	69 607	4,823	5,148	34,088	33,560
Urban Co... ..	1,067,775	1,019,957	36,941	35,274	437,503	402,597
Winchester ..	89,940	88 239	6,768	6,842	56,641	54,491
Wycombe.. ..	100,284	99,661	4,492	4,366	49,648	47,941
Cromer	32,817	31,280	869	704	12,124	11,173
Dorking	37,882	36 995	1,833	1,463	15,906	11,773
Frome	52,248	51,408	626	631	28,833	25,899
Hamilton	63,157	61,571	2,328	1,653	39,291	28,137
Surbiton	*57,850	54,651	*3,484	3,308	*30,669	27,052
Total	£2,765,978	2,713,897	116,626	109,793	1,245,649	1,145,505

* Figures for year ended March 31st, 1909.

National Telephone Co., Ltd.—The directors have resolved, subject to final audit, to recommend at the forthcoming general meeting the following dividends for the half-year ending June 30th, 1909, after payment of the dividends on the preference shares:—At the rate of 6 per cent. per annum on the preferred stock; at the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases, carrying £150,000 to reserve, and about £11,000 forward. The transfer books will be closed from 9th to 22nd inst., both days inclusive, and the dividend warrants will be posted on the latter date.

Delhi Electric Tramways and Lighting Co., Ltd.—The report for the year to October 31st, 1908, states that after providing £619 for debenture interest and debiting the balance of £446 to penalty suspense account, there is a debit balance of £347 to be carried forward.

Notting Hill Electric Lighting Co., Ltd.—The directors have declared an interim dividend of 3 per cent. and a bonus of 1 per cent. on the ordinary preference shares and an interim dividend of 3 per cent. on the ordinary shares for the past half-year.

Victoria Falls and Transvaal Power Co., Ltd.

The report says that the years 1907 and 1908 were occupied by the work of construction, during which, interest on the preference shares issued in December, 1906, was paid by the British South Africa Co. In these circumstances a profit and loss account has not been included, but a revenue and expenditure account is incorporated in the company's balance-sheet, and shows a surplus for the year 1908 of £48,177, which, with the surplus shown in 1907 of £36,685, making a total of £84,863, is carried forward. The new issues of preference shares and debentures are in connection with the formation of the Rand Mines Power Supply Co., Ltd. When the proposed formation of a competing company first took shape, the chairman, assisted by a committee, was entrusted with the difficult negotiations which ultimately resulted in the acquisition by the company of the large power contract with the Rand Mines, Ltd., in accordance with the terms of an agreement dated December 2nd, 1908, and in the successful carrying through of the increase of capital, amounting to £1,800,000, which places the company amongst the largest undertakings in the world engaged in the electric power supply business. In recognition of the strenuous work so successfully accomplished, the board voted a special sum of £7,500 to be applied by the chairman as remuneration to himself and the committee. Throughout 1908 the station at Driehoek, purchased from the General Electric Power Co., Ltd., continued to work satisfactorily, chiefly supplying power to the Consolidated Gold Fields, Ltd., group of mines and the town of Germiston, and at the present time is still working at full load. The original station at Brakpan, purchased from the Rand Central Electric Works, Ltd., supplied current till the autumn, and now is mainly used as a reserve for the new 8,000-h.p. installation, which was put in work in September. The land on which these works are built is held on lease, and is not freehold, as inadvertently stated in the last report. The company completed a provisional contract for supply of electricity to the municipality of Johannesburg in June, 1908, and the plant thus released was at once employed for the power requirements of various mines. Rapid progress in the construction of the 16,000-h.p. station at Simmer Pan has been maintained, and half the plant has already been put into commercial use. Applications for the supply of power continue to be received in a very satisfactory manner, and will provide work for the whole of the Simmer Pan station, and also necessitate an immediate extension of the plant. The new transmission lines along the reef have been in use since October, 1908, and are working satisfactorily. In compliance with the prospectus of April 7th, the Rand Mines Power Supply Co., Ltd., has been registered in the Transvaal Colony. The company has a capital of £500,000, in shares of £1 each, the whole of which is owned by this company. The Rand Mines Power Co., Ltd., will supply 15 mines controlled by the Rand Mines, Ltd., and Messrs. H. Eckstein & Co., with the whole of the power requirements of these mines for the next twenty years in the form of electricity or compressed air. The mines estimate that in the near future they will require 270,000,000 units of power annually. The construction of the plant necessary to fulfil the obligations of the Rand Mines Power Supply Co., Ltd., is being undertaken by the company, and the work will proceed with all possible despatch. A modification of the original agreement with the Vereeniging Estates, Ltd., has been come to in Johannesburg, and a formal agreement embodying this will shortly be signed. In order to cope adequately with the great increase of business Mr. Arthur E. Hadley has been appointed managing director, with powers to be exercised in consultation with the chairman. As this arrangement will involve, on the part of the chairman, practically the same close attention and constant attendance to the affairs of the company as will be given by the managing director, the board feel sure the shareholders will recognise that the chairman should be adequately remunerated. Subject, therefore, to confirmation, the board has fixed the remuneration of the chairman at £3,000 per annum, to take effect on his return from South Africa, where he is now engaged on the business of the company. The company and the managing director thus together constitute an executive committee, for which provision is made in the company's articles of association.

Imperial Tramways Co., Ltd.—The directors announce that it has been customary to pay interim dividends for the first half of each year on the preference and ordinary shares. The company holds 44,446 5 per cent. cumulative preference shares of the London United Tramways, Ltd., and the directors of that company have now intimated that it will be better to postpone any distribution until the accounts for the whole year are before the board. In these circumstances, and as the dividend in respect of this company's investment in the preference shares of the London United Co. forms so considerable a proportion of this company's net revenue, the directors regret they are thus obliged to forego the distribution of the usual interim dividends and to await the results of the complete year, when the accounts of the London United Co. are made up, about February next.

United River Plate Telephone Co., Ltd.—The directors recommend a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend paid last December, 8 per cent. for the year, free of income-tax, carrying forward £5,138.

Dublin United Tramways Co., Ltd.—The directors recommend dividends for the half-year to June 30th at the rate of 6 per cent. per annum on the pref. shares, and at the rate of 6 per cent. per annum, free of income tax, on the ordinary shares, carrying forward £7,501.

Electric Construction Co., Ltd.

The report of the directors for the past year shows a net profit, after payment of £10,250 for debenture interest and crediting £5,000 as formerly to depreciation account, of £10,731. The sum brought forward from last year is £1,746, and the amount available for dividend is therefore £12,477. From this amount there has to be deducted the dividend on the 7 per cent. cumulative preference shares for the year ended May 31st, 1908, paid January 15th, 1909, £4,395, leaving for distribution £8,082. The directors now recommend a dividend on the 7 per cent. cumulative preference shares for the year ended May 31st, 1909, to be paid on July 31st, which will absorb £4,395, leaving a balance, £3,688, to be carried forward. The increase in the volume of business referred to in the last report is reflected in the foregoing results, which show a considerable improvement on those of the past few years. The reduced demand for electrical plant, caused by the introduction of metallic-filament lamps and the general depression in trade, affected the volume of home orders received by the company during the past year, but this was counteracted to some extent by an increase in export business. The directors are very hopeful that the enhanced profits now reported will be fully maintained, notwithstanding that the industry is still in an unsatisfactory condition.

North Metropolitan Electric Power Supply Co.

An extraordinary meeting of the shareholders of this company was held on Friday at the Electrical Federation Offices, Kingsway, for the purpose of passing a resolution authorising the directors to raise further capital.

Mr. C. G. Tegetmeir, who presided, formally moved a resolution, authorising the directors to raise an additional £200,000 of capital by the issue of preference stock, bearing a cumulative preference dividend at the rate of 6 per cent. per annum.

Mr. George Richardson seconded.

Mr. James Devonshire moved an amendment giving the directors power to issue the stock "at such rate not exceeding 6 per cent. as the directors may deem fit." He explained that since the resolution had been issued, it had been suggested that possibly they might be able to raise the capital on better terms than 6 per cent.

Mr. A. L. Barber seconded the amendment, and it was carried.

Chili Telephone Co., Ltd.

The report of the directors for the year ended March 31st, 1909 states that the aggregate number of subscribers at all centres at the end of the year was 8,011, a gain of 345 for the year. The gross revenue in Chile from all sources was $1,720,716, an increase of $251,105; the expenditure in Chile was $824,082, an increase of $79,931; and the net income in Chile from all sources was $896,633, an increase of $171,144. The average rate of exchange for the year was 10·09d., as compared with 11·21d. in the previous year, giving a decrease for the year of 1·12d. Converted into sterling at these rates, the net income figures given are £37,698, an increase of £3,815. The liquid assets and liabilities in Chile on March 31st, 1909, were valued at $11\frac{3}{16}$d., the current rate of exchange on that day, as compared with $8\frac{3}{4}$d. at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £2,777 brought from the previous year, is £38,104, of which £17,683 has been carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 15th last, and the directors now recommend a final dividend of 5s. per share, free of income-tax, leaving a balance of £2,820 to be carried forward. The total mileage was, on March 31st, 1909, 14,121 miles 584 yds., an increase of 625 miles 309 yds.

Prospectuses.—*Rembia Rubber Estates, Ltd.*—An issue of 35,000 6 per cent. cumulative participating preference shares of £1 each has been offered. The company acquires a group of estates in the territory of Malacca, Malay Peninsula, about 734½ acres being planted with 100,500 Para rubber trees, while others are ready for planting.

The Dalkeith (Ceylon) Rubber and Tea Estates, Ltd.—This company has been offering to the public 40,000 £1 shares. The whole of the estate (2,554 acres) has been cultivated with rubber, there being some 435,000 trees of various ages up to 2¾ years.

London United Tramways, Ltd.—A circular has been issued to the 5 per cent. cumulative preference shareholders in the following terms:—"Although the earnings for the first six months of the year show a surplus sufficient to pay the dividend on the 5 per cent. cumulative preference shares at the reduced rate of 2½ per cent. per annum, the directors consider that until they can see their way to the resumption of the full dividend at the rate of 5 per cent. per annum, it will be better to postpone any distribution until the accounts for the whole year are before the board. The registered office of the company has been removed to the company's principal office, High Road, Chiswick, London, W., and in future all communications should be sent to that address."

Telegraph Construction and Maintenance Co., Ltd.—The directors have declared an interim dividend of 12s. per share.

France.—La Société d'Electro-Chimie, of Paris, reports a net profit of £45,335 for the last financial year, as contrasted with only £41,536 in the previous 12 months. A dividend of 7 per cent. is being declared.

MARKET QUOTATIONS.

Wednesday, July 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	£4 10 dec.
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Copper Sulphate	„	£19 10	..
a Lead, Nitrate	„	£25 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %) ..	„	£10 15	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	⅛d. dec.
c „ Tube (brazed)	„	8¼d.	¼d. inc.
c „ „ (solid drawn) ..	„	7¼d.	¼d. inc.
c „ Wire, basis	„	6⅝d.	..
c Copper Tubes (brazed)	„	8⅛d.	..
c „ „ (solid drawn ..	„	8⅝d.	..
g „ Bars (best selected) ..	per ton	£73	..
g „ Sheet	„	£78	..
g „ Rod	„	£73	..
e „ (Electrolytic) Bars ..	„	£60 15	..
e „ „ Sheets ..	„	£77 5	..
e „ „ Rod ..	„	£65 5	..
e „ „ H.C. Wire	per lb.	8d.	..
f Ebonite Rod	„	3/8	..
f „ Sheet	„	9/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine..	„	5/6 to 6/6	..
h India-rubber, Para fine	„	6/6	3d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	48/2	1d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 2 6 to £13 5	5/- dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	91/6	variable.
e Silicium Bronze Wire	per lb.	9¼d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£129 to £130	£2 dec.
n „ Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sb't (Vielle Montagne bnd.)	„	£25 10	..

Quotations supplied by—

a G. Boor & Co.	*h* Edward Till & Co.
b The British Aluminium Co., Ltd.	*i* Bolling & Lowe.
c Thos. Bolton & Sons, Ltd.	*k* Morris Ashby, Ltd.
d F. Wiggins & Sons.	*l* Richard Johnson & Nephew, Ltd.
e Frederick Smith & Co.	*m* W. T. Glover & Co., Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*n* P. Ormiston & Sons.
g James & Shakspeare.	*o* Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.	*p* The Phosphor Bronze Co., Ltd.

Stock Exchange Notices.—The Committee has ordered the following to be quoted in the Official List:—

Mansfield and District Tramways, Ltd.—60,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 60,000; and £70,000 4½ per cent. mortgage debenture stock.

Rio de Janeiro Tramway, Light and Power Co.—Further issue of £200,000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B 12,001 to 14,000.

South African Lighting Association, Ltd.—Further issue of 1,000 shares of £10 each, fully paid, Nos. 8,001 to £9,000.

West Kootenay Power and Light Co., Ltd.—£63,200 additional first mortgage 6 per cent. 35-year sinking fund gold bonds for £100 each, within Nos. 2,491 to 8,082.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Bombay Electric Supply and Tramways Co., Ltd.—£150,000 5 per cent. second mortgage debentures of £100 each, Nos. 1 to 1,500.

Southern Electric Tramways of Buenos Ayres (Compania de Tramways Electricos del Sud).—£100,000 5 per cent. first mortgage debentures, Nos. 1 to 800 of £100 and 801 to 1,800 of £20 each.

Belgium.—La Société d'Electricité du Borinage is declaring a dividend of 22½ fr. per share for the last financial year, as compared with only 21½ fr. in the previous 12 months.

STOCKS AND SHARES.

Tuesday Afternoon.

Consols have at length revived, and have shown some appreciation of the low value of money in the market. Their recovery produced a sensible change of sentiment amongst other investment securities. Some such lead by the Funds has been badly wanted for a long time, and it gives a stimulus to many other markets. It is worth noticing that amongst the *ex* dividend quotations of Debentures on July 1st last week, the telegraph prior charge stocks lost only part of the full amount of the interest payments.

In other directions, the features this week include good recoveries of Canadian-Mexican traction prices, while sharp falls in British Aluminium issues stand out in the manufacturing list.

The Home Railway market has been cheered by the settlement in the Welsh colliery dispute, but so far as electrical stocks are concerned, the only one to benefit is Metropolitan Consolidated, where the rise is 1¼ per cent., dividend prospects being jocularly referred to as one reason for the rise. Districts dropped to 17, but recovered to 17½. Central Londons further weakened on account of the poor traffics. City and South London fell ½, and East Londons, after getting down to 3⅛, picked up to 3$\frac{5}{16}$.

London United Tramways Preference are down ¼, and the Debenture stock 1, on the dividend announcement. British Electric Tractions are flat for a similar reason, and the 5 per cent. first Debenture is marked down nearly 3½ points, stock changing hands as low as 89. The unfortunate concern seems to be sinking into a still worse condition, and the outlook is gloomy. Brush Electrical varieties display no movement.

Edison & Swan shares have been the subject of a little very quiet inquiry during the last day or two. A large line for a deceased account that will be easily guessed is now absorbed and without difficulty. The change for the better in the fortunes of the Electric Construction Company, which has resulted in the Ordinary and Preference experiencing a very fair advance lately, seems to have directed attention to the Edison & Swan. It must, of course, be remembered that most of the shares of the latter company carry a liability of £2 apiece, which naturally deters people who might otherwise buy from putting money into them.

The recent spurt in British Aluminium shares turns out to be short-lived, and the Ordinary are 10s. lower at 15s., the 7 per cent. Preference 10s. down at 2, and the 6 per cent. Preference 7s. 6d. at 3¼d. Various rumours are afloat as to the reason for these heavy falls, but probably the real fact of the matter is that the company could do with additional funds. Callender's Cable shares are 2s. 6d. better, and the Debenture Stock with Henley's Debenture is 10s. to the good. Babcock & Wilcox eased off a trifle.

Mexico Trams have risen 9, Rio Trams 8½, Mexican Light and Power Preference 6, the Common 2, and others in the same group regained smaller sums. The official reassurances from the Mexican Light and Power Company produced a swift rebound as soon as the selling pressure was relaxed from Brussels, and from other quarters nearer London. "It is in the nature of Stock Exchange prices," we ventured to suggest last week, "to rally after any severe and protracted fall," and although there was a further setback after this, the ultimate recovery wiped out the losses handsomely.

There is not much doing in the electricity supply section, and what there is does little to cheer the list of prices. Westminsters are ⅛ down, both Ordinary and Preference, and Bromptons lost a further crown. Urban Ordinary and Preference are nominally rather easier. Victoria Falls Power Preference remain about 16s, the temporary twist-up in Chartered and the Kaffir market failing to move the Victoria Falls shares.

Telegraph stocks are under the cloud of the probability of cable rates coming down. Anglo-American Telegraph issues are good, but the rest of the list—apart from the Debentures and Debenture stocks—is dull. Eastern Ordinary fell 3; Marconi's have been spasmodically active, touching 17s. 6d. before reacting to 16s. National Telephones rallied as soon as the weak stock on offer found permanent holders. The Trust companies' descriptions are steady.

Russia.—The Petersburger Gesellschaft Elektrischer Anlagen vormals Helios, of St. Petersburg, is declaring a dividend of 3 per cent. for the last financial year.

Spain.—La Compagnie Barcelonaise d'Electricite, of Barcelona, is declaring a dividend of 7½ per cent. for the last financial year.

Hobart Electric Tramway Co., Ltd.—The directors have declared a dividend of 5 per cent., free of income tax.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations June 29th.	Closing Quotations July 6th.	Business done week ended July 6th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾ — 3¼	2¾ — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 96	92 — 96 xd	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143 —144 xd	143½—144½	..	..	+ ½	5 10 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98½—100½	97 — 99 xd	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	56 — 58	57 — 59	..	..	+1	5 9 8
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —100	100 —101	100¼	99⅜	+1	5 18 10
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	15⅜— 15⅝	15¾— 16	16 1/16	15⅜	+ ⅜	2 9 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8¼	..	..	4 15 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91 xd	89 — 91	89⅜	..	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8⅛— 8⅞	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	57/6	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	99 —101 xd	..	..	..	8 16 8
60,710l	Direct United States Cable	20	4¼%	4⅜%	4¼%	4¼%	12⅝— 13⅛	12⅝— 13⅛	13	12 15/16	..	6 10 0
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	99 —101 xd	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	130 —133	127 —130	130	127	—3	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 — 87	85½— 87½	86¾	86	+ ½	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104½—106½	105	104½	+ ½	3 15 2
300,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11½— 12	12	11⅝	— ¼	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102½—104½	..	..	+ ½	3 16 7
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾xd	10¼— 10¾	10⅝	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	12⅞— 13⅜xd	12⅞— 13⅜	13¼	13	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	27 — 28	25¾— 26¼ xd	26½	26¼	..	6 17 2
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	99 —101 xd	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	52¾	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	11/16— 13/16	23/32— 27/32	16/-	15/-	+ 1/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	13/16— 15/16	13/16— 15/16	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107½—109	108⅜	107	+ ½	5 10 1
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	119½—121½	122 —124	122½	119¾	+2½	4 16 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10 — 10¾	10 — 10¾	10⅛	..	..	5 11 7
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5½— 5¾	5 9/16	5 7/16	+ 1/16	4 6 11
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99 xd	97 — 99	..	..	..	3 12 2
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100½—102½	99 —101 xd	..	..	..	3 19 3
11,833l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98½—100½	98½—100½ xd	..	..	..	4 9 7
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 13/16— 7 1/16	6⅞— 7⅛	..	..	+ 1/16	5 12 8
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅞— 5¼xd	4⅞— 5¼	5 3/16	..	..	4 18 0
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100½—102½	99 —101 xd	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13⅜— 13⅞xd	13⅜— 13⅞	13⅝	13 7/16	..	5 0 0
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —102	100½—102½	..	..	..	3 18 1
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	11/3	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼— 8¾	8¼— 8¾	..	..	..	6 17 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	..
30,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102½—104½	100½—102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations June 29th.	Closing Quotations July 6th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9¼— 9½ xd	9¼— 9½	9⅜	9¼	..	5 5 3
260,007	Do. 6 % Cum, Prefs., 1 to 260,007 ..	5	5½%	5½%	5¾%	6 %	6 — 6¼ xd	6⅛— 6⅜	6 1/16	..	+ ⅛	4 16 0
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	91 — 92 xd	90½— 91½	91⅝	90¾	— ½	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	100 —102 xd	101 —103	..	..	+1	4 17 1
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 5/16— 4 7/16	4¼— 4⅜	87/6	85/7½	— 1/16	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1 — 1½	½— 1	..	..	— ½	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2¼— 2¾	1½— 2½	45/-	31/3	— ½	16 6 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	2¾— 3¼	..	..	— ⅝	8 0 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¼— 4¼	3 — 4	..	..	— ¼	5 0 0
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	94 — 99	..	..	—1	5 11 1
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	143 —147	142 —146	144¾	144⅛	— 1	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —124	121 —124	..	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —113	110 —113	111¾	110½	..	4 8 6
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	8 %	Nil	Nil	..	⅝— 1	½— ⅞	..	..	— ⅛	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2½— 3	2⅜— 2⅞	51/3	50/-	— ⅛	10 18 2
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	92 — 95	88 — 92	91	89	— 3½	5 8 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	68 — 72	..	..	..	6 5 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	7⅝	7 17/32	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜— 6¾	6⅜— 6¾	..	..	..	4 7 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106 xd	103 —106	..	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42 xd	38 — 42	38½	..	..	9 10 6
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 6
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31 xd	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜— 4¾	4⅜— 4¾	95/-	89/4½	..	6 6 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5 xd	4¾— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97½—100½ xd	97½—100½	..	..	..	4 9 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9⅝— 10⅛	9¾— 10¼	10	..	+ ⅛	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5½ xd	5⅛— 5½	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	103 —105 xd	103½—105½	105½	..	+ ½	4 5 4
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅞— 2	1⅞— 2	..	..	..	6 0 0
210,158	Do. do. 4½ % 1st Mort, Deb. Stock	100	4½%	4½%	4½%	..	102 —106	103 —106	..	..	+ ½	4 4 11
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	63 — 65	62 — 64	64	62	—1	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	83 — 85	85	84½	—1	4 14 2
551,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	47 — 49	45 — 47	46½	45½	—2	5 6 5
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅜%	1½%	81 — 82	80½— 81½	..	..	— ½	4 16 3
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	1 — 1¼	1 — 1¼	..	..	..	9 7 6
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	91½— 94½	..	..	—2½	5 5 10

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 22nd.	Closing Quotations July 6th.	Business done week ended July 6th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	23/9	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 1/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102 xd	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	¼ — ½	¼ — ½	..	..	..	15 0 0
17,189	Do. "A" shares, 01—017,189	5	4⅛%	4⅛%	2½%	..	1½ — 2½	1½ — 2½	..	..	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73 xd	70 — 75	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 7/16 — 1 11/16	1 7/16 — 1 11/16	30/7½	..	..	8 7 2
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛ — 7½xd	7⅛ — 7½	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103¼	102 —108	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅝ — 12⅜	11⅝ — 12⅜	12 3/16	12⅛	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 7/32	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104¼ —106½	105 —107	..	..	+ 9/16	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %		14½ — 15¼	14½ — 15¼	..	..	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	15/16 — 1	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	2 — 3	1½ — 2½	..	..	..	4 8 11
899,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	3½ — 4	3 — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1¾ — 2½	1½ — 2¼	42/6	39/4½	— ¼	15 5 7
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	64 — 78 xd	63 — 67 xd	65½	64¼	..	5 10 5
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	38½ — 39	39¾ — 40¼	40½	38⅛	+ 1¼	1 4 10
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	68 — 70	68 — 70	69	67¼	..	5 13 7
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¼ — 17¾	17¼ — 17¾	17⅝	17⅛	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝ — ¾	⅝ — ¾	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	1/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32 — 27/32	23/32 — 27/32	15/7½	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96½ — 98½xd	96½ — 98½	98¼	97½	..	4 11 5
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	121 —124	130 —133	134¼	122	+ 9	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	92 — 94	93½	90⅞	..	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	83 — 84½	33 — 34½	34 3/16	34	..	5 19 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	99 —101 xd	..	..	..	3 19 3
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101½ —102½	101½ —102½	102⅜	102	..	
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	89 — 91	87 — 89	88¼	87¾	— 2	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	37 — 39	37 — 39	37¼	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¾ — 3¼	2¾ — 3¼	..	..	..	7 7 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 78	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8¼ — 8¾	8 — 8½	..	..	— ¼	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅜	3⅞ — 4⅜	..	..	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛xd	3⅝ — 4⅛	98/9	..	..	5 9 1
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	98	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103 xd	100 —103	102½	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅝	11⅞ — 12⅝	..	..	..	4 14 1
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	119 —122 xd	120 —123	..	..	+ 1	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102 xd	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼ — 3¾	3¼ — 3¾	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½xd	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅛ — 8⅝	8⅛ — 8⅝	8⅛	..	..	5 14 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11	10 29/32	..	5 6 8
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107 xd	104 —107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	14/-	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	85½ — 88½xd	85½ — 88½	..	..	..	5 13 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	100 —101	97½ —100½	98½	98⅜	— 1½	4 19 6
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅞ — 7⅜	6⅛ — 7⅜	7 3/16	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 19 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	5 11 8
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	90 — 94	92 — 96	94¾	94	+ 2	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅝ — 4¾	4¼ — 4⅝	87/6	86/3	— ⅛	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5 xd	4⅝ — 5	95/-	..	..	4 10 0
285,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108 xd	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½xd	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83 — 85	82½ — 84 xd	84½	81½	..	6 1 11
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	67 — 70	67 — 70	71	67	..	5 0 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	100 —104	106 —110	107½	102	+ 6	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85½ — 87½	82½ — 89½	89½	80¼	— ½	5 11 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	92 — 96 xd	..	..	..	4 18 9
180,491	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4¾ — 5¼	4¾ — 5¼	..	..	..	2 7 8
137,000	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 15 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½ — 12½	11½ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅜ — 1½	1⅜ — 1½	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/32 — 1 5/32	1 1/32 — 1 5/32	21/-	..	..	5 15 8
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105 xd	102 —105	103¾	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	8⅞	8¾	..	6 13 4
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	7 5/32	..	..	4 13 4
150,000l	Do. do. 8½ % Deb. Stock Red.	100	8 %	8½%	8½%	8½%	84 — 88 xd	84 — 88	87	86⅝	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2¾ — 3⅛	2¾ — 3⅛	60/7½	..	..	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100—103	..	..	— 1/16	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅝ — 1	½ — 1	..	..	— ⅛	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅞ — 2⅜	1¾ — 2¼	38/9	..	..	11 2 2
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	8	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	25/32 — 27/32	25/32 — 27/32	16/9	..	..	5 19 5
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8¾ — 9⅜	8¾ — 9¼	8⅞	..	— ⅛	5 8 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅛ — 5½	5 — 5⅜	..	..	— ⅛	4 3 9

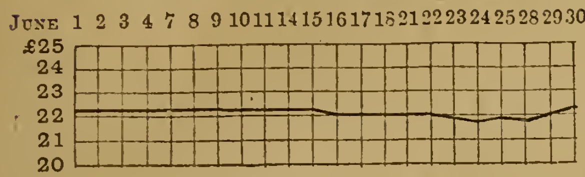
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

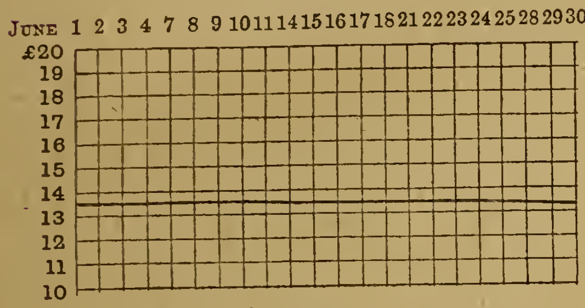
METAL MARKET.

Fluctuations in June.

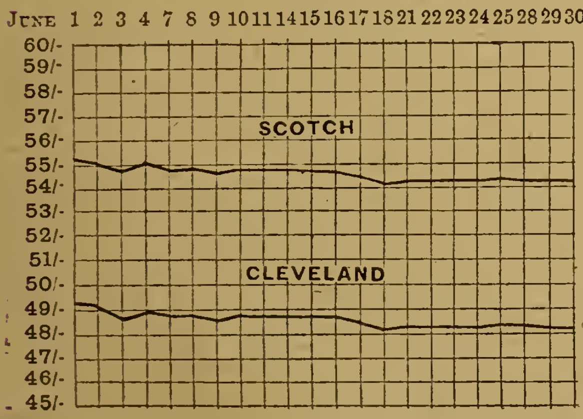
SPELTER (G.O.B's.).



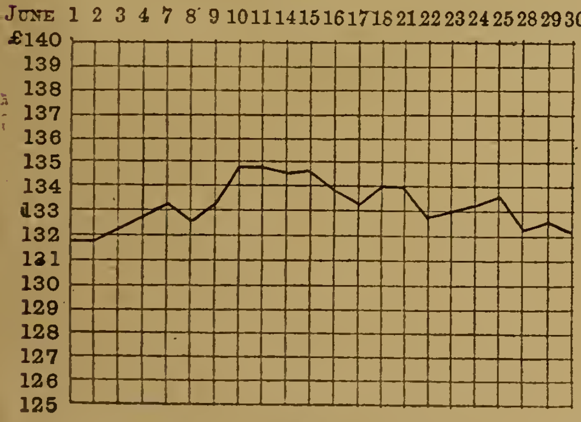
LEAD (ENGLISH).



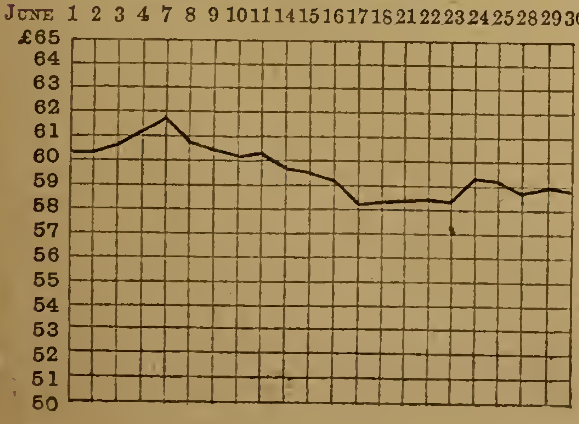
IRON.



TIN.



COPPER (G.M.B's.).



NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Metaflect" Metallic-Filament Lamps.

Mr. S. Horvath, of 51, Standen Road, Southfields, S.W., has designed and patented a new pattern of metallic-filament lamp, which is illustrated in fig. 1; as shown, it consists of a lamp of tubular shape, introduced into a flattened bulb; the cap of the lamp is of special form, provided with ventilating holes, and with three small screws which hold the outer bulb in position. The back of the outer bulb is silvered in such a way that it cannot oxidise or tarnish, and therefore retains its reflecting powers permanently. The effect of the reflector is, of course, to concentrate the light of the lamp in a particular direction; the distribution obtained is shown by the curves, fig. 2, supplied by the National Physical Laboratory, which give the horizontal candle-power over a range of 180°. The N.P.L. Report states that a lamp tested, at 25 volts, gave a horizontal candle-power of 18·8 c.p. without reflector, taking 1 watt per candle; when the reflector was used, the candle-power at the centre of the reflected beam was 97 c.p., the light being concentrated in an approximately parallel beam. The lamps are made for 25 and 50 volts, and are mounted on a flexible nickel-plated conduit tube; with eight lamps, spaced 8 in. apart, the whole system is equivalent to a single high-voltage lamp, with the difference that the "Metaflect" is divided over a long range, and is thus suitable for fixing on the frame of a

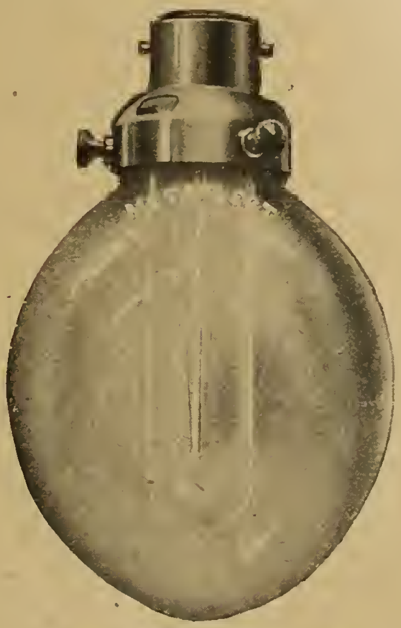


Fig. 1.—"Metaflect" Metallic-Filament Lamp.

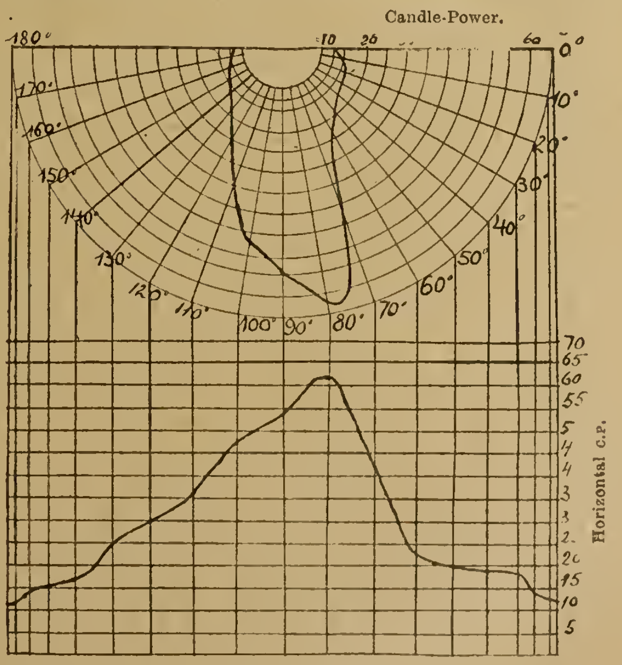


Fig. 2.—Curves of Distribution of Candle-Power (N.P.L).

shop-window, for example, concentrating the light on the contents of the window without casting glare into the eyes of spectators. We have tried one of these sets of four 50-volt lamps in series, and can vouch for the brilliancy of the concentrated illumination. The lamps are of British manufacture throughout. Messrs. Krupka and Jacoby have undertaken the sole sale agency for the United Kingdom.

The Pitman Hydraulic Governor.

The accompanying illustrations show the construction and mode of working of an hydraulic relay governor for Pelton wheels, made by Mr. P. Pitman, of 3, Willcott Road, Acton, W., the maker also of the Pelton wheel, which is to work under a head of 120 ft., generating 80 b.h.p. The nozzles are fixed, and regulation is effected by deflecting part of each jet clear of the wheel. The deflectors are coupled together and to the cross-head of the relay shown at the right hand of the figure. The relay is controlled by a fly-ball governor G, fig. 4, which actuates the small piston valve E, controlling the admission of water to the cylinder. High-pressure water from the pipe-line is admitted to the valve-chest F at A, and is exhausted at B; C and D are ports connected to the ends of the cylinder, in such a way that when the governor balls move apart the pressure water is admitted to the right-hand end of the cylinder, bringing the deflectors into action. At normal speed the water is shut off the cylinder. Changes in speed can be adjusted by means of the screwed link H and lock-nut I. The inventor states that the governor is capable of controlling the speed within 3 per cent. of the normal.

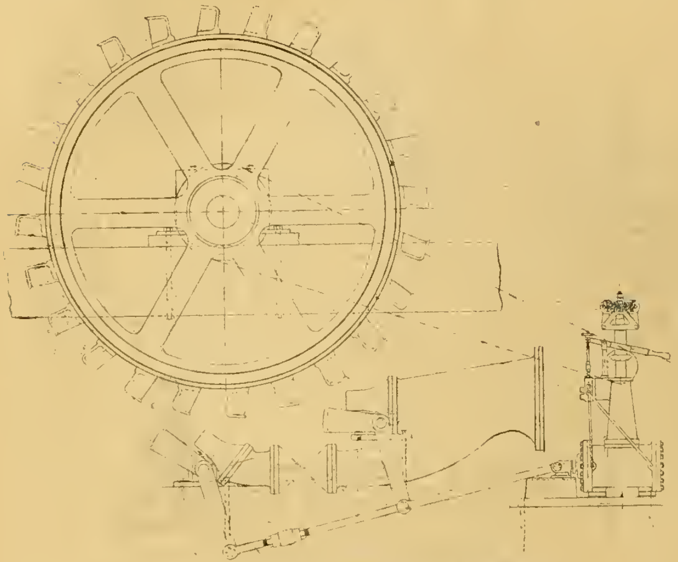


Fig. 3.—Pelton Wheel and Governor.

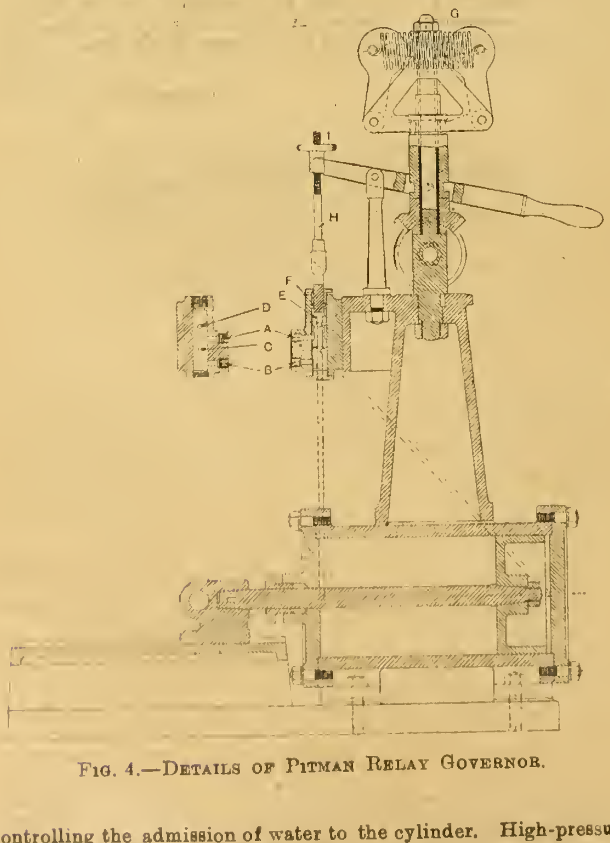


Fig. 4.—Details of Pitman Relay Governor.

New Weston Instruments.

We recently inspected a large number of new a.c. switchboard instruments which have just been brought out by the Weston Electrical Instrument Co., of Audrey House, Ely Place, Holborn, E.C., and of which examples are shown herewith (figs. 5 and 6). Up to the present the Weston Co., whose d.c. switchboard instruments are as well known as they are highly esteemed, have refrained from supplying a corresponding series of a.c. meters, owing to the difficulties that had to be overcome before an equally high standard could be attained. Now, however, after many years' experimental investigation, they are satisfied that they have arrived at a design which is worthy of their reputation. The switchboard instruments, as shown in fig. 5, are exactly similar to the d.c. type, being finished in black and nickel; they are moving-iron instruments, and the following bold claims are made on their behalf:—There is no inductance error throughout the whole range of frequencies met with in ordinary engineering practice; their indications are the same whether left in circuit for a minute or permanently; there is no appreciable error due to changes in the temperature of the room; they are entirely dead-beat; and the scale, over all but the first fifth of its length, is almost uniform. Other errors usually met with have also been rendered negligible. For the dead-beat characteristic, the extraordinary freedom from friction of these instruments, and the remarkable uniformity of the scales we can vouch. Naturally we have not put them through their paces in other respects, but if, as we do not doubt, they are as

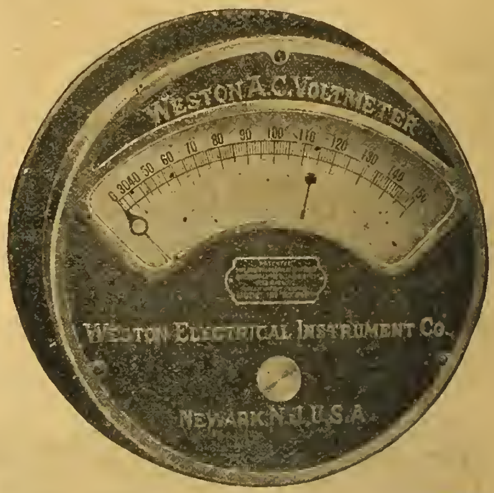


Fig. 5.—Weston A.C. Switchboard Voltmeter.

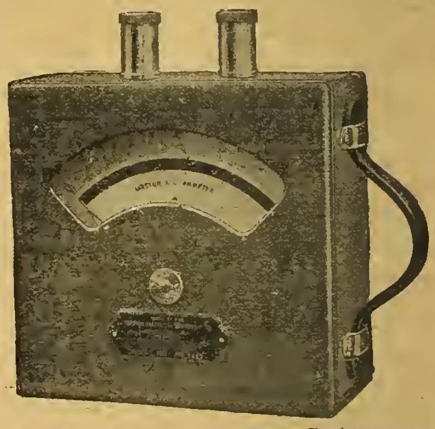


Fig. 6.—Weston Portable A.C. Ammeter.

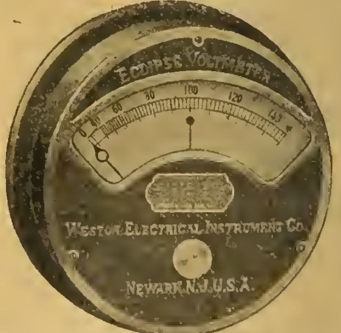


Fig. 7.—Weston D.C. Switchboard Voltmeter, "Eclipse" Pattern.

nearly perfect in their other features as in those that we could verify, the most fastidious critic need have no hesitation in accepting the makers' claims as fully justified. It may not be generally known that even in the D.O. instruments, the scales of which are so nearly uniform that they appear to be printed, every one is calibrated throughout its range, and the scale is drawn by hand and checked to prove its accuracy before the instrument is passed. Fig. 5 shows the A.C. switchboard voltmeter; ammeters of similar pattern are made, and both in two sizes, 9½ and 7¼ in. diameter, for a large variety of ranges. All the meters are highly insulated, and the ammeters are tested with 4,600 volts, for use direct on circuits up to 2,300 volts. The case is provided with an earthing terminal for use when the voltage exceeds 200 volts. For higher pressures and currents above 500 amperes transformers are required.

There is also a complete range of portable instruments of equal merit, of which fig. 6 is an example.

The third illustration, fig. 7, shows one of a new series of Weston D.C. switchboard instruments of the moving-iron type, which is being introduced under the name of the "Eclipse" instruments. These, it is claimed, are inferior only to the Weston moving-coil meters, and are, of course, less costly. They are dead-beat, extremely sensitive, and practically free from hysteresis error, and they are made in the two standard sizes above mentioned.

The "Foster" Automatic Transformer Switch.

The demand for an automatic switch for use with auto-transformers has led the Foster Arc Lamp and Engineering Co., Ltd., Worple Road, Wimbledon, to place on the market the device illustrated in fig. 8. This switch is fully automatic—*i.e.*, no battery is necessary—and it cuts the transformer in with the current taken by one 10-C.P. metallic-filament lamp.

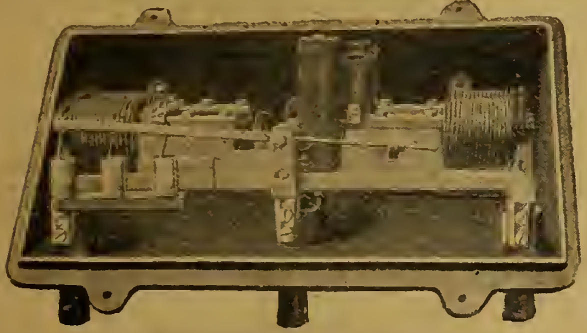


Fig. 8.—Foster Automatic Switch.

The "Popular" Electric Oven.

As recently mentioned, the "Le Radiant" oven of Mr. C. Fonteyn, of 76, Newman Street, W., described in our issue of June 18th, is not the type that is made for the English market; the dimensions of this oven are such that it would be impossible to cook a large joint in it, and further, the lamps are fixed on the top only, whereas it is essential to have lamps at the sides. The actual pattern of oven supplied in this country is called the "Popular" type, 1909 model, and is illustrated in fig. 9; it measures nearly 18 in. each way, and has an internal cooking space of 9½ × 10 × 14½ in., with 7-in. boiling openings on the top. When fully alight the consumption is 1,800 watts; regulation is effected by means of one single and two two-way switches. The stove is of cast-iron, enamelled inside and out; removable nickel-plated reflectors and protected heating tubes are fitted inside. There are eight heating tubes, three on each side and two at the top; there is also a pair of heating tubes under a sheet of iron at the bottom of the oven, which is only used for grilling or baking pastry. Toasting can be done over the heating tubes at the top of the oven. The tubes are stated to have a life of 1,000 hours; they consist of resisting filaments enclosed in glass tubes. The oven is capable of taking in a 10-lb. joint.

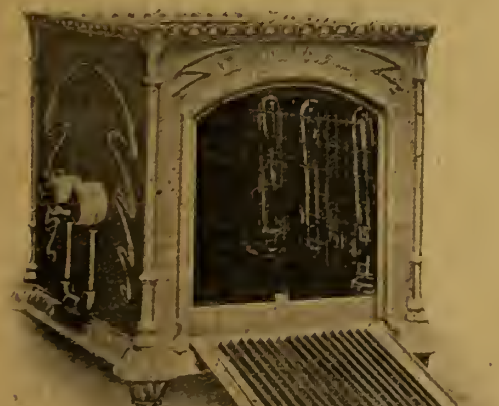


Fig. 9.—"Popular" Electric Oven.

The "Quartz" System of Electric Heating.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., are introducing an entirely new type of electric radiator, under the Bastian patents, which presents several interesting features. The illustration, fig. 10, shows the radiator, type A, as designed for offices, ships' cabins, &c. It consists of a light frame fitted with six horizontal quartz tubes or glowers, each of which contains a spiral of nickel resistance wire, the whole being covered with a brass wire network. The weight of the apparatus is trifling. Within 15 seconds of switching on, the six glowers are brought to a bright red heat, presenting a very cheerful appearance, and distributing warmth both by radiation and by convection. The essential feature of the invention is the use of the quartz tubes, which can withstand the high temperature. The tubes are open at the ends, and should a wire spiral burn out, it can be replaced by the user himself at the cost of a few pence; but the construction of the spiral of pure nickel, of which the oxidisation is extremely small, ensures for it a very long life—a minimum of 1,000 hours is claimed. One of the heating elements is shown separately in fig. 12, with the wire spiral; the element, when wired, is slipped into spring clips secured to the frame. The radiator illustrated takes ·75 KW., and measures 14 in. in length; it can be supplied for a consumption of 1 KW. The device is extremely light, compact, and portable, besides being inexpensive in first cost, with specially favourable terms to the trade. As regards efficiency, the makers claim that its radiating powers "are practically 50 per cent. above any other article on the market," thanks to the very high temperature of the heating elements.

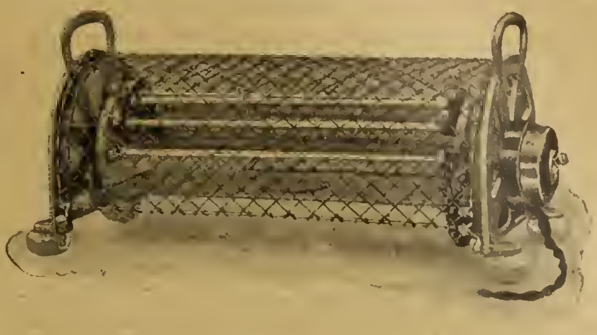


Fig. 10.—The "Quartz" Radiator.

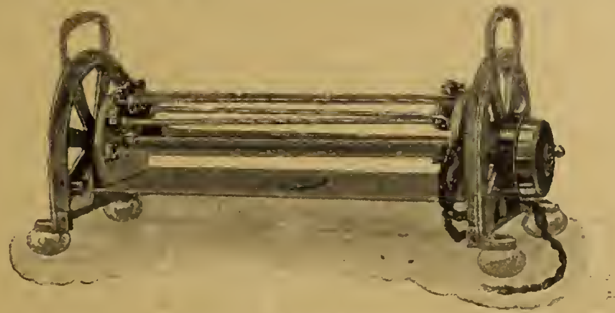


Fig. 11.—"Quartz" Radiator with Cover removed.

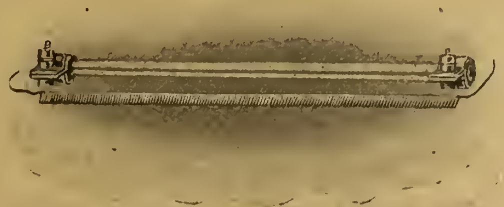


Fig. 12.—Heating Element.

This radiator is only the first of a series of heating and cooking apparatus on the same principle, which the makers hope to put on the market at prices that will place electric heating and cooking on a more commercial basis than has hitherto been possible.

Maximum-Power-Demand Indicator.

Referring to our notice of a new M.P.D. indicator last week, Messrs. The Reason Manufacturing Co., Ltd., Lewes Road, Brighton, take exception to the statement that "hitherto the instruments used for this purpose [that is, measuring the maximum number of kilowatts taken] have only registered the maximum current taken, which, in the case of A.C. circuits, gives no indication of the actual power demanded," which they consider is calculated to give the reader an entirely wrong impression of the true state of progress as regards the accurate measurement of the maximum demand of power circuits at the present time. For some years past they have been manufacturing the demand indicator attachment invented by Mr. Merz, which exactly fulfils the conditions mentioned in the article referred to. We regret that in our notice we inadvertently overlooked the existence of the Merz demand indicator.

A New E.A.C. Ampere-hour Meter.

The Electrical Apparatus Co., Ltd., of Milford Works, Queen's Road, Battersea, S.W., have brought out an ampere-hour meter which embodies several novel features, while its construction is of exceptional simplicity, so that it is inexpensive both in first cost and in maintenance. As shown in the illustration, fig. 13, with the cover removed, it consists mainly of a disk revolving between the poles of two permanent magnets, with registering mechanism of the spring-dial type. The ordinary pattern of the E.A.C. meter was described and illustrated in our issue of February 1st, 1907. The essential feature of its design is the reduction of the armature to the form of a flat disk and its combination with the brake disk, so that the driving torque and the braking torque are both produced by the same magnets. The armature winding consists of three circular former-wound coils, connected with a three-part commutator of the smallest possible diameter, as shown in fig. 15. The coils, of 100 turns each, rest upon an aluminium disk, with the outer edge spun up to stiffen it. In the latest (1909) pattern a second aluminium disk is laid upon the top of the armature winding, as in fig. 14, covering the latter and improving the mechanical qualities of the device, with the additional advantage that as the braking effect is thus doubled, the meter runs at half the usual speed without reducing the driving torque.

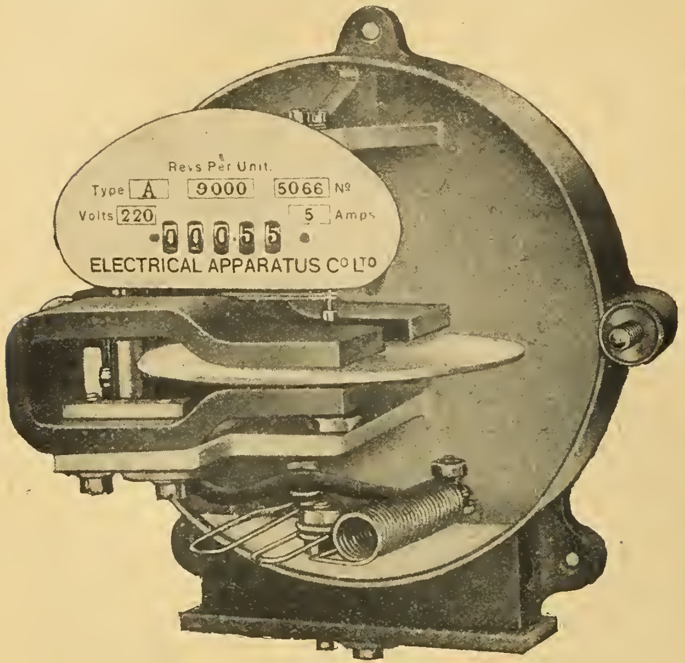


Fig. 13.—E.A.C. $1\frac{1}{2}$-Ampere Meter (Cover Removed).

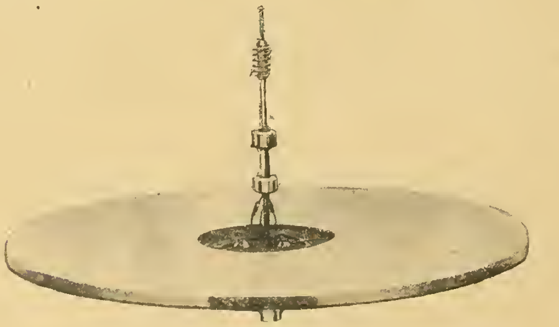


Fig. 14.—Moving Element of E.A.C. Meter.

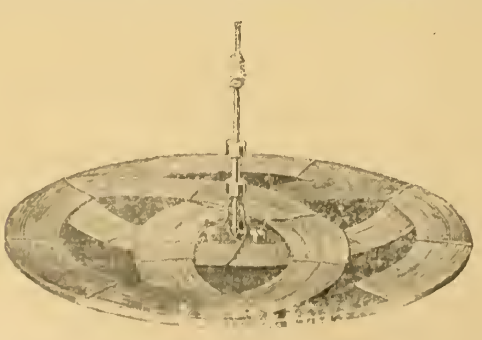


Fig. 15.—Old Form of Moving Element, Showing the Armature Winding.

Each of the brushes has two knife-edges, which make contact with the commutator, the object of the sharp edges being to secure certainty of contact by giving a comparatively high pressure per unit of bearing surface, while the total pressure on the commutator is very small. This prevents error or stoppage due to the intrusion of dust between the contact surfaces, and oxidisation is also obviated by the use of gold for the segments and brushes. The magnets are of high-grade steel, thoroughly aged, but as both armature and brake revolve in the same field, slight variations in the field strength would have no effect on the accuracy of the meter. The moving element weighs about 1 oz., and runs on a sapphire jewel bearing. Mica alone is used for insulating purposes. The shunt consists of an alloy with an extremely low temperature coefficient.

The meter illustrated has a rated capacity of $1\frac{1}{2}$ amperes, equal to the consumption of ten 30-watt metallic-filament lamps at 200 volts; it has a high torque with low starting current, and is claimed to have a permanent accuracy at all loads from full load to half the current taken by the smallest metallic-filament lamp, while it is guaranteed for a period of three years to maintain its accuracy within $2\frac{1}{2}$ per cent. The meter has been specially designed for use on small installations of metallic-filament lamps, for which purpose its remarkably low price renders it particularly suitable; it is enclosed in a strong cast-iron dust and moisture-proof case, and is of British manufacture throughout.

"Eclipse" Fittings for Metallic-Filament Lighting.

We show in fig. 16 a new fitting which is being sold by Mr. G. Braulik, of 8, Lambeth Hill, E.C., for indirect lighting with metallic-filament lamps. It is known as the "Eclipse," and No. 304 fitting, which we illustrate, has an enamelled reflector for lamps of 200 to 400 c.p. Another similar fitting is for from two to seven lights. Both of the foregoing are furnished without reflectors if desired. In the list recently issued by the firm a note of prices with and without reflectors is given.

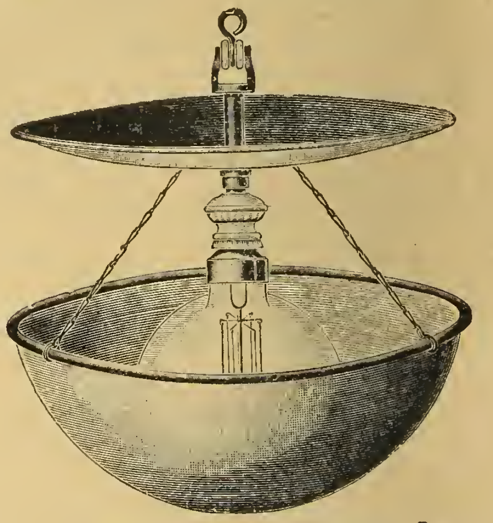


Fig. 16.—"Eclipse" Fitting for Indirect Lighting.

The C.M.B. Patent Auto-Converter.

The want of a simple and convenient means of reducing the voltage on a d.c. circuit without loss of efficiency has long been sorely felt; in this respect the a.c. system has always had a great advantage over its rival. Consumers of electricity for lighting on d.c. supply systems especially have vainly wished for a device that would enable them to use small metallic-filament lamps, though we have our doubts as to whether the supply authorities have seen eye to eye with them in this respect. However, it is impossible to stem the tide of scientific progress, and, as usual, the demand has quickly led to the evolution of the desired d.c. auto-converter. It is made by Messrs. Crompton & Co., Ltd, of Chelmsford, being the invention of two of their staff—Messrs. MacFarlane and Burge who, it will be remembered, read an important paper on dynamo design before the Institution of Electrical Engineers last session.

The general appearance of the machine is shown in fig. 17; it consists in essence of two field-magnet systems, separated on the median plane by an air-space, and a single armature of the ring-wound type, with four brushes. There are two poles in each magnet system; those at the top are excited from the mains, to which the top and bottom brushes are also connected, so that the machine runs as a shunt motor; those at the bottom belong to the secondary or derived circuit, which is taken from the bottom brush and the two side brushes, the connections being strictly analogous to those of the a.c. auto-transformer. The excitation of the bottom field-magnet system is arranged in various ways, depending upon the purpose to which the machine is to be applied. In general there are three windings: a permanent shunt across the primary mains, a winding in shunt across the secondary terminals, and a main winding in series with the secondary circuit. For feeding, say, an arc lamp with constant current, the series winding opposes the shunt, giving a remarkably constant current, so that even a short circuit may be maintained across the secondary terminals for any length of time without injury to the machine. For feeding metallic-filament lamps, on the other hand, the series winding assists the shunt, giving constant pressure in the secondary circuit.

The machine is remarkably compact and efficient, and can be made for any ratio of primary to secondary voltage between the limits of 2 : 1 and 5 : 1. With a 2 : 1 ratio, the machine becomes symmetrical and is then admirably adapted for service as a three-wire balancer, with an efficiency stated as no less than 94 per cent. even in small sizes. With other ratios the machine can be used for supplying arc lamps for search-lights, kinematograph lanterns, &c.; metallic-filament lamps; electrolytic baths; electric welding, &c. A very important application of the system is to electric motive power, for driving cabs, 'buses, tramcars, printing presses, and so on—even colliery winding and rolling-mill driving being claimed as within its scope. In such connection it acts on the Ward-Leonard principle; for instance, on an electric 'bus fitted up by Messrs. Crompton, which has recently run 60 miles on one charge, the auto-converter is employed as an intermediary between the battery and the motors, without increase in weight over the ordinary equipment—for all starting resistances are done away with, and the controller is reduced to a field-controlling device of insignificant dimensions, operated by a pedal. With this equipment any speed from a crawl to full speed, ahead or astern, can be obtained with the greatest ease, and a powerful regenerative effect is produced during braking.

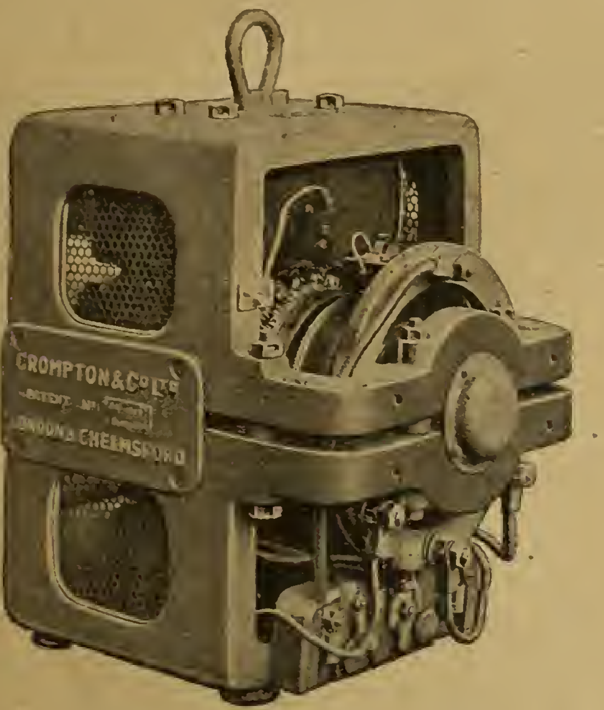


Fig. 17.—The C.M.B. Auto-Converter.

The auto-converter is provided with ball bearings, which, once fitted, need no further attention, so that it can be placed in any dry situation and simply switched on and off like an A.C. auto-transformer. It is made in sizes ranging from 1 KW. upwards; the efficiency at full load of the smallest size, with a ratio of 5 : 1, converting from 250 to 50 volts, is given as 72 per cent., and at half load 65 per cent.—remarkably high values for so small a machine. Auto-converters for ratios up to 10 : 1 can be made, but are less efficient. For a 30-KW. machine, with a ratio of 5 : 1, the efficiency claimed is 92 per cent. at full load and 88 per cent. at half load.

Extreme pressure on our space forbids more detailed reference to this machine at the moment, but in view of its importance we shall return to the matter in a later issue.

Electric Cooking by Silundum: The "White City" Exhibit.

In their exceedingly attractive "Electric Home," situate in the grounds at the White City, the most important thing to be seen from an electrical point of view is the exhibit of "Silundum" cooking and heating apparatus in the kitchen department. Our visit to this year's exhibition does not incline us to break forth into song regarding its wonderful attractions, for we are far from being impressed by them, though there is no doubt whatever that, given fine weather, a very pleasant evening may be passed in the grounds, for the latter are the better for this being their second season. Any of our readers who may find their way there during the next month or two must make a point of seeing this "Electric Home" in the Elite Gardens, if only to see the "Silundum" cooking demonstration. The "Home" is most artistic and effective in the arrangements and furnishings of its different apartments, and if it does not catch the fancy of the public, and leave a very good impression of everything electrical upon their mind, it will not be a Simplex fault, for from start to finish the collection of home appliances is designed for popular purposes, and in our opinion it is bound to do the general cause of electricity good, and get the word "Simplex" engraven upon the memory of thousands who never before heard of it in electrical connections.

The exterior of the building combines coloured tiles and rough cast work, presenting a strong contrast to the whiteness of the surrounding buildings.

The internal arrangement of the building has been carried out with a view to average requirements only, and complicated and expensive arrangements have been avoided.

The "Home" has five rooms, comprising a large showroom, in which visitors may examine the various classes of electrical apparatus, for the dining room, drawing room, bedroom, and kitchen. The showroom contains a representative display of electric lighting, cooking and heating apparatus, and so on, at various prices, in addition to other manufactures of the company, such as conduits, wires, cables, accessories and distribution boards which are prominently displayed on specially designed show-boards. Into all the details in the different apartments it is not necessary to enter here.

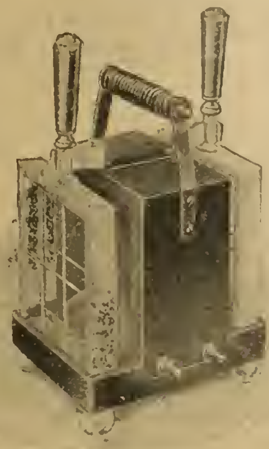


Fig. 18.—Silundum Toaster.

As our readers are aware, the new material Silundum is a compound manufactured in an electric furnace, consisting principally of the carbides of silicon and boron subjected to a temperature of 200° C. The specific resistance of Silundum is approximately three times that of carbon, and it possesses a small positive temperature coefficient of resistance. It can be adapted for almost any voltage, but the standard pressures are at present limited to those between 100 and 250 volts. The nature of the compound renders it admirably suited for the use to which it is put in connection with electric cooking, it being entirely unaffected by acids or alkalies; and water and grease spilt over the elements themselves, even when on circuit, have no effect whatever. A temperature of 3,000° F. can be reached in open air without oxidisation or any chemical or visible change. The material is, however, when made in rods—in which form it is adapted to electric cooking—brittle; but to guard against accidental damage, in every case the elements are efficiently protected by a cast-iron grid. It has the further advantage of being unaffected by being left on circuit for any period of time. The advantage of this Silundum apparatus as against wire resistance coils will be at once apparent, as the latter cannot be run at temperatures sufficiently high to admit of toasting or grilling, and other operations requiring incandescent heat.

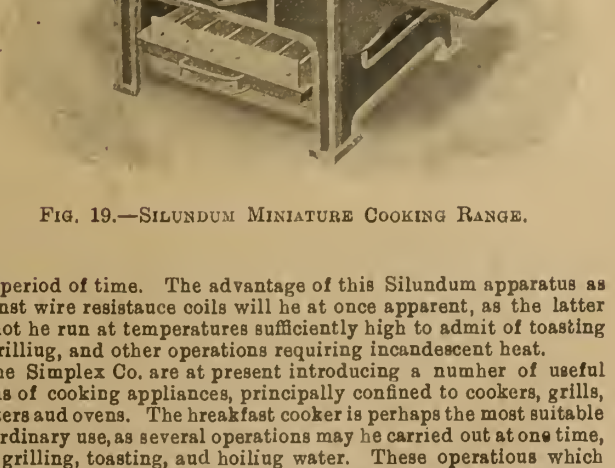


Fig. 19.—Silundum Miniature Cooking Range.

The Simplex Co. are at present introducing a number of useful forms of cooking appliances, principally confined to cookers, grills, toasters and ovens. The breakfast cooker is perhaps the most suitable for ordinary use, as several operations may be carried out at one time, viz., grilling, toasting, and boiling water. These operations which are entailed in the cooking of a complete meal can be accomplished, we are told, in under 20 minutes, and as the full load of the apparatus is only 1,000 watts, the cost of the energy required is exceedingly low. In the small class of apparatus facilities for heat regulation are not provided, but in the case of ovens, one-third, two-thirds, and full heat are allowed for in the course of ordinary cooking operations. The working temperature is about 2,000° F., in which case the silundum rods assume a cherry red appearance. We understand that extensive plant is being laid down for the manufacture of this class of apparatus, for which an exceedingly large demand is anticipated in the near future. Demonstrations of this system are held daily at Simplex Co.'s exhibit at the White City.

The "Silundum" apparatus for electric cooking by incandescent heat is being manufactured by the British Prometheus Co., Ltd., of Salop Street Works, Highgate, Birmingham, and from the catalogue recently issued by them we select two typical examples for illustration. Fig. 18 is the No. 5,000 toaster, with removable and reversible holders. Its dimensions are 5½ in. × 7½ in. × 11½ in., and it has an area of toasting surface 6 in. × 5 in. Fig. 19 illustrates a miniature cooking-range specially useful for breakfast purposes, with side pieces or wings, and polished copper kettle.

UNDERGROUND CONDUIT CONSTRUCTION.*

By S. B. WAY.

Upwards of 170,000 duct-ft. of all-concrete or monolithic conduit has been laid in St. Louis within the last three years; fulfilling every requirement for all uses, from single-duct runs with frequent junction or service boxes, to replace Edison tube, to heavy isolated runs for high-tension cable.

The ideal conduit, or housing, for underground conductors must have smooth, clear, jointless, fireproof duct openings, free from pockets or depressions in which water may lodge; should be laid to true grade to drain to manholes; must be constructed of a material of high electrical resistance, which will be homogeneous and will not deteriorate with age; must be strong and able to sustain itself and a considerable load over fairly long spans, and must be cheap.

It has been found that all-concrete or monolithic conduit possesses many advantages over a conduit built up of pipes of whatever nature, in that with such construction the structure becomes homogeneous; occupies less space for a given number of ducts of equal size; permits perfect inspection of each duct from end to end incidentally to the laying of each tier; provides smooth, straight, clear, jointless and fireproof duct openings from manhole to manhole; eliminates handling, fitting, breakage and cost of pipe; requires no factory, and but few and simple special tools; and for average duct sections uses no more material (concrete) than is required for the armour or envelope of pipe construction. The amount of concrete per duct-foot required for various duct sections for multiple-duct tile and for monolithic conduit, and the cost per duct-foot of completed work, exclusive of trenching, refilling and repaving, are shown by curves in figs. 1 and 5. These curves were plotted from results obtained in actually laying a considerable quantity of each type of conduit, under the same supervision and by the same men. The multiple-duct tile was laid with a 3-in. armour of concrete and with the interstices between the tiles filled with fine concrete, while the monolithic conduit was provided with 2½ in. of concrete between the ducts and the bottom and sides of the trench, with a cover or top 3 in. thick. The items of trenching, refilling and repaving are nearly constant for each type of conduit, except a small differential of about ½d. per duct-foot in favour of monolithic conduit due to the smaller trench and consequent reduced excavation and hauling of displaced earth required by the monolithic construction. Typical cross-sections of multiple-duct earthenware and monolithic conduit are shown in fig. 2.

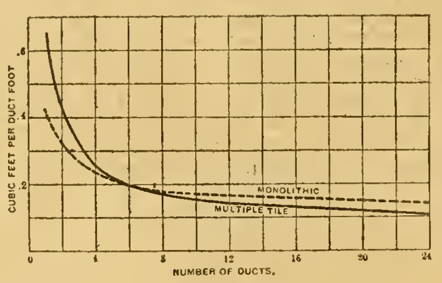


Fig. 1.—Concrete Required per Duct-foot.

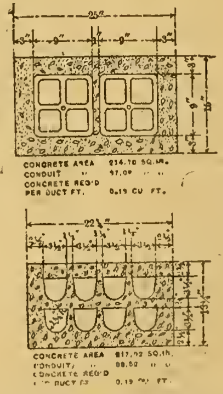

25"
3"
9"
1"
9"
3"
3"
9"
15"
3"
CONCRETE AREA 214.70 SQ.IN.
CONDUIT " 97.0? " "
CONCRETE REQ'D PER DUCT FT. 0.19 CU. FT.
22½"
2½"
3½"
1½"
3½"
1½"
3½"
1½"
3½"
2½"
3½"
3½"
2½"
13½"
CONCRETE AREA 217.92 SQ.IN.
CONDUIT " 88.52 " "
CONCRETE REQ'D PER DUCT FT. 0.19 CU. FT.

Fig. 2.—Comparison of Earthenware and Monolithic Conduit.

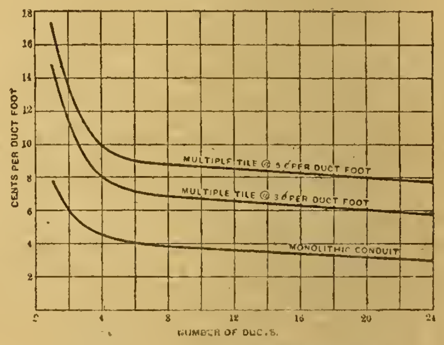


Fig. 5.—Duct Construction Costs.

The construction of monolithic conduit involves only the comparatively simple methods of good concrete work. After a trench of suitable width and depth has been excavated, duct-form supports are set to grade and perfect alignment on 16-ft. centres in the bottom of the trench. These duct-form supports serve to hold the forms or moulds for producing the duct openings rigidly in place and in true alignment while the concrete is worked into place in the bottom of the trench. The duct forms or moulds consist of 16-ft. sections of clear, straight-grained timber, previously dressed to the shape of a U, and are held down in the duct-form supports against the buoyancy of the plastic concrete by suitable cast-iron or other weights. When the duct forms are set, concrete of the proper mixture for good work is dumped into the trench, rammed and puddled around the forms, and finally struck off level with the tops of the moulds. The concrete is then allowed to take its initial set, which in favourable weather requires about three hours, when the duct forms may be removed by simply lifting them upwards and out of the concrete, leaving smooth, straight, continuous U-shaped grooves. Fig. 3 shows the trench with forms set ready for the concrete to be dumped in.

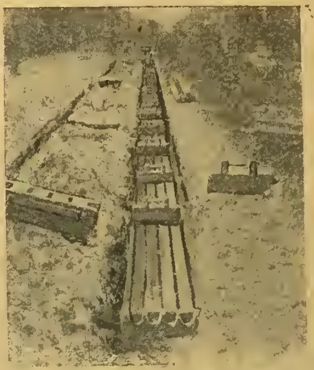


Fig. 3.—Trenches with Forms Ready for Concrete.

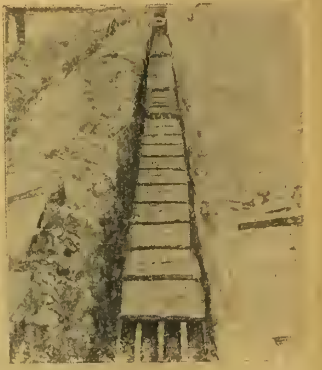


Fig. 4.—Open-Top Ducts with Concrete Covers.

After the duct forms are removed, the grooves are open to the daylight for the full length of the construction, and every possible facility is afforded for perfect and rapid inspection. Any faults in the work may be instantly detected, and this in itself is a potent factor in securing first-class work.

The ducts are closed in by laying across the top of the structure thin, smooth plates, or slabs, of concrete moulded on the site of the work. These slabs are made of just sufficient width to lap over each outside duct a short distance, and are laid as illustrated in fig. 4, with a small quantity of mortar to seal the joints. They serve the double purpose of closing in the top of the ducts and of providing a support for the next layer of concrete, in which an additional tier of ducts may be formed in the same manner as the preceding tier, this operation being repeated as often as necessary to produce the required number of duct openings. The top of the conduit is closed in in the same manner, with the exception that the top layer of concrete contains no duct forms and acts simply as an armour to protect the conduit construction from future excavators.

In addition to its lower first cost and other important advantages, monolithic conduit is especially well adapted for use as a conduit for local distribution. "Blind" handholes, or service boxes, are readily moulded in the concrete structure, intercepting any desired number of ducts. In moulding these handholes or service boxes, the duct forms are allowed to pass through, and the concrete flowing around the duct forms is stopped off by suitable forms arranged to fit closely around the duct moulds. Such handholes or service boxes can be installed at as frequent intervals as desired without increasing the cost of the construction, inasmuch as no additional material is required. The top of the handhole or service box is closed in after the conduit is finished by a suitable cast-iron or concrete cover, made loose so as to be removed readily in case it is desired to open the box for taking off services. Monolithic conduit has been laid under a great variety of street conditions, and during all seasons of the year, with perfect success, and with a material saving in cost over the various pipe methods of duct construction.

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* Abstract of an article published in the *Electrical World*, N.Y., June 17th, 1909.

PROCEEDINGS OF INSTITUTIONS.

The Radio-Telegraphic Station at Cullercoats.

By Aage S. M. Sorensen.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Newcastle, May 24th*, 1909.)

The building of the Cullercoats radio-telegraphic station was started in February, 1906, and the mast and house were completed about June, 1906.

The mast is a lattice-built pole which was completely constructed to its full length lying on the ground. After fixing the upper ends of the guys to the mast, it was lifted bodily into position by means of a derrick crane.

The mast serves to support the antennæ, which originally took the form of an inverted fan, consisting of eight wires connected at the top and about 60 ft. from the ground, spread at equal distances between two smaller masts, 150 ft. apart. The wires were connected to the inlet insulators on the roof, four wires meeting at each of the two inlets.

The present antennæ are made in the umbrella shape. Eight wires are suspended between the top of the pole and eight iron posts, arranged on the rocks and on land at nearly equal distances apart, in a circle round the pole. The upper 160 ft. of each wire forms part of the antennæ, and is separated by a long insulator of hard rubber from the rest of the wire, which only serves as a stay.

The lower ends of the eight antennæ wires are connected by an octagonal boundary wire.

At the top of the mast four wires come together on each side, and are there joined to two copper cables which run down to the leading-in insulators on the roof. The two half parts are suspended from the top of the mast by means of a series of porcelain insulators, and similar insulators are used to cut the guys into short lengths. The insulators are constructed so that the wires are looped into each other through the insulators, and in case an insulator breaks the wires will remain in position. The antennæ are made of seven-stranded silicium-bronze wire, No. 20 gauge.

The earth connection consists of 70 copper wires of about 2 mm. diameter, laid about 6 in. under the surface, and spreading from the centre of the cabin in all directions like spokes in a wheel. The average length of the earth wires is 130 ft.

The engine room contains a motor-generator and the necessary regulating apparatus. The town supply at 480 volts is used. The alternator gives 90 to 120 cycles, according to the speed, and, by field regulation, the voltage can be altered from 300 to 600 volts. To protect the dynamo from high-frequency induction, the cables pass through choking coils with spark arresters before they enter the operating room, where the telegraph key and a variable reactance are inserted in the circuit, which is completed in the spark-room, through the primary winding of a transformer. The secondary of the transformer is connected to the spark-gap, across which is shunted a battery of Leyden jars and a self-induction helix, forming the closed oscillatory circuit; the antennæ and the earth connections are taken off from two points of the same helix, thus forming a so-called galvanic or direct coupling. As the fundamental wave-length of the antennæ (*i.e.*, the wave-length obtained when the antennæ are connected direct to earth through the spark-gap) is 800 metres, and the normal working wave is 600 metres, the antennæ are "shortened" by an inserted small battery of Leyden jars. Over these jars the antennæ are "interrupted" by an anchor spark-gap, which ordinarily leaves the antennæ disconnected from the sender, but during sending is bridged across by a spark.

A branch of the antennæ comes into the operating room to a switch, by which it can be joined through a self-inductance and a condenser to earth. This apparatus forms the receiving circuit. The condenser consists of a set of semi-circular plates, which can be turned in and out in the spaces between a set of similar fixed plates, whereby the capacity can be altered. The helix has 100 turns of thick insulated copper wire about 1 mm. in diameter, and terminals at different places, arranged so that a number of turns in steps of five can be branched off. If self-inductance and capacity are arranged in series with the antennæ and earth, the receiver can be tuned to wave-lengths from 300 to 1,000 metres, and when the condenser is shunted across the inductance, to wave-lengths of between 800 and 2,500 metres.

Inductively coupled to the tuning helix is another coil, the ends of which are connected to the detector, in this case a De Forest electrolytic cell, by means of which the received energy is transformed into audible signals composed of long and short sounds in a telephone.

Ordinarily, the operator on duty is constantly listening in this telephone and on 600 m. wave-length. A ship intending to communicate with the station will send a call signal with the names (in code) of the called and the calling station. To reply, the operator breaks the antennæ switch, which, in its other position, closes the circuit to the control relay of the motor-starter, the motor starts, and in 10 seconds the transmitter is ready for making the reply. When this has been done, the antennæ are switched over again, the motor stops, and receiving conditions are immediately re-established. In this way the communication is kept up between ship and shore station as long as working requires.

In November, 1906, a receiver of the Poulsen type was installed at the Cullercoats station, and at the first test signals were received from the Danish stations, Lyngby and Esbjerg, over distances of about 400 and 600 miles respectively. Early in 1907 an experimental arc was set up in Cullercoats, and very satisfactory results were obtained, considering the energy and the small antennæ then used. In 1908 the antennæ at Lyngby and Cullercoats were extended, and the stations equipped with generators of up-to-date design, and since then perfect working has been obtained at all times between the three stations.

The generator is built in the following way:—On an iron foot-plate are mounted two vertical iron cores, round which the magnetic field coils are placed. Above the coils an air-tight double-walled box is placed between the cores, and horizontal pole-pieces pass through the box on each side, an air space being left between them. The arc electrodes are passed through the end walls of the box, but are insulated from it, and are placed so that the arc is burning between the magnet poles. The copper electrode is in a fixed position, while the carbon holder can be moved to and fro by a screw for adjusting the arc length, rotated by a small motor through wormgear. Outside the box the electrodes end in metallic plates with radiators for air cooling. From a sight-feeder (such as is used for oil in gas engines) methylated spirit is dropped into the arc, and by its decomposition generates the necessary hydrogen atmosphere.

The direct-current supply passes from the switch through a variable resistance, the magnetic field windings, and two air-cored choking coils, to prevent oscillations in the mains, to the arc electrodes.

The signalling is effected by letting the telegraph key short-circuit a part of the self-induction in the circuit, so that the arc is oscillating during the whole period of working, but two different waves are radiated, corresponding to marking and spacing.

It will be understood that as long as the key is pressed the transmitter generates a persistent train of constant oscillations, and consequently nothing would be heard in an ordinary receiver for audible signals. To produce sound it is necessary to cut the oscillations up in groups, occurring with a frequency which can be heard. By the "ticker," a very ingenious arrangement of Mr. Poulsen's, it is possible to advantageously employ this method in the receiver.

The signal is marked in the telephone by a ticking noise, from which the apparatus is named.

This method allows a considerable amount of energy to be given off in the receiver at one time, although only oscillations of very small amplitude are created in the sender, while at the same time it requires and makes use of the sharpness of tuning obtained by undamped waves.

Detectors can be used without the "ticker" for printing arrangements. A specially sensitive type is the photographic printer, in which the feeble direct current obtained from the detector is passed through the fine wire in an Edelmann thread galvanometer. The wire moves in front of a slot, and through a microscope the slot is photographed, with the moving shadow of the wire, on a strip of sensitive paper. As the mass of the wire is extremely small the speed is nearly unlimited, as long as energy enough is obtained to give a visible movement. In this way messages have been received in Lyngby from Esbjerg at a rate of 300 words a minute, and at Cullercoats from Lyngby up to 100 words a minute.

Institution of Electrical Engineers' Conversazione.—Once a year the Institution, as though to mark the modernity of the science on which it is based, disports itself amidst the homes of our many ancestors. This year the linked sweetness long drawn out currently known as the Diplodocus was, however, not on view, having, it is said, been somewhat shocked last year with what went on in its presence; and it is rumoured that the creature expressed its regret at being so very much undressed in a dress gathering. The programme included an excellent selection by the string band of the Royal Engineers in the main hall, and by the Alexandra Ladies' Quartette in the Shell Gallery. Mr. Mordey, Pres. I.E.E., and his daughter, Mrs. E. O. Henrici, received the guests. The evening of June 30th was perfect as regards weather, and Nature smiled as a compliment to the selection, for probably the last time, of the Natural History Museum as the place of meeting, and seemed quite oblivious of the preceding 29 days of rain which she had so generously provided in apology for a dry May. Next year the Institution will presumably hold this annual festival in its own building. The change from South Kensington will be regrettable in many ways, for the surroundings at the Museum add a picturesque quality to the affair that cannot be duplicated in any ordinary building. Among the principal guests were:—Mr. J. Ardron, Profs. H. E. Armstrong, H. T. Bovey, H. L. Callender, H. S. Carhart, H. Cox, and H. T. Davidge, The Right Hon. W. G. Ellison-Macartney, Col. J. A. Ferrier, Mr. S. G. Gamble, Sir John Gavey, Mr. Charles Hawksley, Capt. The Hon. F. Hemphill, Prof. O. Henrici, Col. H. C. L. Holden, Col. Sir T. H. Holditch, Dr. T. M. Lowry, Mr. C. O. Mailloux, Major W. A. J. O'Meara, Sir C. J. Owens, Sir Robert J. Parker, Sir W. H. Preece, Brig.-Gen. R. M. Ruck, Prof. Sir T. E. Thorpe, Prof. W. A. Tilden, Sir C. E. Troup, Prof. W. C. Unwin, Mr. A. J. Walter, and Prof. W. P. Wynne, as well as, of course, very many prominent members of the Institution.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ECUADOR.—All goods imported into the Republic require, for the purpose of clearance through the Customs, the presentation of a Consular invoice stating (*a*) the name of the sender and of the consignee of the goods, and of the ship, her captain, flag, and place of destination; (*b*) the total value of the merchandise included in the invoice; (*c*) marks and numbers, and number of packages; (*d*) the kind of package (*e.g.*, whether bales, cases, casks, &c.); (*e*) the gross and net weight, in kilogrammes, of each package separately, or of a number of packages containing similar merchandise; (*f*) contents of the packages, stating precisely the kind of merchandise, without employing general terms such as "woollens," "cottons," "ironware," &c. Invoices must be signed by the sender or his representatives at the port of embarkation; and every document referring to the same invoice must bear the same signature, or be accompanied by a deed of attorney certified by the Ecuadorian Consul explaining the absence of such signature or the substitution of another.

Shipowners who receive on board their vessels cargo destined for Ecuadorian ports must present to the Consul a freight-list or general manifest for each port of destination, giving particulars of all bills of lading, viz. (*a*) name of shipper or shipping agent; (*b*) name of consignee at the port of disembarkation; (*c*) marks and numbers, and number of packages, specifying the kind of package (whether bales, barrels, &c.); and (*d*) the value of the goods covered by the bill of lading. The Consul who certifies the Consular invoice must also certify the corresponding freight-list and *vice versâ*. Shipowners must present in addition a list of the parcels embarked on their vessels for Ecuadorian ports without bill of lading, which list must state:—(*a*) Shipper's name; (*b*) consignee's name; (*e*) port of destination; (*d*) gross and net weight of each parcel, in kilogs.; and (*e*) declared value.

Consular invoices, general manifests, and lists of parcels shipped without bill of lading, must each be made out in quintuplicate, and all the copies must be presented for Consular certification. These documents should be presented before the departure of the vessel from the port of shipment, but may be taken out subsequently and marked by the Consul as "deferred."

Ecuadorian Consuls are authorised to charge the following fees for the certification of documents:—For certification of invoices up to the value of 100 sucres, 2·00 sucres; for certification of invoices of a value exceeding 100 sucres, 2 per cent. of the declared value; for certification of freight-lists, 20 per cent. of the aggregate invoice fees; for certification of lists of parcels shipped without bill of lading, 0·25 sucre per parcel; for certification of any declaration referring to invoices, freight-lists, &c., 10·00 sucres.

When invoices, freight-lists, or lists of parcels are presented for certification after the departure of the vessel, the above fees will be increased as follows:—For invoices, 1 per cent. additional; for freight-lists, 10 per cent. additional; for lists of parcels, 0·10 sucre more for each parcel.

In the absence of an Ecuadorian Consul at the port of shipment, application should be made to the Consul at the nearest place, if practicable, or to the Consul of a friendly nation, duly authorised by the Ecuadorian Government, or to the principal local authority.

(To be continued.)

French Banking Enterprise in Hungary. — It is reported from Buda-Pesth that the question of converting to electric traction the railway between Fiumc, Cameral and Moravieza, has been under consideration for some time past, especially as the efficiency of steam locomotion, owing to the many difficulties of the line, is very low. It is now believed that sources of power have been discovered in the water-powers near Zengg, which will render it possible to easily proceed with the transformation of the railway. These sources are in the possession of a foreign company, which some time ago submitted an offer to the Hungarian Government regarding the introduction of electrical working on the railway, the scheme providing for the erection of a generating plant of 30,000 H.P., 1·24 mile to the south of Zengg for the railway, and for supplying Fiume, Agram, Abbazia, Trieste and other localities. In connection with these statements it is announced that for the realisation of the scheme a limited company has been constituted at the Austro-Hungarian Consulate in Paris, with a capital of £160,000, and the intention is to issue priority bonds of £833,000, which are to be taken over by the French promoters. The latter include the Banque Transatlantique, two French institutions and several French bankers, and the representatives of this group are shortly to visit Fiume to settle the registration of the company.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,439. "Electric bacteria destroyer tanks." T. Williams. June 21st.

14,457. "Improvements in telephone exchange electric selecting systems." J. E. Kingsbury. (Western Electric Co., United States.) (Date applied for under Rule 13, August 15th, 1908. An invention comprised in application No. 17,209, dated August 15th, 1908.) June 21st.

14,505. "Improvements in and relating to electric arc lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckcrtwerke G.m.b.H., Germany.) June 21st. (Complete.)

14,548. "Improvements in electric ovens." J. G. Childs and T. S. Hill. June 21st.

14,582. "Bonding and electrical continuity device." G. Clarkson. June 22nd.

14,622. "Improvements in or relating to non-interchangeable safety fuses for electrical circuits." Siemens Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, June 23rd, 1908, being date of application in Germany.) June 22nd. (Complete.)

14,623. "Improvements in apparatus for controlling a plurality of independent electric circuits." J. J. Stockall, jun. June 22nd.

14,660. "Improvements in electrolytic apparatus." W. Thum. June 22nd. (Complete.)

14,674. "Improved device for controlling electric arc lamp carbons." H. D. Weaver. June 23rd.

14,675. "Improvements in or relating to the suspending or supporting of electric incandescent lamps and the like, and to the raising and lowering of the same." J. Lear. June 23rd.

14,685. "Improvements in and relating to electro-mechanical apparatus for the transmission, reception and indication of preconcerted signals." A. E. Vickery. June 23rd.

14,717. "Improvements in telegraphic instruments." G. L. Higgins, June 23rd.

14,731. "Improvements in speed control and braking apparatus for electrically-propelled vehicles." W. N. Stewart and E. Foss. June 23rd.

14,732. "Improvements in and relating to the mounting or supporting of electric motors on electrically-propelled vehicles." W. N. Stewart and E. Foss. June 23rd.

14,763. "Improvements in and relating to electric filament lamps and the like." A. E. Lamkin and T. R. Nunwick. June 23rd.

14,790. "Improvements in ironclad electric switches." C. H. Pearson. June 24th.

14,793. "Electric indicator for skittle grounds." Hermann Schluter. June 24th. (Complete.)

14,803. "Improvements in and relating to electric searchlights." Siemens Bros. & Co., Ltd., and J. H. Bradley. June 24th. (Complete.)

14,826. "Improvements in electric signalling. R. A. Fessenden. (Date applied for under Sec. 91 of the Act, July 30th, 1908, being date of application in United States.) June 24th. (Complete.)

14,833. "Improvements in or relating to electric switches." R. P. Howgrave-Graham. June 24th.

14,858. "Improvements in or relating to electric furnace electrodes." C. Binoham. June 26th.

14,873. "Improvements in or relating to electric clocks." F. Holnen. June 26th.

14,898. "New or improved manhole cover for sewers, electrical conduits and similar purposes." R. Ames. June 26th.

14,899. "Improvements in electric quantity indicators." R. Kenneny. June 26th.

14,911. "Improvements in or connected with telegraphic apparatus for use on road vehicles and the like." W. Chadburn. June 26th.

14,934. "Improvements in and relating to electric reflector lamps." C. C. Reonart. June 26th.

14,937. "Improvements in electrical induction furnaces." Carl Grunwaln. (Application for patent of addition to No. 3,599/09. Date applied for under Sec. 91 of the Act, October 2nd, 1908, being date of application in Germany). June 26th. (Complete.)

14,972. "Improvements connected with the raising and lowering of arc lamps and the like." A. Wunderlich and G. A. Hughes. (Application for patent of addition to No. 25,398/07). June 26th. (Complete.)

14,980. "Improvements relating to the rectification of alternating electric currents and to devices for use therein." E. Fassler. June 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Automatic Electric Cut-Outs. A. J. Boult. (Electrical Manufacturing Co. 12,142. June 4th.

Asymmetric Electric Conductor of the Electrolytic Type Applicable for Use on Electric Current Modifying Device and for other Purposes. British Thomson-Houston Co. (General Electric Co., United States.) 12,267. June 5th.

Installations of Electric Lamps having Metal Filaments. W. Dierman. 12,398. June 9th.

Telephone Apparatus. A. M. Cobb. 16,029. July 28th.

Portable Electromagnets. W. A. Trier. 16,597. August 6th.

Igniter with Intermediate Electrode Arranged between the Electrodes. T. Bergmann. 17,816. August 25th.

Ignition Devices for Internal-Combustion Engines. H. N. Bickerton, P. W. Robson and National Gas Engine Co. 18,621. September 4th.

Secrecy System for Wireless Communication. L. do Forest. 20,638. October 1st.

1909.

Electrical Resistance Coils of Covered Wire. Siemens-Schuckert-Werke Ges. 580. January 9th. (Date applied for under International Convention, January 9th, 1908.)

Electric Candle Lamps. C. C. Regnart. 5,567. March 8th.

Means for Supporting Telephones. H. F. Hansell. 7,081. March 24th. (Date applied for under International Convention, February 4th, 1909.)

Manufacture of Electric Glow Lamps with Metallic Filaments. Bergmann Elektricitäts Werke Akt.-Ges. 9,265. April 19th. (Date applied for under International Convention, February 18th, 1909.)

THE

ELECTRICAL REVIEW.

VOL. LXV. JULY 16, 1909. No. 1,651.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
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Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4 Ludgate Hill, London, E.C.

THE CITY LIGHTING.

THE public lighting of the City of London has for decades been the subject of controversy, and seems destined to remain in that category for some time longer, if we may judge by the report of the deputation to the Continent, which has just been issued. This deputation consisted of five members of the City Corporation, who, unprovided with expert advice and assistance, fared forth to investigate the systems of public lighting in vogue in some of the chief Continental cities. They visited Brussels, Cologne, Düsseldorf, Dresden, Vienna, Munich and Paris, and found that *not one* of these cities had adopted high-pressure incandescent gas lighting in any form, and only two of them were even experimenting with it. Yet they came back with the recommendation that high-pressure incandescent gas lamps with inverted burners should be adopted by the City of London, apparently because Berlin alone, which uses a number (not stated) of lamps of this type, has decided to adopt the system throughout the principal streets!

The first, and presumably the principal, recommendation of the deputation is that, wherever possible, the streets should be lighted by means of centrally-hung lamps with lowering gear, because the number of obstructions upon the footway is already so large. We might point out that the lamp-trimmers at present go up the arc lamp-posts and cause no obstruction whatever. As for the centrally-hung lamps in Cannon Street, they are trimmed in position with the aid of portable ladders, in the early hours of the morning, when there is very little traffic; there would be no less obstruction if lowering gear were used—rather more, indeed, if the operation of trimming was not then restricted to the small hours as at present. Open spaces, says the report, should be lighted with lamps on standards, fitted with lowering gear.

Our readers are now in a position to realise the full beauty of the recommendations of this well-meaning but absolutely inexpert party of inspectors of public lighting. The report, briefly summarised up to this point, recommends that high-pressure inverted incandescent gas lamps shall be used, *centrally-hung wherever possible, and provided with lowering gear*. Who ever saw, or even heard of, such a system? Not only does the deputation recommend a lamp that is found in only one of eight great cities on the Continent, but it advises the adoption of a combination of lamp and suspension that it has never seen at all!

It is after digesting the foregoing propositions that we arrive at what proves to be the redeeming feature of the report—the concluding recommendation: "Where gas is impracticable, electricity with open arc and flame arc lamps should be installed." Seeing that high-pressure gas lamps with lowering gear are quite out of the question as regards practicability, the ultimate effect of the report, it seems, is simply this:—Arc lamps shall be used, centrally-hung where possible, otherwise on standards, and equipped with lowering gear.

How far is this conclusion justified by Continental practice ?—If we examine the report, we find that *in every instance* the deputation finds that the important streets are lit with electric arc lamps. There is no escape from it—no exception ; electric arc lamps are the first illuminants to be mentioned in each of the eight cases. In some instances electric glow lamps are used also ; gas invariably is mentioned last.

As regards the expression "open arc and flame arc lamps," this in itself indicates the inexperience of the deputation ; no one who knows anything about the subject would think of installing open arcs for public lighting nowadays.

Why does Berlin alone propose to use incandescent gas lighting throughout ? If we look into the details, we soon find the reason : the municipality supplies gas from its own works charging 1s. 4½d. per 1,000 (said to be cost price) for public lighting, and no less than 3s. 6d. to private consumers ; electricity is supplied by a company—cost not stated. In London, gas for public lighting is supplied at 2s. 4d. per 1,000.

Another significant feature—one to which we are accustomed in connection with this question—is this : while, in the case of arc lighting, the illumination *as measured* near the ground level is generally stated, in the case of gas lighting we are given only the *estimated* candle-power of the lamps themselves. The numerous data given, therefore, are absolutely useless for the purpose of comparison—the essential feature is missing. Further, in Berlin, where high-pressure gas lamps are used, the height to burner ranges from 14·7 to 18·7 ft. It is hardly necessary to point out that centrally suspended lamps would have to be placed 10 ft. higher, and the polar distribution C.P. curve of the inverted gas mantle is such that, at this height, it would be quite useless for illuminating the roadway—assuming, of course, that centrally-hung high-pressure inverted incandescent gas lamps with lowering gear had any existence other than in the imagination of the deputies.

The latter apparently felt a lurking suspicion that there was something wrong ; for they suggest that before any drastic alterations are made, further experimental lighting be carried out. The parties concerned must be getting rather tired of these interminable experiments, but after all there is no better course, provided that the experiments are carried out with scrupulous fairness and under expert advice, with a single-minded desire to select the most economical and efficient system of illumination. It is to be hoped that in conducting such trials, the authorities will not fail to take into consideration the new situation created by the development of the metallic-filament lamp, which has been practically ignored in the report, but nevertheless bids fair to provide an ideal solution to the problem of lighting the less important streets.

CHEAP POWER.

It is rapidly being realised that the provision of cheap power is vital to the industrial prosperity of this country. It is only necessary to quote as evidence of this the Presidential Address to the Municipal Electrical Association a week or two ago, the paper read on the subject at the same Convention by the chairman of a Municipal Electricity Supply Committee, and the proceedings at the Local Government Board inquiry into the application by the West Ham Corporation for leave to borrow a large sum for extensions to their electricity supply undertaking. In each case the standpoint from which the subject was approached was different, but the final question reached was the same—viz., to what extent must the large power user contribute towards the capital charges of the whole undertaking ? In the majority of the municipal undertakings of the country, the question may be paraphrased as an inquiry as to the number of generations to which "the sins of the fathers shall be visited upon the children."

To illustrate our meaning West Ham will serve as an example, though others might equally well be cited. Ten years ago a supply for public and private lighting in certain parts of the borough was started, and was moderately successful. A tramway load was added, which helped to improve matters, but even then in some years the sinking-fund charges had to be partly provided out of the rates.

A part of the borough untouched by the private lighting supply presented great possibilities for industrial development, if really cheap power were available. The Corporation a few years ago adopted a spirited policy, built a new station, installed new and suitable plant, laid special mains, and took such steps to push their power supply business, that last year over 5½ million units were supplied to that district alone, at an average price of less than one halfpenny per unit.

In order to reduce the working costs of the undertaking, the original generating station has been abandoned, and the generation of energy for all purposes has been concentrated at the new station. The present buildings will suffice for large extensions of plant. This means that the total capital outlay on the undertaking with its disused generating station and extensive network of lighting mains is high, but that extensions of plant as well as of the mains necessary for the supply of large power consumers can be carried out for a relatively very small sum.

The question argued before the inspector at the inquiry, and now under the consideration of the Local Government Board, is whether the Council were justified in the course they took—that is, to consider what portion of the total capital outlay was directly concerned with the supply to any particular class of customers, and only charge to them the annual capital charges required to meet that part of the capital cost—or whether the capital charges for the year should be divided *pro rata* among all the units sold in the same period, irrespective of the use to which they were put.

It was pointed out, as justifying the action of the Council, that had the latter course been adopted, not one power customer would have been secured. The "sins of the fathers"—represented by their enterprise in embarking in the business of electricity supply before finality had been reached in the design and methods of working of an electricity undertaking—would have prevented any present development or future prospect of power supply. This would have been done, too, at the expense of the lighting part of the undertaking, for the diminished output for this purpose during the past year, due to the use of the new wire lamps, would have necessitated a rise in the price charged per unit.

As a result of the policy adopted, this has been avoided ; the average price obtained for private lighting has been brought down from 3·66d. in the year the power supply was commenced, to 2·72d. last year, and the average price of all the power units sold has been ·591d., one specially long-hour consumer getting his supply at ·37d.

Cheap power is having its inevitable result ; new industries are being attracted to the neighbourhood, and older ones are extending their operations. This means increased rating value and, more important still, more employment for the inhabitants. There are signs that soon the undertaking will be able to bear, as a whole, its full share of capital responsibilities, and that thus the policy of treating the power supply as a new business, to be considered on its own merits, rather than as an adjunct of the lighting supply, will be fully justified.

What has been done by a municipality at West Ham and a company on Tyneside may be done—and, fortunately, has been done in some cases—elsewhere. The application of this principle needs caution, but, judiciously applied, it may bring increased prosperity to many undertakings without inflicting any disadvantage or injustice on the present consumers.

TEMPORARY REPAIRS TO STEAM SETS.

The functions of the maintenance engineer of a power house do not only include the economical running of the plant and the upkeep of the same in an efficient condition, although this is the larger proportion of his work, and the part for which he is mainly paid. It may be taken that the better the maintenance of the plant the less sensational, as a rule, are the experiences of the engineer in charge of the same, and it is therefore best to keep a good and experienced maintenance engineer upon the staff at a respectable salary, in preference to economising wages and trusting to Providence. At the same time, however, accidents may happen even in the best regulated power house, and it is at these times that the ingenuity and resourcefulness of the maintenance engineer provide a further test as to his worth. It is a first principle in power-house practice that the plant which is available shall be kept running at all costs in order to avoid a breakdown to the supply of electricity, and this rule receives special emphasis nowadays, when such binding contracts as to reliability and continuity of supply are made in connection with the distribution of electric power.

It may therefore be interesting to give one or two notes regarding breakdowns of power-house plant and the way in which they were overcome in a temporary manner, so as to enable the supply to be resumed with a minimum of interruption. It is not, of course, suggested that these repairs are anything like standard practice, or that the efficiency of a temporary job to meet the conditions of the moment should be a pretext for its becoming a permanent repair. The possession of ingenuity and resourcefulness, however, in overcoming difficulties is of very great value, and it is possible that the following notes may bring forward further instances of rapid repair work which may be of use to engineers in power houses.

As an instance of a temporary repair may be taken a fairly common accident—that of a broken gland in a stuffing box (fig. 1). It is very seldom that the centre-piece is broken away, the fracture usually occurring at the side of the flange, generally at the point where the bolt or stud passes through the flange. Its usual cause is from the fact that the packing in the stuffing-box is too hard, or else that the gland has been screwed too tight or screwed up unevenly between the two sides. If the gland in question is one which can be got off without unshipping a large proportion of the engine, the simplest way to effect a repair is to cut a strong steel plate to the shape of the gland flange (fig. 2), mark off upon it the position of the bolt-holes on the flange, and drill these out. This can be placed on the top of the broken gland, as shown in fig. 3, and in order to make up for clearance, if this is necessary, one turn of the packing can be taken out of the stuffing box. In the case of a gland such as that, for example, of a piston-rod, that cannot be taken off without a considerable amount of trouble, two of the holes in the plate should be modified into the form of slots, as shown in the fourth figure, the whole blade being thus somewhat of the shape of a horseshoe. By taking the nut completely off one stud or bolt, the blade can be slipped on this stud, which is therefore used as a pivot, and the blade is then swung into place and secured by means of the nut on the other bolt, which has previously been slackened back. It is found that this repair gets over the difficulty in a very quick and satisfactory manner.

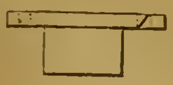


Fig. 1.

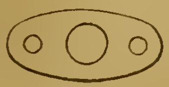


Fig. 2.

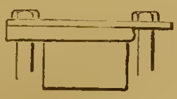


Fig. 3.

It occasionally happens that trouble is experienced with the air pump, due to the fact that the brass guard for the valves comes adrift because the split pin securing the nut is not in place. This may occur through this pin either breaking or working out; the nut then becomes slack, and if not found in time it works off, leaving the guard loose. As a rule, there is sufficient clearance in the pump to allow for this so long as the guard lies flat, but it is possible in one stroke for it to rise on its edge. The result of the occurrence will probably be that the cover of the pump will be broken into four or five pieces, although it is not likely that the stuffing box will be damaged.

In a case of this kind, the repairs were carried out in the following manner:—A good strong stokehold plate, made of cast-steel, was taken, and the broken cover was laid on this and pieced together in the manner shown in fig. 5. The holes in the cover were then marked off on the plate and drilled, and a centre hole was cut in the plate to fit the spigot of the stuffing box. This stuffing box was thus bolted on to the plate accurately centrally, and the temporary cover thus formed (fig. 6) was fitted on to the air pump, the small pieces of cover being thrown aside. It was found that this enabled the set to be got away again and worked satisfactorily until there was time to order another cover from the makers.

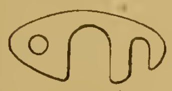


Fig. 4.

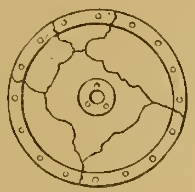


Fig. 5.

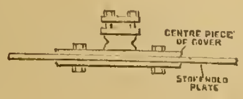


Fig. 6

An accident which, fortunately, does not occur very frequently in power-house work, but which is occasionally to be met with, is the breaking of a cylinder cover, due to one of the piston nuts working slack and fouling the cover. This kind of accident is at its worst when it occurs on the high-pressure line of the engine, and the way in which this trouble was temporarily got over may be of interest. A strong plate, which, as a matter of fact, was a stokehold plate, was taken and holes were marked off on it, and drilled to suit the studs on the cylinder flange. This in itself would have been sufficient, when properly jointed, to have served for a low-pressure cylinder cover, or even a medium-pressure cylinder cover, but, in order to strengthen it sufficiently to allow the high-pressure steam to be taken, it was suggested that strong iron bars should be bolted across the cover from stud to stud, as shown in fig. 7. Unfortunately, at the time, these bars were not available, and the somewhat risky expedient of using wood was adopted. Heavy timber baulks were obtained and laid across the top of the cover, as shown in the sketch, fig. 8, and these were secured with long bolts and wide washers to similar baulks on the underside of the cylinder. The baulks were protected from the action of the heat by interposing two thicknesses of asbestos sheet, and although the set was started up in fear and trembling, it managed to perform its work until the necessity of running the engine could be avoided.

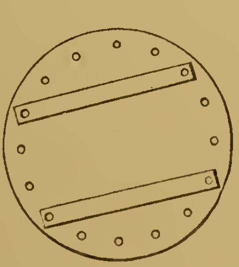


Fig. 7.

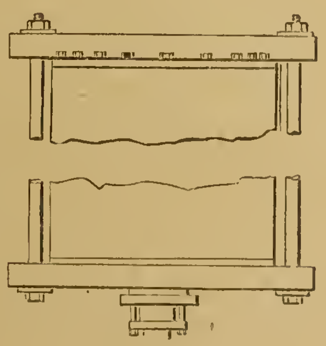


Fig. 8.

The above examples typify the class of trouble which a maintenance engineer is sometimes called upon to negotiate, and it may be that a considerable number of similar examples can be called to mind by engineers engaged in this class of work.

THE I.M.E.A. CONVENTION.

Notes on Condensing and Water-Cooling Plants.

The above title very well describes the nature of the paper submitted in competition for the I.M.E.A. Travelling Studentship, 1909, by Mr. E. Lunn, of Huddersfield, who was the only competitor, and was, of course, successful.

There is nothing very striking in this paper, but it is one of a sort that it is well to have from time to time, for it brings under review the different varieties of plant that may be employed on the condensing side of a steam station, and should be of real assistance to the engineer who has condensation in mind. A saving of 20 per cent. may be made by the adoption of suitable condensing plant, and on the face of it there appears no question as to the desirability of effecting this saving. But it is necessary to be very careful in drawing up an estimate of the saving to be expected. To begin with, the size of the plant and its cost must be known.

It may be assumed at first that the plant should be big enough to deal with the maximum load. Then it will cost so much. Next, what is the load-factor of the plant, and what are the working hours?

Suppose that the load-factor is 12½ per cent., and the conditions are that a plant of 100-H.P. capacity is put to the duty of saving 20 per cent. on the steam output of an average load of 12½ per cent. This is the saving to be made, and as a set-off against the saving, there is the interest on capital, depreciation and maintenance of plant, and the cost of steam to drive the air pump.

An engineer faced with such a case will probably decide that he will be content with a poor vacuum during the period of peak load, for otherwise his condensing plant will cost him too much, and will absorb a lot of steam during low loads when working so much below its capacity. It may, therefore, be an economy to install condensing plant much smaller than will give a good vacuum on the peak load, and yet will save fuel all the rest of the day without being too costly to begin with.

The author sums up well in stating that the saving ought to be more than 10 per cent. on the cost of the plant, for it will cost this in interest, repairs, &c.

When the engines are already taxed to their limit, condensing plant may well be laid down to add 20 per cent. to their power, and in a case of this sort it becomes necessary to consider the cost of an additional engine as compared with the cost of the condensing plant. The advisability of installing an exhaust steam turbine ought also to be considered.

But ordinarily, unless the load factor exceeds 10 per cent. with cheap condensing water, or 13 per cent. when cooling towers are used, it will not pay to condense.

Attention is drawn to the increased cost for higher vacua; this is a point deserving of special attention when cooling towers and lifting pumps are employed. The various types of condenser are briefly stated and their salient features noted.

The author has found that the 400 ft. per minute of air-pump bucket speed is usually too high, and has found better results when the speed of an 18-in. × 18-in. pump designed for 350 ft. per minute was reduced to 300, and even to 250 ft. Hustling air pumps are probably a mistake; they seem to have come into being as a bit of the general high-speed hustle of generating stations; and the cases have not been few where a vacuum, poor because of air leakages that might be avoided, has been brought up to normal by over-running the air pumps—a proceeding not unlike that of the man who lifts himself by his own boot straps.

It is noted that steam-driven pumps call for 50 to 100 per cent. more steam than electrically-driven pumps, though this is often largely counteracted by the use of the pump exhaust for feed heating, a plan far preferable to sending the steam to the main condenser. But there is usually so much waste heat available for feed heating, that it is not always easy to see how to use it.

At page 60 we suppose the depth of the circulating trough is 7 in.—not 7 ft. There troughs are stated by the author to be very inefficient coolers, presumably because they surround themselves with a saturated atmosphere, and evaporation then ceases. Water-cooling plants may now be had wherein the wooden laths are self-locking in position, and the depreciation is much less than when nails are used.

Perhaps, to-day, condensing has been carried somewhat to extremes. A few years ago the reverse was the case, and many plants were run on the atmosphere which ought to have had the benefit of condensing plant and were well situated in respect of water. But much less has been obtained from condensation by reason of inattention to details than ought to have been. Condensation is a means of getting rid of the atmospheric resistance. Why, then, has there been so very much carelessness in letting that objectionable atmosphere leak into cylinders, boilers, pipes, by way of direct leaks or through the feed water?

These points might perhaps have been more emphasised in the paper before us.

Modern Cable Systems.

By E. M. Hollingsworth, Chief Electrical Engineer, St. Helens.

(*Abstract.*)

For overhead transmission lines aluminium has been used for many years with satisfactory results, but until quite recently it had not been tried for the conductors of insulated cables. Compared with copper conductors of equal conductivity, aluminium conductors are 50 per cent. lighter in weight, and 28 per cent. greater in diameter. Beyond a probable saving in carriage the reduced weight does not affect the question of insulated cables, with copper and aluminium at present prices. In the matter of increased diameter the advantage of a greater cooling surface is obtained, but against this extra insulating and sheathing materials, and troughs or conduits of larger size are required.

With copper at £60 per ton and aluminium at £65 per ton, there is an advantage in favour of the latter for single-core cables above the equivalent of ·05 sq. in. of copper. Taking cables having the equivalent of ·1 sq. in., ·2 sq. in. and 1 sq. in. copper conductors, there is a saving of 15, 20 and 30 per cent. respectively. In the case of triple-concentric and three-core cables the difference is not so great.

For underground work, rubber-insulated cables have almost entirely dropped out of use; for medium-pressure systems vulcanised-bitumen cables are used.

Compared with paper insulation, vulcanised bitumen claims the advantage of being absolutely non-hygroscopic, thereby obviating the necessity for lead sheathing, but although moisture that is neutral, or acid, has little or no action, moisture that is at all alkaline will attack this cable, and under certain conditions rapid deterioration takes place, the material becoming a spongy mass and, of course, no longer waterproof. It is certainly the best plan to lay vulcanised-bitumen cables underground on the solid system, to prevent as far as possible contact with deleterious matter.

These cables are very extensively used in collieries, where the conditions generally are damp, and where in the case of the pit shaft the question of weight is an important factor, for a single-core vulcanised-bitumen cable of ·1 sq. in. section is only half the weight of the equivalent paper-insulated lead-covered cable.

For all systems and pressures, paper insulation is used, as it possesses the advantages of high dielectric strength, greater durability and low electrostatic capacity. It is strong, does not soften under heat, and is not liable to crack, and cables so insulated can be safely worked at a greater current density.

The chief drawback to this class of insulation is its susceptibility to moisture, which necessitates the use of lead or other sheathing to render it waterproof.

There is a danger of electrolytic corrosion, particularly where the cables are laid in the neighbourhood of a tramway system, but if the precaution is taken of solidly bonding the lead sheaths and connecting them at suitable points to earth plates, the risk is reduced to a minimum. Good sturdy bonds of lead strip are far superior to copper wire. It is advisable to keep a record of all the earth plates, and they should be tested frequently.

Leadless sheathing has a great advantage as far as prevention of electrolysis is concerned, but such cable is not mechanically as strong as that with lead sheathing, and in certain localities there is risk of chemical action.

The direct system finds favour where the initial outlay is a consideration, and for cables placed where there is little danger of mechanical injury, and where the soil is of a sandy nature and free from acids and organic matter, this system is very suitable.

With few exceptions, all the cables laid direct are armoured with steel tape or galvanised iron wires, and are usually paper-insulated lead-covered, with a substantial jute covering between the steel armouring and the lead sheathing, and also over the steel armouring.

Although comparatively little of this cable is in use at St. Helens, it has given more trouble than all the rest of the network. For one reason the soil, being impregnated with acids, quickly rotted away the jute covering, and in places the armouring entirely disappeared. In nearly every case the faults occurred in single-core cables, the triple-concentric cables giving little or no trouble.

On account of the thickness of the layers of jute and the dimensions of the armouring being now fixed by the Engineering

Standards Committee, and the cable manufacturers taking greater care with respect to the quality of the materials and their application, this class of cable is being more generally adopted for all systems of supply.

The solid system is very little more expensive and is almost as flexible as regards laying as the direct system, and cables laid in this way are better protected from external influences than when laid in any other way.

Stoneware troughs appear to have superseded to a great extent those of wood or iron; they are as cheap as wood, considerably cheaper than iron, more durable, and if properly glazed inside and outside, proof against chemical action. They have, however, the disadvantage of being only about 2 ft. long, which means an increase in the number of joints in a given length. Butt-jointed troughs should not be used. The author has experienced considerable trouble with certain lengths of cable through moisture getting in at the joints, owing to the careless laying of the troughs.

For bitumen cables, bitumen filling is used, but very little bitumen is now used with lead-covered cables, good pitch reduced by a suitable oil being found satisfactory and very much cheaper. Pitch has also the advantage of a lower melting point than bitumen and does not require the same care in filling, and in the case of a fracture there is a better chance of its healing again.

The minimum thickness of filling should not be less than ½ in., and to ensure an even thickness the bridge pieces should be placed at suitable intervals, usually 18 in. apart, but never exceeding 2 ft., depending upon the size and weight of the cable.

When cables are laid through a busy thoroughfare, or where a great many of them are banked together, the system in which they are drawn into conduits or pipes is the only one suitable.

Cast-iron, fibre and glazed stoneware conduits are in most common use; a good method is to build up in concrete with single ducts the number of ways required, care being taken to prevent the cement at the joints from entering the ducts. This type, provided not less than nine ways are installed, represents the cheapest form of conduit.

The author thinks that subways are likely to be more generally adopted in the future. There is in St. Helens, down the two principal thoroughfares, a subway, 6 ft. 6 in. high and 5 ft. 6 in. wide, nearly half a mile in length, with an entrance at each end and one midway, and with lateral ways at the inter-sections of the other streets. With the exception of a 4½-in. ring of blue bricks forming the inner arch it is constructed entirely of concrete; the form of construction and arrangements of the gas and water mains and electric cables are as shown by fig. 1.

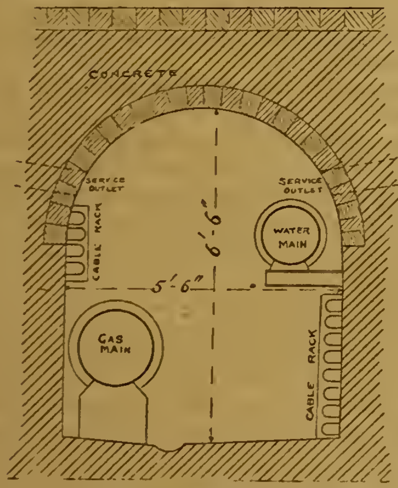


Fig. 1.—Cross-Section of Subway.

For the gas, water and electric service connections, 6-in. earthenware pipes are laid at frequent intervals.

The work was completed in 1899; the cost including the lateral ways was £7 per lineal yard, and the electricity department's share of the capital and maintenance charges is £90 per annum.

At the present time, exclusive of service connections, it contains 4 miles of cables ranging from ·1 to 1 sq. in. single and multi-core. The average cost, including the racks and the placing of the cables, is about 1½d. per yard of cable. About 100 consumers are supplied through services connected to the mains of the subway. Large three-wire consumers are in each case connected direct, but in the case of small consumers three or four are supplied from one set of service cables.

Before concluding, the author refers to the value of overhead conductors for supplying isolated districts, and gives a brief description of the system that has been in use in connection with the St. Helens Corporation scheme since 1902.

By means of overhead conductors a supply of energy at 500 volts D.C., with one side earthed, is given to several glass works and collieries situated within a radius of two miles from the power station, but separated by rough ground impregnated in places with chemical waste. For this reason, it was quite out of the question to lay cables underground, and the Board of Trade, being convinced of this, consented to the conductors being placed overhead.

The total length of the pole line is just over 1½ miles, and the poles are placed about 40 yd. apart. The dimensions of the poles and cross arms and the arrangement of insulators and conductors are shown by fig. 2.

The poles are of red fir, well creosoted, and are to the specification issued by the General Post Office in connection with the supply of telegraph poles. They are planted to a depth of 8 ft. with a packing of concrete, and about every two years the base of each pole is exposed to a depth of about 2 ft. and coated with oil of creosote. Apparently so far there is little or no deterioration, which undoubtedly is due to the process of creosoting these poles, for, by some misunderstanding, one or two poles that had not been treated were erected, but after six years' use they had to be replaced. The cross-arms are of creosoted oak with stays of wrought-iron, and the insulators are the Post Office heavy telegraph type.

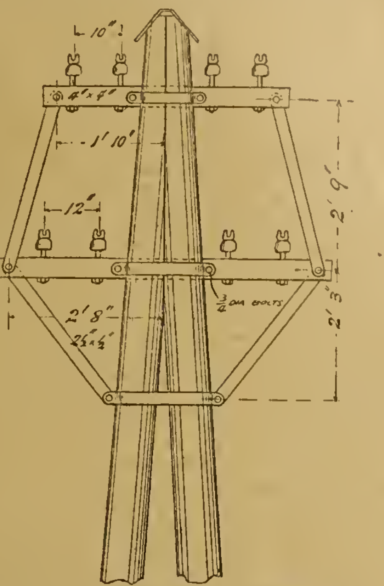


Fig. 2.—Arrangement of Cross-Arms.

The conductors are 0000 s.w.g. solid drawn copper, staggered in order to comply with the Board of Trade Regulations. Three pairs of conductors are in use for a portion of the distance, and there is room for another pair.

Distribution and Service Cables—Cost per Mile.

Area of each conductor, sq. in.	Type and number of cables.	Cost of cable only.		Total inclusive cost.		
		Plain lead covered.	Armoured.	Armoured cable laid direct.	Lead-cov. laid solid in e.w. troughs with pitch filling.	Drawn into 3-in. e.w. ducts inc. draw-in boxes.
		£	£	£	£	£
·007	Twin	83	133	159	197	275
	Conc.	72	121	147	186	264
·0229	Two	128	221	258	271	508
	Twin	129	185	214	247	320
	Conc.	123	176	205	241	314
(*a*) ·035	Two	162	256	293	305	543
	Twin	170	230	259	288	362
	Conc.	165	223	252	283	358
	Three	229	369	420	402	761
	3-core	236	307	344	376	434
	3-conc.	237	314	351	377	435
(*b*) ·1	Two	342	454	494	507	731
	Twin	353	432	465	489	551
	Conc.	335	412	445	471	533
	Three	462	624	683	664	1,009
	3-core	468	558	602	630	673
	3-conc.	460	555	599	622	665
(*c*) ·25	Two	714	865	913	905	1,111
	Twin	706	816	853	860	910
	Conc.	692	796	833	846	896
	Three	885	1,092	1,158	1,116	1,443
	3-core	950	1,075	1,126	1,134	1,163
	3-conc.	975	1,105	1,156	1,159	1,188
(*d*) ·5	Two	1,329	1,524	1,579	1,549	1,737
	Twin	1,312	1,450	1,490	1,485	1,525
	Conc.	1,274	1,406	1,446	1,447	1,487
	Three	1,623	1,889	1,966	1,887	1,295
	3-core	1,659	1,829	1,886	1,868	1,879
	3-conc.	1,672	1,845	1,902	1,881	1,892

Note.—Electrolytic copper bars taken at £70 per ton and lead at £15 per ton. The cost of disconnecting boxes and trenchwork is not included. All cables are taken as being paper-insulated, lead-covered; there is very little difference in cost between such cables and bitumen. In case of three singles, three-core and triple cables, the neutral conductor is taken as: ·025 sq. in. for (*a*), ·06 sq. in. for (*b*), ·10 sq. in. for (*c*), ·20 sq. in. for (*d*).

The cost of the work, exclusive of the conductors, was £220 per mile, and for each pair of conductors erected must be added £170 per mile. If copper conductors were replaced by aluminium at present prices, the cost would be for each pair of conductors £120 per mile. For comparison the cost for the equivalent underground mains, that is, two ·15 sq. in. cables, laid solid in earthenware troughs, would be £800 per mile.

From these figures it will be seen that the installation of overhead conductors is considerably less expensive than in the case of underground cables, and, in addition, the cost of maintenance is less, and such a system offers more flexibility and less risk of breakdown.

Discussion.

In opening the discussion, **Mr. W. W. Lackie** (Glasgow) said that he favoured the earthing of the metallic sheathed cables at a limited number of points, so that it was easy to disconnect for testing, &c. He did not agree with the use of metal sheathed L T. cables, preferring V.B. cables; in Glasgow the solid system was used, and the standard practice was to run a feeder to a disconnecting box which supplied its own section of the network, the sections being independent of each other. This also facilitated testing and load measurement, &c.

Mr. S. J. Watson (Bury) commented on the importance of the subject as 30 out of the 80 millions invested in electrical undertakings, is invested in mains, &c. There was still no standard practice in mains laying, and it was broadly a question of "laying solid" or "drawing-in." To him it was difficult to understand anyone using an inaccessible solid system, when one considered the modern tendencies of engineering design. He agreed with the previous speaker that V.B. cable was superior to lead-covered; he found it quite satisfactory except in draw-in systems near urinals, &c., and in such a situation he had known the bitumen to be dissolved owing to a leaky drain. But V.B. cables were not liable to give such serious shocks or leaks, even if damaged, as other types of cable. He considered that overhead mains did not get the attention they deserved, when one considered that their cost was 1s. to 2s. per yard, as against 6s. per yard underground; and that bare instead of insulated copper was used.

Mr. F. A. Newington (Edinburgh) said lead-covered paper-insulated cable on the drawn-in system suited the Edinburgh conditions, saving a good deal of expense in breaking concrete pavements, &c. Bitumen cable he had found unreliable, as also the old rubber cables. He disagreed with some of the author's tabulated costs; he had found less difference in cost than the author between the draw-in and solid systems.

Mr. W. A. Vignoles (Grimsby) said the author had not referred to the boxes, which gave most trouble in a cable system. He was using a special cast-iron box, with the lead of the cable wiped on to the box, and this provided a water-tight connection. He thought triple-concentric cable was most satisfactory, but the jointing was an expensive matter. For side streets he was using three-core ·02 cable; this was small owing to the small property and demand. From tests made in Grimsby he found the average current per house to be about 2 amperes, and in the case of small houses, it was, of course, less.

Mr. F. Ayton (Ipswich) said, in reference to small services for street lamps, he was using lead-covered rubber-insulated cable, with bitumen-filled fuse boxes in the base of the lamp. He was using some overhead mains, and had a span of 350 ft. across the river in use; he had had no trouble whatever with the overhead mains, and wished he could make more use of them.

Mr. J. E. Edgcome (Kingston-on-Thames) defended the armoured insulated cable laid direct, from his experience of some 16 years. He had recently opened up some lengths of cable and found them in an excellent condition, except in the case of a few yards near a leaky gas main, which latter had caused corrosion. It was a very flexible system and cheap; the L.G.B. seemed to think that it would not last quite so long as the solid system, but they eventually agreed to allow the same loan period as for that system.

Mr. C. C. Atchison (Rochdale) said he had used armoured lead-covered paper cables since the start, and had had no cause to repent it. He was glad to hear that overhead mains were being used as distributors, as he had found them useful. If aluminium were used instead of copper for this purpose, the extra size and wind pressure would have to be taken into account.

Mr. S. E. Fedden (Sheffield) said that bitumen cables laid solid had proved absolutely reliable during his 16 years' use of them. He was not a believer in joint boxes on mains, where they could be avoided. He had some 230 miles of lead-covered cable, and had not had a fault in eight years. This class of cable should be run in iron pipes rather than concrete ducts. It was no use trying to keep a conduit dry, and not necessary if suitable cable were used.

Owing to the shortness of time, **Mr. Hollingsworth** decided to communicate his reply.

Modern Cable Systems.

In some introductory remarks at the beginning of his paper on "Modern Cable Systems," Mr. Hollingsworth emphasises the importance of his subject by pointing out that the cable network is that part of a supply system which involves the greatest expenditure, and is generally the cause of most anxiety. There is no doubt that far more attention is now paid to the testing and maintenance of the network than was the case some years ago. But we are afraid that, even now, there are cable networks, more especially those of some of the smaller undertakings, which do not get their fair share of attention, owing, probably, to the fact that the staff have sufficient work to do with the plant that is always before their eyes, and that what is out of sight is often out of mind, until it is brought to their recollection in an unpleasant manner by a fault of a serious nature. We are, therefore, always pleased to see a paper on this subject presented by a practical man for discussion at a meeting like that of the M.E.A.

When dealing with conductors and the possible use of aluminium instead of copper, the author of the paper says that the former metal will make as reliable a cable as the latter; and that the question whether aluminium will be adopted for insulated cables will depend principally on financial considerations. He further says that, with copper at £60 and aluminium at £65 per ton, there is an advantage in favour of the latter for single-core cables above the equivalent of ·05 sq. in. copper; and that, with cables having the equivalent of 0·1, 0·2 and 1 sq. in. copper conductors, there is a saving of 15, 20 and 30 per cent. respectively. We think there must be some mistake in these figures, as, with copper at £60 per ton, the conductor does not account for half the cost of the finished cable, even in big sizes; and the equivalent aluminium conductor, at £65 per ton, only saves 46 per cent. of the cost of the copper, or less than 23 per cent. of the cost of the cable, even supposing the insulation does not cost any more on account of the increase of 28 per cent. in the diameter of the conductor. From calculations made by taking the prices of two finished cables, one having a conductor 1·28 times the diameter of the other, deducting the cost of the copper in the larger cable, and adding in place of it the cost of an aluminium conductor of equal section, we should put the cost of the cable with the aluminium conductor a trifle higher than that of the cable with a copper conductor of equal resistance per mile. There is, of course, an element of uncertainty about any such calculations, unless they are made by the cable maker, or by some one to whom he has imparted the secret of the exact percentage of profit he adds on his net costs of material and labour; but we find it difficult to believe that this can account for the difference of 20 to 30 per cent. that exists between the author's figures and our estimate.

With regard to insulating materials, the author's conclusions are that rubber is too expensive and has not proved permanently satisfactory; that vulcanised bitumen is suitable for medium-pressure systems, except where alkaline moisture is present; and that lead-covered paper cables are suitable for all systems and pressures, provided proper precautions are taken to prevent damage to the lead covering, and to protect any exposed paper from moisture when making joints. The necessity of carefully bonding the lead sheathing and of connecting it to earth at suitable points is insisted on, if electrolytic troubles are to be avoided. An interesting piece of information is given on the authority of Mr. Highfield, viz., that the Metropolitan E.S. Co. have some rubber cables working at 3,000 volts, which have been in use for 18 years; and we cannot help wondering whether the difference between these cables, and others that have not been satisfactory, is due to efforts on the part of the manufacturer to cut down prices to try and meet the competition of the cheaper paper and bitumen cables.

The author discusses the merits and demerits of the three most generally used systems of laying cables—viz., the direct, solid and draw-in systems, and says that the first of these is being more generally used now than some time ago. In our opinion, the slight extra cost of the solid system gives such a much better and more lasting job, that the direct system should never be used for permanent work if it can possibly be avoided. The draw-in system has great advantages for feeders, especially when it is probable that an increased section of copper will be required in the near future in busy streets; but for the distributing main, this system has little advantage over the solid system, as it is seldom that a breakdown in the distributors can be repaired without disturbing the paving and interfering with the traffic. We notice that in comparing cast-iron pipes with stoneware conduits, the latter are preferred on account of the secondary insulation they provide, which appears somewhat inconsistent with the author's remarks about bonding and earthing the lead sheathing; and even if a secondary insulation does exist, as might be the case with an unsheathed cable, it is a very doubtful advantage, as it makes the localisation of a fault much more difficult.

The author concludes his paper with a description of an overhead line which has been in use at St. Helens since 1902 to supply energy to an outlying district. There is no doubt that there are many places where permission to use such an overhead line would render it possible to supply current at remunerative rates to outlying districts; and we think that if the author and other engineers would publish details of the cost of maintenance, which we understand is small, and of the freedom from breakdown and risk to the public of overhead lines, it might help other undertakings to get permission from the Board of Trade to erect and put into use similar lines in their districts.

The fourteenth annual report of the Council shows that the membership of the Association now stands at 390, made up as follows:—

Committees	(Members)	167
Chief electrical engineers	(Members)	176
Honorary members ...	... ...	3
Chief Assistants	(Associate Members)	8
Assistants	(Associates)	36

A net increase of three on last year's total. Mr. J. F. C. Snell, a Past President, has accepted honorary membership of the Association.

The Council has appointed a sub-committee to inquire further into the matter of economic wiring, which has circularised all the members of the Association on the subject. The replies received were unanimously in favour of doing everything possible to bring about a set of satisfactory regulations which would allow of installation work being carried out in a less costly manner than under the present methods of casing or conduits.

The Cable-Makers' Association has promised to go fully into the whole matter, and if possible to draft a specification for a suitable standard class of material and fittings which, whilst being moderate in first cost, will comply with all reasonable restrictions tending to safety and durability.

The Electric Lighting Acts (Amendment) Bill contains some suggestions made to the Board of Trade by the Association.

Clause 6 enables the Board of Trade to authorise undertakers to supply premises outside their area of supply, under certain conditions.

Clause 16 gives power to local authorities to provide and hire out fittings, &c. In consequence of the amendment to the clause passed by the House af Lords, a circular letter was issued to Members of Parliament, asking that they should use their influence to get the clause passed in the form in which it was drafted, so that local authorities might be left with a free hand and not be compelled to have such works carried out by contractors, who, it was feared, might form a ring and thus increase prices. This circular also advocated the insertion of a new clause as follows:—

"Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or provisional order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful without the consent of such local authority, company or person, for any other local authority, company or person to supply, distribute or transmit electricity within the same area unless such supply, distribution, or transmission, is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts."

The Council has been engaged in conjunction with the Municipal Tramways Association in considering the action which is being taken by the Institute of Municipal Treasurers and Accountants (Incorporated), and a Departmental Committee in relation to the accounts of local authorities.

Attention is directed to the proposals which are being made, and which strike at the existing arrangements for the management and carrying out of all municipal work, but more especially affect the trading departments whether electrical or otherwise.

These regulations have apparently been drawn up without consultation with the heads of any municipal trading departments, and an attempt is being made by the Institute of Municipal Treasurers and Accountants to get them approved and adopted, or recommended by the Local Government Board.

If the matter is allowed to go through on the proposed lines, the control of every department, whether trading or non-trading, will centre in the Finance Committee and the Financial Comptroller, who will override the powers now exercised by the other committees and chief officers of the various departments.

It is evident that some accountants, at any rate, are endeavouring to get supreme control of all work carried out by local authorities. This would be most disastrous, more especially to all the great trading departments, where it is essential that, for the proper and economical working of the department, the same should be self-contained and each under one head. The Departmental Committee issued its report after receiving evidence from 28 witnesses, not including a single engineer-manager of any trading department.

It has been suggested that the proposals are too obviously unworkable and ridiculous to be worthy of serious attention. Since, however, the Departmental Committee has considered a section of the scheme after hearing one side of the question only, it is imperative that the matter be at once taken in hand.

The Institute of Municipal Treasurers and Accountants has approached the Chief Inspector of Taxes and the Board of Inland Revenue with a view to getting standard rates of allowances for wear and tear. The Council feels that, in questions of wear and tear of machinery and other works, the technical managers should be consulted, and it has, therefore, taken up the matter with the above-named Institution, which, however, in this matter, also has apparently endeavoured to evade co-operation, although the matters dealt with are essentially questions involving engineering experience.

The following are some extracts from the agreed terms to which exception is taken:—

"*Cables.*—In addition to repairs, allowance for depreciation shall be granted at the rate of 3 per cent. per annum *on the written-down value.*"

"*Plant and Machinery.*—On all other plant exclusive of loose tools, meters and office furniture, depreciation shall be allowed at the rate of 5 per cent. per annum *on the written-down value* in addition to the cost of repairs."

"*Conduits, Meters, Loose Tools and Office Furniture.*—No allowance shall be made for depreciation, but annual expenditure on repairs *and renewals* shall be charged as working expenses as and when incurred."

The Council on May 26th resolved that the proposed allowances for depreciation were inadequate, and should not be accepted by local authorities, and that, in arranging allowances for depreciation for the purpose of income-tax, full regard should be given to the periods allowed by the Local Government Board for the repayment of loans in respect of similar assets.

The following table shows the periods usually allowed by the Local Government Board:—

Item.	Local Government Board allowances.			Inland Revenue and treasurer's agreed terms.	
	Period of loan. Years.	Percentage per annum on original sum.	Percentage per annum on written down value.	Percentage per annum on written down value.	Equivalent life. Years.
Buildings	30	3	7	Not mentioned.	
Cables (laid solid)	25	3½	9	No allowance for conduits until renewed.	
Switchboards ...	25	3½	9	5	45
Dynamos	20	4½	11	5	45
Steam generators ...	17	5½	12½	5	45
Engines Motor transformers Instruments	15	6	14	5	45
Cables (in ground)	15	6	14	3	75
Lamp pillars, &c. ...	10	9	21	—	—
Receivers piping ...	10	9	21	5	45
Accumulators ...	7	13	28	5	45
Arc lamps	5	18	37	5	45

The above figures indicate the allowances or periods required to reduce to 10 per cent. of the original sum approximately.

The table shows that the two Government departments go to extremes, the one department allowing for the life of a cable being five times as great as that allowed by the other department. The extremes in each case operate to the disadvantage of the municipalities. The Board of Inland Revenue allow for the life of switchboards being twice as great, machinery generally three times and arc lamps nine times that allowed by the Local Government Board.

The Honorary Treasurer's report shows that this year there is a surplus of £42 4s. 9d. for the year, and a total surplus of £391 8s. 10d., as compared with last year's amounts of £39 4s. 10d. and £349 4s. 1d.

High-pressure Currents and Hailstorms. — The question whether the establishment of a high-pressure transmission installation is able to exercise an influence upon the path followed by hailstorms has just been discussed before the Paris Academy of Science. It was reported to the Academy that surprising alterations had occurred in the distribution of hail by the creation of such an installation in the vicinity of a mountain chain. The mountains formerly apparently exercised an attraction on hail clouds, presumably in consequence of the situation of the numerous valleys, along which the clouds were turned upwards towards the mountains. An electric transmission line on the three-phase alternating-current system, with a pressure of 45,000 volts, has recently been established in this neighbourhood, and since then the hailstorms have no longer passed along the valleys, but have travelled straight across them, following the course of the transmission line. We publish this with all reserve, for we have grave doubts as to the existence of any such effect; however, if so distinguished a body as the Academy considers it a matter suitable for discussion, we may be excused for giving it publicity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Friction in Water Pipes.

The article in your issue of July 2nd on "Friction in Water Pipes," presents some useful information in a readily understandable manner. As, however, there is much confusion in the minds of engineers on this question, might I suggest that Box's formula gives results between those given by Darcy for new and for incrusted cast-iron pipes, only for pipes of greater diameter than about 2½ in. For smaller diameters of pipe, Box's formula would give results less than both values given by Darcy. The relation between the results given by the two formulas, in fact, varies with the diameter of the pipe. In Box's formula for a constant rate of delivery of water, the head varies inversely as the fifth power of the diameter, while, according to Darcy, the head may be said to be inversely proportional to the diameter raised to the n power, where n is not a constant quantity, but varies with the diameter and is always greater than 5.

The smaller the diameter of the pipe the greater is the ratio of Darcy's head to Box's.

R. M. Neilson.

Glasgow, *July 8th*, 1909.

A Sensitive Microphone.

After trying a long time to get some form of telephone which will catch the sounds of the human heart, I have happened on a form of transmitter which does so partially, at least, and which gives other results which may interest your readers.

The innovation is merely to introduce one or more pieces of copper wire (about No. 22 size) into a mixture of carbon granules with iron and aluminium filings. It seems to me a better result follows if you insulate the copper wire; and then coil round it (after induction coil fashion) a much finer wire (about No. 42 or thinner). This combination I have enclosed in an ordinary carbon cup transmitter.

You must be careful, of course, that the wire does not make contact with the diaphragm (I have found a carbon one the best), and that the filings are not in mass on top of the granules, in contact with diaphragm.

If this be fairly carefully done, I think anyone will find, on comparing under equal conditions a transmitter charged as above with one charged with simple carbon granules, that the former shows more sensitiveness and a real magnification of sound. I only judge by the following three tests:—

1. Putting a watch in contact with transmitter, and seeing how far from one's ear one can hold the receiver and still get the watch-tick.
2. How far from a clock you can place transmitter, and the clock-tick be heard in receiver placed right on ear.
3. The pulsations of one's heart.

If your readers are interested, a few more details could be given (even a theory to account for the thing).

J. W. Pickford.

Cleethorpes, *July 8th*, 1909.

E.M.F. in a Dead Underground Cable.

I have read with great interest the various letters *re* the above, and think that the following experience may not only be of interest to many of your readers, but explain the cause of the shock received by "Enquirer's" jointer.

I had on one occasion to investigate a fault which occurred on an overhead line and sub-station connected to a 10,000-volt system, and used for giving a supply to a large colliery. The fault proved to be intermittent, and therefore very elusive to locate, so it was decided to make the gear alive in sections. This was done, and the line proved to be quite O.K., but the moment the sub-station was energised one of the oil switch insulators broke down, causing one phase to be earthed. The switch case was efficiently connected to an earth pipe, buried in coke breeze, generally reckoned to be one of the best methods of providing a sound earth. The centre point of the star-wound generator at the power station, about six miles away, was earthed through a large resistance of 48 ohms, so that there would be current flowing between the sub-station earth and the power station one, causing a difference in potential between them, which would be large or small, depending on the amount of current passing and the nature of the earth circuit. In this case the earth circuit would be of fairly high resistance, as there were no gas or water-pipe lines or tram rails.

After locking out the feeder and examining the faulty insulator, I was leaving the sub-station, when the mine foreman reported that as the signalman at the pit bottom took hold of the signal lever to signal to the engineman in charge of the winding engine, he received a very severe shock, which knocked him head over heels.

The explanation of this is that as the power station was built practically on top of the coal bed, the coal bed at the pit bottom, on which the signalman was standing, would be at practically the same potential as the power station earth, and the signal wire from the pit head would be at practically the same potential as the sub-station earth, so that any difference in potential between the two earths would be felt at once by the man touching the signal lever.

In the case of "Enquirer's" jointer, the cable sheath must have been acting as a pilot from an earth in a district where the lightning discharge took place, and which would, therefore, for a second or so, be at a much higher potential than the surrounding districts, in one of which the jointer was working, so that when the discharge took place the jointer got a shock in the same manner as the signalman in the instance mentioned above. The whole proof of this explanation rests on the question "Was the cable sheath at the sub-station end connected to earth?" and I should be glad to hear from "Enquirer" if it was.

J. W.

Metal Lamps.

Recent technical papers have been full of pyrotechnic displays in journalese on the subject of the lighting achievements on the part of a certain firm of electric lamp manufacturers who have recently placed before an enthusiastic and grateful public a 16-C.P. 200-volt lamp. Now that the period of excitement has passed, is it not time to ask ourselves what we really have got? There are several lamp makers who have advertised their 25-C.P. tungsten lamps at an efficiency of about 1 watt per Hefner candle, but so far it has only occurred to one firm to make that lamp and under-run it until it gives 16 C.P. at an efficiency of 1·56 watts per candle. In these times of strenuous and skilful advertising, it will pay the consumer and the retailer to read advertisements with both their eyes skinned.

Slide Rule.

[A tungsten lamp giving 25 C.P. at 230 volts, 1·25 watts per candle, will give about 16 C.P., 1·5 watts per candle, we believe, when under-run at 210 volts. But has such a lamp been made, other than the one mentioned above? The nearest approach to it apparently is one advertised by the Deutsche Gasglühlicht A.G., in the *E.T.Z.*, on July 1st, stated to give 25 hefners at 200—240 volts, with an efficiency of about 1·25 watts per hefner—say, 22·5 C.P. at 1·39 watts per candle. At 1·5 watts per candle, this lamp would probably give about 20 C.P.—EDS. E.R.]

Municipal Trading and the Electric Lighting Acts (Amendment) Bill.

I am obliged to "Borough Electrical Engineer" for his reply to my last letter, but should have been still more so had he answered the two questions I then put to him.

Will he kindly also give the grounds upon which he bases his statement that "in the House of Lords there were representatives of one class only." One would have thought that the House of Lords contained more men interested in municipal life than in electrical contracting, but doubtless before making his very positive assertion he investigated the matter, and it would be interesting if he would give us the results. He also states that "the municipalities had no chance of stating their case." What is his authority for this statement?

"Borough Electrical Engineer" claims for a municipality equal powers to those of a supply company, but he appears to overlook the fact that the latter is a purely trading body established for the purpose of making profits, which a municipality is not. Further, shareholders in a supply company become so of their own free will, whereas in the case of a municipality all the ratepayers are virtually compulsory shareholders.

In the same way his contention that a contractor "has as much grievance against a new private contractor opening up as he has against a municipal wiring department opening, no more and no less," would only be true if the new wiring contractor were able to raise a portion of his requisite capital on the security of the existing contractors, and also compel them to bear a share of any loss he might make in his business. This would scarcely be called fair competition, yet it is the position of a municipality opening a wiring department.

"Borough Electrical Engineer" charges me with deliberately misquoting his article, but he is good enough to give in full the original words of his article, and my quotations from the same, and I could wish for no better refutation of the charge. The only part of his original article with which I (as a contractor) dealt, was the portion dealing with the wiring contractors' grievance, which was stated to be at the outside a matter of 4s. 2d. per annum, this being based upon a loss on the municipal wiring department equal to a 1d. rate. It was solely this so-called "outside" figure with which I dealt, contending that it should be enormously increased, and yet I am charged with "deliberate misquotation and perversion," because I did not quote from the original article to the effect that in the author's opinion the loss would in many cases be less, in fact, "usually nil" as the wiring department "usually pays."

In my first letter I assumed that "the average loss made by a municipal wiring department does not exceed 10 per cent." Twice has "Borough Electrical Engineer" characterised this as "absurd," but whether because the figure taken is too high or too low I have not yet been able to ascertain, although I definitely asked him the question in my last letter. Perhaps he will tell us upon what percentage of of average loss he based his outside figure of the loss on a wiring department being equal to a penny rate.

I am glad to note considerable modification in "Borough Electrical Engineer's" previous attack upon contractors—in his last letter his strictures were against contractors generally, but they are now narrowed down to the black sheep from whom, unfortunately, no fold is free. But is it right that the many should suffer for the few?

Contractor.

Electric Lighting Acts (Amendment) Bill.

May I direct the serious attention of electrical companies to the grave danger of allowing this Bill to pass in its present form? The Bill does not give effect, as might be inferred from the memorandum accompanying the Bill, to the recommendations of the Joint Committee of 1898, nor does it carry out the promises made by a former President of the Board of Trade. On the other hand, it imposes fresh conditions of a very onerous kind on electrical companies.

The effect of Clause 6 is to empower the Board of Trade to authorise a local authority to supply outside its area, and to compete with a company without the consent of such company, while a company can only be authorised to supply outside its area, and compete with a local authority, with the consent of such local authority.

Clause 13 relates to the audit of companies' accounts. Under this clause a company may be compelled to comply with the recommendations and requirements of the Board of Trade auditor in regard to matters affecting the interests of the authority empowered to purchase the undertaking. In view of the fact that many electric lighting companies have agreed with the local authorities on special terms of purchase, this clause is exceedingly dangerous to the interests of such companies.

No one doubts the impartiality of the Board of Trade officials, but they cannot be expected to do more than fairly interpret the law, and if this Bill becomes law many electric lighting companies are certain to suffer grievous injustice. It is safe to say that there is no precedent for this kind of legislation in the law affecting any other industry in this country.

Does anyone still doubt the urgent necessity of the electrical industry possessing some organisation which will protect its interests in these matters?

E. Garcke.

Electrical Federation Offices,
London, W.C., *July* 12*th*, 1909.

[Our readers will find a summary of the proposals of this Bill, together with our critical commentary thereon in a leading article that appeared in our issue of March 26th, 1909, page 502. Notices have been filed of numerous amendments, and we give some particulars of these in our "Parliamentary" columns to-day. We have a good deal of sympathy with the views advanced by our correspondent in the above letter, as reference to our article will show, but it seems to us that only a sectional organisation representing electrical companies can act with a view to protecting companies' interests. If a national organisation which counted among its members municipal electrical undertakings were to endeavour to protect interests of this kind, it would be acting in direct opposition to the desires of part of its membership!—Eds. E.R.]

The Ethics of Advertising.

It may interest you to know that the data which you reprinted in your last issue under the heading "Ethics of Advertising," were made up by me for the use and instruction of our salesmen. Only three dozen copies were printed or neostyled.

The assertion, therefore, that these data have been sent out as a circular or with statements, under the cloak of anonymity, is untrue.

If your correspondent obtained a copy, it must have reached him by other means than "Fair Play," under which *nom de plume* he hides his identity.

Whatever code of etiquette may hereafter be drawn up, I am satisfied that it will never be considered unfair for a tungsten lamp maker to point out that the tantalum lamp, though a metal-filament lamp, has not the efficiency of an Osram or tungsten lamp.

James Young Fletcher,
Manager, Osram Lamp Department.
The General Electric Co., Ltd.

London, E.C., *July* 13*th*, 1909.

I also was the recipient of the circular dealing with various types of incandescent lamps alluded to by your correspondent "Fair Play," and so far as I can find out from my friends, it seems to be thought that the lamps in the second column and the lamps in the fourth column of this leaflet proceed from works which are closely connected. If this is so, it seems unfair that this little fact should not be stated in the comparison table. It is not cricket, any way.

Interested.

The Prevention of Smoke.

I have read with great interest the paper on "The Prevention of Smoke," by Mr. Wilfred Yorke, A.M.I.E.E., in your issue of 2nd inst.

Possibly it is the more "interesting" because so misleading that it will put people on the wrong track when trying to get rid of smoke, either with chain grate stokers or any other stokers.

Mr. Yorke's suggested panacea of letting in air over the fire is the same old device used by innumerable patentees from the early days.

The actual causes of the smoking of a chain grate, once the arch has become incandescent, are probably :—

1. Too short an arch to complete combustion.
2. Too thick a fire for the draught.
3. The running of live fire over the back ends.

The remedies are obvious. The best way to run a chain grate with a given amount of draught, so as to get the most steam from the boiler, is to run it with as thin a fire as possible, within the limits of complete combustion of the fuel before the clinker is delivered over the end of the grate, thereby ensuring the lighting-back of the fuel as it enters the furnace up to the doors. In this way the resistance of the fire-bed to the entrance of the air is lessened, and the largest amount of air compatible with the draught can be got through the grate. By this means the largest possible amount of fuel can be burnt with the chain grate stoker.

Speaking from a wide experience with many types of boilers and stokers, I can say that I have never found it necessary to introduce cold air in the wrong place. If it is put through the fire in the right quantities for the fuel that has to be burnt, other conditions being right, smokeless combustion ensues.

It will be noted in the test Mr. Yorke gives, that the CO_2 dropped from 12·6 to 10, showing a considerable loss in efficiency. Surely Mr. Yorke must know there are many chain-grates working, in which 12·6 CO_2 can be got with an absolutely smokeless chimney? If by any chance he is not practically acquainted with them, I shall be pleased to help him in his investigations.

The emission of smoke can be prevented either by the use of chain-grate stokers, or by the use of coking stokers, the latter being considerably cheaper and quite as efficient. The latter have the advantage that it is possible to introduce more air through the fire than can be done with natural draught suction only, so that grate area for grate area the coking type of stoker will do the most work. Where, however, the available space for grate area is large, the chain-grate may be the better machine to install—circumstance must largely govern the choice.

A. W. Bennis.
pro Ed. Bennis & Co., Ltd.

Bolton, *July* 12*th*, 1909.

Temperature Errors in Shunted Ammeters.

I have noticed a letter from Mr. Ernest F. Moy in your issue of the 9th inst., and am interested to find that he has experienced the same difficulty of false reading in shunted ammeters, due to thermal effects.

With regard to the actual cause of the heating of the shunt at one end, I do not think that his explanation is adequate, and I have reasons for thinking that my explanation of bad contact (although it is very simple), is the correct one, and that Mr. Moy's explanation, although very interesting, is out of the question. The reasons are as follows:—

1. We have on the switchboard quite a dozen similar shunts, and they do not heat particularly at either end.
2. The particular shunt in question gives no trouble, now that the contact has been carefully cleaned and remade.

Seeing that no alteration has been made in the material, in the position of the shunt, or in the current passing, it is clear that bad contact was the cause, and that the effect which Mr. Moy quite correctly describes, is, at ordinary current densities, quite negligible.

W. Fennell.

Electricity Works, Wednesbury.
July 12*th*, 1909.

With reference to Mr. Fennell's article on shunted ammeters in your issue of June 25th, it is unfortunate that he gives no particulars regarding the volt drop at full load across the shunt he used in his experiments.

Without this figure and the maximum scale reading of the ammeter, one is unable to take out figures for the temperature of the hot end of the shunt, but even if the shunt were constructed of copper and constantan, the temperature must, it seems, have been abnormally high.

These thermo-electric troubles can be practically eliminated by using manganin for the resistance strip—the combination, copper and manganin, having very roughly about $\frac{1}{26}$ of the thermo-electromotive force of a copper-constantan combination for the same difference of temperature.

Charles H. Wright.

Chelmsford, *July* 7*th*, 1909.

The article and correspondence on the above subject tend to upset all our preconceived ideas of thermo-electric phenomena. Except in manner of expression, Mr. Moy seems to agree with Mr. Fennell that it is possible to record a thermo-electric current of 10 amperes on an ordinary commercial ammeter by means of the fluctuations of temperature which occur in the daily routine of electric generation, because, as Mr. Fennell puts it, the junction was composed of lugs, one of which was tinned while the other was raw copper.

Mr. Moy suggests that the "false reading" was due to the difference between the P.D. of the thermal couple at the cold end of the shunt and the P.D. of the couple at the hot end, but would it not be more instructive to know something of the value of those P.D.'s? What was the difference of temperature between the junctions to generate a pressure or to alter the P.D. sufficiently to oppose the "legitimate E.M.F." and show a — current of 10 amperes, and what was the junction composed of which when "dead" and heated with a blow lamp showed a current of more than 10 amperes?

The couple which gives the highest known thermo-E.M.F. consists of "constantan" (Cu 60 per cent. Ni 40 per cent.) and copper. It is possible to get 37 micro-volts per degree C., but if we take copper and tin it is much less, namely, 0·1 for each metal, and as both are of negative quantity, 0·1 — 0·1 = 0·1, which multiplied by 80° C. = $\frac{8}{1000000}$ volts, but this seems too infinitesimal to successfully oppose an E.M.F. used for practical purposes, even if it is only the small portion passing through the shunted instrument.

W. C.

Wednesbury, *July* 7*th*, 1909.

[We do not follow our correspondent's arithmetic. As regards the thermo-electrical effect, the only question is the magnitude of the current that could be sent round the circuit composed of the shunt and the moving coil of the ammeter by the thermo-E.M.F. set up at the heated contacts, quite regardless of the actual current flowing in the main circuit. Mr. Fennell's experiment, showing that when the main current was zero and the contact was heated with a lamp, the E.M.F. sufficed to produce an indication corresponding to the passage of 10 amperes under normal conditions, appears to us to be conclusive. Of course, the current actually generated and flowing in the circuit would probably be only about one-thousandth as great.—Eds. E.R.]

New Home Office Regulations.

Mr. Johnston's letter appearing in your last week's issue confirms the misunderstanding that a number of engineers are under, regarding the above, judging from the correspondence we have had on the subject.

Mr. Johnston's supposition that the word "not" appears in error in the last sentence of the second paragraph, Clause 13, is incorrect. If it were the case, the immunity against shock, should the lampholder become alive, would be entirely dependent upon the reliability of the earthing connection. The regulation, however, calls for the lampholder to be completely protected against the liability of hand contact or metallic connection with any metal work of the portable lamp, and to achieve these conditions it is necessary for the lampholder to be completely insulated.

This arrangement acts as a two-fold precaution against all possible shock, as even with a live holder, if the insulation of the lampholder is efficient, as in our Guardian hand lamp, the portable lamp is absolutely "shock-proof."

It does not appear to be generally understood that the the adoption of a "shock-proof" portable lamp is an alternative to the necessity of earthing. A similar alternative equally applies to the remarks regarding the earthing of pendant lampholders occurring at the beginning of the second paragraph under Clause 13, and also contained in Clause 21. In these cases the use of a "shock-proof" lampholder, such as the Guardian pendant lampholder, avoids live lampholder dangers, and dispenses with the necessity of earthing. We understand, what we think will be of general interest, that an explanatory memorandum is being issued by the Home Office authorities dealing with the above and other matters contained in the new regulations.

For **The British Central Electrical Co.,**
E. S. Conradi.

London, E.C., *July* 12*th*, 1909.

LEGAL.

J. Musgrave & Sons, Ltd., v. Bradford Corporation.

A Question of Costs.

In the King's Bench Division, on Thursday, July 8th, this case was mentioned to Mr. Justice Darling on a question of costs.

Mr. Hutchinson appeared for the defendants, and said that the action was tried by his Lordship, and a question now arose on the form of the certificate given by the Master in regard to the costs of the action. His Lordship gave judgment for the defendants on the claim and counterclaim, with £10 damages in respect of the latter. His Lordship gave defendants the general costs of the action and the counterclaim, except on the issue on which they had failed.

Mr. Disturnal, for Messrs. Musgrave, pointed out that if the order went as drawn up, the plaintiffs would be deprived of all costs, and that he submitted was not what his Lordship intended.

His Lordship said he thought that the certificate as the Master had drawn it up, expressed his intention with the exception of one point. With regard to that, the following words must be inserted:—"Except so far as regards the counterclaim as to the issue concerning the defective workmanship of the shaft. Upon that issue the defendants will not get costs as against the plaintiffs, neither will the plaintiffs against the defendants."

Beardwood v. Bury Corporation.

At the Manchester Assizes on 8th inst. William Sidney Beardwood claimed damages for personal injuries. He said that on November 30th last he went to Bury, and in the evening attempted to board a Radcliffe car opposite the Knowsley Hotel. He had one foot on the step when the car started, and he fell, dislocating his left shoulder. It was three months before he recovered the full use of his arm, during which time his business suffered, as he was unable to give proper attention. For the defence it was suggested that Beardwood, on being told that the car was not going to Whitefield, got off while it was in motion, though warned not to do so. The guard stated that he put his hand on the plaintiff's shoulder to prevent him alighting while the car was moving.

The plaintiff was awarded £50 damages.

Metropolitan Electric Supply Co., Ltd., v. Uxbridge and District Electric Supply Co., Ltd.

A motion in this matter for the appointment of a Receiver of the defendant company was before Mr. Justice Neville in the Chancery Division on Tuesday last, but with the consent of all parties it stood over for a week.

It was stated that the applicants had just had affidavits from the other side which they desired to answer.

Laird v. Erith Oil Co.

At Dartford County Court on July 7th, before Judge Emden, Wm. James Laird, a wharf labourer, sued the Erith Oil Co., Ltd., for damages for injuries received through an electric shock.

Plaintiff stated that whilst at work on a barge, he took hold of a chain from an electric crane, and feeling the current he called to the crane driver to switch it off. He did so, but plaintiff could not release his hold, and it was not until the current was switched off that he could do so. By that time he had lost consciousness.

Counsel for the defence admitted that the accident happened, but contended that it was without negligence on anyone's part. It was explained that the accident was due to a defective cable, not protected, lying across the rails on which the crane worked.

Judgment was given for plaintiff for £75 and costs.

North-Western Electricity and Power Gas Co.

The petition by Harper Bros. & Co. and others for the compulsory winding up of this company, was again before Mr. Justice Neville, in the Winding-up Court, on Tuesday last.

Mr. Hansell, for the petitioners, now stated that the petitioners' debt had been satisfied, and they were willing to have the petition dismissed, with costs.

There was no opposition to this course being adopted, and his Lordship dismissed the petition accordingly.

Sequel to Fife Pit Explosion.

The hearing of actions by miners and their dependants in connection with the recent explosion in the Fife Coal Co.'s pit at Lochore, has resulted in damages being awarded, ranging from £300 to £500. The accident took place in the Mary Pit, the deepest in Fife. In the course of operations inflammable gas was met with, and safety lamps only were in use. A fan, driven by an electric motor, circulated a current of air throughout the workings. Prior to the accident several miners were waiting at the mid-working station until the fireman reported that all was safe. The fireman went forward to the motor and switched on the current, the pursuers stated, and immediately a terrific explosion took place. Three workmen were killed or fatally injured, and others received injuries. The pursuers imputed the fault to the defenders in respect that their system of working was defective, and that they failed to observe the rules. The company contended that the accident not being attributable to their fault, or to the fault of those for whom they were responsible, or to any defect in their system of working the mine, they were entitled to absolvitor. After a three days' trial, the jury returned a verdict for the pursuers. Other claims were settled.

Fanshawe v. Salford Corporation.

On 9th inst. an action was heard at the Manchester Assizes, before Mr. Justice Hamilton, in which Mr. George Henry Fanshawe, a clerk, residing at Stanley Grove, Eccles, sought to recover damages against the Salford Corporation in respect of an accident on January 11th, by which he lost a leg.

The allegation of the plaintiff was that whilst a passenger on one of the Corporation tramcars he was hustled off the car by the conductor and fell in the roadway, his leg going under the wheels of the car. On the other hand, it was contended by the Corporation that the plaintiff was under the influence of drink, was quarrelsome and disorderly, and that it was while attempting to strike the conductor that he fell under the car.

The jury found for the plaintiff, and awarded £500 damages. Judgment was given accordingly.

Bray v. Rawtenstall Corporation.

At the Rawtenstall County Court monthly sitting just held, Judge Hamilton heard an action brought by Mrs. Dorcas Bray, a widow, of 5, Queen Street, Cloughfold, for personal damages sustained in a runaway tram disaster between Rawtenstall and Haslingden on Christmas Eve last. The Corporation, as owners of the car, did not deny liability. The car ran backwards a distance of over a mile down a declivity, and one of the passengers who jumped off the vehicle was killed. Mrs. Bray sustained a fractured jaw, a bruised shoulder, a cut arm, and severe shock to the system. It was stated that probably she would never recover. She claimed £100, and the Corporation had paid £30 into Court. Judgment was given for the plaintiff for £60.

The Johannesburg Contract—Appeal.

On Tuesday, July 6th, the House of Lords, consisting of the Lord Chancellor and Lords James, Atkinson, Gorell and Shaw, allowed an interlocutory appeal by the Municipal Council of Johannesburg against a decision of the First Division of the Court of Session. The respondents were D. Stewart & Co. (1902), Ltd., Glasgow, William Beardmore, shipbuilding and steel manufacturer, of Victoria Street, London, and Mrs. Joseph Beardmore sued as the executrix of her late husband.

The action arose out of certain contracts under which the respondent company contracted to supply the appellants with gas producer and electric generating plant for electric lighting, power, tramway and other purposes. The Town Council of Johannesburg, in September, 1903, resolved to install plant for the production and supply of electrical energy for municipal purposes, and issued forms. The specifications were divided into sections, and the tenders made by Messrs. D. Stewart & Co. (1902), Ltd., Glasgow, for Sections B, C, D and E (the last three being electrical generating machinery) were accepted. The plaintiffs in the action claimed that as the defendants were in breach of their contracts, they were liable to repay to the Council the payments already made on account of the contract price, and to pay them damages for breach of contract.

The present appeal, so far as this part of the action was concerned, related entirely to the determination of the tribunal and procedure by which this question between the parties was to be settled, the appellants contending that the question fell to be decided by the Court being outside the scope of the arbitration clauses contained in the contracts. The Court of Session decided that the question should be decided by arbitration in England. Further, they dismissed the claim against the sureties as being premature.

The Municipal Council appealed, and in the course of the arguments, it was stated that the sums claimed against the Scotch company were in all £418,694, and against the sureties (Mr. William Beardmore and the executrix of Mr. Joseph Beardmore) £115,134.

At the close of the arguments, the Lord Chancellor expressed the opinion that the arbitration clauses were to be construed according to English law, and that so construed the Courts had power to enforce the contract. He was further of opinion that the suit against the sureties had been wrongly dismissed.

The other noble and learned Lords concurred, and the appeal was allowed, with costs, and the action was directed to be tried in the Scotch Courts.

Mr. Clyde, K.C., Mr. T. B. Morison, K.C., and Mr. Mitchell appeared in support of the appeal, instructed by Faithfull & Owen for P. Morison & Son, Edinburgh; Sir Robert Finlay, K.C., Mr. Macmillan, the Hon. W. Watson and Mr. Fletcher Moulton, instructed by Nicholson, Graham & Beesly for Davidson & Syme Edinburgh, were for the respondents.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Legal" writes:—"Will you be kind enough to advise on the following? A builder owns an estate on which he lays out 100 small houses, and contracts with the electricity supply authority to wire the whole of the houses on the estate; the authority on their part agree to supply the current at contract rate per lamp demanded, and lay all cables and connections free of charge. Later, when the builder wishes to get a supply of gas into each house for cooking and heating purposes only, have the gas company a right to refuse to lay the mains for this purpose apart from lighting? In several parts of the country known to the writer the gas authorities, although not giving point-blank refusal to lay the necessary gas mains and pipes, are pressing the builder to put in gas pipes for lighting purposes also. Are they not exceeding their right in so doing? And is not the builder entitled to a gas service for heating and cooking only—*i.e.*, for all domestic purposes other than lighting?"

⁂ This is a question the answer to which depends upon the statutory terms under which gas is supplied in the district in question. These may or may not be different from the terms laid down by the Gas Works Clauses Act, 1871. That Act provides (by Sec. 11) that the undertakers, upon being required to do so, shall provide gas for any premises within twenty-five yards from any of their mains; and (by Sec. 36) that whenever the undertakers neglect or refuse to give a supply of gas to any owner or occupier of premises, within the limits of the special Acts, entitled to the same, under such pressure as is prescribed, they shall be liable to a penalty not exceeding forty shillings for each day during which such default continues. It is possible, of course, that the provisional order under which gas is supplied in the district in question makes special provision for the supply of gas for purposes other than lighting; but all consumers in the district must receive equal treatment. If "Legal" could procure a copy of the provisional order under which gas is supplied in his district, he could probably answer all these questions for himself.

REVIEWS.

Electric Lighting and Power Distribution. Vol. I. By W. Perren Maycock, M.I.E.E. London: Whittaker & Co. Price 6s. net.

This is the seventh edition, and is practically re-written. It is specially suitable for students preparing for the Elementary and Ordinary Grade Examinations of the City and Guilds of London Institute, and has, indeed, been used for many years throughout the country for this purpose. In the present volume there are 167 more pages and over 100 more illustrations than in the previous edition, rendered necessary by the advance in the science; but the book is still very compact and of a size suitable for students' use.

Though the work as a whole is elementary, yet the student is supposed to be acquainted with the fundamental principles of magnetism and electricity, and to have a knowledge of simple algebraical equations and their manipulation. Given these, he should find that he has before him one of the best text-books of its kind, and should have little difficulty, if he be in earnest, in mastering sufficient of the subject to enable him easily to pass the above-mentioned examinations.

How very difficult it is to write a good text-book on elementary electrical engineering; what a nice balance must be struck between theory and practice, between mathematics and experiment, between the fundamental and side issues! Little wonder, indeed, that a suitable work is rare and difficult to obtain. The work under review, however, as is evidenced by a popularity of so many years, to a large extent satisfies the needs of the student, and we cannot fail to be struck on perusal of its pages with the orderly and systematic arrangement, with the clear and succinct definitions, with the original and suitable illustrations, and with the care taken to touch upon and explain only those parts of the subject that are of fundamental importance to the young engineer.

With regard to resistances the author contents himself with a few well-drawn figures, thus fixing the mind on principles and not confusing it with useless and academic side exercises. Fall of potential is illustrated by hydraulic analogy—the diminution of head through resistance of water flowing in a pipe. This is good in its way, but we think that few of the students who will find this book useful will have actually seen the experiment for themselves, and unless they have done so the analogy is useless, as this particular experiment is one that must be seen to be believed.

In describing the effects of current, a section is given to the phenomena of radiation, a novelty in a work of this kind. Mention is made of cathode rays and Röntgen rays, the peculiar effects of the latter being well detailed, and a diagram of their effect on the fluorescent screen inserted. A point that is very noticeable with regard to the direction of the field induced by a current is a number of excellent diagrams, which show a student very clearly the relation between current and field. We have seen nothing like this before, and we know from experience that the teacher will find them very valuable indeed. A similar diagram is the one determining the polarity of a solenoid or of an electromagnet.

Under the section "Experiments on Induction," we have again to note the very luminous diagrams on the motion of a current-carrying conductor when placed in a magnetic field, and the diagram illustrating magnetic drag. The latter is particularly interesting, and gives a student, at a glance, a reason for the phenomenon. A very useful chapter is that which deals with electric bells, contact makers, fire alarms, rules for bell wiring, indicators, relays, circuit diagrams, earth returns and telephones; the circuit diagrams are especially interesting and clear.

In Chapter VI, that most difficult matter to the young electrical engineer, the laws of magnetomotive force, is taken up. We consider this one of the best chapters ever written on this subject for an elementary student.

Chapter VII is on electrical measurement, and we notice that the illustrations here resemble the stuff we are accustomed to see in the workshop, and not the prim, impossible apparatus we behold in many text-books.

The last chapters have to do with the construction of the dynamo, the examples chosen being up-to-date modern specimens.

On the whole this book is the best of its kind that we have come across, and it is safe to predict that the new edition will enhance its popularity.

Heat for Engineers. By Chas. R. Darling. London: E. & F. N. Spon, Ltd. Price 12s. 6d. net.

As pointed out in the preface, the author seeks to deal with the "numerous applications of heat in modern industrial processes, and to furnish the information and data required for a correct understanding of the thermal phenomena involved."

The book consists of 21 chapters and some 415 pages. Amongst the chapters are those on "Practical Applications of the Property of Expansion," in which pendulums and steam traps are dealt with.

There is a chapter on "The Measurement of High Temperatures," and pyrometers of all types are dealt with, from Wedgewood's to the more recent Callender, Roberts-Austen, and Le Chatelier types.

Another interesting chapter is that on "Practical Applications of Fusion and Allied Phenomena." Here the action of water sprinklers is dealt with, and the use of sodium acetate in footwarmers.

Low temperatures are discussed in Chapter XV, and the following chapter gives complete descriptions of refrigerating apparatus. The various refrigerators illustrated would rejoice the heart of Sir Francis Bacon, who lost his life through a chill caught by packing a chicken in snow to see whether its flesh could be preserved. The temperature necessary to preserve most meats, vegetables, &c., is about 33°-40° F., and only in a few cases is it necessary to go below 32° F. by a few degrees.

The lagging of steam pipes is dealt with on page 323, and there the author gives an improved electrical method of testing laggings.

Ventilation, fire grates, and chimneys follow, and the limitations of formulæ are discussed. Electric radiators receive rather drastic treatment towards the end of this chapter, and one might suggest that here "comparisons are odious," and that electric radiators are very nice things if one can afford them. In order to make a strict comparison, the fact that coal is burnt in a coal fire when it is not wanted has to be considered, and servants' wages reckoned at so much per hour must be taken into account. Perhaps if the author did this instead of merely comparing heat units in an unpractical manner, he would be surprised to see what happens in cases where rooms have to be only temporarily heated.

The final chapter discusses the losses in steam engines and refrigerating machinery.

We congratulate the author on producing quite a useful treatise. The task of teaching "Heat"—a somewhat "dry" subject (as students generally remark)—in a practical way is no easy matter, and the present work stands almost by itself as the only treatise on "Practical Heat."

It is well printed and illustrated.

Boiler Feed Water. By F. A. Anderson, B.Sc. (Lond.). London: The *Electrician* Printing and Publishing Co. Price 6s. net.

This is an attempt to place the subject of boiler incrustation and corrosion fully before the engineer, with special reference to the reduction of the hardness of water, to which incrustation is due.

Probably most hard waters can be treated fairly well by the Clark process and its modifications, but with many waters there are complications of which the engineer should be aware. Lime will remove lime carbonate wholly, but to remove lime sulphate requires soda, and the sulphate is not removed; it is only converted into a new soluble salt of soda, and gives rise to a danger, for it may concentrate in a boiler, and cause trouble.

An engineer in charge of boilers must be alive to all their tricks, and alert against being caught napping. He can see the coal fed into the furnace, but the feed water goes in unseen, to perhaps, tenfold the weight, and may carry in great quantities of salts.

The author confines his studies chiefly to the ordinary lime and soda re-agents. He makes very little reference to the barium salts; perhaps he thinks they are still outside the realm of practical cost. But the barium salts, for sulphate reduction, more especially, deserve more mention, if only to urge on some electrochemist to study their formation electrolytically.

A few boiler scale analyses are tabulated as examples, two of them from Canada showing high percentages of magnesium salts. The analysis of a scale is no sure criterion of what was in the water. The author explains the various reactions which cause this and other apparent anomalies.

Under the head of corrosion we find no reference to that which often goes on under an apparently clean white sulphate scale. This sort of corrosion may be found in boilers at Burton.

On the other hand, the author suggests a case of two waters, harmless alone, but which would cause corrosion if mixed. This is quite true, and we have known where a pair of Yorkshire streams appeared each to be very good for boilers, yet when they were mixed a few hundred yards lower down, a boiler fed with the mixed water was corroded rapidly.

Also, water that is good enough for low pressure may be corrosive at modern pressures, for the higher temperature may change the behaviour of some of the salts present.

Chapter III is the chemists' chapter—for use in the laboratory—for it deals with water analysis and soap tests. Chapter IV is a continuation of it, and Chapter V deals with the practice of water softening, no attempt being made to describe the details of apparatus. Their action is described generally, and the results are given in formulæ. Silver and phenolphthalein tests are cited, and stress is laid on the importance of pure lime, such as "Buxton," by which, of course, is generally meant Derbyshire lime from the carboniferous rocks of that county.

White chalk lime is good, but hydraulic or aluminous limes, such as Dorking gray lime, are less suitable. The various forms of soda are described, and the cost compared per 1,000 gallons softened of interchangeable re-agents. An interesting question is discussed by the author in respect of how far it is desirable to deal with magnesia. He thinks that if lime carbonate be removed, magnesia may remain if present in other than the carbonate form. Magnesia has, he says, little tendency to form scale.

Thus, it will be seen that the author has thought on his subject, and, perhaps, stirred up controversial matter. And we seem to see between the lines that the lime and the soda treatments are not all-satisfying. As Punch's footman thought, with his beef and mutton diet, it was high time another animal was invented, so, perhaps, it is high time another softening re-agent was discovered. Barium salts have points of great excellence. True, they are poisonous and have a huge atomic weight. But, on the other hand, they are insoluble and cannot exert their toxic property. They have peculiarly good qualities for easy use, and the author, as we have said, might give room to a discussion of them in a future edition.

A sixth chapter treats of grease in boilers. Has the author sufficiently considered the supposed danger of greasy water and magnesia salts?

The removal of oil is very difficult. The de Laval cream separator will take out much of the oil from condensed water, but does not seem to take it all out. Then there are electrical methods, said to be very efficacious, and methods of coagulation.

We can hardly agree with the paragraph on page 130, which says that in softening circulating water it is only necessary to deal once with the main quantity and then to soften the make-up. This might be true if softening did remove all the scale-forming matter. But it does not; circulating water by constant evaporation becomes as "hard as a brick-bat," and must be repeatedly re-softened.

A final chapter on steam boilers contains some good general advice on boiler setting and management. We might add to this, that when there is the slight risk of grease getting into a boiler, the latter, when laid off, should be well blown off by way of its scum trough, so as to remove floating grease and prevent it from settling down on the plates when the boiler is finally blown down in the usual way. Turning over a page, we find the author recommends this very safeguard at page 142.

BUSINESS NOTES.

Electrical Enterprise in the Near East.—At the end of April we announced that an international financial group had been formed for the promotion of electrical enterprises in the Orient, and that a trust company would first be constituted at Zurich. The latter has now been established under the title of the Union Ottomane, Société pour Entreprises Electriques en Orient, with headquarters at Zurich, and with a share capital of £480,000 divided into £20 bearer shares, of which one-half has provisionally been paid. The objects of the company are the initiation and execution of all kinds of transactions which refer either directly or indirectly to the erection, purchase, working, transformation and the sale of electrical undertakings, and in particular those which aim at lighting, the transmission of power, railway working and electro-chemistry in the Orient. The promoting syndicate, which is headed by the Deutsche Bank of Berlin, comprises the following influential firms and individuals:—

Société Générale, Paris.
Banque Impériale Ottomane, Paris.
Thalmann & Co., Paris.
Continentale Gesellschaft fur Elektrische Unternehmungen.
Commerzienzat A. Walker.
Paul Dansette, Brussels.
Mitteldeutsche Credit Bank.
Gebruder Bethmann.
Gesellschaft fur Elektrische Industrie, Basle.
Banque de Paris et des Pays Bas.
A. Spitzer & Co., Paris.
Josse Allard, Brussels.
Commerz und Disconto Bank.
M. M. Warburg & Co.
Elektrische Licht und Kraft Anlagen, Berlin.
Jacob S. H. Stern.
Vienna Bank Verein.
Bank fur Elektrische Unternehmungen, Zurich.
Schweizerische Credit Anstalt, Zurich.

The board of directors of the company, whose headquarters are at the premises of the Swiss Credit Anstalt, Zurich, comprises representatives of the banks mentioned, and includes the names of W. C. Escher, of Zurich, and Dr. Walther Rathenau, of Berlin. It will be seen that whilst French, German, Belgian, Swiss and Austrian capital is represented by the promoters, the participation of English interests, contrary to former reports, finds no part in the undertaking.

Anglo-Russian Trade.—We have received a copy of the *Anglo-Russian Gazette*, a new 3d. paper which contains a good deal of matter of interest to those who are concerned with the development of trading relations between England and Russia. The publishing offices are at Salisbury House, E.C.

Our Trade in Canada.—In a recent article we commented upon the imperative necessity of devoting greater attention to the fostering of electrical trade between this country and Canada, and we quoted the views expressed to us by a Canadian electrical engineer who recently paid a visit to this country. In order that the matter may not be lost sight of, and to lend support to the comments that we and others have made at different times, we quote the following extracts from an article "by a Canadian expert" appearing in the *Daily Mail* of Friday last. The titles of the are, "Canada's Trade; Indictment of our Manufacturers; 'Common Cause' of Failure." The author writes:—

"The common cause of the comparatively low standing of British imports into Canada is the indifference of the British manufacturer. The merits of the British-made article are recognised by the Canadian people. It is preferred to the foreign, and we have given practical evidence of our preference by admitting British goods at 33⅓ per cent. less duty than the goods of any other country.

"But if the British-made article were a hundred times more meritorious, and if the people of Canada were 100 times more eager to buy it, results could not follow without the necessary initiative on the part of the British manufacturer. The purchaser, in these days of strenuous competition, will not go to the seller, and that, in sharp contrast to the methods of the United States merchant, is what the British manufacturer seems to expect the Canadian purchaser to do.

"Few commercial travellers for British houses are to be met in Canada. There is but a feeble effort on the part of the British merchant to get in touch with his Canadian customer. His catalogues contain price lists in pounds, shillings and pence, which nullify their value to a large majority of the people they reach. In what little advertising the British merchant does in Canada, there is, in many instances, the same careless disregard of modern business methods.

"Great Britain has held her own in Australia and South Africa, as the trade returns prove. The British manufacturer has not held his own in Canada. I venture to say that if he had shown the same languid interest in the African and Australasian markets that he has so long shown in the Dominion, the outcome in these places would have been the same.

"When I was in Montreal a few weeks ago I talked with an advertising manager who is associated with one of Canada's largest firms.

"'There are advertisements,' he said, 'that have been running without a change of copy for 25 years. I know of one advertisement in a leading Toronto paper which I can remember as a boy. It is still there without a solitary change, with its ancient cut and ancient wording.'

"Though I have made the closest inquiries among business men, I have yet to learn of a British manufacturer who, having put forth the necessary initiative in Canada, has failed to secure his share of Canadian patronage.

"Mr. Grigg, the British Trade Commissioner, who made intelligent study of trade conditions in our land, gave four reasons for Great Britain's unfavourable showing in Dominion trade:—

"1. Lack of commercial agents in Canada.

"2. Geographical position of the Dominion.

"3. Inability of the British manufacturer to adapt goods to to Canadian requirements.

"4. Indifference of British merchants to the Canadian market.

"In my opinion the fourth factor should be mentioned first. If the British manufacturer woke up and studied our market, he would rapidly repeat the success he has so constantly won in the other parts of the Empire."

Curtis Steam Turbines.—The following is a list of orders that have been received by the British Thomson-Houston Co., Ltd., for Curtis turbines of the horizontal type for exhaust and mixed pressure:—

Cleveland & Durham E.P. Co. (Teesbridge).—One 1,500-kw. two-stage plain exhaust three-phase alternator.
Fife Coal Co.—Two 750-kw. three-phase mixed pressure.
Earl Fitzwilliam Collieries.—One 350-kw. mixed pressure A.C.
Wath Main Colliery.—One 500-kw. plain exhaust A.C.
Braidwater Spinning Co., Ireland.—One 750-kw. mixed pressure A.C.
Bolsover Colliery Co.—One 500-kw. A.C. plain exhaust.
Lothian Coal Co.—One 560-kw. mixed pressure D.C.
Shirebrook Colliery Co.—One 500-kw. mixed pressure A.C.
Bolckow, Vaughan.—One 750-kw mixed pressure A.C.
Carrongrove Paper Co.—One 1,000-kw. high pressure A.C.
Oriental Timber Co.—One 750-kw. mixed pressure A.C.
Watford U.D.C.—One 500-kw. high pressure A.C.
Hakota E.L. Co.—One 1,000-kw. high pressure A.C.

It may be added that repeat orders for vertical Curtis steam turbines have been received from the Liverpool Corporation for its Lister Drive station, where three vertical Curtis steam turbines are installed and giving satisfaction, and that five vertical Curtis steam turbines are installed at the County of London Electric Supply Co.'s stations.

Exhibition.—Another scientific Exhibition, on similar lines to that which proved so successful in 1907, is to be held at the Royal Horticultural Hall, Westminster, S.W., in October next. The exhibits will include engineering models, electrical and scientific apparatus, lathes and light workshop appliances, model aeroplanes, and technical education equipment. A number of firms have already taken space, and a very interesting display is assured. An attractive feature will be the exhibits in the competitions for model and scientific apparatus making, several events for both amateur and professional workers having been arranged, for which prizes are being offered. Full particulars may be obtained from the organisers, Messrs. Percival Marshall & Co., 26-29, Poppin's Court, Fleet Street, London, E.C.

Electricity at the Golden West, Earl's Court.—There is not a great deal which is of special interest to electrical engineers at the Golden West, but there are one or two things which attracted our attention during a recent visit. One of these was the automatic telephone exchange exhibited by the Automatic Electric Co., which is, we think, worthy of notice. The use of automatic telephone exchanges would be limited in this country to private installations. The intercommunication system is useful up to a certain point, beyond which an exchange becomes necessary, and this, of course, involves the expense of an exchange attendant. The exchange attendant introduces the time element, that is to say, there is always a certain amount of time lost in ringing up the exchange, giving her the number and then waiting for her to call up the number, make the necessary through connection, and advise subscribers that they are connected. The automatic system reduces this to a minimum, the time required being very little more than in the intercommunication system. In the latter all one has to do is to press one button or move a lever to the required number, and then use the instrument. In the automatic system the only difference is that one or two seconds more are taken up in moving the lever once for each digit of the subscriber's number. During our visit the operator rang up some half-dozen people in about half a minute, whereas with the manually-operated exchange system one would be fortunate to get one call through in twice the time. If one rings up an engaged subscriber, the engaged signal is automatically given; if an instrument is out of order a distinctive signal is also given. In fact, the automatic system appears to do everything that the ordinary "Hello girl" accomplishes, and does it silently and more expeditiously. Another interesting feature is the side show of X-ray apparatus in charge of Mr. Dean, who is one of the pioneers who have suffered in the cause of X-ray science. He shows the most up-to-date apparatus in radiography, including the safety screens which are now used by operators. He claims that by means of the apparatus he exhibits the operator is quite immune from harmful effects. There are several other interesting exhibits in the way of tools and engineering apparatus generally.

Athletics.—The second annual athletic meeting of the various Vickers, Sons & Maxim's works was held at the Vicker's Sports Club Ground, Carbrook, Sheffield, on Saturday afternoon, July 10th, teams from the following works taking part:—Vickers, Sons & Maxim, Sheffield, Barrow-in-Furness, Erith and London Office; the Wolseley Tool and Motor-Car Co., Ltd., Birmingham; and the Electric and Ordnance Accessories Co., Ltd., Birmingham. Prizes to the total of £60 were offered, and in addition a 30-guinea silver challenge cup was competed for, to be held for one year by the works whose representatives secured the highest number of points. In addition to those for employés only, there were several open events, including two for local school children. The holders of the challenge cup for the ensuing year are the Barrow Works of Messrs. Vickers, Sons & Maxim, who sent up a contingent of splendid athletes, and secured three first, three seconds, and two thirds, making a total of 17 points out of a possible 36. Considering that only seven men were present from Barrow, this is a very meritorious performance. The winners of the cup last year were the Electric and Ordnance Accessories Co., Ltd., Birmingham. The Master Cutler, Mr. Douglas Vickers, was present during the afternoon, and presented the prizes and challenge cup to the successful competitors.

Trade Announcements.—Messrs. Stoodley Bros., electrical engineers, have opened new business premises at The Arcade, Aldershot.

Messrs. W. T. Glover & Co., Ltd., of Trafford Park, Manchester, inform us that they have appointed Messrs. Haslam and Schontheil, of Western Mail Chambers, Cardiff, to represent them in South Wales, for the supply of electrical wires, cables and accessories.

Messrs. Gillespie & Beales, of Amberley House, Norfolk Street, Strand, have been appointed selling agents for the Bastian electric heating and cooking devices, which were described in our last issue.

Mr. J. Lambie, in conjunction with Mr. C. R. Wrigley, late of Laurence, Scott & Co., Ltd., of Norwich, are taking over the London contracting business of the Walsall Electrical Co., Ltd., at 116, City Road. Messrs. Lambie & Wrigley will also represent the Wallsall Electrical Co., Ltd., for their various manufactures, including all classes of switchboards and measuring instruments. The telephone number remains unaltered, viz., 8,841, London Wall.

The British Oil Co. have removed to Norfolk House, Lawrence Pountney Hill, E.C.

On and after the 15th inst., the address of the Newcastle office of the Union Electric Co., Ltd., will be Collingwood Buildings, Newcastle-on-Tyne.

Mexico.—According to the *Mexican Herald* a company, to be known as the Mexico Steel and Chemical Co., has been formed, with a capital of $1,000,000 (about £102,000), to manufacture steel and chemical products by the use of electrical power. Work is soon to be begun on the plant, which it is hoped will be completed within a year. It is intended to manufacture, among other things, rails, steel castings, shoes and dies for mining mills, and calcium carbide.—*Board of Trade Journal.*

South African Exhibition.—H.M. Trade Commissioner for South Africa (Mr. R. Sothern Holland) now reports that it has been decided to hold, instead of an international exhibition, a South African exhibition on a large scale; it will include an international show of agricultural implements and machinery, electrical appliances, motor cars, &c.

Catalogues and Lists.—Mr. Jens Orten-Böving, 72 74, Victoria Street, Westminster, S.W.—32-page catalogue (No. 27E) containing well-illustrated particulars and prices of Dr. Horn's patent tachometers for launch, turbine, tramway, locomotive and other service, also tachographs, engine counters, and electrical counters for distance operation. We understand that five special turbine tachometers are being installed on the turbines for the Westminster Electric Supply Corporation. In all probability, these tachometers will shortly be manufactured under licence in England.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.—New list (32 pages) containing particulars, with prices, of jointing tapes, compounds, jointers' tents, tool-boxes and tools, safety lamps and accessories. It sets out in convenient form particulars of a large variety of insulating and other tapes. It describes their various properties and the purposes for which they are best suited, with particulars as to the prices, widths, weights, &c.—information likely to be of service to tramway engineers, mains superintendents, mining engineers and electrical contractors.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—List No. 6,020, of about 30 pages, dealing fully with their "Fortiter" direct-current motor-starting switches, controllers and resistance apparatus. Tabulated data, with illustrations and prices, are given, also diagrams of connections and dimension sketches. A number of special devices to which attention may be called are: Motor-starters with oil-cooled resistances, with field-reversing switches, and with step-by-step slow action, also standard speed regulators without automatic features, and motor-starters of the multiple-solenoid type.

Messrs. Arnold Goodwin & Son, Ltd., Sumner Street, Southwark Bridge, S.E.—Several leaflets relating to their runways, lifting blocks, the "Beatall" system of raising water by compressed air, also their pulleys, shafting, gearing, &c.

Adams Manufacturing Co., Ltd., Bedford.—Large collection of illustrated lists in binding cover, describing some of their Standard types of "Igranic" motor starting and controlling apparatus for alternating and direct-current duty. It is difficult to know where to begin in trying to indicate the contents of these lists, for they cover such a variety of manufactures, starting with rheostats of heavy duty type, fool-proof motor starting rheostats, automatic solenoid pump starting rheostats, rheostats for large motors, for air compressors, capstans, winches, and for slip-ring three-phase induction motors; self-acting motor starting switches, compound starting and speed regulating rheostats for shunt or compound-wound motors for machine tools; shunt field regulators, motor-speed regulators, controllers for organ blowing, reversible lift controllers, and controllers for rotary printing machines. All these and many more classes of "Igranic" apparatus are illustrated and described, lists of prices and dimensional particulars being also given.

Messrs. Cowans, Ltd., Springfield Lane, Salford.—Twenty odd leaflets (caught in a red-covered binder) neatly illustrating on art paper a number of the firm's manufactures, commencing with the Cowan-Still regulating transformers, and proceeding with resistances, generator rheostats, spring-break switches, house service and motor switches, switch fuses, field-breaking switches, service-joint boxes, Andrews's patent current direction indicator, oil and other circuit breakers, overload relays, and other things, concluding with current transformers.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—Price list No. 30, relating to the "Falcon" liquid motor starters and control panels of D.C. and polyphase slip-ring motors; also leaflet showing and pricing the "Poland" knife type ironclad double-break switches for motor circuits up to 600 volts.

Messrs. Alfred Herbert, Ltd., Coventry.—Catalogue Section C 3, describing their Universal grinding machine (12 in. × 36 in.).

British Insulated and Helsby Cables, Ltd., Prescot.—Leaflet (P 102), tabulating sizes, &c., of Prescot braided aerial cables and wires impregnated with a special weather-proof compound.

The Albany Engineering Co., Ossory Road, Old Kent Road, S.E.—A number of current lists of their "Albany" water-sealed rotary pumps, improved pattern electrically-driven pumps, high-lift centrifugal pumps, electrically-driven "Blizzard" fans, small power motors, &c. We learn that the company has been recommended for the highest award (Diploma and Gold Medal) at the 1909 International Exhibition, Paris, for its "Albany" patent rotary (water-sealed) pumps.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester.—Glover's eighth almanac, for the ensuing 12 months, has come to hand. As usual, it contains numerous items of useful technical information from various sources, relieved by not a few humorous illustrations and allusions to the lighter side of things.

Messrs. Geo. M'Cartney & Co., Burnside Works, Cumnock, N.B.—Loose lists giving prices and particulars of their "J" type switch, and the "E" type double-pole main switch.

Messrs. T. W. Broadbent, Ltd., East Parade, Huddersfield.—Leaflet relating to their N-type single-phase motors and P type motor-starters. It is claimed that a reduction of the starting current required by these motors has been obtained by means of more effective "phase-splitting." The firm reports a continuance of good trade, and sends us a list of a number of contracts for electric generators, motors, switchboards, &c., received during the last few weeks.

Messrs. Alex. Turnbull & Co., Ltd., St. Mungo Works, Bishopbriggs, Glasgow.—Coloured wall sheet showing a large illustration, in section, of their patent "Excelsior" full-bore parallel slide sluice valve. The valve embodies a number of special features which are detailed on the sheet; copies of the latter will be forwarded to any reader on application.

Book Notices.—*Electricity in Factories and Workshops* By A. P. Haslam. London: Crosby Lockwood & Sons. Price 7s. 6d. net.—The author has made an attempt to produce a book which shall be useful to electric power users, whether the power be taken from the public supply or produced on the premises. The book is divided into three sections, the first dealing with the electric motor and its accessories, in which both D.C. and A.C. motors, together with their starting gear, are very clearly set forth, the advantages of each type of apparatus being carefully described. Section 2 deals with the provision of electrical energy, and the author explains fully how the cost of energy is affected by the conditions of working, and thoroughly discusses the meaning of "load factor," "diversity factor," &c., showing how these affect the cost of supply. The bearing of the questions are made clear by worked-out examples under different conditions. The "maximum demand" system is treated in the same way, although, as the author points out, this system has never been satisfactory and is gradually going out of use. Comparisons are also made in this section between the cost of power by electric motors and gas engines for the small power user. In the third section, the author deals with the applications of electric power, chapters being devoted to textile factories, printing works and engineering shops, the special requirements being thoroughly discussed. The bearing of the Home Office regulations on power installations is also gone into, and in the final chapter we have a good deal of valuable information on the lighting of industrial establishments. The author has done his work very conscientiously, and the reader may rest assured that any information given in the book is accurate and reliable.

Rules for Recovering Coal Mines after Explosions and Fires. By W. E. Garforth. London: Chichester Press. 1909. Price 3s. 6d. net.—In this novel work the author embodies the results of his experience in the subject indicated by the title, with a detailed description of the recovery of the Altofts Pit, in accordance with these rules—most of which, he points out, are intended as reminders rather than rules. The importance of having a plan "cut and dried" for use in such an emergency as the explosion of a coal mine, where the lives of hundreds of men depend upon the promptitude and resourcefulness of the officials, needs no demonstration, and this unique little handbook will be of untold value at such times—though that it may rarely be needed is, we are certain, the sincere wish of the author. As regards electrical matters, the book has little to say; no doubt at such a time all electric circuits within range of the disaster would be utterly disorganised and useless. The author recommends that a supply of portable electric lamps be kept in constant readiness, in addition to the ordinary safety lamps; he mentions also the immense value of a portable telephone with a cable and reel for connecting an exploring party with the surface.

"Thoughts on Natural Philosophy and the Origin of Life." By A. Biddlecombe. Newcastle-upon-Tyne: R. Ward & Sons. 1909. Price 2s. 6d.

"The I.C.S. Student." Souvenir Number. July, 1909. London: From the I.C.S.

"Proceedings of the American Society of Civil Engineers." Vol. XXXV. No. 5. May, 1909. New York: The Society.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University." Vol. I. No. 4. 1908. Kyoto: The University.

Bankruptcy Proceedings.—W. T. Harris (W. T. Harris & Sons), electrical engineer, Commercial Road, Portsmouth.—The receiving order in this case was made on debtor's petition, and the statement of accounts shows gross liabilities £3,883, of which £678 is unsecured, and assets, after allowing £55 for preference claims, estimated at £844, thus showing an estimated surplus of £166 odd. The debtor was formerly in the Navy, and started business in 1899, when his capital amounted to about £700. He cannot state what his profits have been. He attributes his failure to heavy expenses and bad debts. The secured creditors are the first and second mortgages of 460, 462 and 464, Commercial Road, £1,200 and £600 respectively, and the mortgages of 47, Emanuel Street, £1,350, the properties being valued at the same amounts. The debtor further states that he has not been sued for debt during the 10 years of his trading, and that if the estate could be realised as a going concern he is now solvent. The first meeting is called for July 19th; and the public examination for July 26th—both at Portsmouth.

Dissolutions and Liquidations.—British Aluminium Co., Ltd.—A petition presented by Messrs. A. Schonfield and Herman Kuttner, of Glasgow, creditors, for the winding up of this company, is to be heard in London on July 20th.

Vanadium Co., Ltd.—A meeting is to be held at 9-10, Fenchurch Street, E.C., on August 11th, to receive the report of the liquidator (Mr. T. A. Ward).

Chipping Norton Electric Light and Power Co., Ltd.—A meeting is to be held at 1, West Street, Finsbury, on August 11th, to hear the report of the liquidator (Mr. A. Barlow).

Gunbie, Rees & Co., gas and electrical engineers, 7, Finsbury Square, E.C.—Messrs. F. G. Gunbie and F. H. Rees have dissolved partnership. Mr. Rees will attend to debts.

Ados, Ltd., Lincoln.—This company is winding up voluntarily. A meeting of creditors is to be held at Francis Court, Lincoln, on July 20th. Mr. J. S. Streets, Royal Insurance Buildings, Lincoln is liquidator. The total liabilities, exclusive of shareholders, is £165, and the estimated value of the assets is £260.

Annual Outings.—The members of the Osram and Robertson Social and Athletic Club had their first annual outing to Hastings on Saturday, July 3rd. Some 550 members left by special train from Addison Road, and arrived in Hastings about 11 o'clock. The staff had luncheon at the Waverley Hotel, with Mr. C. Wilson (manager) in the chair, and this was followed by a drive to Battle. Amongst the visitors were Mr. Davey (chairman, Assn. Engineers-in-Charge), Mr. S. D. White (G.E.C., London), and Dr. Levey (D.G.A., Berlin).

MR. J. H. HEATHMAN, of ladder fame, not finding a sufficient outlet for his superabundant energy in devising new forms of ingenious ladders and fire appliances, finds time to organise a series of launch trips on the Thames to which his numerous friends and customers turn out with unfailing enthusiasm. On Saturday last the trip was combined with the annual outing of the staff, and a company of nearly a hundred spent an enjoyable day in a run from Kingston to Windsor and back, luncheon and tea being served on board, and sufficient time being allowed at Windsor for a short visit to the Castle. Both on the outward and return journey the time was beguiled with an excellent programme of music, to which several of the friends and staff contributed. The few speeches on the return journey bore evidence to an excellent understanding between Mr. Heathman and his staff, and the desire to work heartily together to ensure the continued prosperity of the firm.

The third annual outing and sports of the MARYLEBONE ELECTRICITY DEPARTMENT took place last Saturday week. The party, considerably over 100 strong, spent the day at Brighton. The annual sports took place in Preston Park. Some of the party visited the Brighton Electricity Works. At the dinner, Mr. G. Parr proposed "The St. Marylebone Electricity Undertaking," and Mr. Smyth replied. Mr. A. H. Seabrook, the newly-appointed engineer, was unable to be present.

The eighth annual outing of the BROMLEY ELECTRIC LIGHT AND POWER CO., LTD., was held at Brighton last Saturday week.

Fire in Moscow.—Reuter reports that on the 10th inst. a fire broke out in the premises of the Russian Westinghouse Co. at Moscow and caused damage estimated at £10,000.

LIGHTING and POWER NOTES.

Ayrshire.—At a meeting of the Northern District Committee of Ayrshire C.C., intimation was given by the Skelmorlie Electrical Supply Co. that it intends to apply to the B. of T. for a prov. order to authorise the company to supply Skelmorlie and district with electric light.

Bath.—The T.C. has decided to apply for a prov. order for E.L. in the area of the R.D.C., and a similar application is being made by the Western Electrical Construction Co.

The Corporation has notified its intention of applying for a prov. order, in view of numerous applications received for a supply. As the District Council's own prov. order has not yet lapsed, it was suggested at a meeting of the latter body that the city should be approached with a view to its taking over the existing order.

Beckenham.—The U.D.C. has decided that an endeavour should be made, in co-operation with the wiring contractors, to arrange a better system of advertising the free-wiring scheme. A suggestion that a show-room should be opened in connection with the E.L. undertaking has not been entertained by the Council.

Bristol.—The accounts of the city electricity undertaking, recently published, show that the department has suffered not only from the prevailing complaints of trade depression and "metalitis," but also from the necessity of using the older Temple Back generating plant owing to the unsatisfactory state of recent turbine plant at Avonbank, whereby working costs were adversely affected. The total units sold were 8,110,957, including 822,362 units for public lighting, and the balance for lighting and power. It is satisfactory to note, moreover, that the aggregate H.P. of motors and heating has increased from 7,103 to 10,179 during the 12 months. The gross receipts amounted to £81,390, and expenditure to £38,226, leaving a gross profit of £43,164, which, with certain additions, gave £45,821 to meet financial charges amounting to £46,126, leaving a deficiency of £305 on the year's working. Mr. H. Faraday Proctor pointed out that restricted lighting consumption may be anticipated during the present year, after which he looks forward to a steady increase in consumption for all purposes. The department has earned a balance of £24,741 net profit in previous years, and some £18,306 remains to the credit of the reserve fund.

Buxton.—The U.D.C. has decided to reduce the cost of energy for power and heating to 2½d. per unit for one hour's use of the maximum demand per day, and 1½d. per unit beyond; 2½d. per unit for 300 units per quarter; 1¾d. per unit between 300 and 450 units per quarter; and 1½d. per unit beyond.

Continental Notes.—EUROPEAN WATER-POWERS.—The following figures are given by *l'Elettricita*, Milan:—France has available hydraulic power totalling 4,500,000 H.P.; Italy is using at the present time nearly 350,000 H.P.; Switzerland is using about 300,000 H.P.; Germany is using about 100,000 H.P., out of an available 700,000 H.P.; Russia probably has 11,000,000 H.P. available, of which only 85,000 are at present used.

ITALY.—The Anglo-Romana Co. for the illumination of Rome reports that during 1908 a total of 27,053,145 units were sold, made up as follows:—Lighting, 7,611,463; traction, 9,063,585; motive power, 10,357,440; heating, 20,658, this total being about 10 per cent. more than during the previous year. The total number of arc lamps connected is 2,118, and incandescent lamps 308,458. There are over 5,000 motors on the mains, the average size being about 5½ H.P. The network now comprises 216,387 m. of high pressure and 102,831 m. of low pressure mains, all underground.

Clacton-on-Sea.—The U.D.C. has decided to apply to the L.G.B. for a loan of £630 for electricity purposes.

Cowdenbeath (Fife).—At a meeting of the T.C. a requisition by the Fife Electric Power Co. as to the granting of a provisional order for the sale of electricity in the town was discussed. It was agreed to instruct the Council's legal adviser to intimate to the company that it refused to give consent, and it was suggested that the Council take the necessary steps to obtain a provisional order itself.

East Ham.—Upon the recommendation of the electrical engineer and manager, the Lighting Committee has arranged reductions for power consumers. The revised scale is as follows:—Not exceeding 150 units per quarter, 2d. per unit; from 150 to 1,000, 1½d.; from 1,000 to 6,000, 1¼d., subject to 5 per cent. discount for prompt payment. Special terms will be arranged for consumers who guarantee over 6,000 units consumption per quarter.

Gillingham (Kent).—In sanctioning a loan of £2,804 for electricity purposes, this being a part of £5,000 applied for, the L.G.B. has advised the T.C. to engage a highly-qualified electrical engineer to investigate the working of the undertaking and report upon the best means to reduce the annual loss incurred. The Council has adopted this suggestion.

Glasgow.—At a meeting of Parish Council, it was reported that as the result of various inquiries made of the Clyde Valley Electrical Power Co., in explanation of the original offer, the master of works has submitted a detailed report as to the suggested electrical supply to the Goatloch Asylum by that company. As the report indicated clearly that the saving, if any, which might result from the transference of the supply would be infinitesimal, while considerable expense, estimated at £1,159, would be incurred at the outset in adapting the plant to suit the altered conditions, the Sub-Committee unanimously resolved that the supply be continued from the existing installation at the asylum.

Hereford.—The T.C. has received from the L.G.B. sanction to a loan of £7,038 for electricity purposes, made up as follows:—£1,190 excess expenditure on buildings, plant and machinery; £648 excess expenditure on cables, services and meters; £1,500 for new services; and £3,700 for water cooling plant, &c.

Keynsham.—The P.C. has accepted the tender of the E.L. Co. for public lighting for a year at £260 15s.

Leyton.—The Council has agreed to a suggestion of the electrical engineer to give a three months' trial to arc lamps by Johnson & Phillips, Jandus Arc Lamp Co., Crompton & Co., and the Oliver Arc Lamp Co., in connection with the public lighting scheme. In view of the increased number of metal-filament lamps available, the electrical engineer has obtained a reduction in the price of Osram lamps from 40s. to 30s. 3d. per doz.

London.—BATTERSEA.—On June 9th the Council decided to apply to the L.C.C. for a loan of £1,500 for providing consumers with arc lamps and motors, and wiring premises therefor on the cash and hire-purchase systems. As it appears to the Lighting Committee that to await the sanction of the central authority would probably cause delay, £500 is to be taken out of current revenue to inaugurate the scheme.

FULHAM.—Additional condensing plant (pump, piping, &c.), costing £160, is to be installed at the electricity works.

Longton.—The annual report of the Electricity Committee states that the total number of units generated during the past year was 273,401, an increase on the preceding year of 71,817, or 35·6 per cent. The increase in current used both for lighting and motive power showed that electricity was making rapid headway, and additional generating plant would have to be put in before the winter, and an extension made to the station. The extensions proposed would double the capacity of the works. The gross profits for the past year amounted to £1,634, and the net profit to £101.

Ludlow.—Messrs. Foote & Milne have informed the T.C. that they intend applying for a prov. order for E.L.

Market Harborough.—The B. of T. has deferred the question of revoking the E.L. order of the U.D.C. for a year from June 22nd.

West Ham.—An agreement has been entered into with the Poplar Guardians to supply energy to the branch workhouse in Forest Lane for five years. The Electricity Committee has arranged to include in its orders on the present contractors the Osram lamps required for the Marylebone B.C.

Motherwell.—In submitting the annual statement of the accounts of the Electricity Department to the T.C. for approval, Mr. M. Kendrick pointed out that the balance-sheet showed the gross profit to amount to £5,931, and the net profit, after deducting payment of interest and sinking fund, to amount to £229. The year's working, he explained, had undoubtedly been affected by the general bad trade of the year. He drew attention to the fact that the works were not meant to be carried on as a money-making concern.

Nailsworth.—The Gloucestershire E.P. Co. is applying for a prov. order for electric lighting in the area of the U.D.C.

Newport (Mon.).—The E.L. Committee of the T.C. has decided to replace 230 gas lamps with Osram electric lamps. The charge for the lamps is to be £2 each per annum.

Newton-in-Makerfield.—The B. of T. has informed the U.D.C. that the electric lighting order has been revoked as from May 25th.

Oldham.—The published report of the electricity department for the year ending March last shows a considerable financial improvement over the previous 12 months, the net profit being £3,451, as against £1,724 in 1907-8. During the year some 16 million units were sold, including 1,692,240 for private use, 21,827 for public lighting and 4,325,972 for traction. The maximum load reached 3,178 KW., load factor 21·73 per cent., and total cost ·910d. per unit. It is satisfactory to note that the private motor load advanced from 376,813 to 570,897 units during the year, although the latter amount is an insignificant quantity for an industrial centre such as Oldham.

Petersfield.—The Petersfield Electricity Supply Co. has informed the R.D.C. that it intends applying for a prov. order for E.L. for the parishes of Liss, Sheet and Steep.

Portugal.—The staff of the electricity works at Oporto has decided to strike, with a view to obtaining increased wages.

Runcorn.—Mr. G. H. Cox and Mr. H. J. Falk, of the Salt Union, have given notice of their intention to apply for a prov. order for electric supply within the urban district.

Sandwich.—The T.C. has been informed that a prov. order for E.L. is being applied for by Mr. Mark Parker, of 3, East Cliffe, Dover.

St. Helens.—The T.C. has applied to the B. of T. for consent to a supply of energy being given to the Sutton district, on a three-phase H.T. system at 6,000 volts pressure, and a loan of £8,000 for the necessary plant and cable has also been applied for.

Sheffield.—The annual report of the electric supply department, shows a total income of £77,728, and a gross profit of £52,702. Financial charges bring the surplus down to £2,423. The latter sum, together with the accumulated surplus of previous years, make a total of £18,752, from which £10,000 has been transferred to a renewals fund, and the balance of £8,752, the manager, Mr. S. E. Fedden, recommends should remain as an available surplus to meet a possible deficiency next March, owing to the effect of the metallic-filament lamp in reducing sales for the time being. Mr. Fedden points out that there has been a fall in revenue of £4,251 on lighting, although there had been an increased number of new consumers; the increase in motor energy had been well maintained in view of local trade depression.

The T.C. has decided to apply for a loan of £56,000 for electricity purposes.

Southport.—The result of the past year's working of the electricity department, was a total revenue of £25,350, and a gross profit of £15,054; the net result was a surplus of £3,005. The full effect of the new lamps was not experienced until the latter half of the year when there was a decrease of 18,631 units supplied for lighting, as compared with the previous year's return.

Stroud (Glos.).—The Gloucestershire Electric Power Syndicate, Ltd., has informed the U.D.C. that it intends applying for a prov. order for E.L.

Stockton-on-Tees.—Some discussion has taken place on the recommendation of the Electricity Committee to continue to supply Messrs. Head Wrightson & Co. for a further five years at a lower price than previously. In reply to the argument that the price was too low, it was shown that since commencing this supply five years ago, the cost of production had fallen from 2·10d. to 1·31d. per unit, and that a loss on working had been turned into a profit. The price quoted was ⅝d. per unit, and the load was purely a day load, which if refused would reduce the electricity output by one-third.

Swansea.—At the meeting of the Electric Lighting Committee on Wednesday last, a letter was read from Mr. Edward Harris, on behalf of certain clients, requesting an appointment to discuss a scheme to transfer the Council's electricity undertaking to a company, which would become responsible for the financial charges, and would agree to extend the supply and reduce prices. The company expected that the reduced prices would appeal to a number of local industries, and would check the tendency to go in for private plants, &c. After a long discussion, the Committee decided not to entertain the offer.

Sutton.—The South Metropolitan Electric Tramways and Lighting Co. has given notice of a proposed increased charge for energy in October next. The matter was discussed at the last meeting of the District Council, when it was stated that at present the careful householder could have his lighting at practically a flat rate of 3½d., whereas now it was intended to raise this charge by something like 60 per cent. Mr. Jackson, as chairman of the General Purposes Committee, stated that he had had numerous letters from residents drawing attention to the matter. The clerk was asked to look into the powers of the company under its order.

Taunton.—At the T.C. meeting on the 13th inst., the report and accounts of the Electricity Committee for the past year were adopted. The electricity department showed a gross profit of £4,138 and a net surplus of £19 after carrying forward £46 to reserve.

Transvaal.—In his evidence before the Electric Power Commission, Prof. Klingenberg, consulting engineer to the Victoria Falls Co., said that the capital of the company was being provided as to 63 per cent. by Germany and the remainder in England; 40 per cent. of the expenditure went in orders to Germany, and up to the present 11 per cent. to England, leaving, roughly, 43 per cent. for freight and erection. Mr. Gilfillan, one of the solicitors for the Vereeniging Estates, gave evidence that there was no hostility on the part of the agricultural interests through whose land the transmission would pass; there was a demand for electricity for pumping, lighting and general power purposes on the farms, and it would facilitate both irrigation and ploughing.

Walsall.—The Electricity Committee has recommended the T.C. to apply for a loan of £35,000 for extensions to the plant and electricity works.

Whitefield.—The B. of T. has approved of the transfer of the E.L. order of the U.D.C. to the Lancashire Electric Power Co.

Wimbledon.—Negotiations are proceeding with the Maldens and Coombe U.D.C. with regard to a supply of energy to that district. A notice is to be served that Wimbledon is to apply to the B. of T. for a prov. order to supply electricity to Maldens and Coombe.

Worthing.—On the understanding that the annual consumption will amount to 10,000 units, the T.C. has agreed to supply energy to the Theatre Royal for lighting purposes at a special rate of 3d. per unit.

Wolverhampton.—The Corporation Electricity Committee has recommended that a loan of £10,000 be applied for for mains extensions.

The result of the year 1908-9 as regards the electricity department, was a gross profit of £16,892, and after meeting financial charges, a surplus of £3,401. The receipts show an increase of £5,551 on the year's work, attributable to new power consumers; at March last 5,338 B.H.P. of motors were connected, representing an addition of 3,203 H.P. during the year, when H.T. feeders were run to the works of the Chillington Tool Co., Thomas Parker, Ltd., Electric Construction Co., and Chubb & Son's new works. During the year 6,555,125 units were sold, as compared with 4,554,457 in the previous year, the quantity sold for traction being 1½ million units practically in both years; the works costs were ·521d., and the total costs ·682d. per unit sold.

TRAMWAY and RAILWAY NOTES.

Bournemouth.—A lengthy report of the Tramways Committee came before the T.C. on the 6th inst., which included an estimate by the general manager that £33,000 will be required for permanent way renewals, apart from ordinary maintenance, during the next four years. Improvements are being carried out in the matters of brakes, controllers, ploughs, &c., and arrangements are to be made for setting up a training school for motormen and conductors.

Bury.—The annual report of the working of the Corporation tramways for the year ended March 31st, just issued, states that the expenditure on repairs and maintenance of permanent way, compared with the previous year, showed an increase of 20 per cent., the total being £1,330. The expenditure on overhead equipment and cables had been £659, practically double the amount of the previous year. The gross traffic receipts had been £58,929, an increase of £1,630. The number of passengers carried had been 7,265,909, equal to the estimated population of the district being carried 100 times. The working expenses were 4·112d. per car-mile, exclusive of power, and the total working expenses were 5·833d. per car-mile. The financial statement showed a net surplus of £3,120.

Continental Notes.—Switzerland.—A decree has been granted for an 80 years' concession for the construction and working of a single-track metre-gauge electric railway from Berne to Zollikofen, with a branch from the Tiefenau bridge to Worblaufen. The total cost of the undertaking is estimated at £26,000. Another 80 years' concession has been granted for the construction and working of a single-track metre-gauge electric railway from Goppenstein to Blatten. The total cost of the latter undertaking is estimated at £50,000.

Halifax.—The total revenue of the tramways department during the year ended March last amounted to £86,158, and the gross profit amounted to £26,013, against £19,337 for the previous 12 months. Special expenditure of £17,982 for accident compensation, and on track and equipment, in addition to the ordinary financial charges, more than absorbed this surplus, leaving a loss on the year of £13,542, as compared with a loss of £9,605 in the previous year. Some 16,413,434 passengers were carried during the 12 months.

Hastings.—Owing to the bad weather of the past six months the tramway receipts have fallen £800 compared with the same period last year. In intimating to the preference shareholders that they are not in a position to pay any interim dividend, the directors of the Tramways Co. state that the measures taken for the reduction of expenses, foreshadowed at the last general meeting, have not had time to become effective. With fine weather during the next few months it is hoped to make good the falling off in gross revenue.

Heywood.—Considerable discussion took place on the 8th inst., at the meeting of the T.C., with regard to the new agreement with Bury and Rochdale in relation to the running of cars between the three towns. Councillor Popple said that in the new agreement they would get all they desired. All the Corporations would have running powers into each other's boroughs, but Heywood did not propose to run its own cars, but would allow Bury and Rochdale to do so for it. The Corporations would take the whole of the fares collected, and the cost of working would be that actually incurred. It was decided to seal the agreement. The Mayor said Rochdale T.C. had already sealed the agreement, and the Bury Corporation would do so on Monday. On Tuesday the agreement was to come before the House of Commons' Committee for confirmation.

Peterborough.—Following the complaints by the Corporation and ratepayers generally, Col. Druitt, of the B. of T., has made an inspection of the track of the Peterborough Electric Traction Co., Ltd., and has reported favourably to the company. He states that though some repairs are necessary, yet the company has not made default in the maintenance within the meaning of Sec. 26 of the 1900 Light Railway Order. The Corporation gave the report a hostile reception, and decided to approach the County Council with a view to joint action.

Salford.—The overturning of an overhead equipment repair "tower" owned by the Corporation Tramways Department, on Sunday last, resulted in a serious accident. Four men were on the tower in Bolton Road, Pendleton, and they were all thrown to the ground. John Roberts (45), the foreman, sustained a fractured skull, and died the following day in the Salford Hospital. The other men received severe injuries, one having a broken ankle, and one having several ribs fractured.

South Shields.—A joint meeting of the Corporation Tramways Committee and Electricity Committee was held on the 9th inst., to consider the dispute between the committees as to the charges for energy for traction purposes. It was stated that the Electricity Committee had rendered an account to the Tramways Department for energy for traction amounting to £8,446 for the 11 months up to the end of February, and an account for £510 for March, a total of £8,956 for the financial year. In the opinion of the tramways manager, Mr. L. E. Harvey, the consumption of energy represented by this account was excessive, and representations were made by him, with the result that the meters were tested and found to be defective. The meters having been recalibrated, the consumption from April 1st was found to be at the rate of 1·37 units per car-mile, and Mr. Harvey suggested, as a compromise, that the Tramways Committee should pay for the 12 months at the rate of 1·45 units per car-mile, which would make the account £6,795, and that the electricity department should grant a rebate of £501 on the previous year's account, bringing the total down to £6,294. The Electricity Committee offered to make an allowance of £1,057, reducing the bill to £7,930, and the sub-committee now endeavoured to adjust the difference. Mr. Wylie, chairman of the Tramways Committee, undertook to recommend his committee to forego the claim for a rebate of £500 for 1907, and settle the 1908 account on the basis of 1·37 units per car-mile. The representatives of the Electricity Committee declined to agree to this proposal, and Alderman Rennoldson, the chairman of that committee, offered to recommend his committee to grant an abatement of £1,850, the claim of the Tramways Committee with respect to 1908 to be waived. This proposal would reduce the account to £7,107, and it was unanimously adopted. It represents a consumption of 1·52 units per car-mile. If this settlement is ratified, it will mean that the tramways balance-sheet for the past year will show a credit balance, instead of a loss; but probably the electricity department will then be unable to show a profit for 1908.

Taunton.—The tramways extension to Rowbarton has been practically completed, and the company is now carrying out repairs to the old track, as required by the borough surveyor.

Walsall.—In a report to the T.C., the Corporation Tramways Committee states that it has had before it a suggestion that the tramways should be extended from Walsall Wood through Brownhills, Chasetown, Chase Terrace and Heath Hayes to Cannock, and from there back to Bloxwich, and that it has appointed a sub-committee to report on the subject. The extension, if carried out, would open up the most populous portion of Cannock Chase.

Whitworth.—The Lancashire and Yorkshire Railway Co. has intimated to the Town Clerk of Bacup that it intends to oppose any application for a light railways order to extend the Whitworth trams to the centre of Bacup. The company had presented a petition to Parliament opposing the Bill confirming the Whitworth Tramways Order.

Wolverhampton.—The Corporation Tramways Committee, in its annual report on the working of the Lorain system, states that the gross profit for the year has been £17,048, and after meeting financial charges, the balance of profit was appropriated thus:—For loss on omnibus account, £82; reserve or renewals account, £4,505; extraordinary items of expenditure, £573; leaving a balance unappropriated of £746 13s. 9d. The sum of £26,590 now stands to the credit of the renewals fund.

The Committee expresses regret that the traffic receipts on the electric cars, in common with most other tramway undertakings, show a considerable decrease for the year as compared with the previous 12 months. The Committee considers it very gratifying to record a substantial decrease in the working costs per mile of the Lorain surface contact system as compared with last year, these being 6·374d. against 6·509d., or a reduction of ·135d. per car-mile.

The motor-omnibus account shows total receipts of £2,658.

TELEGRAPH and TELEPHONE NOTES.

Argentina. — The proposed agreement between the Argentine Government and the Western Telegraph Co., to which reference was made a few weeks ago, relates to the laying of a cable between Argentina and Europe. It is in reality directed, a Frankfort paper declares, against the efforts of Germany to establish a cable to South America. Nevertheless, the newspaper states that public opinion in Argentina is by no means agreed with the arrangement, by means of which the Argentine Government grants a monopoly to the company in question, and thereby binds its hands for the future. Thus the *Prensa* of July 1st remarks that "the monopoly clause in the contract proposed by the Western Telegraph Co. must be excluded. The same is unnecessary, as the times are past when the Argentine Republic must be induced to draw upon foreign capital by the granting of monopolies." According to an announcement made by another Argentine newspaper, the German South American Telegraph Co., with the support of the German Government, has lodged a protest against the proposal.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Dakar-Conakry	May 13, 1909	
Tangier-Cadiz	May 19, 1909	
Cayenne-Salinas	June 7, 1909	
Trinidad-Demerara	June 19, 1909	July 10, 1909
Assab-Perim	July 8, 1909	

Telegraph Arbitration Bill.—On Tuesday this Bill, which is intended to facilitate the purchase of the National Telephone Co.'s system by the Post Office, came before a committee of the House of Commons. On Clause 1, which provides for the reference, by agreement, of any matter in dispute between the parties to the Railway and Canal Commission as arbitrators, Mr. McArthur proposed that the Commissioners should be given power to allow costs. Mr. Buxton opposed the amendment, on the ground that when the agreement was signed the parties knew that the Commissioners were not entitled to give costs, and that the grant of such power would not expedite matters. The amendment was defeated, and the committee ordered the Bill to be reported to the House.

CONTRACTS OPEN and CLOSED.

OPEN.

Acton.—Tenders are about to be called for lamps, &c., for the new public offices.

Altrincham.—July 30th. Electrical installation at the new Higher Elementary Schools, Hale (deposit, £1 1s.). J. Howarth, Clerk, Education Department, Altrincham, Cheshire.

Australia. — Melbourne. — August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" to-day.

Belgium.—August 4th. La Direction Generale des Ponts et Chaussees (38, Rue de Louvain, Brussels) is inviting tenders for the equipment of a transformer sub-station at the harbour at Ostend.

Bradford.—July 30th. Eight automatic point controllers for the Tramways Department. See "Official Notices" July 9th.

Brussels.—July 28th. A number of the contracts for the electric lighting material for Tournai are open again, as the last tenders were not satisfactory. They include (*a*) insulators, (*b*) phosphor-bronze wire, (*c*) small metallic material for incandescent lamps, &c., (*f*) lamps and lighting and wiring fittings.

Canada.—Winnipeg.—August 2nd and 16th. The city of Winnipeg is advertising for tenders for the hydraulic and electric equipment of the generating station now under construction on the Winnipeg River, at Thirty-foot Falls. Some particulars were given in this column on July 2nd.

Dublin.—July 26th. Machinery oils for the Corporation electricity works. See "Official Notices" to-day.

Eccles.—July 19th. Electric wiring and fittings for 12 houses for the T.C. (deposit, 10s. 6d.). E. Parkes, Town Clerk.

Edmonton.—July 28th. Private telephone equipment at the infirmary. See "Official Notices" to-day.

France.—July 21st. The Paris municipal authorities are inviting tenders for a 60-h.p. steam engine and a 40-kw. continuous-current dynamo at the Paris Municipal School of Physics and Industrial Chemistry.

Paris.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

July 22nd.—The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of 10 tons of galvanised iron wire 1 mm. dia., 200 tons ditto 3 mm. dia., and 400 tons ditto 4 mm. dia.

August 11th. The Direction de la Manufacture d'Armes at Châtellerault (Vienne) require tenders for cables, copper wire, and dynamo construction material (11 lots).

Paris.—July 26th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 10 lots of telegraph and telephone (subscribers) material.

Germany.—Charlottenburg.—August 6th. A 6-ton travelling crane of 19 m. span is required for the new waterworks by the Charlottenburg Wasserwerke Co., and specifications may be obtained at their office, Escheraller 1.

Hellingly (Sussex).—July 20th. Storage battery for the County Asylum. See "Official Notices" July 9th.

Hull.—July 28th. Electric and gas light fittings for the new Public Hall of the Corporation. See "Official Notices" to-day.

Hull.—July 29th. Electric lighting mains extensions for the year for the E.L. Committee. See "Official Notices" July 9th.

Italy.—August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as from home makers for the supply of 100,000 metres of telegraph cable.

Keighley.—August 7th. Two 1,000-kw. turbo-alternators with condensers, and two water-tube boilers for the electricity department. See "Official Notices" to-day.

Leyton.—July 27th. Electric light installation for Sybourn Street School for the U.D.C. Education Committee. Architect, Mr. W. Jacques, 2, Fen Court, Fenchurch Street, E.C. (deposit, £1).

London.—L.C.C.—July 21st. Electric lighting and fan installation at the extension of the Paddington Technical Institute. See "Official Notices" July 9th.

G.P.O.—August 9th. Creosoting telegraph poles for the P.M.G. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Luton.—July 19th. 500-kw. steam-driven generator and condensing plant for the Electricity Department. See "Official Notices" July 2nd.

Pontypridd.—July 27th. One 500-kw. steam dynamo for the U.D.C. See "Official Notices" to-day.

Russia.—September. The Governor of Jekaterinoslaw requires tenders for the lighting of the streets of Bachneut by electricity, either arc or incandescent lamps.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

Sunderland.—The Tramways Committee is to advertise for tenders for the doubling of half-a-mile of the track upon the Grangetown section of the Corporation electric system.

Whitehaven.—July 20th. Lighting the Harbour Quays for five years, by electricity, gas, or other means, for the Harbour Commissioners. See "Official Notices" June 11th

CLOSED.

Australia.—Adelaide.—News was received by this week's Australian mail of the acceptance of the tender, at £36,673, for 50 cars from the J. G. Brill Co., Philadelphia, U.S.A., for the Adelaide tramway system. The highest tender was submitted by an Adelaide firm, who offered to build the cars locally for £45,361.

Bournemouth.—At a recent meeting the Council decided to place eight international time recorders at various points on its tramway routes, to record the times the cars pass on both the up and down lines, and the order was given to the International Time Recording Co., of City Road, E.C., whose tramway recorders are already in use by numerous corporations and private companies in Great Britain.

Bradford.—The T.C. has accepted the tender of Messrs. Manlove, Alliott & Co., Ltd., for the reconstruction of the destructor cells at the Cliffe Road works, at £2,472. The tender of Messrs. Gent & Co. for an extension of about 100 electric impulse clocks, with master clock and wiring, for the Town Hall, has been accepted, at £194.

London.—L.C.C.—The following tenders were received for wooden fittings for 130 electric cars:—

James Challis, Ltd.	(less 2½%)	£772
B. E. Nightingale		987
Hurst, Nelson & Co., Ltd.		1,050
United Electric Car Co., Ltd.		1,418

It was subsequently discovered that the fittings could be supplied from the Council's own car works at Leytonstone for £558, as there is a good deal of timber there that was taken over at a low price from the tramway companies.

Hammersmith.—The following tenders were received by the Electricity Committee for the supply of cable and the purchase of old cable to be replaced, viz.:—

	Quotation for cable. 215 yards 1·25 e.h.t.	Offer for old cable. 163 yards ·8 e.h.t.
Standard Cable Co.	£161	Scrap price, no amount mentioned.
Western Electric Co. (recommended)	180	£85
Henley's Telegraph Works Co.	186	80
Siemens Bros. Dynamo Works	188	82
Callender's Cable, &c., Co.	190	80
Lahmeyer Electrical Co.	192	80

As a quotation for the old cable was made a condition of tendering for the supply of the new cable, the tender of the Standard Cable Co. was out of order, as they did not name a price for the old cable.

Stepney.—The Electricity Committee recommends the acceptance of the tender of the Sloan Electrical Co., Ltd., for carbons, at £1,092. The tenders were as follows:—

Sloan Electrical Co.	(recommended)	£1,092
Union Electric Co., Ltd.		1,123
Crompton & Co., Ltd.		1,144
General Electric Co., Ltd.		1,184
Braulik, G.		1,190
Siemens Bros. Dynamo Works, Ltd.		1,434

The tenders for meters, for two years' supply, were as follows:—

Bastian Meter Co., Ltd.	(incomplete, does not comply)	£281
Electrical Apparatus Co., Ltd.	,, ,,	402
Gillespie & Beales	(incomplete, no samples)	422
British Westinghouse Electric Co., Ltd.	(incomplete, does not comply)	522
Braulik, G.	(does not comply)	545
Electrical Co., Ltd. (*a*)	,,	577
Simplex Conduits, Ltd.	,,	591
International Electric Co.	(no samples)	604
Electrical Co., Ltd. (*b*)	(does not comply)	650
Reason Manufacturing Co., Ltd.	(recommended)	671
Siemens Bros. Dynamo Works, Ltd.		713
British Thomson-Houston Co., Ltd.		761
Bat Meter Co.		765
Chamberlain & Hookham, Ltd.		878
Ferranti, Ltd.		878
General Electric Co., Ltd.		933

The Reason Manufacturing Co., Ltd., submitted the lowest tender which complies with the specification. The meters tendered for are of a capacity of from 2·5 amperes to 300 amperes, and in this connection the borough electrical engineer and manager has pointed out that for the meters of a lower capacity, that is, meters of a capacity of 2·5 amperes and 5 amperes, the "Midget" type of meter manufactured by the Reason Co., could be used. This would reduce the tender of the Reason Manufacturing Co., Ltd., by £94, making it £578. The borough electrical engineer and manager is satisfied with the "Midget" type of meter, and having regard thereto, and to the saving which would be effected by using the same, the committee recommend the acceptance of the tender of £671, less £94.

Plymouth.—The T.C. has accepted the tender of Cory Bros. & Co., Ltd., for 7,500 tons of Russell's new black vein washed beans coal at 13s. 4½d. per ton by sea, and 17s. 1d. per ton by rail, for the electricity undertaking. This price is 3d. per ton in excess of last year's contract.

Rotherham.—The T.C. has accepted the tender of, Felgate & Storey, Reading, for the electrical installation at the High School, for £225.

Stockport.—The T.C. has accepted the tender of Messrs. John Longson, Ltd., for electricity requirements; and that of Messrs. Wilson, Twyford & Roscoe for tramway requirements.

Swansea.—The following tenders for plant for lighting and power purposes at the new King's Dock were unanimously accepted at a meeting of the Harbour Trust on Monday:—

Turbo-generators, alternators and condensers.—Willans & Robinson, Ltd.
Switchboards and sub-station equipment.—Crompton & Co., Ltd.
Boilers.—H. & T. Danks (Netherton), Ltd.

Some extraordinary tendering was reported at the Swansea Education Committee on Monday for electric light wiring and fittings for the new Swansea Technical College. Eight tenders had been received; the highest was from T. Arthur Evans and Co., Swansea, amount £817, and the lowest from A. G. Arnold and Son, Newport, amount £289 12s. 8d. The latter was recommended for acceptance, but the firm wrote stating that they had made mistakes in two items, and desired to increase their tender to £366. The next lowest on the list was from Mr. E. Perman, also of Newport, amount £337 11s. 4d., but the Committee was disposed to give the contract to a Swansea firm, and the matter was deferred, the whole of the firms to be asked to re-tender. Resolutions for the equipment of the new electrical engineering laboratory, at a cost of £250, were approved.

Walsall.—The T.C. has accepted the tender of the Wood Farm Colliery Co., Ltd., to supply 1,000 tons of steam coal for the electricity works.

Warrington.—The T.C. has accepted the following tenders for annual supplies:—

British Electrical Engineering Co.—Transformers.
Mawdsleys, Ltd.—D.C. motors, ½-H.P. to 5-H.P.
British Westinghouse Co.—D.C. motors from 7½-H.P. to 20-H.P.
British Thomson-Houston Co.—A.C. motors.

Wolverhampton.—The T.C. has accepted the tender of James Hodgkinson (Salford), Ltd., at £750, for a coal-conveying plant and coking stokers for the generating station.

The Tramways Committee of the T C. has accepted the tender of the Wolverhampton and District Electric Tramways, Ltd., for 11 magnet equipments, at £500.

Worcester.—The T.C. has accepted the tender of Messrs. Heenan & Froude, Ltd., for a steel storage bunker and elevator and conveyor at the Hylton Road station, at £656.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, July 17th. At 10 a.m. Visit to the ordnance engineering works of Messrs. Vickers, Sons & Maxim, Erith.

PARLIAMENTARY.

Electric Lighting Acts (Amendment) Bill.

The above Bill, which the Government have introduced for the purpose either of generalising provisions usually inserted in local Acts dealing with electric supply, or of removing certain further difficulties which have been experienced in the working of the Electric Lighting Acts, has been remitted to Standing Committee C, and already a large number of amendments have been scheduled.

At the end of Clause 2, which deals with the construction of generating stations on land acquired by agreement, Mr. A. H. Scott will move to add, "This section shall not apply to any station or works for transforming, connecting or distributing electrical energy, or the machinery or appliances used in connection therewith."

On Clause 4, dealing with supply in bulk, Mr. Scott will move to add the words, "Provided that a provisional order authorising the breaking-up of roads outside the area of supply of the local authority or company by whom the supply is to be given shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade in any case in which the consent of any such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the ground on which they have dispensed with the consent."

Mr. Leverton Harris has given notice to move the following new section to Clause 4: (4) The powers contained in this section shall not apply to the County of London or to any area contiguous to that county wherein a supply of electricity is afforded by a local authority or company authorised to distribute electricity within that county.

On Clause 5, dealing with the supply of electricity to railways, tramways and canals partly outside the area of supply, Mr. Harmood Banner will move the omission of Sub-sec. II, which states that the Board of Trade may, by provisional order, authorise any such local authority, company or person so to supply electricity to be used for purposes incidental to the working or lighting of the railway, tramway or canal other than the purposes aforesaid.

Mr. Holt proposes to add "dock estate" to railway, tramway or canal.

On Clause 6, which deals with supply to premises outside the area of supply in certain cases, Mr. Tennant will move to add: "Provided that the Board of Trade shall not make any such order except with the consent of the local authority within whose district the premises are situate, unless the Board of Trade in any case in which the consent of such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in such case the Board shall make a special report stating the grounds upon which they have dispensed with such consent."

On Clause 7, containing provisions as to the right of the local authorities to purchase generating stations, &c., situated outside their districts, Mr. A. H Scott will move to add: "(3) Without prejudice to the foregoing provisions of this section, where the undertaking of a company is situate within the districts of two or more local authorities the Board of Trade may by provisional order transfer any rights of purchase vested in the local authority of any district in which part of the undertaking is situate to the local authority of any other district in which part of such undertaking is situate, but such provisional order shall not be made except with the consent of both such local authorities."

A large number of amendments will be moved on Clause 16, which provides for the local authorities "through a contractor but not otherwise" to let for hire electrical fittings. Mr. Cleland proposes to strike out the words "through a contractor but not otherwise," and there are several amendments for the deletion of Sub-sec. D, which gives the undertakers the power of exercising the powers of the Clause without the employment of a contractor if there is no firm carrying on the business of electrical contractor within the area of supply.

Notice of intention to move the following new Clauses has also been given:—

By Mr. Tennant: "Money borrowed under the Electric Lighting Acts shall not be reckoned as part of the total debt of a local authority for the purpose of any limitation on borrowing under the enactments relating to borrowing by the local authority."

By Mr. Cleland: "Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament, or under licence or provisional order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful, without the consent of such local authority, company, or person, for any other local authority, company, or person to supply, distribute, or transmit electricity within the same area unless such supply, distribution, or transmission is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts."

"Nothing in this Act contained shall supersede, prejudice, or affect the provisions of any local Act or any order confirmed by Act of Parliament applicable to the Corporation of the city of Glasgow."

"Nothing in this Act contained shall supersede, prejudice, or affect the provisions of any local Act or any order confirmed by Act of Parliament applicable to any undertakers."

"Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament or under licence or provisional order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful without the consent of such local authority, company, or person for any other local authority, company, or person to supply, distribute, or transmit electricity within the same area unless such supply, distribution, or transmission is authorised by Act of Parliament or by licence or provisional order granted in terms of the Electric Lighting Acts."

By Mr. A. H. Scott: "Sub-sec. 2 of Sec. 234 of the Public Health Act, 1875 (which places a restriction upon the amount which a local authority may borrow under that Act) shall not apply to sums borrowed by any undertakers (being a local authority) for the purposes of the Electric Lighting Acts, or of any provisional order under the Electric Lighting Acts, and in calculating the amount which any local authority may borrow under the Public Health Act, 1875, the sums borrowed by them for those purposes shall not be reckoned."

"Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament or under licence or provisional order granted under the Electric Lighting Acts it shall not, after the passing of this Act, be lawful, without the consent of such local authority, company, or person, for any other local authority, company, or person to supply, distribute, or transmit electricity within the same area unless such supply, distribution, or transmission is authorised by Act of Parliament or by licence or provisional order granted in terms of the Electric Lighting Acts."

"Except by this Act expressly provided, nothing contained in this Act shall prejudice or affect any powers or rights conferred upon any undertakers by Act of Parliament or provisional order passed or confirmed before the passing of this Act."

The Bill was to be considered by Committee C yesterday.

Third Reading.—In the House of Commons, on July 12th, the West Kent Electric Power Bill was read a third time.

Folkestone, Sandgate and Hythe Tramways Bill.—This Bill, as amended by the House of Commons, was on Tuesday before the House of Lords Committee as an unopposed Bill, and was ordered to be reported for third reading. It will be remembered that the House of Commons Committee struck out the important clauses allowing the substitution of some other system for the conduit system.

Oxford and District Tramways.—This Bill, which provides for the substitution of the conduit and overhead system in place of the Dolter surface-contact system, was on Tuesday before Lord Onslow's Committee of the House of Lords. There was no opposition, and the Bill was reported for third reading.

Torquay and Paignton Tramways.—The Torquay and Paignton Tramways Bill came on Tuesday before the House of Lords Committee on Unopposed Bills, and was ordered to proceed.

Fire Tests.—On July 7th the British Fire Prevention Committee continued their series of fire tests with doors by testing a large roller shutter to a 7-ft. opening, the temperatures ranging up to 1,800° F., followed by the application of water from a steam fire-engine, the test lasting 2½ hours.

NOTES.

Navigation Improvements and Hydro - Electric Works.—The question of improving the means of transport between Marseilles and Geneva, so as to allow vessels having a cargo of 500 tons to journey between the Rhone and the Rhine, has incidentally brought into prominence a comprehensive scheme of electricity supply. Already ships of this capacity are able to travel, with the exception of a few days, all the year round between Lyons and Arles, and the canal now being constructed between Arles and Marseilles will complete the southern connection. As to the northern section between Lyons and Geneva, the deep slopes of the land render the Rhone completely impracticable to navigation. Between Lyons and Jonage, which is about 9¼ miles below Lyons, the vessels are able to use the derivation canal of the well-known Jonage electricity works, but this distance only represents a few miles, whereas the section from Lyons to Geneva is 112 miles long. It is considered that the navigability of the river between Bellegarde, which is 18·6 miles below Lyons, and Geneva can only be effected by carrying out the project suggested by MM. Blondel, Harlé and Mähl. These engineers have asked the French Government to authorise them to proceed, at their own expense, with the establishment of electricity works at Genissiat (near Bellegarde), which, by means of damming the Rhone, would permit of the creation of one of the largest works in Europe, and the electricity generated for the most part would be transmitted to Paris. The dam would be 230 ft. high, and in this way a canal of a length of 14·8 miles would be formed, whilst the construction of electricity works at Chancy, in the Canton of Geneva, near the French frontier, would largely facilitate the navigability of the last part of the Rhone to Geneva. It is stated that the French Minister of Public Works has no objection to the proposed works at Chancy, for which MM. Terrisse and De Loriol have sought a concession for several years past, but a decision on either of the schemes is still awaited.

Late Legal.—Seebold *v.* Page & Miles.—Mr. Justice Bucknill on Wednesday delivered a considered judgment in this action, which was brought by the plaintiff for damages for alleged breach of contract. Defendants denied the breach and counterclaimed for £25 6s. 8d. for work done and materials supplied. The case was reported in our issues of April 30th, *et sqq.* His Lordship, in giving judgment, after stating the facts and the terms of the contract, said that the question was whether the contract had been performed by the defendants. It was not suggested that there was anything the matter with the engine or gas producer, or with the generator or scrubber, but the plaintiff's case was that these things were not carefully fixed up, and that from their being improperly and negligently fixed, the plaintiff was injured, in that the work had to be stopped, and he could not make sufficient electric light for the theatre, and had to go to the Corporation of Worthing and take the light at a greater expense. Plaintiff claimed, in addition, the expenses to which he had been put in making the plant do its work properly. To make the plant work properly, it was requisite that it should be kept clean and treated with care. It was alleged that defendants had been guilty of negligence in not providing iron silencers instead of the brick chambers or pits. The defendants, however, were not bound to put before the plaintiff the alternative whether the brick chambers or the iron box should be used for silencing. He found, as a fact, that, but for accident, the silencers put in were efficient. Turning to the question of the explosions, his Lordship referred to the fact that the man put in charge of the engines could neither read nor write; he appeared to be a man of limited intelligence, who was now employed on a horse 'bus. Before he took charge of the engines, there had been no explosion, and they had been running for six months under the supervision of the defendants' foreman. The young man took charge in January, and the explosion took place in the following month, as the defendants alleged, from the negligence of the driver. He did not propose to say how the explosions did occur, but he found, as a fact, that they did not occur in consequence of any of the things alleged against the defendants. He found that the installation was properly put together; the objectionable smell complained of had not been caused by any defect in the defendants' work; and, on the whole, he found that the work had been properly carried out. The plaintiff's case, therefore, failed on every point, and an agreement having been arrived at on the counterclaim, there must be judgment for the defendants on the claim and on the counterclaim of £25, with costs on both. Judgment accordingly.

The High Price of Rubber.—The *India Rubber World* of New York publishes the following interesting remarks regarding the rubber outlook:—"The topic of chief interest and importance to the rubber trade to-day is the high cost of rubber, and this involves the consideration of whether lower prices are a near possibility. It may be that the rates just now prevailing will not be long maintained, but no present indication points to really cheap rubber. A salient fact is that the recent record high prices accompanied probably the largest production of the raw material in any year, from a constantly increasing number of sources, under conditions which preclude any idea that supplies have been under manipulative control, and in spite of the fact that the market is soon to receive larger quantities of rubber from plantations. Clearly the explanation is in a growing demand for rubber in the industries—a larger production of goods either actual or in prospect. It is of interest, therefore, to consider the probable output of rubber in the early future. The growing production on plantations has been mentioned; there is reason to believe that the Amazon region will continue slowly to increase its yield, year by year, as has been the case for a half century, as the available working force can be augmented. The net total supply from other forest sources does not promise any increase. Meanwhile the world's needs for rubber grow incessantly. Can the plantations keep pace with the growing demand? From time to time *The India-Rubber World* has reported on the progress of typical plantations of Hevea, as it does in this issue, the point of each report being a rapid increase of annual yield and a lower cost of production. But still the total plantation yield is too small to be of great present importance to the industry; it is of interest more from the promise which it gives for the future. While all the plantations that have been formed may not prove so successful as 'Lanadron' or 'Vallambrosa,' for example, undoubtedly many millions of trees already planted will in time become prolific yielders of rubber. But, as we have said, the demand for rubber grows. Our friends in the East continue to discuss the cost of their rubber as compared with Brazilian, evidently with the idea that they possess a marked advantage. But so long as present conditions of supply and demand obtain, the world will need all the rubber that can be produced in the Amazon region as matters exist there. And considering that real 'Pará' rubber has not been produced elsewhere, it is not unlikely that this grade will yet outrank the best plantation rubber in the matter of prices. Malaysian planters may produce rubber at a low cost, but they cannot meet the world's demand for quantity, nor supply everything that is needed in the way of quality. All of which being true, the world must pay enough for Brazilian rubber to make its production interesting to the *seringueiros.*"

Salaries and Prospects for Engineers in India.—A correspondent ("Entropy") writes in the *Engineer* giving advice regarding the salaries that should be asked by men contemplating going out to India from home. He says:—

"A salary of Rs. 300 (£20) per month is for juniors, who do not go out to accept extensive responsibility, and every farthing of that amount is required for living expenses in any city in India, and it would be preferable to work at home on £2 per week than be reduced to the necessity of living in a mixed community in Calcutta in order to save a few rupees off 300 per month.

"The above is the lowest possible figure that any young fellow who has served an apprenticeship can go out upon, and the yearly increase of salary should not be less than Rs. 50 per month throughout the term of service. A man of over 24 years of age should not go out on less than Rs. 400, and if to take charge in any department, on not less than Rs. 600 per month.

"It would be well for any applicant before signing an agreement for service in India to apply to, say, the Institution of Civil Engineers, the secretary of which would no doubt be pleased to recommend a solicitor to inspect, and, if need be, to modify the terms of agreement.

"An outsider stands no greater chance of promotion in any firm in Calcutta than in London; the changes on the staff are quicker, but unlike the conditions at home it is seldom beneficial, or even creditable, to change your firm. Prospects advertised by those whose interests it may be to get capable men on prospects are often found to be those of being ousted by nepotism, and of having most of the hard work and few of the loaves and fishes.

"The possibility of a bonus may be discovered to you, but it generally belongs to a nebular series; in fact, the only prospect that is not written in the agreement is that of being punted home as an invalid after a few years' service, or of finding an opening in the vicinity of Lower Circular Road, without a concrete slab to keep you down.

"I may remark that in the department in which I was engaged in Calcutta for three years, in that time out of a European staff of seven men, three had been invalided home and other two had died; of the remaining two, one was born in India. This may be a somewhat exceptional record of European mortality, but such can be the rate amongst assistants whose salaries afford but a bare living and whose prospects are nil.

"It is a mistake to accept an agreement specifying second-class travel; everybody in India travels first-class, and likewise to and from India, except with the P. and O. mail-boats, when second-class is good enough for most people. In the early days men worked out there in their shirt-sleeves, and lived pretty much anyhow, but the advent of the memsahib has changed all that, and nowadays top hats are not stoned, and people dine at eight."

Electrolytic Disinfectant at Poplar.—Dr. F. W. Alexander, the Medical Officer of Health for Poplar Borough, refers in the course of his annual report just issued, to the working of the electrolytic disinfectant department during 1908. The plant has been installed three years, and is still in good working order, producing 185 gallons of fluid in eight hours, at an average strength of 4·5 to 5·0 grammes of chlorine per litre. Repairs, renewals and improvements during the year cost £45. 28,280 gallons of the electrolytic fluid have been manufactured and distributed, the total cost of materials used being £56 2s. 5d., including £28 7s. 10d. for 4,543 units of electricity at 1½d. Dr. Klein, bacteriologist to the L.G.B., in a recent report arrives at the conclusion that 1 oz. of the fluid to 150 oz. of water (or 1 oz. in nearly 1 gallon of water) will kill the cholera germ in 2½ minutes, and the electrolytic fluid in the same proportion will kill the germ of typhoid fever. The germ of plague would be killed by a more largely diluted solution, as its vitality is much less than that of cholera and typhoid fever. Dr. Alexander says that during 1908 there must have been a saving to the borough of £700. The plant has paid for itself and the depôt, while there has also been a saving of considerably over £1,200 to the borough, and the health of the inhabitants is good.

Educational Notes.—University College Awards.—The following awards have been made at University College (London University):—Archibald P. Head Memorial Medal, 1908-9, R. A. Pfleiderer. Engineering Diplomas—H. F. Anns (Civil), E. E. Baily (Civil and Municipal), S. M. Hitchcock (Electrical), J. W. Mason (Civil), S. G. Nottage (Electrical, with distinction), B. J. Pfleiderer (Mechanical), R. A. Pfleiderer (Mechanical, with distinction), A. C. Russell (Mechanical, with distinction), A. M. Sims (Civil and Municipal), A. T. C. Sutton (Civil and Municipal), F. L. Thompson (Civil and Municipal).

Imperial College of Science and Technology.—On Thursday last week the King laid the foundation stone of the new College at South Kensington, which will consist of mining, metallurgical, geological and engineering departments; the last-named adjoins the Central Technical College of the City and Guilds Institute, which will form an integral part of the scheme.

Electric Shock Fatalities.—According to the *Daily Telegraph*, an inquiry into the death of Samuel Higgs, 36, and Daniel Eyre, 27, miners, who were killed whilst engaged with an electric coal-cutting machine at the Clifton pit, was concluded on Tuesday at Nottingham. The jury returned a verdict that the men accidentally met their deaths through an oversight in the inspection of the working of the machine, "the 'pommel' of which was not in order to carry away the escaping current."

Mine Accident Inquiry.—An inquiry has just been completed by agents of the Lanarkshire Miners' Union into the cause of the recent explosion in the No. 1 pit, Ferniegair Colliery, Hamilton. Three men were working an electrically driven coal-cutting machine on one of the seams when the explosion took place. The agents' report is of such a nature that the Union executive has decided to lay the whole circumstances before the Home Office, with a request that a Government inquiry be made into the cause of the accident.

City of London Lighting.—The deputation appointed by the Corporation to visit Continental cities *re* public lighting has reported as follows:—"We are of opinion that the public lighting in the City of London can be materially improved, and we have come to the following conclusions:—(1) That, wherever possible, streets should be lighted by means of centrally hung lamps with lowering gear. This we think particularly important in the City of London, where the number of obstructions upon the footways in the form of lamp-posts, bins, letter-boxes, &c., is so large. (2) That open spaces should be lighted by means of lamps upon standards, fitted with lowering gear. (3) That high-pressure incandescent gas lamps with inverted burners should be adopted as the illuminant, but where gas is impracticable, electricity with open arc and flame arc lamps should be installed. We think, however, before suggesting any drastic alterations in the general lighting of the City, that the Streets Committee should be authorised to arrange for some further experimental lighting of the City thoroughfares." We refer to this matter in our leading columns.

Mediterranean Push.—Messrs. Gent & Co. send us the following amusing example of the business methods pursued by two of our Maltese fellow-subjects:—

"Reg. A, Letter No. 1.

"Malta, *July 2nd*, 1909.

"Mr. Gent & Co., London.

"As we are on the point to leave our station as electrical apprentices in the Government department, we have decided to introduce your well-known firm in our country, and so will start business with you under the above condition.

"That you will supply us with electrical materials to our account, with a percentage discount, paying you six months after the expedition.

"That in the meantime we will represent you as your sole agents with a favourable percentage discount, and that the materials will be forwarded to us, shipment paid.

"We hope that as no one yet represents you here, our demand will be taken into a favourable consideration, and that in a very short time we will have your esteemed answer.

"With many thanks, we remain ——."

Gas Poisoning.—In the report of the Medical Inspector to the Home Office for 1908, he states that there were 55 cases (five fatal) of carbonic oxide poisoning, as compared with 81 cases (10 fatal) in 1907. Twenty-six were in connection with blast furnaces; 19 (two fatal) were due to "power gas, producer or suction gas"; some of these occurred whilst starting up the engine, others were caused by escape from exhaust pipes (in one case leaking into a cotton mill and rendering four operatives unconscious), feeding the hopper, and a leak in the generator. Seven were due to escape of coal gas—in one case overcoming four weavers—and two followed on the inhalation of fumes from a coke fire.

Duncan Watson v. Jackson.—On Friday last, before His Honour Judge Bacon, at the Bloomsbury County Court, Mr. H. Jackson, late manager to Roger Dawson, Ltd., was sued by Mr. Duncan Watson, who recently purchased the goodwill of the late firm, for the value of goods sent by the firm to defendant's private house. Defendant said that some of the goods were booked out to him in error, instead of to clients, and other goods returned were not booked in. Plaintiff claimed that the fact of these goods being booked out to defendant made him responsible for them, and he brought this action to recover the price (50s.) of same. Defendant counterclaimed for some fittings belonging to him, which he said plaintiff had undertaken to return, but which had not been returned. Judgment was given for defendant both on the claim and counterclaim.

E.C.C. Rolling Mill Installation.—It having been reported that Sir Alfred Hickman had said that he would have been better served if he had entrusted the installation of the electrically-driven rolling mills at his works to German contractors, the Electric Construction Co., Ltd., who carried out the work, quite naturally opened their eyes very widely with surprise, then frowned, and next wrote a letter to the *Iron and Steel Times*, in which the statement appeared, asking for an apology and withdrawal. Sir Alfred Hickman writes to the same journal emphatically contradicting the statement. He adds:—"It is true that some difficulties not unusual in a new departure have been experienced, but, if I am correctly informed, they are far less than have attended a somewhat similar installation by a German firm at works in the north, the engineering staff of which have honoured me by repeated visits in order to obtain information and assistance. The arrangements here are not yet perfected; but there has been no shirking of responsibility on the part of the contractors, and I have every confidence that in the end the work will be fully equal, if not superior, to anything the Germans have done, and the cost will certainly not be greater than they would have charged."

Institution and Lecture Notes.—Institution of Mining Electrical Engineers.—At a meeting held on the 7th inst., at Ilfracombe, under the chairmanship of Mr. H. F. J. Stewart, A.M.I.E.E., it was unanimously resolved to form a branch of the above Institution, there being many prospective members present, including several mining engineers and managers from the Gloucester and Somerset coal fields and the Cornish tin mines. The chairman said that there were already 12 centres; the Southern Section would cover a very large district, but its mineral area was almost entirely confined to the Western Counties. This part of Devon was about midway between the Gloucester mines and the wheals of the Duchy, and seeing the unique nature of its mining operations in these islands, he hoped that the Stannaries would send strong support to the Institution. The number of applications already received was entirely satisfactory, the members and associates showing a total to date of 230. It was agreed that the hon. secretary should be asked to approach Mr. R. Hood Haggie, with a view to his election as president of the Section, and a small provisional committee was formed, with Mr. H. J. F. Stewart as chairman.

At a meeting of the Royal Cornwall Polytechnic Society on the 7th inst., Mr. N. Trestrail read a paper on the Cornish Pumping Engine, which he said was the most durable and economical plant yet installed for the work. Fast running engines or electric motors attached to a pump might, if not economical, appear highly satisfactory whilst running for a short time; but when the weak points began to fail, endless trouble was caused by frequent stoppages. Mr. H. Davey said he did not think that electricity could compete with the Cornish engine in economy of fuel, but he protested against a too hasty generalisation. Mr. L. Hards, of Camborne Urban Electrical Supply Co., in defence of electric pumping, said they were perfectly willing to go into the whole thing on a fair basis—if they put an example to them where they had their Cornish engine, they would put down an electric pump against it. His impression was that in a great many cases electricity would come off best.

Royal Society of Arts.—The Council has awarded the Society's Silver Medal to the following among other readers of papers during the Session, 1908-9:—Mr. Walter Rosenhain, "The Application of the Microscope to the Study of Metals"; Herr Sam Eyde, "The Manufacture of Nitrates from the Atmosphere by the Electric Arc."

Society of Engineers.—The third vacation visit of the present session took place on Wednesday, when a party of members and associates of the society, with their friends, inspected the Greenwich generating station of the L.C.C.

Appointment Vacant.—Shift engineer for Greenock (£2). See our advertisement pages to-day.

Fire Prevention.—Last year the *Liverpool Courier* premises, and all the buildings occupied by Messrs. C. Tinling & Co., were fitted with the May-Oatway automatic fire detection system, this installation being connected with the Central Fire Station. Early on Sunday morning, the 4th inst., a fire occurred in the telephone room, the flooring catching fire, but, thanks to the efficiency of the system and the immediate warning given, the fire brigade were able to step in before more than trifling damage was done. The May-Oatway Co. inform us that this is their seventieth "save" in seven years, a fact of which they are justly proud.

An interesting demonstration of the efficiency of "Kyl-Fyre," a dry powder extinguisher, was arranged for Wednesday afternoon last, by Messrs. Wiggins & Ribll, of 7, Mark Lane, E.C. The "Kyl-Fyre" powder is supplied in a tube some 20 in. long, weighing about 6 lb., with a readily detachable cover, and one has only to look at the extensive list of users, including a score of electricity works, to realise its success. The mere fact of its being in powder, instead of liquid form, ensures that the damage shall be due to fire only, and not, as has frequently been the case, attributable largely to water.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At a meeting of the Burslem Town Council on Monday the E.L. Committee recommended that the salary of the electrical engineer, Mr. Ashton Bremner, be increased from £350 to £400 per year. The recommendation was opposed by some of the members of the Council, and it was pointed out that the Committee had two years ago passed a resolution that in future all applications for increase of salary in connection with the electricity department were to be made in the month of February, so that they could be taken into consideration when the annual estimates were prepared. The Mayor thereupon ruled the Committee's recommendation out of order, and it was not proceeded with.

The Barrow Corporation has decided to increase the salary of Mr. Barnwell, works superintendent, from £155 to £165 per annum, and afterwards by annual increments of £5 to £185 per annum; and the salary of Mr. Heslop, mains superintendent, from £135 to £150 per annum, and afterwards by annual increments of £5 to £170 per annum. There was considerable discussion on the matter at the Town Council meeting, but Alderman Smith said the salaries were reasonable in proportion to the training and skill of the men.

Mr. A. J. Brooks has been appointed electrical station superintendent at Avonbank, Bristol, at £175 per annum, rising to £200 after six months' service, and then to £250 by two annual increments.

Torquay T.C. has granted Mr. Storey, electrical engineer, an honorarium of 100 guineas in appreciation of his services in connection with the laying down of the tramway plant.

Worksop (Notts.) U.D.C. decided on Monday to increase the salary of the assistant electrical engineer from £109 to £120 a year.

From among 220 applicants, Mr. E. Taylor, of West Ham, has been selected for the post of fourth assistant engineer at the Hammersmith electricity works.

Tramway Officials.—It has been arranged by the Bournemonth Tramways Committee that Mr. F. T. Olding (the present chief clerk) is to be relieved of all work other than traffic matters, and appointed as traffic superintendent, at his present salary (£200); Mr. Harry Baker, the present official, is appointed cashier, at a salary of £175; Mr. Ignatius Bulfin, the present electrical engineer, is appointed chief assistant to the general manager and electrical engineer at his present salary, £450; and Mr. W. B. Tait will continue to hold the position of works superintendent, at his present salary of £175.

Mr. C. W. Mallins, general tramways manager of the Liverpool Corporation, has had his salary increased by £100 per annum.

General.—The Derby Chamber of Commerce has appointed Mr. Henry Davis, of Messrs. John Davis & Son (Derby), Ltd., the well-known electrical engineering firm, to be its delegate at the seventh Congress of Chambers of Commerce of the Empire, which is to be held at Sydney, New South Wales, in September next.

NEW COMPANIES REGISTERED.

Gavan Inrig, Ltd. (103 894).—This company was registered on July 6th, with a capital of £2,000 in £20 shares, to acquire the business and assets of G. Inrig, of Great Eastern House, 20, Bishopsgate Street (Without), E.C., to develop and work the foreign patents granted to him for France, Belgium, Spain, Italy, Germany, Switzerland, Portugal, Canada and U.S.A., and to carry on the business of electrical and general engineers, manufacturers of insulating material and rubber substitutes, &c. The subscribers (with one share each) are: G. Inrig, M.I.E.E., Aberleigh Lodge, Bexley Heath, Kent; G. Whatman, 2, Christie Road, South Hackney, electrical engineer. Private company. G. Inrig is the first managing director; remuneration, £360 per annum.

Walter Scott & Co. (Edinburgh), Ltd. (7,193).—This company was registered in Edinburgh on July 8th, with a capital of £500 in £1 shares, to acquire the business of electrical, mechanical and general engineers, carried on at 148, Rose Street, Edinburgh, as Walter Scott & Co. The subscribers (with one share each) are:—Walter Scott, 70, Elm Row, Edinburgh, engineer; D. M. Fraser, 29, Comely Bank Road, Edinburgh, engineer. Private company. The number of directors is not to be more than three; D. M. Fraser is the first: qualification, £25; remuneration as fixed by the company. Registered office, 148, Rose Street, Edinburgh.

E. M. Redfern, Ltd. (103,873).—This company was registered on July 5th, with a capital of £2,000 in £1 shares, to adopt an agreement with E. M. Redfern, and to carry on the business of electricians, electrical engineers, &c. The subscribers (with one share each) are:—E. M. Redfern, Grassmere, Upper Pershore Road, Selly Park, Worcs., engineer; F. C. Martin, 88, Gillott Road, Birmingham, electrical engineer. Private company. E. M. Redfern is chairman and managing director for life; qualification, 100 shares. Registered office, 9, Ethel Street, Birmingham.

Premier Electric Institute, Ltd. (103,969)—This company was registered on July 9th, with a capital of £100 in £1 shares, to inaugurate an institute for selling curative electrical appliances and advising on electrical treatment, to carry on the business of manufacturers and dealers in electrical specialities, &c. The subscribers (with one share each) are:—A. Baker, 142, Ruskin Avenue, Manor Park, Essex, clerk; L. K. Brown, 80, Tournay Road, Walham Green, S.W., clerk. Private company. Table "A" mainly applies. Registered office, 133-5, Regent Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd. (73,480).—This company's annual return was filed on June 17th, when 949,808 ordinary, 248,132 "A" preference and 235,000 "B" preference shares had been taken up out of a capital of £1,675,000 in 1,000,000 ordinary, 400,000 5 per cent. "A" preference and 275,000 6 per cent. "B" preference shares of £1 each; £7 has been received and £1,432,933 is considered as paid. Mortgages and charges: Nil.

Electric Batteries and Carbons, Ltd. (97,710).—Debenture dated June 2nd, 1909, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. G. Orr, End House, Cavendish Road West, N.W.

Wells, Rayner & Co., Ltd. (78,655).—This company's annual return, made up to April 13th, was filed on June 7th, when 3,450 ordinary and 2,006 first preference shares had been taken up (in addition to 2,550 ordinary shares surrendered to the company) out of a nominal capital of £20,000 in 4,000 first preference, 10,000 second preference and 6,000 ordinary shares of £1 each. £1,831 has been received on 2,006 first preference, leaving £175 in arrears; £6,000 is considered as paid on 6,000 ordinary shares (including those surrendered). Mortgages and charges: £1,000.

Solium Electrical Co., Ltd. (99,009).—Debenture dated July 5th, 1909, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder, Nottingham and Nottinghamshire Banking Co., Ltd., Thurland Street, Nottingham.

British Aluminium Co., Ltd.—Mortgage dated June 28th, 1909, to secure all moneys due, or to become due, from the company to Parr's Bank, Ltd., charged on certain aluminium in course of transit.

Cowans, Ltd. (57,378).—A memorandum of satisfaction to the extent of £3,000 on May 4th, 1909, of debenture stock covered by trust deed dated February 26th, 1902, securing £5,000, notified July 5th.

CITY NOTES.

Bombay Electric Supply and Tramways Co., Ltd.

Sir Edward Sassoon, Bt., M.P. (Chairman), presided at the Electrical Federation Offices, Kingsway, on Tuesday, over the fourth ordinary general meeting of the above company.

In moving the adoption of the report (to which we referred in our issue of July 2nd), the Chairman said the net receipts amounted to £67,066, as compared with £40,880 in the previous year, being an increase of £26,186. After deducting the proportion of debenture interest, amounting to £24,592, there remained £42,474, to which had to be added the amount brought forward from the previous year, making an available total of £45,363. The preference dividend paid up to August 15th, together with the accrued dividend to December 31st last, amounted altogether to £35,978, which left a balance of £9,385 to be carried forward to the next account. The total revenue from all sources, including the amount represented by the sale of current to the tramways, was £177,855, an increase of £49,935, and this additional revenue was obtained at an increase in expenditure of £23,749. Dealing with the general conditions prevailing in India during the period under review, the chairman quoted from an article in the *Times*, and said that the effect of the trade depression had shown itself in a marked degree in Indian railway receipts, and had no doubt also reflected itself in the tramway receipts. They had also been prejudiced by the riots which occurred in Bombay. He thought it a cause of satisfaction that notwithstanding these unfavourable conditions they were able to come before the shareholders with an increase of receipts for both branches of the business, and given normal conditions the directors looked to a steady if not very rapid growth of the receipts now that the tramways had been entirely electrified. They were providing an excellent service, which compared favourably with the majority of the tramway systems of Europe, and this, coupled with the extension of the city, should result in steady progress. They were devoting particular attention to the ticket system, whilst traffic organisation had their unremitting attention. This year they were adding 10 cars to the rolling stock, making a total of 172. From January 1st to May 18th, a small portion of the lines continued to be worked by horse traction, and in consequence of their having to maintain a separate organisation for this service, the operating expenses of the horse section practically amounted to the receipts it earned. The power and running expenses of electric traction were last year somewhat higher than in the previous year, owing to the fact that they ran a considerably greater car-mileage, whilst the rate paid to the power section was raised. The total receipts from the electric supply amounted to £47,714, as compared with £21,566, whilst the working expenses amounted to £39,737, as compared with £19,545. On the face of it, the increase in the working expenses appeared somewhat out of proportion to the increase in the receipts, but this was accounted for by the fact that over 66 per cent. of the total units sold were sold to the tramways. The electric supply branch debited the tramways with the units at just about the cost of production, but, of course, this was reflected in the lower cost of generation in respect of the total number of units generated. There was nothing very material in it, because if they charged the tramways a higher price, it would be shown in the tramways expenses. The receipts, exclusive of the revenue represented by the current supplied to the tramways, amounted to £25,683, as compared with £17,707 last year; an increase of nearly

£8,000, and the board carried to profit and loss account £7,976, as compared with £2,021 in the previous year. Last year they added 215 consumers, representing 40,208 equivalent 8-c.p. lamps. The progress of the company had been well maintained in the current year, and up to the end of May they connected 135 new consumers, representing 20,629 equivalent 8-c.p. lamps. Having regard to their increasing business and with a view to lowering the cost of generation, they had completed arrangements for erecting a new generating station at Kussara Basin, but as the benefits which this would bring were fully explained in the report he had nothing material to add. Negotiations were in progress for the supply of power to the workshops of the Bombay and Beroda Railway Co., who would take a supply of about 500 kw., and other important contracts were being negotiated for, so that the supply might commence about the date of the completion of the new power station which they anticipated would be early in 1911. The capital expenditure of the year amounted to £232,482, which represented amounts payable under various contracts. The authorised capital of the company had now been issued, and in order to provide for the future capital expenditure contemplated, they made an issue recently of £150,000 5 per cent. mortgage debentures, which were underwritten in Bombay and London. These were to be redeemed in 28 years by annual drawings, commencing in 1913, and a fixed sum of £6,060 had been provided annually for the purpose. The directors had set aside £6,000 for the purpose of creating a sinking fund for the redemption of the 4½ per cent. debenture stock, and this sum, which was being separately invested, would appear in next year's accounts. The question of making proper provision for debentures was also receiving attention, and this, of course, would have to be made out of profits. The chairman proceeded to refer to the action taken in appointing a consultative committee in Bombay to advise the board on local matters, and to the retirement of Mr. E. Hopwood, the secretary, who had secured a post in the North of a more remunerative character, giving greater scope for his activities. Eulogistic references was made to Mr. Hopwood's loyal services to the company, and the wish expressed that he would be successful in his new post. In conclusion, the Chairman said he would like to refer to the foolish reports which had been circulated in India, presumably by unscrupulous and interested persons who were desirous of bearing the shares of the company. It was stated that (1) the company was going into liquidation; (2) that in addition to its debentures, the company was largely in debt; (3) that they were going to embark in enterprises outside of Bombay, and, indeed, outside India; (4) that the company was still not free to buy its plant and stores in the cheapest market; and (5) that it was dependent, in some degree, on the working and results of other electrical companies—the Brush Co., and other companies connected with the British Electric Traction Co. being specially mentioned in this connection. To all of these reports the board gave most emphatic contradiction. The past history of their undertaking had been one of uninterrupted progress, and its future prospects were most promising, whilst its financial position was sound and free from any embarrassment. Their net earnings that year were sufficient to pay the debenture interest and the preference dividend, and they looked forward before long to being able to pay a dividend on the ordinary shares.

Sir Charles Ollivant, K.C.I.E., seconded the motion, and the report was adopted without discussion.

The following particulars are given in the directors' report:—"The directors look forward to a steady increase in the tramway receipts now that the electrification of the system has been completed.

	Year ended Dec., 1907.	Year ended Dec., 1908.
Route miles opened	18·27 (avge.)	20·38
Number of passengers carried	25,766,916	30,486.666
Proportion of expenses to receipts	60·9 %	53·1 %
Electric cars in stock	84	162

"The gross receipts from electric supply for the year, including the amount represented by the sale of current to the tramways, amount to £47,714, as compared with £21,566 for the previous year. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amount to £25,683, as compared with £17,707 for the previous year. The working expenses amount to £39,737, as compared with £19,545 for the previous year. The balance of £7,977, as a result of the year's operations, compares with a balance of £2,021 for the previous year.

"The following figures show the comparative results of the past three years:—

—	Consumers.	Equivalent of 8-c.p. lamps.	Units sold.			Revenue.	Expenses.	Balance.
			For ltg. and pwr.	For tramways.	Total.	£	£	£
1906	330	58,849	531,731	—	531,731	8,435	10,075	1,640 (debit)
1907	588	84,648	1,233.661	823,246	2,056.907	21,566	19,545	2,021
1908	803	124,856	1,738,676	3,524,954	5,263,630	47,714	39,737	7,977

"In order to meet the increasing demand for the supply of electrical energy, and to reduce the costs of generation, the company have recently completed arrangements with the Trustees of the Port of Bombay for the lease of a piece of land having an area of about 17,737 sq. yd. for the erection of a new generating station at Kussara Basin. This site has recently become available owing to a reclamation which has been undertaken by the Port Trust. It possesses many important advantages over the existing one at Wari Bunder. At the latter the costs of generation are enhanced by the high cost of water for condensing, and the necessity, owing to its distance from the sea, of employing cooling towers for this purpose. The cartage of coal from the sea front is also a substantial enhancement to these costs. At Kussara, on the other hand, the situation will provide special advantages for an unlimited supply of sea water for condensing, and for the handling of coal either by boat or by rail. On its eastern boundary the new site has a landing wharf immediately on the Kussara Basin, while the new Port Trust goods railway is contiguous with its western boundary, and a siding from the latter will be provided into the property. In consequence of these and other advantages, the removal of the generating station will result in an important reduction in the company's generating costs; and future developments of the power house, for which there is abundant space, can, as the expansion of the business calls for them, be provided far more economically than would have been possible at Wari Bunder. The company have entered into a contract with the Brush Electrical Engineering Co. for the erection of the new generating station, and have placed an order with that firm for the supply of 4,000 kw. of additional steam plant. The company's existing generating plant at Wari Bunder, representing 4,800 kw. of plant, will also be transferred to the new power house, and it is intended then to dispose of the Wari Bunder lease and the buildings there. Before deciding on an extension of the existing steam generating plant, the directors very carefully considered the alternatives of adopting for this addition, oil or gas plant. After a full inquiry it was decided, having regard to the large size of the sets required, to uncertainties regarding the future price of oil fuel at Bombay, and to other considerations affecting the questions of reliability and economy of generation, that neither oil nor gas engines could at the present time be prudently adopted in substitution for steam plant at Bombay, but the directors are carefully watching the development of these other types of plant."

New General Traction Co., Ltd.

The directors' report for the year ended March 31st, 1909, states that the revenue for the year, received and accrued from the various sub-companies, amounted to £18,701, against £18,893 in the previous year. The general expenses, including directors' fees and legal charges, amounted to £1,991, as against £2,509 in 1907-8. The accounts for the year show a small profit of £428, thus reducing the balance of loss previously shown, to £25,807. The dividend received from the Coventry Electric Tramways Co. for their year ended December 31st, 1908, was the same as for the previous year, viz., 3½ per cent., but owing to the general depreciation of trade, the result of the year's working only allowed of the sum of £2,000 being placed to reserve for depreciation, against £3,900 in the year 1907. The Norwich system showed no improvement for the year ended June 30th, 1908; but since that date certain changes have been made in the service and considerable economies effected in the working, and a better result for the current year is expected. The Douglas Southern Electric Tramways Co. paid 5½ per cent. on its preference shares for the year 1908, as compared with 6 per cent. for the preceding year. The income from the Philadelphia undertaking for the year amounted, under the terms of the lease, to £10,437, being an increase of £481 over the previous year. The directors' reports and accounts of the Coventry, the Norwich, and the Douglas Southern Tramway Companies respectively are annexed.

Baron Emile B. d'Erlanger presided on Tuesday, at the offices, 20, Bishopsgate Street, E.C., over the thirteenth annual meeting of the company.

The Chairman, in moving the adoption of the report, said it would only be necessary for him to detain them a short time, as the accounts were not at all complicated, and the items differed little, if anything, from those of the previous year. The receipts from the Coventry property for 1908 were exactly the same as for 1907; whilst those from Norwich were £913 less, and from Douglas £58 less. On the other hand, the Philadelphia property paid them £482 more than in the previous year, represented by the increased rate of interest on their shares in that undertaking for the second half of 1908; and the interest they received on the outstanding balances owing to them by the Coventry company on construction account, was £1,050, against £750. The result was that their receipts were practically the same as in the previous year, being, in fact, only £190 less. In addition to the income mentioned, however, they had also received out of the profits of the Coventry company for 1908, a further payment of £1,000 on account of the indebtedness of that company to the traction company, which payment would appear in the next year's accounts. Turning to the debtor side of the profit and loss account, they would see that the general expenses, &c., showed a reduction of £518, and interest on loans, a reduction of £356; the result for the year being that they had a small profit to show of £427. They had, since the date of the last annual report, disposed of a further amount of £5,000 of the bonds of the Darby Media and Chester Street Railway Co., which reduced the total amount of securities held by them as at March 31st last, to £643,248. He might say that since that date, they had realised yet further about £12,000 of those bonds, which had been sold at better prices than those previously obtained, viz., 95, and they trusted that they could be able presently to sell gradually further blocks of the bonds.

Under the terms of the trust deed for their 4 per cent. prior lien debentures, they had to commence amortising them by paying to the trustees on January 1st, 1910, £4,000, to be applied in redeeming those debentures at par by drawings. The receipts for the year from their various subsidiary companies, of which he had spoken, exhibited to them in a word their position. Coventry continued to make a fairly satisfactory profit; and as to Norwich Tramways, the directors of that company had for some time been hard at work, together with the manager, trying to devise some means by which the expenses might be reduced and the traffics increased, and he was glad to think that these efforts were bearing fruit, and they might now reasonably look forward to better results. With regard to Philadelphia, in accordance with the terms of the lease, they would receive an increased dividend at the rate of 1 per cent. from the 1st of the present month.

Mr. Francis Fitzgerald seconded the motion.

Mr. Jackson said that the Chairman had only given them the bare facts in the balance-sheet, and he suggested that in the future it would interest the shareholders if they gave the number of passengers carried on the various lines, and also the average takings. He would like to know whether the expenses of their undertakings were uniform per car-mile, and further, what the fees of the directors were. He noticed that the amount put down for light railways was £1,448 as against £1,973 last year.

Mr. Soanes asked if the Philadelphia Rapid Transit Co. was a substantial company which could carry out its undertakings.

The Chairman said fuller information was not given because they had published the full balance-sheets of the Coventry and Norwich Tramways. In the Norwich undertaking they gave the number of passengers, and would do the same with the Coventry system next year. The cost per car-mile received the closest attention of the directors, and both at Coventry and Norwich it compared most favourably with that of other undertakings. The fees paid to the directors were £100 each. When he was asked to take charge of the company it was not in a flourishing condition, and he had done his best for it since. They had a certain number of bonds which were not pledged to the prior lien debentures, and as soon as they could get rid of a sufficient quantity they intended to pay off the floating debt on which they paid 6 per cent. The Philadelphia Co. had a capital of $30,000,000, and controlled all the tramways in Philadelphia. The difference in the amount put down for light railways was due to their having sold some shares.

Mr. Winslow (engineer) said that the working costs per car-mile averaged 5½d. both in Coventry and Norwich. The receipts per car-mile were low in each town, between 7½d. and 8d.

British Electric Traction Co., Ltd.

The thirteenth ordinary general meeting of this company was held on Thursday of last week at the Electrical Federation Offices, Kingsway, Sir Charles Rivers Wilson presiding.

In moving the adoption of the report (see Electrical Review, July 2nd), the Chairman said that included with the report was a separate document giving particulars and statistics relating to the associated companies, from which it would be seen that a unique and economical organisation had been devised for the administration of about 60 undertakings. The Electrical Federation Offices, which had been built for their accommodation, were provided in the first instance by the British Electric Traction Co., and would be reccuped either by way of principal, or in the shape of payments covering interest, sinking fund and repairs. The cost had been about £36,000, and after allowing for all charges in respect of the expenditure, there would be a saving upon the rents formerly paid. The building was on a 99 years' tenure. They would see from the statistics the magnitude of the work done, and a close study of the details could not fail to convince them that it had been done efficiently and economically. The enterprises in which they were interested had taken many years to develop, but the directors felt disappointed that the net result of the heavy work of the last 13 years had not been more profitable in recent years. They had always looked forward to the time when the undertakings would be able to show profits; but, unfortunately, they had fallen on bad times. The companies had been subjected to unnatural competition and opposition by the local authorities, with the result that they had had to submit to a gradual reduction in the fares, representing a loss of something like £200,000 per annum. At the present moment their difficulties were aggravated by the exceptional trade depression all over the country, such depression as he felt himself warranted in describing as the most severe and general the country had experienced since its adoption of Free Trade. If there were no profits there could be no creation of fresh capital, and without new capital there could not be an extension of enterprise. Dealing with the accounts, the revenue from the associated companies was about £33,000 less than in the previous 12 months, a large number of the companies having paid slightly reduced dividends. At Greenock the traffic receipts had fallen from £34,200 to £27,000; Hartlepool, from £15,500 to £12,300; in the Potteries they had decreased from £97,400 to £94,300, and many other undertakings showed a lower revenue than in the previous 12 months. In the aggregate the receipts of the Federated Companies showed an increase, but this was due to the increases at Auckland and Bombay, while in the case of the Metropolitan Tramways Co. additional lines had been opened. He hoped that with a revival in trade the receipts would go up. As to the current year, they had been able to hold their own, but unless there was a revival in trade before the end of the year he did not think there would be any material changes in the dividends of the associated companies. They had hoped to pay the reduced dividend of 3 per cent. on the preference shares as a regular half-yearly instalment, but the profits for the past year were £15,000 less than the amount required to pay such a rate of dividend. Unless the profits increased, it would obviously be unwise to pay the same dividend for the current year, and the directors were of opinion that unless profits materially increased, it would be wiser to suspend the payment of the dividend until the accounts had been made up for the year. The management and general expenses were £16,800, as compared with £24,100, the reduction being due to the fact that the Federation now bore items of expenditure which the company formerly met. As to the investments, the return of those which were remunerative was about ½ per cent. less than in the previous year, and the proportion of non-revenue-earning investments was larger, but he thought that was only temporarily. The average fare per passenger in 1908 was 1·23d., an improvement of ·02d. as compared with 1907, which represented £24,000, or six months' interest on the preference shares. In 1901 the average fare was 1·38d., and that meant an increase in revenue of no less than £200,000. The securities of the company appeared at cost in the accounts, and the time might come when it would be necessary to consider whether steps should be taken to deal with the matter. During the past year the directors had been considering the question of opening up electrical enterprises in other countries, and steps had to be taken with a view to securing a concession for tramways in St. Petersburg, accompanied by contracts for the construction of the work. A strong syndicate had been formed, in which the company had a substantial participation. Other negotiations were pending in regard to places abroad.

Mr. Emile Garcke, in seconding the motion, referred to the Electric Lighting Acts (Amendment) Bill, which had been introduced by the Board of Trade into the present session of Parliament. He said it was impossible to read the Bill without feeling that it had been drafted with intent to prevent private enterprise from further engaging in electrical industries; and it applied not only to the future but to the companies already in existence.

Mr. J. B. Braithwaite suggested that steps should be taken to see if a new coin could be introduced worth about 1·15d., as it would enable a slightly higher fare to be charged, and so bridge over the loss which at present resulted on the tramways.

After further discussion, the Chairman, in reply to criticisms, remarked that suggestions had been made for reorganising the capital, but that meant a reduction in capital, and the board did not think that necessary. No further capital would be raised by the British Electric Traction Co. for the St. Petersburg undertaking.

The report was adopted.

A shareholder, " W. F. P."—" who occupies a responsible position in the public service "—writes to the *Financial Times*, suggesting that, in the interests of shareholders of all classes, the Board of Trade make an investigation into the affairs of the above company, as provided for in Sec. 109 of the Companies' (Consolidated) Act, 1908. He remarks that the company has proved as speculative as any mining venture, and he continues:—" In 1899, when I first became a shareholder, the market value of the £10 preference share was 14¾, and of the £10 ordinary 21⅞. To-day, after ten years' working, the prices of these shares are 2½ and ⅝ respectively, while no dividend is being paid on nearly £3,000,000 of ordinary and preference capital.

" The question of the absorption by this company of the Electrical Power Distribution Co., two directors of which were also directors of the British Electric Traction Co., calls for the strictest investigation. So also do the relations of the British Electric Traction Co. with the Brush Electrical Engineering Co. These two cases are simply cited as examples for inquiry. A Board of Trade inquiry is suggested, as officers, agents, and so forth of the company can be examined on oath. The Act requires that in the application to the Board of Trade one-tenth of the issued shares should be represented. Further, the Board of Trade may require the applicants to give security for the payment of the costs of inquiry, and in connection with this, although I am not a great shareholder in the British Electric Traction Co., still I am prepared to advance £100 to any security fund that may be formed for the purpose now suggested."

City and South London Railway Co.—The accounts for the half-year ended June 30th, show a balance, after providing for the debenture stock interest, the payment of dividend on the 5 per cent. preference stocks 1891, 1896, 1901 and 1903, and the transfer to renewal fund of £1,500, sufficient to allow of the payment of a dividend on the consolidated ordinary stock at the rate of 1¾ per cent. per annum, carrying forward £1,411. For the corresponding period last year, the dividend was at the rate of 1½ per cent. per annum, carrying forward £1,868.

Direct United States Cable Co., Ltd.—The board recommend a final dividend of 4s. per share, together with a bonus of 1s. per share, both free of income-tax, payable on 31st inst., making, with the three interim dividends already paid, a total distribution of 4¾ per cent. for the year ended June 30th, and after placing £5,000 to reserve fund account, carrying forward £3,596. The transfer books are closed from July 13th to 27th.

Electric and General Investment Co., Ltd.

The twentieth ordinary general meeting of the above company was held on Wednesday of last week, under the presidency of Mr. J. B. Braithwaite.

The Chairman, in proposing the adoption of the report, said that the past year had been one of comparative stagnation in electrical business, and therefore the company had not had the opportunities which it had had in former years of employing its capital to the extent which it would have liked. At the same time, it would be seen that the result of the year was that they had considerably reduced their liabilities. The profit for the year had amounted to £11,566, against £7,889, or very nearly £4,000 more, which was an increase of about 40 per cent. The directors proposed to pay the preference dividend, and theywould then be left with a balance of profit to carry down of £4,095, against only £568 last year, so that there was a net improvement of over £3,500. That sum represented about 15 per cent. on the amount of capital paid up upon the ordinary shares, but looking at the continued depression in many of the electrical securities which were held by the company, he believed the directors would have the support of the shareholders in their proposal to transfer that amount to the contingency fund, which was a reserve against depreciation in the market value of their securities. Of course, if the market improved later on, that contingency fund might be drawn upon, if necessary, for dividend purposes, providing, of course, that the value of their investments in the market stood at a price which was equal to, or in excess of, the cost at which they stood in the books. As regarded the current year, it was a little early to say much, as they only commenced on June 1st; but, looking all round the market, he felt that, on the whole, he could say that there were indications of a slight improvement in business, and in all probability they would be able to present better results when he next had the pleasure of meeting them.

A discussion followed, and Mr. Croft expressed the opinion that the shareholders generally would be satisfied with the proposal of the directors as to dealing with the balance. He was speaking as a preference shareholder, but he thought that the view of all the shareholders would be that the course suggested was a prudent one.

Mr. Mathews said that he only held ordinary shares, and he thought that the directors might have used some of the profits to have paid a dividend to the ordinary shareholders on that occasion. The reserve and contingency fund now amounted to a very substantial sum, and he thought that they might have spared a little to have given the ordinary shareholders a dividend, however small.

Mr. Parker pointed out the desirability of maintaining a strong financial position looking at the depression which existed in electrical concerns.

The Chairman, in reply, pointed out that the ordinary shareholders had always recognised that that was a finance company, and they must therefore look for fluctuations in the dividend from time to time, but the ordinary shareholders had received already a return of £4 16s. per cent. on every £1 share, so that they had practically received their capital back five times over. With regard to the events of the past year, he considered that the London Electric Supply Bill had greatly improved the position of the electric light supply companies, and that an improvement in that class of security would set in in the future. He alluded to the unfair treatment which electric companies received at the hands of municipalities and various Government and local bodies, and pointed out that in London the omnibuses, the motors, the tubes and the underground railways upon which enormous sums of money had been expended, were being carried on with comparatively small returns, and he contended that it was utterly impossible for this state of things to continue to go on, and he trusted that municipalities would soon wake up to the position.

The report was adopted.

The Transition Period in Paris.

The reports of the original electric lighting companies in Paris, whose undertakings are being conducted on common account pending the definite assumption of sole control by the Compagnie de Distribution in the course of the next few years, are now being issued in relation to the first period of the stage of transition. In the case of the Compagnie Continentale Edison, the directors state that the extension of the cable network during 1908 was carried out at the expense of the Compagnie de Distribution, and the total amount of energy sold on behalf of the six Sectors, advanced from 45,311,000 KW.-hours in 1907, to 52,422,000 last year. A larger increase had been expected from the reduction in prices under the new *régime* of joint working, but the laying of the requisite new mains involved a considerable amount of work which was hampered by Continental strikes. The surplus on working obtained by the Edison Co. was £92,000, as compared with £136,100 in 1907, the diminution being attributed to the reduction in prices. On the other hand, the sale of buildings, mains and materials, which had already been written off, yielded £60,000, and the work of disposal has not yet been completed. The net surplus, including the balance brought forward, amounts to £168,400 as contrasted with £144,400 in 1907, and a dividend has been declared at the rate of £4 12s. per ordinary share, as against £4 in the preceding year, and £3 8s. on the founder shares, as compared with £2 16s. in 1907. The company holds 35,340 shares in the Compagnie de Distribution, which were subscribed for on the constitution of the latter. The Secteur de la Place Clichy, which is also one of the original companies, reports a financial year comprising 18 months, the working results of which are not comparable with any previous period owing to the changed conditions due to the course of the transition from the old to the new order of affairs. As net receipts the accounts show the sum of £72,000 for 1908, while the net profits total £37,000, thus enabling the payment of a dividend of 9 per cent., as in the previous financial year, on the share capital of £240,000. The installation account stands at £360,000, and although all the installations have been taken over by the city, and the price has not yet been determined, it is expected that it will not in any case be less than is represented by this sum. The company held shares of £140,000 in the Société Triphasé at the end of the year, and has since increased its investment by subscribing for the larger portion of the additional capital of £320,000 issued recently by the Triphasé Co., thus becoming the principal shareholder in the latter. On its part the Triphasé Co. is largely interested in the Compagnie de Distribution, and will survive the Secteur de Clichy, which is really a subsidiary of the former company.

General Electric Co., Ltd.

The report of the directors just issued reflects a very substantial improvement in net income during the year ended March 31st, 1909. In quoting from the report below, we have also added in parenthesis figures for the year ended March, 1908. The net trading profits and income from investments, &c., amount to £78,201 (£59,753); after deducting depreciation and debenture interest amounting to £26,987 (£25,030); there remains a balance of £51,213 (£34,723); out of which the dividend on the preference shares at the rate of 5 per cent. for the year ended March 31st, 1909, has been paid, absorbing £12,500 (£12,500); leaving an available balance of £38,713 (£22,223). This the directors recommend should be appropriated as follows:—Provision for managing directors' and employes' bonus, £3,871 (£2,222); provision for dividend on ordinary shares at the rate of 5 per cent. for the year ended March 31st, 1909, £18,697 (£18,026); to reserve account, £16,145 (£1,974). The reserve account stands in the accounts at £120,343 (£118,369), being the amount of undivided profits as at March 31st, 1908. The proposed appropriation of the undivided profit of the year ended March 31st, 1909, amounts to £16,145 (£1,974), giving a total of reserve account of £136,488. The result of last year's working can be considered satisfactory, in view of the prevailing depression in the engineering trades. The works of the company at Witton, Salford, Birmingham and London have been profitably employed throughout the year, although they have not been working up to their full capacity. The Osram metal-filament lamp has established during last year a great reputation. A considerable proportion of lamps recently supplied have been produced at the new works at Hammersmith, and the quality has proved in every respect equal to those supplied by the Continental factory. The company's telephone works at Salford have been considerably extended. Further ordinary shares to the number of 1,342 (1,466) have been allotted during the period covered by the accounts, to the directors and staff at par. Mr. H. Bevis tendered his resignation as director, which was accepted by the board. Mr. Ernest G. Byng retires, and offers himself for re-election.

National Telephone Co., Ltd.

The directors' report for the half-year ended June 30th, 1909, states that the income accrued in respect of the business of the half-year amounts to £1,546,838, as compared with £1,452,569 for the corresponding period of 1908, being an increase of £94,269. The working expenses for the half-year amount to £893,768, as compared with £828,969 for the corresponding period of 1908, being an increase of £64,798. The net result for the half-year (after deducting the Post Office royalties, amounting to £148,951) is a profit balance of £504,119, as compared with £484,069 for the corresponding period of 1908, being an increase of £20,050. The rentals carried forward for unexpired terms of running contracts amount to £1,366,283, as compared with £1,314,591 at the corresponding period of 1908, being an increase of £51,692. Out of the available balance of £379,850 shown by the net revenue account, the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £150,000 to the reserve fund account, and to carry forward the balance of £11,100. The sum of £313,394 has been expended on capital account during the half-year in the erection of 13,848 additional exchange and private stations, and in the construction of underground works.

United River Plate Telephone Co., Ltd.—The report for the year ended March 31st last, states that the gross receipts in sterling for the year in the River Plate were £287,064, against £250,750 for last year. Deducting expenses in Argentina and London, debenture interest, dividend on preference shares and interim dividend on ordinary shares, and adding interest on investments, transfer fees, &c., there remains a profit of £89,233, plus £4,904 brought forward, making an available balance of £94,138. After applying £32,000 to reduction of special replacement account and £25,000 to reserve, the directors recommend a final dividend of 5 per cent. on the ordinary share capital, making a return of 8 per cent. for the year, free of income-tax, that a sum of £2,000 be voted towards a staff provident fund, which is being formed among the company's employés in Argentina, and that the balance of £5,138 be carried forward. The board record the death of Mr. Alfred Le Rossignol, who had been for many years a director of the company.

Delhi Electric Tramways and Lighting Co., Ltd.

The third ordinary general meeting was held on Thursday, last week, at Winchester House, E.C.

Col. Sir Buchanan Scott, in moving the adoption of the report, dealt at length with the trouble which the directors had had with the contractors, who had the work of constructing the line at Delhi. The delay occasioned by the failure of the contractors in the completion of their contract had, he said, been most serious, and had handicapped the directors from the commencement of the company's operations. When the contractors failed, the company had to make arrangements themselves to do the work, and not only that, but they had to pay a large sum to get the materials released, which were seized by those who had claims on the contractors. The line was opened for traffic in June, 1908, and even then their troubles were not at an end, but continued during the five months of operation covered by the accounts. The receipts from both the tramway and lighting sections, and in particular the tramway system, were seriously affected by an unparalleled outbreak of malarial fever, which was so severe that between 60 per cent. and 70 per cent. of the population of Delhi were prostrated. The staff of the company also suffered. The receipts of the company, therefore, had not reached anything like the amount estimated in the prospectus. The gross receipts for the five months under review amounted to Rs. 67,500, and the total expenses to Rs. 55,600, leaving a total net receipt of Rs. 11,900, or £787. Negotiations were in progress for the sale of the original power station and plant taken over, and its replacement by more modern and efficient machinery, with a view to reducing the generating costs. It was very satisfactory to note that a new contract for street lighting upon improved terms, had been submitted to the company by the Delhi Municipality for approval, and the directors had every hope that a substantial revenue would be derived from that section in the future. The passengers carried on the tramways totalled 805,670, the car-miles run 142,755, and the average receipt per passenger was about 1d. Their latest advices from India showed that the receipts were increasing week by week. There had been a falling off during the cold weather, but that was only to be expected. The negotiations had been concluded for the issue of a number of debentures in India, which showed that the residents there thought well of the undertaking.

Mr. J. M. Campion, M.I.C.E., seconded the motion, and after a short discussion, the report was adopted.

North Melbourne Electric Tramways and Lighting Co., Ltd.

The directors' report for the year ended September 30th, 1908, says that the operation of the company's undertaking has been under the management of Messrs. J. G. White & Co., Ltd., during that period, and the directors have arranged with Messrs. White to continue the management for a further period of two years from June 1st, 1909. The results of the operation of the undertaking continue to be unsatisfactory, although there is some improvement in the results as compared with the preceding year. The profit and loss account shows a better position on the Melbourne operation, largely due to savings in the operating expenses, with an increase in the lighting business. The tramway receipts continue to show poor results. Negotiations have been continued with the Government for authority to make the connection with the Melbourne Tramways Co.'s undertaking at Flemington Bridge, and the Government has announced its intention to introduce a Bill in Parliament during the present session to authorise the extension. The company is extending its lighting system, and there is an improvement in this department. In view of the fact that it will probably take some years before the earnings of the undertakings will be sufficient to pay the full debenture interest and arrears, and the sinking fund, an arrangement was concluded in November last with the debenture-holders, whereby they deposited their debentures for five years with the United States Debenture Corporation, Ltd., and agreed that their security should not become enforcable, nor the principal moneys become payable, solely on account of their interest being in arrear during such period. The debenture-holders also assented to the amount of the interest which was payable December 1st, 1908, being retained by the company to be used for necessary extensions to the lighting system. The company is greatly indebted to the debenture-holders for the concessions made by them. It is hoped that this will give the company a reasonable period to develop its business and avoid the danger of foreclosure. Every effort is being made to economise in the operation. The directors have continued without their fees. Messrs J. G. White and Co., Ltd., make no charge for office expenses and staff, other than actual out-of-pocket expenses, and the total London expenses, with the exception of interest and trustees' fees, amounted to only £42 for the past year.

The annual general meeting was held on Tuesday at 9, Cloak Lane, Cannon Street, E.C., Mr. Arthur F. Farish in the chair.

The Chairman having formally proposed the adoption of the above report, the motion was seconded by Mr. A. T. M. Johnson, who said that for 41 years he resided in Melbourne and knew well the position of the tramways. It was 19 years since he was in the city, and at that time the district was a little scattered, but still even then he considered there was a very fair opening for a tramway. The only drawback that he saw to the company's line was the close proximity of the railway which ran a few yards behind their main route, and the people had become so accustomed to travel by train that they were biased against anything in the nature of electricity. He was pleased to see that the accounts showed an improvement over last year, for they had not only paid their way, but had a balance of £1 500. He felt confident that in the course of the next two or three years the line would be a splendidly paying one, because it went through districts that must have electric tramways, and as soon as the people accustomed themselves to travelling, he felt sure the receipts would vastly improve.

Mr. Henriques asked the Chairman for some information as to the progress of the company during the year under review.

The Chairman said that the receipts on the tramways from passengers for the year ended September 30th, 1908, amounted to £12,577, as against £12,618 for the preceding year, and the total tramway receipts were £12,770, as compared with £12,919. In the lighting department they had done much better—the receipts having amounted to £1,828, as against £696. The total revenue from the tramways and lighting was £14,598, as compared with £13,600. The operating expenses were £13,046, against £14,857, showing a satisfactory decrease of £1,240. There was no doubt that Mr. Johnson had put his finger on the spot when he alluded to the competition of the railway, and the sooner the population took to the tramways the better. He was pleased to say that the Government had promised to introduce a Bill into Parliament during the present session to authorise them to make a connection with the Melbourne Tramway's undertaking at Flemington Bridge, and if that connection was made they hoped their traffics would greatly improve. From the manager's report they gathered that building operations were going on along the route of the trams, but in any event he was afraid it would be a long time before they could expect to be in the position they would like to be in regard to the company. Everything was being kept perfectly in order at a minimum of expense. Messrs. J. G. White & Co. were managing the tramways free of cost, and the directors and secretary were working without fees.

The report was then adopted.

Prospectuses.—*Fife Tramway, Light and Power Co., Ltd.*—The prospectus of this company shows that the authorised share capital is £200,000, divided into 125,000 6 per cent. cumulative preference shares of £1 each—£125,000; 75,000 ordinary shares of £1 each—£75,000. Subscriptions are invited for 109,700 cumulative preference shares of £1 each, conferring the right to a fixed preferential dividend at the rate of 6 per cent. per annum. The company has been formed to take over the construction, equipment and working of the tramways and other works authorised by the Dunfermline and District Tramways Order Confirmation Act, 1906, the production, supply and distribution of electricity for lighting, and all other public and private purposes within the Royal burgh of Dunfermline and parts of the county of Fife situated beyond the burgh. The tramways to be constructed at present extend to about 12 miles of single track over 9½ miles of route. It is intended to apply to Parliament for powers to construct a line from Dunfermline to the Rosyth Naval Base. Messrs. Hawtayne and Zeden, consulting engineers, London, estimate that the annual net earnings of the tramways, lighting and power properties should amount to £18,500; interest at 5 per cent. on, say, £80,000 debenture stock, is £4,000; dividend of 6 per cent. on £125,000 preference shares in £7,500, leaving £7,000. The registered office of the company is Commercial Bank Buildings, High Street, Dunfermline.

Bandar Sumatra Rubber Co., Ltd.—This company has been offering an issue of 94,000 shares of £1 each. The company is acquiring the Bandar Pinang Estate, in the Serdang District, East Coast of Sumatra.

Kamuning (Perak) Rubber and Tin Co., Ltd.—An issue of 775,000 "A" shares of 2s. each has been offered. The company is acquiring the Kamuning Estate, Perak, from Linggi Plantations, Ltd.

Oriental Telephone and Electric Co., Ltd.—The list is to close to-day in an issue of £50,000 4 per cent. redeemable debenture stock at 86. The proceeds are to be applied to assist the Bengal Telephone Co. in its undertakings, to rapay temporary advances, and for general purposes.

Interborough Ropid Transit Co.—An issue of $10,000,000 5 per cent. 45-year gold mortgage bonds has this week been offered for subscription in London.

The Italian Thomson-Houston Co.—This company has recently completed the first monophase electric traction system which it has had occasion to carry out between Padova and Fusine, forming part of the secondary Italian railway system. The balance-sheet of the company to December 31st last, shows a net profit of 579,240 lire, say, £23,000, which, added to the balance brought forward from 1907, makes a total of 734,236 lire, say, £29,300; of this the shareholders receive 540,000 lire (£21,500); 28,962 lire are placed to reserve, 155,247 lire are carried forward, and the balance of about 10,000 lire goes to the directors.

Dublin and Lucan Electric Railway Co.—The directors recommend a half-year's dividend of 5 per cent. on the preference shares, placing £250 to reduction of electrical equipment (capital account), and carrying forward £420.

Hastings and District Electric Tramways, Ltd.—According to the *Financial Times*, the directors announce that they are not in a position to pay any interim dividend on the preference shares.

London Electric Wire Co. and Smiths, Ltd.—The directors announce an interim dividend for the half-year at the rate of 5 per cent. per annum.

Okonite Co.—An interim dividend of 2 per cent. has been declared.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	July 7	2,877	— 182	5	7,664	— 226	..	..
†Ayr	" 10	676	— 42	8	2,462	— 166	8	..
Bath	" 7	1,790	+ 65	27	19,294	+ 614	..	..
Belfast	" 9	7,642	— 566	13	55,068	+ 1,784	37	..
Birkenhead.. ..	" 11	2,339	+ 41	14	15,634	— 412	18·52	..
Birmingham Corp.	" 3	13,122	+ 395	14	88,628	+ 650	..	..
Blackburn	" 7	2,193	— 255	15	17,103	— 537	13·97	..
Blackpool-Fleetw'd	" 10	2,386	+ 73	..	..	..	..	..
†Bolton	" 4	2,546	— 147	14	32,755	— 700	26	..
Bournemouth ..	" 7	3,096	— 163	14	23,227	+ 72	21·96	..
Bradford	" 3	9,806	— 422	13	66,809	+ 931	54·9	..
Brighton	" 11	1,989	+ 37	15	13,843	+ 733	9·5	..
Bristol	" 9	11,846	—1,472	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	" 2	439	— 40	26	5,641	— 128	3·65	..
Barnsley	" 2	320	— 38	"	4,313	— 181	..	..
Barrow	" 2	488	— 96	"	5,642	— 446	5·37	..
Cavehill	" 2	191	— 98	"	2,005	— 252	..	..
Devonport ..	" 2	644	— 402	"	9,473	— 2,126	8·85	..
Gateshead ..	" 2	2,081	— 245	"	25,660	— 293	11·25	..
Gravesend ..	" 2	434	— 57	"	5,051	— 224	6·5	..
Greenock	" 2	1,361	— 80	"	13,541	— 155	7·25	..
Hartlepool ..	" 2	502	— 56	"	5,645	— 169	6·72	..
Kidderminster ..	" 2	231	— 45	"	2,473	— 182	..	..
Leamington ..	" 2	393	— 12	"	4,161	+ 141	..	..
Merthyr	" 2	415	+ 2	"	5,439	+ 21	2·9	..
Metropolitan ..	" 2	12,691	— 766	"	153,288	+11,926	22	..
Middleton ..	" 2	675	— 233	"	8,535	— 680	8·5	..
Mid. Joint Com'tee	" 2	11,259	— 342	"	143,646	— 4,071	..	..
Oldham—Ashton	" 2	1,120	— 104	"	14,329	— 1,002	9·13	..
Peterborough ..	" 2	231	— 56	"	2,808	— 254	5·31	..
Potteries	" 2	3,672	— 52	"	45,840	— 1,290	29	..
Rothesay	" 2	695	— 184	"	3,281	— 102	2·75	..
Southport.. ..	" 2	681	— 110	"	6,922	— 236	8·17	..
S. Metropolitan ..	" 2	1,621	— 306	"	19,501	— 380	..	..
Swansea	" 2	1,947	— 108	"	23,841	+ 438	12·5	..
Tynemouth ..	" 2	673	— 156	"	4,844	— 119	3·75	..
Weston-s-Mare ..	" 2	374	— 85	"	2,237	+ 139	3	..
‡Worcester ..	" 2	590	— 67	"	6,748	— 122	5·75	..
Wrexham ..	" 2	199	— 23	"	2,463	— 112	..	..
Yorks. Wool. Dist.	" 2	1,816	— 151	"	22.901	— 575	17	..
Miscellaneous ..	" 2	436	— 76	"	5,083	— 29	..	..
Burnley	" 10	2,604	— 47	..	..	..	..	..
Burton-on-Trent ..	" 11	543	— 29	15	3,909	— 96	6·62	..
Bury	" 11	2,465	+ 2	$14\frac{4}{7}$	17,672	— 464	22·5	..
Cardiff	" 3	4,325	— 465	14	29,425	— 904	..	..
Carlisle	" 10	404	— 31	27	4,333	— 141	..	..
Chatham and Dist.	" 8	1,648	— 104	27	20,757	+ 1,044	14·98	·61
Cork	" 8	1,160	..	27	11,127	— 937	..	..
Croydon	" 2	2,886	— 279	..	20,096	— 65	11·25	4·75
Darlington	" 10	575	— 32	14	2,787	— 182	..	..
†Darwen	" 2	247	— 41	13	3,401	— 146	4·86	..
Dover..	" 3	406	— 66	14	2,710	— 206	4·75	..
Dublin	" 9	11,533	— 935	..	..	..	54·25	..
Dundee	" 7	2,415	— 94	$7\frac{4}{7}$	9 060	— 883	15	..
East Ham	" 10	2,080	+ 188	$14\frac{1}{2}$	14,750	+ 2,171	8·43	·68
Exeter	" 9	679	— 23	15	5,184	+ 560	5·5	..
Glasgow	" 10	33,846	—1,450	..	100,629	— 1,878	90·5	1·5
Hastings	" 8	2,076	— 192	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	" 10	5,157	+ 271	14	36,001	+ 424	13	..
Ilkeston	" 7	281	— 12	14	1,873	— 149	..	..
Ipswich	" 10	850	— 60	15	5,691	— 25	10·5	..
Kilmarnock.. ..	" 3	293	— 21	7	1,040	— 67	4·25	..
Lan'kshire Trm. Co.	" 8	2,7·8	+ 46	27	33,167	— 1,810	17·62	1·18
Lancashire United	" 7	3,586	+ 884	27	35,282	+ 171	..	..
Leeds	" 3	14,355	— 216	14	92,558	+ 3,270	96·75	·25
Leicester	" 3	4.545	— 107	..	..	..	..	..
Leith	" 3	1,204	— 8	7	4,320	+ 317	6	..
Liverpool	" 3	22 129	— 707	26	277,441	— 3,605	104	..
‡L.C.C.	June 26	73,004	— 81	..	449,661	+19,311	121	4·25
London United ..	July 10	13,534	—2,232	..	158,093	—15,257	..	..
†Lowestoft	" 8	190	— 32	40	5,897	— 666	3·5	..
Manchester.. ..	" 10	32,907	+ 953	15	221,901	— 466	90·5	6
Newcastle	" 10	7,256	—1,700	..	57,822	— 1,246	..	..
Newport	" 10	1,355	— 65	15	9,915	— 261	14·5	..
Oldham	" 11	3,729	— 150	15	29,520	— 1,827	23·75	..
†Pontypridd.. ..	" 3	390	+ 61	$13\frac{1}{2}$	5,838	+ 1,005	5·5	1·75
Portsmouth.. ..	..	..	..	..	..	..	..	..
Preston	" 7	1,478	— 101	..	..	..	..	..
Rotherham	" 8	1,166	— 62	14	8,626	— 232	10	·66
Salford	" 5	9,439	— 710	$13\frac{5}{7}$	64,000	— 2,271	..	..
Sheffield	" 11	11,217	— 52	$15\frac{3}{7}$	87,055	— 1,302	87	1·25
Southampton ..	" 6	2,195	— 108	14	14,813	— 465	..	..
Southend-on-Sea ..	" 7	1,080	+ 84	14	6,708	+ 972	..	..
South Shields ..	" 10	1,196	— 11	$14\frac{3}{7}$	8,181	— 55	..	..
Swindon	" 7	260	— 52	..	..	..	..	..
Tyneside	" 7	1,059	— 99	..	..	..	..	..
Wallasey	" 8	1,909	— 58	$18\frac{1}{2}$	12,670	+ 853	..	·22
Walthamstow ..	" 10	1,842	— 102	15	9,992	+ 161	9	..
West Ham	" 1	4,729	— 84	13	81,822	+ 1,732	15	·8
Wolverhampton ..	" 7	1,552	— 212	14	11,410	— 780	12·5	..
Baker St.-Waterloo	" 10	6,575	— 515	26	83 860	+ 7,710	4·25	..
Cen. London Rly...	" 10	11,253	—2,975	26	144,758	—18,554	6·82	·55
Char. +, Eus. Hamp.	" 10	7,870	+1,185	26	101,120	+16,450	7.75	..
City & S. Lon. Rly.	" 11	6,445	+ 159	26	84,602	+ 1,514	7·3	..
Dublin-Lucan Rly.	" 9	808	— 14	26	8,280	+ 252	7	..
G.N. and City Rly.	" 10	2,716	— 229	26	88,716	— 4,607	3·5	..
G.N., P'y. & Brmtn.	" 10	11,825	+ 625	26	150,765	+ 9,775	9·25	..
L'pool Overh'd Rly.	" 11	2,982	+ 78	..	..	..	6·8	4·8
Llandudno-Col. Bay	" 2	741	— 42	31	5,597	+ 1,569	..	..
Mersey Railway ..	" 10	8,882	+ 257	26	51,219	+ 1,609	4·5	..
Metropolitan Rly...	" 11	38,589	+1,051	26	419,007	+14,215	24·5	..
Met. District Rly...	" 10	20,691	+2,081	26	258,578	+25,066	24	..
Anglo-Argentine ..	" 8	76,081	—3,716	..	1,059,186	+60,811	..	..
§Auckland	June 18	14,218	+3,180	24	83,101	+11,794	22·8	3·1
Bombay (B.E.T.) ..	" 10	4,921	+ 160	22	58,625	+ 3,404	..	..
§Brisbane	"	15,480	+2,120	..	..	..	..	..
Calcutta	July 10	7,006	+ 966	..	..	..	..	..
§Cape Electric T. Ld.	June	11,208	..	..	..	..	..	..
§Kalgoorlie, W.A...	"	4,008	..	26	22,629	..	20·5	..
Madras	" 30	1,185	— 75	26	15,061	— 20	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	July 9	2,687	— 182	27	88,724	+ 78	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

MONEY continues to be remarkably cheap, and a fall in the Bank Rate at an early date is confidently anticipated. The languor of summer, however, is beginning to tell upon business, in spite of the weather, and there is very little doing in any save a few departments.

Railway prophets are at work upon dividend estimates, and next week will see the first of the declarations from the trunk lines. The City and South London announces $1\frac{3}{4}$ per cent., an advance of $\frac{1}{4}$ per cent., and the result is a rise of $\frac{1}{2}$ in the price to $31\frac{1}{2}$. The Metropolitan, it is thought, will improve upon its recent performances. The Central London statement is awaited without enthusiasm, and the prices of the Ordinary and Deferred stocks continue to shrink, the latter being 2 points down at 44.

Metropolitan reacted $\frac{1}{4}$, but Districts made further upward progress. The Tube Debenture stocks are all very firm, and Underground Electric Railway prior lien bonds are $\frac{1}{2}$ better.

British Electric Tractions continue flat, both the Debenture stocks are down 2 points. M. Emile Garcke's letter to the newspapers, appealing for a combined effort to induce Parliament to ameliorate the conditions of electrical supply companies, has been read with polite interest. Brush issues are unchanged. London United Trams are also without alteration. Anglo-Argentine Tramways First Preference shares are, of course, extinguished now, but the Second Preference show a slight fall, and the Third Preference are quoted $4\frac{5}{16}$. The 4 per cent. Debenture stock has hardened.

Calcutta Electric Supply shares came down with a run, from 6 to $5\frac{1}{8}$, recovering again to their former figure. The movement had a singular cause. The company is about to issue more Preference capital, and invited shareholders to underwrite the new shares at a commission of 3 per cent. Apparently this thoroughly alarmed some of the proprietors, who, it is clear, failed to realise in the least what it meant. They seemed to think it a a sort of confession of weakness. Instead of being glad to have the opportunity offered them to underwrite the new issue, they hastened to sell their old shares, and knocked the price down in the manner described. The incident is certainly amusing; to those in charge of new issues it may prove instructive.

The new-issue market is, at the moment, concerned mainly with rubber companies. These pour out in greater volume than even roller-skating propositions, though it is hardly fair to mention the two classes of industry in the same sentence. Some of the rubber companies are achieving remarkable success. The subscription lists of the Kamuning (Perak) Rubber and Tin Company were closed on Monday, a few hours after opening, and the issue was applied for many times over. The 2s. shares went to nearly 100 per cent. premium straightaway. Other rubber shares are firm, and notwithstanding the fact that a large speculative position is open for the rise, the market looks strong enough, although it will naturally be susceptible to violent fluctuations.

Electricity supply shares are steady, but featureless. Charing Cross Preference and City Lights Preference are $\frac{1}{8}$ better, these being the only London shares to show any change.

The South American Traction group is generally easier. Mexican Light and Power Common fell 2, and the Preference reacted the same amount after its substantial advance of a week ago. Mexico Trams have held their rise pretty firmly, but there is an easing-off in others of this section. Business is rather quieter. River Plate Electricity Ordinary and Preference fell away a little.

National Telephones further rallied upon consideration of the dividend statement. The Preference shares are better, too. United River Plate Telephone Preference picked up $\frac{1}{8}$ upon a capital report. Telegraph descriptions lack animation. Anglo-American stocks are a little irregular. West India and Panama fell $\frac{1}{16}$. Globe Telegraph and Trust Preference have come into demand, and the price gained 7s. 6d., while buying from the States led to a point rise in Submarine Cables Trust certificates.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

United Electric Tramways of Monte Video, Ltd.—Further issue of 12,800 ordinary shares of £5, fully paid, Nos. 147,201 to 160,000, and 2,777 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 76,501 to 79,277.

Gateshead and District Tramways Co.—13,500 ordinary shares of £10 each, fully paid, Nos. 1 to 37, 41, 43 to 2,227, 2,232 to 5,121, 5,123 to 6,957, 6,975 to 6,994 and 6,997 to 13,528.

Telegraph Construction and Maintenance Co., Ltd.—The directors have declared an interim dividend of 12s. per share, free of income-tax, for the past half-year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations July 6th.	Closing Quotations July 13th.	Business done week ended July 13th, 1909.		Rise + or Fall −	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾— 3¼	2¾— 3¼	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96 xd	93 — 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143½—144½	143½—144½	..	..	..	5 10 9
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99 xd	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	3¼%	3⅞%	3½%	£3 4s.	57 — 59	57 — 59	..	..	..	5 9 8
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 —101	100½—101½	101½	100	+ ½	5 18 3
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	15¾— 16	16 — 16½	16⅜	16	+ ½	2 8 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 15 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	90	89¼	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8⅛— 8⅞	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	8¾	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	3 16 8
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	12⅝— 13⅛	12¾— 13¼	12⅝	..	+ ⅛	6 8 5
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	127 —130	127 —130	129	127½	..	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85½— 87½	85½— 87½	86	..	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	..	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½— 12	11½— 12	11 13/16	11½	..	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102½—104½	102½—104½	..	..	..	3 16 7
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	10⅜	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	12⅞— 13⅜	13¼— 13¾	13 5/16	13¼	+ ½	4 7 8
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	25¾— 26¼ xd	25¾— 26¾	26⅜	25¾	..	6 17 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	52¾	51½	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	23/32— 27/32	23/32— 27/32	16/9	15/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	13/16— 15/16	13/16— 15/16	..	..	..	5 12 11
3,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107½—109	108 —109½	109	108⅜	+1	5 9 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122 —124	124 —126	125½	123	+2	4 15 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10 — 10¾	10¼— 11	10⅜	..	+ ¼	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5½— 5¾	5 9/16— 5 13/16	..	..	+ 1/16	4 6 0
[illegible],000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	98	97½	..	3 12 2
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87¼	87⅛	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..	3 19 3
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7⅞	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98½—100½ xd	98½—100½	..	..	.	4 9 7
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	129 —132	100	..	+1	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	7	..	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅞— 5¼	5 — 5⅜	..	..	+ ⅛	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13⅜— 13⅞	13½— 14	13¾	13⅝	+ ⅛	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100½—102½	101 —103	102	..	+ ½	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	9/16— 11/16	½— ⅝	10/7½	..	+ 1/16	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼— 8¾	8¼— 8¾	..	..	..	6 17 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations July 6th.	Closing Quotations July 13th.	Highest	Lowest.	Rise + or Fall −	Present Yield per cent.
320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9¼— 9½	9 3/16— 9 7/16	9⅜	9 9/32	— 1/16	9 6 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90½— 91½	91 — 92	91½	91	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
[illegible]	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4¼— 4⅜	4¼— 4⅜	87/6	85/7½	..	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½— 1	⅛— ⅜	7/6	6/3	— ⅜	60 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1½— 2½	1 — 1¼	35/-	30/-	— ⅜	46 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	2¾— 3¾	2½— 3½	63/9	62/6	—1¼	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3 — 4	2½— 3½	..	..	— ½	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	94 — 99	94 — 99	..	..	..	5 11 1
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —146	143 —147	146	145¼	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —124	121 —124	123	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —113	110 —113	..	..	..	4 8 6
233,[illegible]0	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	102½	..	..	4 6 7
212,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
[illegible]	British Electric Traction	10	9 %	Nil	Nil	..	½— ⅞	½— ⅞	15/-	11/3	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2⅜— 2⅞	2⅜— 2⅞	51/10½	50/-	..	10 18 2
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	86 — 90	90½	88	—2	5 11 1
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	66 — 70	..	..	—2	6 8 7
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	7 9/16	7⅜	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜— 6¾	6¼— 6⅝	6 5/16	6¼	— ⅛	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	105	..	..	4 4 1
204,91[illegible]l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,016,868	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜— 4¾	4⅜— 4¾	..	..	..	6 6 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97½—100½	97 —100	..	..	— ½	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9¾— 10½	9¾— 10½	10 7/32	9 13/16	..	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5½	5⅛— 5½	..	..	..	4 15 3
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	103½—105½	104 —106	..	..	+ ½	4 4 11
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅞— 2	1⅞— 2	39/4½	37/9	..	6 0 0
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —106	103 —106	105	..	..	4 4 11
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	62 — 64	61 — 63	63	61¾	—1	5 8 2
551,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	81½	84	..	4 14 2
551,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	45 — 47	43 — 45	31	30¼	—2	5 11 1
1,[illegible]	City and South London Railway	Stock	1¾%	1⅛%	2⅛%	1½%	30½— 31½	31 — 32	..	..	+ ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	1 — 1¼	1 — 1¼	..	..	..	9 7 6
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	91½— 94½	91 — 94	..	..	— ½	5 6 5

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations July 6th.	Closing Quotations July 13th.	Business done week ended July 13th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	..	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 — 102	99 — 102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	2½%	..	¼ — ½	¼ — ½	..	..	..	15 0 0
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	2½%	..	1½ — 2½	1½ — 2½	..	..	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	70 — 75	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 7/16 — 1 11/16	1 7/16 — 1 11/16	..	..	..	8 7 2
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛ — 7½	7⅛ — 7½	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 — 103	102 — 103¼	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅝ — 12⅜	11¾ — 12½	11⅞	..	+ ⅛	6 5 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 — 107	105 — 107	105	..	..	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	..	14½ — 15¼	14½ — 15¼	15 1/16	14¾	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ — 2½	2 — 3	..	..	..	4 8 11
899,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	3 — 4	3½ — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1½ — 2¼	1¾ — 2½	..	..	..	15 5 7
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	63 — 67 xd	63 — 67	64¾	64¼	..	5 19 5
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	39¾ — 40¼	39½ — 40	40¼	39¾	— ¼	1 5 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	68 — 70	68 — 70	68⅜	68¼	..	3 13 7
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¼ — 17¾	17½ — 18	17¾	17½	+ ¼	Nil
391,387	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝ — ¾	⅝ — ¾	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32 — 27/32	23/32 — 27/32	..	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96½ — 98½	95 — 97	96½	..	—1½	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130 — 133	131 — 134	133	127	+1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	91½ — 93½	94	92¾	— ½	5 6 11
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	33 — 34½	33 — 34½	..	..	..	5 19 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 — 101 xd	101 — 103	..	..	..	3 19 3
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101½ — 102½	102 — 103	102¾	102½	+ ½	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88½	87½	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	37 — 39	37 — 39	37⅞	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¾ — 3¼	2¾ — 3¼	..	..	..	7 7 4
2 5,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 78	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations July 6th.	Closing Quotations July 13th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	8 — 8½	8⅛	8 1/16	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 — 100	97 — 100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅜	3⅞ — 4⅜	84/4½	..	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	95/-	92/6	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3¾ — 4¼	..	..	+ ⅛	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	97¼	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	78/9	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 — 103	100 — 103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10⅞	10 13/16	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅝	12 — 12¾	12⅝	12½	+ ⅛	4 14 1
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	120 — 123	121 — 124	123½	122¾	+1	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 — 102	99 — 102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼ — 3¾	3¼ — 3¾	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅛ — 8⅝	8⅛ — 8⅝	..	..	..	5 14 8
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11	10 25/32	..	5 6 8
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 — 107	103 — 106	104¼	103½	—1	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 — 103	100 — 103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	85½ — 88½	85½ — 88½	87¼	..	..	5 13 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 — 101	98 — 101	..	..	..	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½ — 100½	97½ — 100½	98⅝	98½	..	4 19 6
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅛ — 7⅜	6⅞ — 7⅜	7⅜	7 5/16	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 — 100	97 — 100	98¼	..	..	3 19 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	5 11 8
£82,[illegible]55	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	93 — 97	94	..	+1	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4¼ — 4⅝	4¼ — 4⅝	88/9	85/7½	..	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	93/9	..	..	4 10 0
235,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 — 108	105 — 108	107	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82½ — 84 xd	82 — 84	83½	82½	— ½	6 1 11
13,5[illegible]5,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	67 — 70	65 — 68	69⅞	65	—2	5 2 11
$[illegible]00,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	106 — 110	104 — 108	109	105	—2	6 9 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	82½ — 89½	88 — 89	89½	88½	+3	5 12 4
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	92 — 96 xd	92 — 96	..	..	..	4 13 9
120,4[illegible]1	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4¾ — 5¼	4¾ — 5¼	..	..	..	2 7 8
137,000	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½ — 12½	11½ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	6 11/32	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅜ — 1½	1 5/16 — 1 7/16	28/3	27/3	— 1/16	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/32 — 1 5/32	31/32 — 1 3/32	20/6	..	— 1/16	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 — 105	102 — 105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	9	..	..	6 13 4
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2¾ — 3⅛	2¾ — 3⅛	60/-	57/6	..	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 5/16	1 1/16 — 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 — 103	100 — 103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¾ — 2¼	1¾ — 2¼	37/6	..	..	11 2 2
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	25/32 — 27/32	25/32 — 27/32	16/9	..	..	5 19 5
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	9 1/16	9 1/16	..	5 8 1
61,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 1/16	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

THE L.C.C. AND THE PURCHASE OF STORES.

[COMMUNICATED.]

The report of the General Purposes Committee (No. 2), dated June 14th, contains matter of considerable interest to municipal officials whose duties include the purchase of material. The extent of the operations of the Council is shown by the fact that the purchase and distribution of general stores, stationery and school material employs a staff of 350 persons, in addition to which the Highways, Architects, Fire and Tramways Departments possess their own depôts and buying organisations. An attempt to secure increased efficiency and economy by consolidating this work of the stores staffs under a common purchasing department is not unnaturally attractive to the business men who form so large a proportion of the Council, and a scheme for effecting this is outlined in the report above referred to.

The principle of centralised working is too generally accepted in modern business to call for discussion, but it may not be amiss to direct attention to the limitations of its usefulness which may well arise in a system where the material in use is so diverse in character, and so largely consisting of highly specialised products.

The purchasing department is an essential part of the organisation of many large manufacturing businesses to-day, but, since particular attention was directed to this and other features of factory systems a few years ago by certain specialists in business methods, its useful range has been found to be much more limited than was anticipated. Unless administered with the greatest care, such a department may only multiply paper work and delays, and bring discouragement to those actually responsible for production, by interposing a more or less inflexible barrier between the designer and maker and those who supply him with his raw material, much of which may be far from raw, and already the product of skilled labour and special processes with which the buyer must be closely in touch if the best and most economical results are to be obtained.

Although the report appears to have been drafted with a careful regard to the special requirements of the engineering departments of the Council, which suggests that strong representations have been made on the subject by those departments, yet in practice, possibly, the tendency would be to extend the scope of the central stores and treat as common many items of material which the superintendents would prefer to select more particularly with regard to their own use and purpose.

Amongst the general controlling and administrative duties of the officer proposed to be appointed in charge of the department appear the following:—

"To ascertain from the heads of departments the extent and nature of their requirements, and to obtain and supply the necessary stores, and to advise the heads of departments in cases in which economy can be effected.

"To keep the standard patterns and examine quality of deliveries, except in case of special goods, which the consuming department shall examine and report upon.

"To advise the Stores Committee upon the acceptance of tenders, investigate complaints against contractors, &c."

In working under these particular orders, the stores superintendent would be called upon to exercise exceptional discretion in order to avoid actually hindering and reducing the working efficiency of his consumers, and yet keep his operations from degenerating into a mere repetition of paper work. In the first instance, the head of a technical department can hardly produce the best results unless he is a competent buyer of stores with regard to quality and price, and well up to date in the productions and charges of those suppliers who cater particularly for the needs of his department.

To check deliveries for quality with the necessary promptness would involve the employment of expert examiners who, possibly, would not be always fully occupied, and certainly must to some extent be subject to the heads of the consuming departments if inefficiency and friction are to be avoided.

The placing of tenders, it may be feared, would, under the rather impersonal advice of the general storekeeper, be more and more decided on price rather than the real economic suitability of the goods for the purpose in view, and complaints against contractors are not likely to be diminished or adjusted more easily by putting a barrier between the user and supplier.

It would be of some assistance in the consideration of the scheme if estimates were available showing (*a*) the proportions of the annual purchases of the Council which are represented by stores common to all or several departments, and special goods, the buying of which cannot properly be taken out of the hands of the consuming department.

(*b*) The estimated cost of the new scheme over and above the present buying expenses of the Council.

(*c*) The percentage which such increased cost represents on average yearly purchase totals—an amount which has to be balanced against the economies to be effected by the new scheme.

Amongst objections to present method, it is claimed that contractors would offer better prices in some cases but for the fact that the goods supplied, although in large quantities yearly, have to be made up in comparatively small parcels and delivered to many depôts. This complaint will only really disappear if the central stores succeeds in opening bulk deliveries, dividing, repacking and distributing more cheaply than each contractor is willing to make up and deliver the small parcels—a proposition possibly presenting some difficulties under the methods of working in vogue with this model employer.

ACCIDENTAL EXPLOSIONS AT GAS PRODUCER INSTALLATIONS.

Although it is quite true that, with a reasonable amount of care on the part of the attendant, explosions of producer gas of any serious extent can be avoided, experience shows that at times these accidentally occur, with results of damaged apparatus, and sometimes of a nature dangerous to life. It is worth while, therefore, to consider the possibilities in this connection, as well as the means to be employed to prevent their occurrence.

In the case of mixtures of pure combustible gases with air, as low a proportion of hydrogen as $4\frac{1}{2}$ per cent. is capable of ignition; while, on the other hand, hydrogen with $43\frac{1}{2}$ per cent. of air is also liable to ignition, but in either case the pressure developed would be very slight.

Carbon monoxide in the proportion of $7\frac{1}{2}$ per cent. can ignite if the temperature is about 1,000° F., or $9\frac{1}{2}$ per cent. if at 750° F., but if at atmospheric temperature, ignition will only take place when 16 per cent. of CO is present. When the proportion of CO is in excess, ignition may take place with 42 per cent. of air. As both these gases are present in considerable proportions in producer gas, it is evident that explosive mixtures, through leakage, cover a large range.

Other combustible gases have ranges of ignition less than those stated, so that they need not be considered. When the mixture of combustible gas and air, at atmospheric pressure, approaches the proportions for perfect combustion, ignition may cause a rise of pressure up to about 80 lb. per sq. in.

To provide against damage from accidental explosions in apparatus employed in the generation and purification of power gas, one of the following conditions may be adopted:—(1) All the vessels may be designed to resist a pressure of 80 lb. per sq. in., with the usual factor of safety; or (2) vessels of less working strength can be provided with water seals, to act as safety valves. While slight explosions occurring in coke scrubbers provided with seals only result in the ejection of a little water, explosions through gas passing through the gas engine and exploding in the exhaust or air silencers might result in damage, if these are not designed of sufficient strength to resist the pressure developed.

Although water seals and pipes leading from silencing chambers to the atmosphere act as safety valves in the manner referred to, it must not be overlooked that they are only effective when of sufficient capacity in proportion to the volume of space in which the explosion occurs, as otherwise, owing to the rapidity of the increase of pressure due to the explosion, with small pipes, the necessary relief is not available. In designing gas generating and purifying plant, precautions should be taken to prevent, as far as possible, any leakage of gas into air, or air into gas, and one of these is the provision of faced joints for all pipes fitted with flanges, for even a very slight leak, such as might occur from a cracked flange or small test cock, will admit a considerable volume of air if the difference of pressure between the internal and external surfaces only amounts to a few inches of water gauge pressure.

As the amount of leakage depends upon the difference in pressure on either side of the aperture, especial precautions should be taken to keep the internal and external pressures as nearly similar as possible.

In "pressure" gas plants any leakage is outwardly, as long as the entire system is free from a higher pressure than that of the gas; the air supply to provide for overcoming friction, &c., in passing through the fire, is maintained at a higher pressure than the gas, so that in any saturation or regenerative system, where the air and gas are brought near together, separated only by tubes or sheet-metal shells, any leakage in this part of the system would be inwardly, *i.e.*, air into gas.

In suction plant all leakage is inward, owing to the reduction of pressure in the whole system, at each charging stroke of the engine, and even a small cock left open by accident may admit a considerable volume of air.

Quite recently, as recorded in the June issue of *Vulcan*, there was an accidental explosion at a pressure-gas plant in the district of Manchester, due to air leakage through the corrosion of tubes through which the gas passed. The plant was for providing gas for driving engines of 320 H.P., and consisted of a gas producer, saturator, coke scrubber, sawdust filter, tar extractor, air-blast fan and a gas-holder.

The plant had been off for repairs, and at re-starting the usual precautions were taken to ensure that any residual gas and air in the apparatus was duly removed, by blowing out the contents a number of times. However, the gas delivered by the gas-holder was found to be of too poor a quality to start the engines; further attempts were made, and the contents of the gas-holder were renewed, and while the attendant was preparing to test the gas again with a torch, an explosion occurred in the gas-holder, doing such damage as to put the installation out of work for several days. It was found on examination that the trouble was caused by the deterioration of the tubes of the saturator during the three years the plant had been at work.

The saturator consisted of a cylindrical vertical vessel provided with tube plates near the ends, connected by 4-in. diameter tubes; water surrounded the tubes, through which the hot gas ascended. The supply was constant and the depth regulated by an overflow, so that the vessel was only partly filled; the cooling of the gas heated the water, and the air-blast was led through the upper part of the chamber, becoming charged with vapour on its passage. One of the tubes was so corroded as to be separated into two parts, while the other six could be pierced by a pointed tool.

The interior of the tubes was subjected to the mechanical action of a cleaning bar for the removal of tar and to prevent accumulations from obstructing the tubes.

As the air-blast surrounding the tubes at the upper portion was at about 2 in. water-gauge pressure higher than the gas passing through the interior, air leaked into the gas, and thus filled the holder with a more or less explosive mixture. The conditions of warm water, steam and air are conducive to corrosion of wrought-metal tubes, so that any apparatus of the type mentioned should have special facilities for the examination and cleaning of all surfaces liable to be attacked by rusting, as well as the renewal of any part found deteriorated.

We may quote an instance where a feed-water heater fitted with copper pipes was applied as a cooler for a gas plant, and in which it was found that, after a comparatively short run, the pipes had become eaten away in places by corrosion from contact with the gases; but in this case, as there was pressure in the pipes, the leakage did no damage.

Another instance of the danger from leakage of air into gas pipes may be quoted, in the case of a blast-furnace gas-cleaning plant.

The gas was drawn from the underground flue through a washer and condenser by the suction of a fan, and then passed on through sawdust filters to a gas-holder to supply a large engine.

A small gas engine, driven by the same gas supply, was situated at a considerable distance from the gas-holder. A leakage occurred at a joint in the pipes on the suction side of the fan, and air entered the system along with gas. Both the engines were at work, but when the mixture of gas and air reached them there was an explosion right through the gas apparatus.

Owing to the low heating power of the gas when not compressed, the effects of the explosion were only slight; the gas-holder bell was lifted about a foot or so, and the sawdust filter covers were blown off.

In suction-gas plants, besides the possibilities already referred to, there are possible dangers from the wrongful manipulation of the valves and test cocks; to reduce these as far as possible, one method is to have as few of these valves and test cocks as can be made effective, while three-way valves should be so designed that they cannot inadvertently be turned so as to connect vessels in a manner not intended, or in such a way as to connect all the three passages at once through the valve not being moved to the required extent.

POWER SUPPLY TO BREWERIES.

By E. P. A.

It has been said that an electrical engineer must possess a knowledge of everyone's business, together with a smattering of electrical lore; and in dealing with the requirements of power consumers, the station engineer fully appreciates the appositeness of the statement.

The requirements of breweries are such that a number of interesting points arise bearing on the means of electrically driving brewery plant and installing the necessary control gear, &c., and it is the writer's intention to endeavour to deal with the more interesting problems that he has met with in connection with the supply of power to breweries of moderate size.

The processes of brewing necessitate a certain amount of steam-raising plant, and a steam-driven brewery follows in natural sequence, unless it can be proved to the owners that advantages are gained by using another source of power. It is not difficult to convince a prospective consumer that electric motors offer the best means of driving his various apparatus, principally on account of the number of isolated pieces of machinery in use and the distances between the seats of operation. With any form of main driving, abnormally long shafts are required, with the usual accompaniment of clutches, loose pulleys, belts and suchlike power wasters; and, in addition, certain small machines, such as portable pumps, hoists of various kinds, and grain-handling gear, have to be hand-operated.

Illustrations of an instance where an antiquated beam-engine has been displaced by a 10-H.P. motor are shown in figs. 1 and 2. The beam engine is geared to a vertical shaft of ample proportions, which passes through two floors of the building, in order to drive a grain mill and hoist. Fig. 2 shows the 10-H.P. motor used to do the same work, and fixed near to the mill. Counter-shafting and belting are used in this case in order to adapt the old driving pulley and hoist gear to the modern method of driving, so that the increase in efficiency is not so marked in this instance as it is in cases where the mill, &c., are made for electrical driving.

The hoist is driven off the main shaft of the mill, and is put into operation by a cone friction clutch.

It was found necessary to reduce the speed when lifting heavy sacks, such as sugar, in order to suit the capacity of the clutch, and a resistance with a short-circuiting switch was introduced into the armature circuit. This method, although wasteful, has the advantage of varying the speed of the motor in accordance with the load on the hoist, owing to the drop across the resistance, and thus keeping within the power-transmitting capacity of the friction clutch.

A feature of brewery work is the variety of uses to which electric motors can be adapted. A tabulated list of some of the machines in use in a brewery in actual operation is given below, to show in a convenient manner the class of work to be done and the type of motor used in each case.

All the apparatus installed is specially adapted for motor driving, and consequently the motors and gearing are arranged to run at the most economical speeds, necessitating in most cases only single-reduction gears. Refrigerating apparatus is direct-coupled to a low-speed motor, which arrangement gives a great economy of space, although the first cost of the motor is somewhat high for the rating. In the bottling department the machines used require such a small amount of power to drive them that it is found convenient to use only one small motor, driving on to countershafting. A 3-H.P. motor will drive four bottling machines and four bottle-washing machines, and find employment for about 15 hands tending the machines.

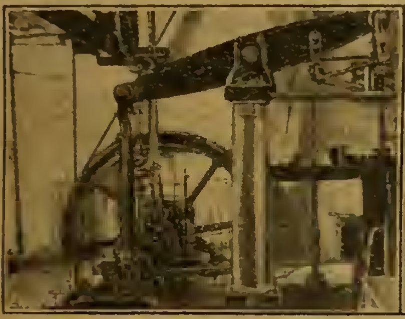


Fig. 1.

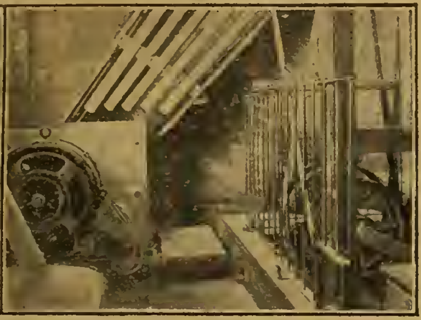


Fig. 2.

It is sometimes necessary to use a reversible motor on the grain conveyor. Single-reduction worm gear is most suitable in this case, and the reversing operations are best carried out at the starter, although mechanical devices are sometimes used for this purpose when the apparatus is in an easily accessible position.

Table of Motors.

Type.	Machine driven.	Remarks.
10-H.P. totally enclosed	Mill	Belt drive.
5 H.P. enclosed	Hoists	Mechanical reversing gear.
10-H.P. enclosed	Barrel hoists	These machines in damp situation where liquor is barrelled.
10-H.P. enclosed	Grain conveyor	Single reduction, worm gear. Reversible starting gear. Subject to steam from hot grain.
5 H.P. enclosed	Pump	Artesian well pump.
3-H.P. enclosed	Centrifugal pump	Single-reduction gear.
¼-H.P. protected	Portable pumps	Circulating liquor in fermenting vats.
10 H.P. enclosed	Mash tun	—
15-H.P. protected	ditto. rakes	Double-reduction gear, enclosed motor not necessary.
9 H.P. protected	Refrigerator	Low speed (200 R.P.M.), direct coupled, mounted on same bed as compressor.

All the motors used in a brewery should be of the totally enclosed type, to guard against steam and dust. The atmosphere is heavily laden with vapour from the hot liquor and from the liberal use of hot water for scouring purposes, resulting in a considerable amount of condensation on the walls and machinery, which will sometimes lower the insulation resistance of the motor to a dangerous degree.

Trouble from this source can be avoided by using a non-hygroscopic insulating material on the brush gear, as that is the part most affected by the damp. Also the insulating bushes, distance pieces, &c., used between the live parts and the brush-racker, should be arranged so as to give a long leakage path.

The motors installed in damp situations should be raised from the floor about 1 ft., and, where possible, housed in a brick compartment properly ventilated. If brick is not suitable, then a substantial wooden structure can be used to cover the motor. A good method of securing the efficient ventilation of a motor covering, whether of wood or of brick, is to burn a single 16 C.P. lamp at the bottom, and provide an air inlet and outlet. The heat from the lamp is sufficient to keep the air in circulation, and the improvement in the condition of a motor under these conditions is most marked.

In situations where abnormal damp is not in evidence, fine dust will probably have to be guarded against. This is particularly the case in the mill room, especially if the mill is an old-fashioned one, with no efficient means of carrying off the dust. The motor is best protected by enclosing it in a tin-lined wooden house, particular care being taken to see that the pulley side is well protected. A totally-enclosed motor should still be used, as the dust is inflammable to a certain extent, and should therefore be kept clear of the brushes or any other gear where sparking may take place.

The starters and other control gear are worthy of particular attention, and should be of ample design and proof against the ill effects of moisture. Starters of the grid type, with the usual accessories, have been found very satisfactory, providing that all the insulating material is of non-hygroscopic material. It is good practice to enclose the whole of the control gear of each motor in a fireproof glazed case, and to provide each motor with a separate switch fixed in a convenient position for the operators of the machine to use for stopping the motor if necessary. The machines are often under the control of unskilled persons, and therefore liable to much abuse when starting. To prevent trouble arising from this source, the starters should be of such a type that the rate of acceleration is out of the control of the operator. Elaborate automatic devices are not to be recommended for such work, but a simple worm-geared starter will answer the purpose well, if of sound mechanical construction.

In view of the fact that condensation is a serious consideration, it is evident that a perfectly watertight system of installing the necessary cables and wires is essential; also an electrically continuous metallic covering is necessary to prevent danger of shock. The only two systems that are suitable are lead-covered cables, and rubber-insulated cables run in screwed barrel, and the writer's experience in this direction leads him to favour the use of paper-insulated, lead-covered cables. They should be fixed by means of porcelain cleats or insulators, and kept quite clear of all brickwork or ironwork about the building, in order to prevent the accumulation of moisture between the lead and the building, which will otherwise cause rapid deterioration of the lead and the fastenings. The principal advantage of using this class of cable is the absence of space between the conductors and the metallic covering, thus preventing trouble from condensation around the insulating material. In the mill room and grain stores, steel conduit wiring should be used, to protect the cables from vermin, as lead covering is useless for this purpose.

Particular care should be bestowed on all junctions with fittings, control gear and motors, and any precautions taken to make all such points mechanically and electrically sound will amply repay any reasonable additional expense incurred. If paper-insulated cables are used, suitable sealing-end connections are necessary to make a lasting job, and rubber tails can be conveniently used to connect up to motors and starters, as these will be inside the protective cases and coverings. The writer has found that, in such situations as are dealt with here, a satisfactory way of connecting-up to motors is to dispense with terminal boards, and bring rubber leads through a suitably bushed hole in the motor frame and join them by means of screwed connectors to the supply cables, suitably insulating the joints thus formed. This method makes a safe job, and helps to keep up the insulation resistance, and also reduces the number of live terminals to a minimum.

The efficient earthing of motor frames, starters, cable coverings, &c., is of the utmost importance in breweries. The floors are usually wet, and the workmen often wear iron-shod clogs on that account, so that a shock under such conditions is attended with considerable danger.

Although it is an expensive method, the writer recommends the installation of a complete earthing system, to which all motor frames, starter cases, switch covers and metallic cable sheathing should be connected. To merely bond a motor frame on to the lead covering of a cable is inviting damage to the cable if the motor sparks over to frame or the insulation breaks down, besides introducing an element of danger of shock. Instances of the lead covering of cables being melted away at the point of contact of an earth wire, and thus leaving the faulty apparatus "alive" to shock any unwary persons, are not uncommon. The earthing system, in its turn, should be connected at several points to a water-supply pipe that always contains water, and contact with any apparatus used for heating or in conjunction with the covers should be avoided.

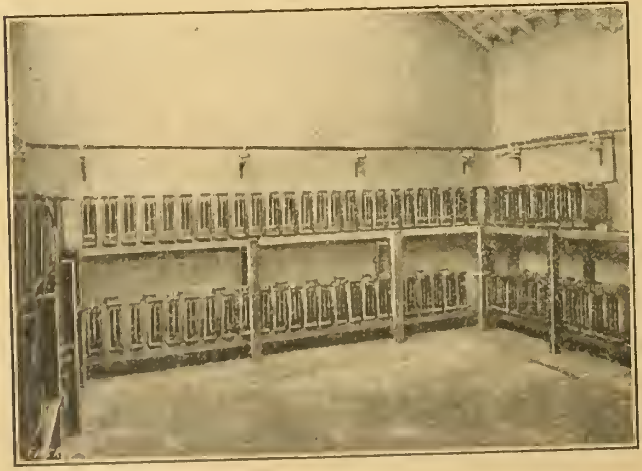
A brewery load is a desirable one to obtain, as a power load factor of about 20 per cent. may be expected, and a load factor on the combined lighting and power load of 16 per cent. The peak will coincide with the station peak, but a small all-night load will be experienced.

Brewery owners usually require some assurance as to the continuity of supply, as in the case of main breakdowns a valuable brew may be damaged if the process is discontinued for any length of time. Under such conditions provision for supplying energy by more than one route is generally sufficient to satisfy the brewer's requirements.

The rates for charging for energy must depend on the local conditions, and as much has recently been written on this subject, it is unnecessary to go into the matter here.

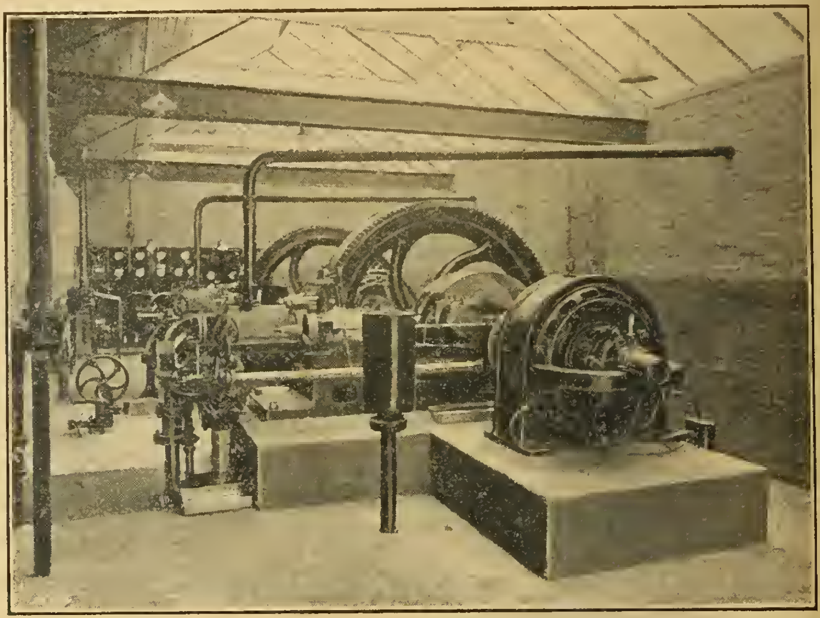
ELECTRIC LIGHTING AT PENRITH.

Some years ago the Penrith Urban District Council obtained powers for electric lighting in the town, and had proceeded so far as to let tenders provisionally for the carrying-out of the work, when the L.G.B. stepped in and refused to sanction the necessary loan, chiefly owing to the fact that the Council had also in hand at the time sewerage and water schemes involving a considerable expenditure.


Interior of the Battery Room, Penrith.

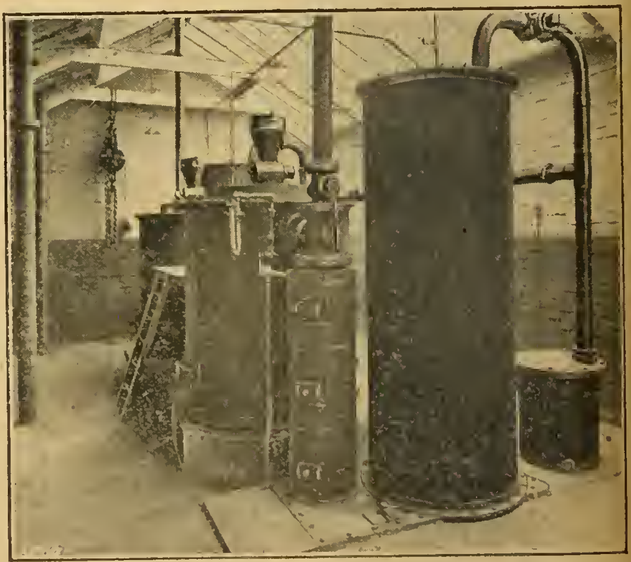
However, the desire for the electric light remained, and ultimately the provisional order was handed over to a syndicate which, under the style of the Penrith Electric Supply Co., Ltd., has installed the necessary plant and mains for supplying electricity.

The plant consists of two 65-B.H.P. Crossley gas engines, running at 200 R.P.M., and direct coupled in each case to a 40-KW. compound-wound 220-volt generator. The engines are of the suction type, and two producer plants are installed in an adjoining room, so arranged that either engine can be worked from each producer.


Generating Plant, Penrith Electric Supply Co.

At one end of the engine room the necessary switchboard is fixed for controlling the dynamos, balancers, boosters, batteries, feeders, &c.

A 120-cell storage battery is provided, with a capacity of about 200 ampere-hours, and in connection with this a balancer-booster set is installed.


Crossley Producer Plant, Penrith.

The feeder and distributing mains are of the three-core type, lead-covered and armoured, and laid direct in the ground; feeder pillars are provided containing bus-bars and plug fuses for three feeding mains and five distributors.

The three-wire system of supply has been adopted, with 220 volts across the outers; this pressure was decided on, in the first instance, in order to facilitate the use of metallic-filament lamps of low candle-power in parallel. Throughout the whole of the plant has been designed so as readily to double the pressure if found to be advantageous.

Already some 40 consumers are connected to the mains, representing approximately 800 25-C.P. lamps for lighting, and the motive power installed, and applications received, are equivalent to 60 H.P., a matter which augurs well for the ultimate success of the undertaking.

The price charged for lighting purposes is 5d. per unit, and for power, heating and cooking purposes 2½d. per unit.

The generating station is situated almost in the very centre of the area of supply, and the buildings were erected by Messrs. Richardson & Co., of Penrith; the contract for the whole of the generating plant was let to, and carried out by, Messrs. W. P. Theermann & Co., of Manchester; Messrs. Henley's supplied and laid all the mains, feeding pillars, and distribution appliances.

The works were designed by, and have been erected under the supervision of, Mr. J. W. Speight, M.I.E.E., of St. Anne's-on-the-Sea, who previously acted as consulting engineer to the Penrith Council.

BOARD OF TRADE REGULATIONS.

Electric Lighting Acts, 1882 and 1888.

With reference to the Regulations made by the Board of Trade under the above-named Acts for securing the safety of the public, and for ensuring a proper and sufficient supply of electrical energy, we are officially informed that Regulations having recently been made by the Home Office for the generation, transformation, distribution, and use of electrical energy in premises under the Factory and Workshop Acts, 1901 and 1907, the Board have found it necessary to amend their Regulations so as to avoid overlapping between the Regulations of the two departments. The Board of Trade have accordingly made new Regulations which from July 1st, 1909, except as to so much of any electrical station as was constructed before July 1st, 1908, take the place of the Regulations previously made by the Board, and will, after January 1st, 1910, entirely supersede the last-mentioned Regulations.

The forms differ from one another as regards Regulations for ensuring a proper and sufficient supply of energy in order to meet the different cases where the undertakers are :—

1. A local authority in the provinces (index letters on right-hand corner of form 1 L.A. (P.)).
2. A company in the provinces or in the City of London (index letters 2 C. (P.)).
3. A company in London except as to the City (index letters 3 C. (L.)).
4. A local authority in London (index letters 4 L A. (L.)).

The differences between the four sets of Regulations are found only, we believe, in those defining the relations between the undertakers and the local authority, the Board of Trade, and the London County Council respectively, as regards any alteration in the declared pressure or frequency of supply.

The alterations in the Regulations as a whole consist mainly in the addition of a rider to the effect that the Regulation shall not apply within the premises of a factory, a workshop, a mine, or a quarry (where the apparatus is under the jurisdiction of the Home Office) to each of the Clauses Nos. 1, 2, 9 and 10.

Copper.—The extraordinary figures for visible supplies of this metal continue to be maintained, as shown by Messrs. Merton's circulars for the month of June. The mid monthly return was 62,261 tons, and that for the end of the month 67,379 tons. In the face of such figures as these, it does not seem probable that any attempt to enhance the price can be maintained at present. The visible supplies for June 30th are principally composed of bars, ingots and standard copper at Liverpool and Swansea, totalling to 41,020 tons. Of the supply figures, those for North America to Liverpool, Swansea and Havre are above normal, implying that stocks are no longer being held at the mines. Other shipments are about the average.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

Further Financial Results Showing Reduced Dividends.

The unfavourable effects of the decline in the condition of trade in general continue to be reflected in the working results of German manufacturing companies for the past year, although the worst of the depression in the light electrical engineering departments, at all events, is reported, correctly or incorrectly, to have now been overcome. So far, no opportunity has presented itself for bringing into play the powerful financial resources which are to be utilised by the electrical banks which were formed a short time ago, and from the prevailing conditions of the national finances and the uncertainty regarding legislative schemes for the imposition of additional taxes, there seems little hope of any speedy development of electrical enterprise that could afford profitable activity for the banks.

The recent issues of capital in Europe only include one German emission, namely, a 4½ per cent. loan of £150,000 offered by the Birnbaum-Meseritz-Schwerin overland central station. In Switzerland subscriptions have been invited for a 4½ per cent. loan of £280,000 by the Wangen Electricity Works on the Aare; £280,000 in a 4½ per cent. loan by the Watt Co. for electrical enterprises of Glarus; and for £240,000 forming a 4½ per cent. loan of Escher, Wyss & Co., of Zurich, a large proportion of which was intended for the repayment of former loans.

German Works.

The general meeting of the Felten & Guilleaume-Lahmeyer Werke, of Mulheim-on-Rhine, recently approved the report and accounts for 1908. The unfavourable effects on industrial activity in all countries, according to the directors' report, affected the several departments variously, there being, on the one hand, a diminution in the quantity of work, and on the other less satisfactory results owing to the condition of sale prices. In the home market business was influenced by the uncertain political circumstances, the disquiet produced by taxation schemes, and the many social-political legislative proposals; trade became worse as the end of the year was approached, and the fall in prices was specially perceptible in the case of machines and apparatus and in regard to installations. The principal items in the accounts for the past two years are represented below :—

	1908.	1907.
Share capital	£2,750,000	£2,750,000
Bond capital	1,250,000	1,000,000
Gross profits on manufacturing, investments, &c....	730,940	772,200
General expenses ...	291,670	287,580
Depreciation provision	115,240	121,300
Net profits	278,130	329,780
Dividend...	220,000	264,250
Dividend, per cent. ...	8	10

The deliveries of machines by the dynamo works comprised 10,200 of a total of 500,000 H.P., as compared with 9,330 and 358,000 H.P. respectively, in 1907. The construction of electricity meters developed quite satisfactorily, and the production of measuring instruments was embarked upon by the acquisition of a factory already in existence, whilst the manufacture of arc lamps and switchboard apparatus was also added in the newly-erected apparatus factory. In addition, the output of metallic-filament lamps was started in the Berlin department, and was in course of favourable development. As to the question of the working of main lines of railway by electricity, the directors believed that this particular field would result in important orders in the future. The number of officials and workmen employed at the end of 1908 was 11,357, as contrasted with 11,760 at the close of 1907, 5,319 of the former being occupied at the dynamo works and most of the remainder at the Carlswerk. The orders possessed by the latter at the beginning of 1909 were approximately the same as the corresponding period in 1908, this being partly due to the maintenance of the wire business at the end of the year. The wire works in May were abundantly supplied with orders, which again permitted of full-time working, and prices were higher; the same remark was applicable in regard to the activity of the cable factory, although prices in respect of new orders were unsatisfactory. The degree of employment at the dynamo works was also satisfactory in general, though the prices obtained left much to be desired.

The principal activity of the Elektrizitäts Gesellschaft vorm. W. Lahmeyer & Co., of Frankfort, during 1908 9, was limited, as in the preceding year, mainly to the development of the electricity works and tramways owned or managed by the company. Although the unfavourable course of business in general exercised a hampering influence upon the progress and results of these undertakings, most of them yielded improved returns, whilst the slight decline in the gross profits was chiefly due to the reduction in the dividend paid by the Felten & Guilleaume-Lahmeyer Works, in which the company holds fully paid shares to the extent of £800,000. The accounts show net profits of £75,310, as compared with £80,070 in 1907-8, and it is proposed to pay a dividend at the rate of 6 per cent. as against 7 per cent. in the previous year, the share capital participating being £1,000,000 for the year and £250,000 for one quarter of the year.

The Akkumulatorenfabrik Gesellschaft, of Berlin-Hagen, was more largely employed in 1908 than in the previous year. Notwithstanding the reduction in prices in the first quarter in accordance with the fall in the cost of raw materials, the directors state in their report that the value of the turnover advanced from £956,500 in 1907, to £961,500 last year. The English Tudor Co. did not pay any dividend for 1907, although one was in prospect for the past year. The accounts show the following figures:—

	1908.	1907.
Share capital	£400.000	£400,000
Gross receipts	318,890	330,620
Depreciation provision ...	19,500	37,900
Net profits	75,360	59,450
Dividend, per cent.	12½	12½

The report also refrains, as in 1907, from giving any details respecting the subsidiary companies in which the company is interested, the balance-sheet indicating an advance in the account for syndicate participations and securities of from £322,000 in 1907, to £342,500 in 1908. The reserve fund remains unchanged at £80,000, whilst the premium reserve fund for maintenance of consumers' batteries has been increased by £16,000 to £169 500. At the recent general meeting the chairman mentioned that business in the current year seemed to be more active, and the orders coming to hand were quite satisfactory.

The Mix & Genest Telephone and Telegraph Works Co., of Berlin, which was first formed in 1889, and has paid dividends almost averaging 9 per cent., is unable to make any distribution for 1908. According to the directors' report, the unfavourable results were partly due to the extraordinarily severe competition caused by the constantly growing circle of inland contractors. The price convention concluded in 1906 between the most important firms in the light electrical engineering branch only existed nominally during the past year, and it has since been discontinued. In England and Russia the competition of inferior manufactures manifested itself, whilst the depression in the general situation of business severely affected the London branches of German firms. In addition to these conditions, the cause of the diminished results was also to be found in special occurrences. Several extensive undertakings of the company abroad in part yielded no profits, and in part led to losses which rendered necessary the provision of special reserves. But, above all, the reduced profits were the result of an increase in the cost of production and management as brought about by the large new works at Schoneberg, Berlin. The accounts show the appended figures:—

	1908.	1907.
Share capital...	£350 000	£250,000
Bond capital	150,000	150,000
Surplus on working	65,090	69,900
Reserve provision for participations	6,250	Nil.
Depreciation provision	17,210	12,800
Net surplus	6,560	33,090
Dividend, per cent.	Nil.	9

During the year the company opened engineering offices at Munich, Dresden, Halle and Hanover, and one at Buda-Pesth for the Hungarian trade. The directors state that satisfactory results may be expected in the future on an improvement taking place in the general situation of business.

The report of the Akkumulatoren und Elektrizitätswerke (vorm. W. A. Boese & Co.), of Berlin, records a diminution in the turnover in 1908. The net profits amounted to £12,630, as contrasted with £11,300 in 1907, when no dividend was paid on the share capital of £225,000, and the proposal to distribute £1 4s. per share on the preference shares was withdrawn and still forms the subject of legal dispute between the company and one of the holders. It has been decided not to make any distribution on either classes of shares for 1908, but to apply the available surplus to the strengthening of the working capital and as a reserve for contingencies in respect of the unpaid preference dividend in 1907. The company is still interested in 13 central stations arising from its former financial activity, and some of these yield profits, whilst others require payments in fulfilment of guarantees.

Various Financial Results.

	Share capital.	1908 dividend.	1907 dividend.
Kabelwerke Wilhelminenhof, Berlin	£50,000	12%	15%
Land und Seekabelwerke, Cologne...	262,500	8%	8%
Deutsche Kabelwerke, Berlin ...	—	6%	6%
Norddeutsche Seekabelwerke, Nordenham (distribution paid out of dividend and redemption funds)	300,000	4%	Nil
C. Lorenz Gesellschaft, Berlin ...	—	16%	12%
Elektra Gesellschaft, Dresden ...	—	4%	3½%
Westinghouse Electricitäts Gesellschaft	15,000	Nil	Nil
Gesellschaft fur Elektrotechnische Unternehmungen, Munich ...	—	Nil	Nil
Schlesische Akkumulatoren Werke, Breslau	—	Nil	Nil

French and Other Works.

The Société Anonyme Westinghouse, of Paris, which has an ordinary and preference capital of £600,000 and bond capital of £300,000, realised gross profits amounting to £67,400 in 1908, as compared with £29,200 in 1907. After deducting administrative expenses and interest on bonds, the balance, including amount brought forward, reached £35,400, which has allowed of the payment of 5 per cent. on the preference capital of £200,000, and the allocation of £21,200 to the purpose of depreciation. The company is interested in the Italian Westinghouse Co., the Société Westinghouse-Leblanc, the Hungarian Automobile Co. and the Compagnie Internationale des Systemes Heintz.

The Ateliers de Constructions Electriques du Nord et de l'Est, of Paris, whose works are situated at Jeumont, realised net profits of £61,500 in 1908, as against £45,800 in the preceding year. As the latter sum was brought forward, the available balance amounted to £107,300, of which £46,000 has been placed to renewals fund and £20,000 provided for depreciation. The balance has permitted of the payment of a dividend of 10s. per share on the bearer shares and 3s. 8d. per share on the profit shares. In addition to extensive workshops, the Jeumont establishment comprises an iron and bronze foundry, a cable factory and a central station for general supply of light and power from two turbo-generators, each of 5,000 H.P., whilst a third unit of 10,000 H.P. is being installed to meet further contracts concluded for 8,000 H.P.

The Ateliers de Constructions Electriques de Charleroi are stated in the directors' report for 1908 to have received orders of the value of £328,000, as compared with £345,000 in 1907, and £276,000 in 1906. The diminution was more apparent than real, as the quantity of manufactures sold was greater than in the preceding year, but the heavy decline in raw materials reduced the cost and sale prices. It was possible to fully complete the programme of equipping the Marcinelle works with plant of the most modern type, and this had enabled the efficiency of the workmen to be increased and the prime costs to be reduced. A further development took place in the electrical equipment of collieries, and a motor transport service had been organised for the rapid delivery of material and motors to customers in the Hainault. Apart from electrically-operated centrifugal pumps and cranes for quarries and the usual orders from native and foreign tramways, the company supplied to the Belgian State Railways the first electric locomotive for use on these lines, the equipment comprising four motors of 250 H.P. Numerous orders were received for alternators of from 1,500 KW. to 4,000 KW. for use with steam turbines, and several three-phase motors for iron works and rolling mills were also delivered. New works were in course of erection with a connection with the State railways, and it was proposed to transfer to them certain branches for the development of which the Marcinelle works no longer sufficed. The accounts show net profits of £36,600 for 1908, as contrasted with £27,300 in the previous year on a share capital of £200,000, and a bond issue of £198,000. A dividend at the rate of 26s. per share has been declared on the fully paid priority shares, and 6s. per share on the ordinary shares.

The Russian General Electricity Co., which is associated with the A.E.G., of Berlin, and has a share capital of £600,000, states that the turnover increased normally during 1908, although Government orders were lacking, as in the previous years, and an active and regular working took place at the Riga works during the whole of the year. The gross profits amounted to £150,394, as compared with £126,784 in 1907, and the net profits, including the balance forward, were £67,523 and £51,147 in the two years respectively. A dividend at the rate of 6 per cent. has been declared, as contrasted with 4 per cent. in 1907. It is proposed to provide additional working capital by making a fresh issue of shares to the extent of £100,000. The directors add that the United Cable Works Co., in which the company is financially interested, intends to distribute 7 per cent., being the same rate as in 1907.

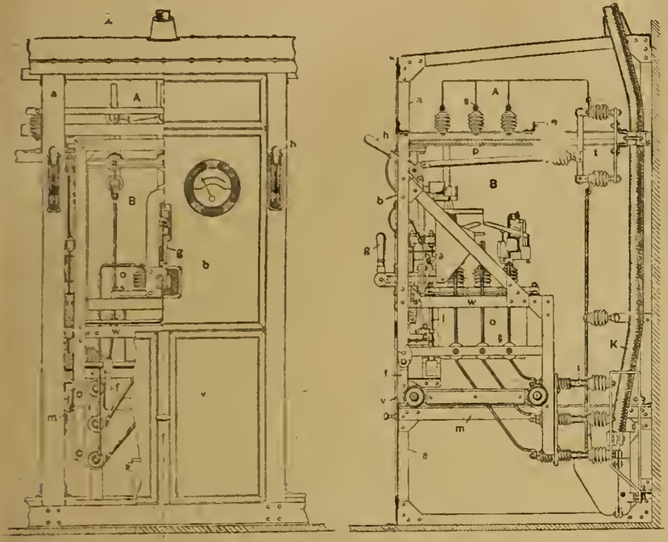
The Russian Siemens & Halske Co., of St. Petersburg, realised net profits amounting to £32,046 in 1908, as contrasted with £30,629 in the preceding year, when the share capital was reduced from £700,000 to £560,000. It is proposed to pay a dividend at the rate of 4 per cent., being the same as in 1907, and comparing with no distribution in 1906.

The United Cable Works Co., of St. Petersburg, which is the amalgamated cable manufacturing departments of the German companies in that city, earned a surplus on working of £57,545 in 1908, as compared with £41,510 in 1907. After placing £2,746 to the reserve fund and applying £14,114 to the redemption of capital, the balance has allowed of the payment of 7 per cent., as against a dividend of 5 per cent. in 1907.

HIGH-PRESSURE SWITCHBOARDS WITH REMOVABLE SWITCH CARRIAGES.

The general adoption of high-pressure alternating current for the distribution of electrical energy has necessitated the evolution of switchgear, which shall be at the same time perfectly safe to handle whilst alive, and readily isolated when necessary for the purpose of repairing and cleaning the gear without risk and without interfering with the working of the system. Progress has advanced mainly in two directions – towards the adoption of remote-control switchgear on the one hand, and towards hand-operated cellular removable switchgear on the other, the whole of the high-pressure apparatus in the latter case being made capable of complete detachment from the switchboard in separate sections, which may also be interchangeable, so that a spare section may be kept at hand ready to replace any other when required. When the connections to these sections are made by hand, sufficient space must be provided behind the board so that the high-pressure plug contacts can be connected and inspected from time to time when the switch carriage is in position. It will be evident that these plug contacts form the most sensitive part of the switch-carriage construction, and great care must be taken to see that they always make good contact.

This arrangement cannot, however, be employed when the switchboard is to be installed in extremely limited spaces, as, for example, in mines, where the space necessary for the switchboard can only be gained by expensive excavations. It is, further, frequently necessary to erect the high-pressure gear immediately behind the control board. In this case all switches, measuring transformers, &c., are mounted close up against the wall, and are consequently quite inaccessible from behind. Considerable attention has been devoted by the Felten & Guilleaume Lahmeyerwerke A.-G., Frankfort-on-Main, to combining safety with ease of inspection in the design of switchboards of this type on the cellular system, and an interesting example of their switchgear, which is protected by several patents, is shown in the accompanying illustrations. Figs. 1 and 2 show the front view and section of a complete three-phase distribution switchboard of this type. Each cell consists of a strong angle-iron framework completely covered with sheet iron, which can be mounted directly up against the wall, and is divided into two chambers by means of a horizontal insulating partition *p*. The top chamber A contains the high-pressure bus-bars S, which are mounted on porcelain insulators, and the lower one B the actual switchgear. In addition to this, the lower chamber B of each cell is separated from the adjacent ones by means of vertical flame-proof partitions built up of incombustible stonework or insulating material. The jaws of the three-pole isolating switch *t*, mounted in the bus-bar chamber A, are in direct connection with the bus-bars, and their blades, which pass through slots in the insulating partition *p*, are provided with earthing contacts *e* at their lower ends. When one of the isolating switches is opened, all the apparatus carrying current which are contained in chamber B are completely isolated from the bus-bars, and all parts of the switchgear below the partition are in direct connection with earth. Consequently there is no possibility of danger from a residual charge when the panel is opened up for inspection. The isolating switch *t* is actuated through a system of rods connected to the lever *h*, which is fitted to the rigid part of the switchboard front.



Figs. 1 and 2.—Front View and Section of Cell, Showing Switch-Carriage, &c.

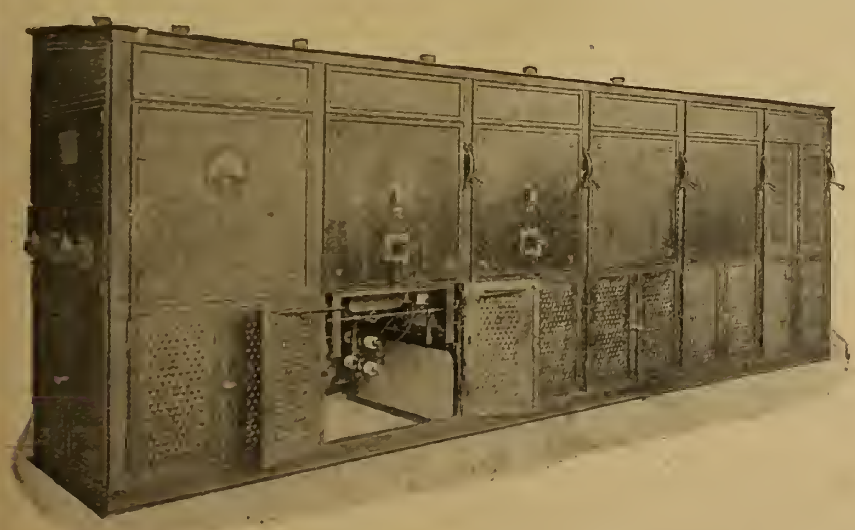


Fig. 3.—High-Pressure Switchboard, with Inspection Doors Open.

The front of the top chamber A as well as the front of the top part of the chamber B is formed by a rigid covering of sheet iron, whilst folding doors *v* of ornamental sheet iron are fitted below that portion of the panel forming the front of the removable switch carriage.

The removable switch carriage *w* consists of a riveted angle-iron framework mounted on wheels, which run on the rails *m*. It carries the oil-break circuit switch *o*, together with the relays and other auxiliary apparatus, the hand lever *g* for operating the oil switch, and on the sheet-iron front mentioned above, the measuring instruments and signalling apparatus. The connection of this removable portion of the panel to the isolating switch *t* and the bus-bars S on the one side, and to the feeders K on the other side, is made by means of two sets of three-pole high-pressure plug-contacts *i*. These contacts are carried on the lower part of the switch carriage, into which fit the corresponding fixed contacts mounted at the back of the board. These fixed contacts are further fitted in such a manner that, after opening the doors *v* at the front of the switchboard, they are easily accessible to the attendant. This is an important point, as it is of great advantage that the contacts may be examined when the switch carriage is in position, to obviate the possibility of their becoming displaced, and to ensure their making good contact. The switch carriage is withdrawn from the switchboard by means of a truck provided for the purpose. After the folding doors *v* have been opened, this truck is wheeled right up in front of the switch carriage, and is fastened in place by means of a catch. The switch carriage may then be withdrawn from the switchboard for the purpose of testing or adjusting, and can, after loosening the catch holding the same, be completely removed from the switchboard. In order to prevent jolting whilst removing and replacing the plug-contacts, the necessary horizontal motion of the switch carriage is effected by the claw-shaped handle *f* by means of an arrangement of levers, while the other motion takes place directly. The company have further, by interlocking all the gear, provided a system in which all the necessary operations can only take place in a definite way without danger. The lever *h* of the isolating switch is, in its "on" position, interlocked with the lower inspection doors *v* by means of the vertical rods *l* and with the switch carriage, in such a manner that the former cannot be opened, nor the switch carriage withdrawn, as long as the plug contacts and main switch are under pressure. In like manner the isolating switch cannot be closed while the doors *v* are open or the switch-carriage is withdrawn. The isolating switch is further interlocked with the handle *g* of the main oil switch, so that the former can be opened or closed only when the latter is open, and there is thus no possibility of the isolating switch being opened while carrying current. In this way, the opening of the doors *v* and, therefore, access to

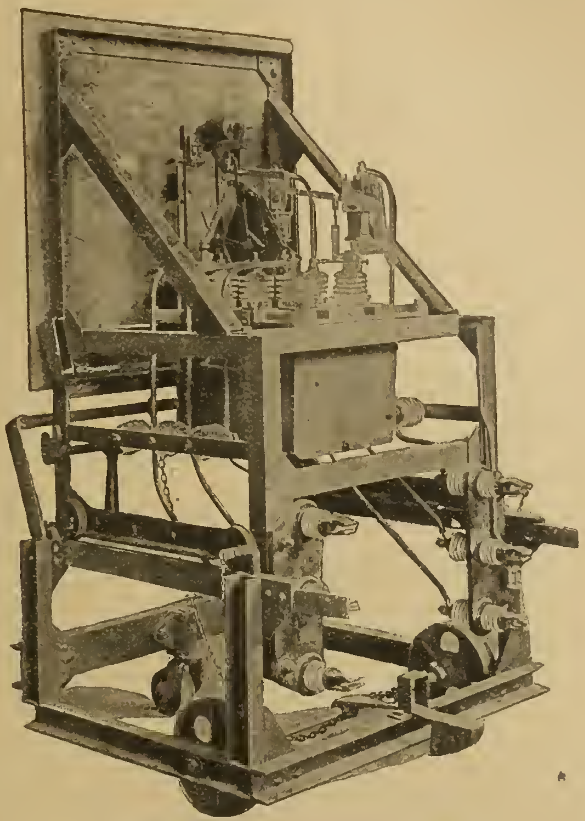


Fig. 4.—Switch-Carriage on Truck.

the interior of the switch carriage and the withdrawal of the same can only be effected after the main oil switch, and then the three-pole isolating switch, have been opened, and by this means the whole switch carriage earthed and made dead. On the other hand, the isolating switch can only be closed again, and the switch carriage put under pressure, after it has been replaced and both parts of the folding doors *v* closed. All eventualities are thus provided for, and contact with any bare metal carrying current is absolutely impossible.

The switchboard attendant is therefore only able to undertake all the manipulations necessary for opening, withdrawing, or replacing the switch carriage in definite order, and accidents or mistakes on his part cannot possibly occur. The interlocking is in all cases accomplished by means of simple but effective catches, operated either directly by the respective switch handles or by their own weight. The use of springs of every description has been avoided in the interlocking gear, owing to their liability to rust and stick, thus becoming deranged and seriously affecting the security of the service.

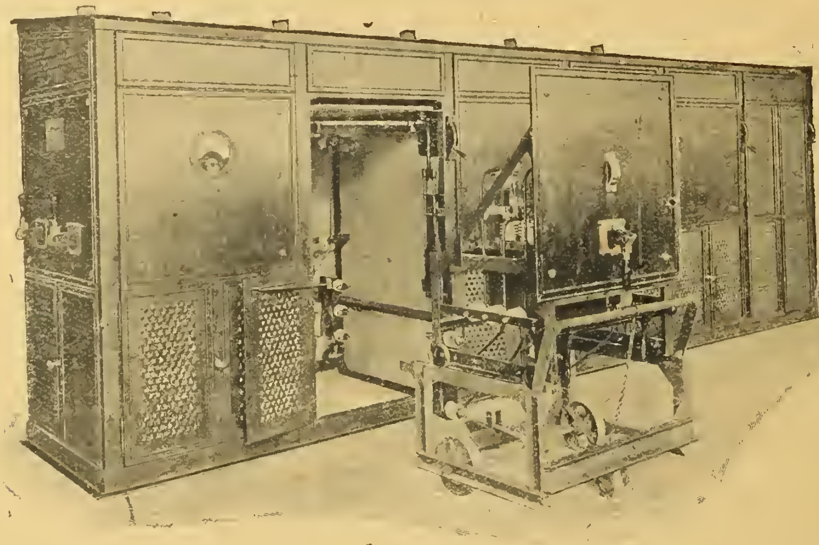


Fig. 5.—Switch-Carriage on Truck, and Empty Cell.

The outgoing cable K is, in accordance with the system of wiring generally used in mines, led in at the top of the switchboard and connected directly to one set of plug contacts in the chamber B. The outgoing and incoming single rubber-covered cables are also led in and out from above, thus making easy and economical erection possible. If desired, however, the cable can be led in at the bottom of the switchboard. Where two or more feeders supply current to a sub-station, or where the switchboard is connected to a network or ring main, there is, however, always a possibility that the cable will still remain under pressure, even though the main switch has been cut out. In this case the ends of the cable are taken to the top chamber A, and connected to the plug contacts *i* through isolating blades, which are fitted in exactly the same manner as the blades E. These isolating switches are then mechanically coupled together, and form a six-pole isolating switch, which is simultaneously operated by a single lever. By this means perfect safety is ensured, and no dangerous pressures can exist in the switch carriage when cut out of circuit. Figs. 3 and 5 show a 5,000-volt switchboard of the type described, which is installed underground in the Franziska Pit, Gelsenkirchen, Westphalia.

Fig. 3 shows the switchboard complete, with the lower doors open to give access to the high-pressure plug contacts of a switch carriage after it has been cut out of circuit; fig. 5 shows the truck carrying the switch carriage, and the accessible empty cell, and fig. 4 shows a switch carriage containing the high-pressure automatic circuit-breaker resting upon its truck after removal from the switchboard.

The switch carriage is also specially adapted for receiving other apparatus, such as arresters, together with resistances and similar apparatus, as, for example, in the installation shown in fig. 6. The above-mentioned construction, *i.e.*, with removable switch carriages, is suitable for building up switchboards for generating plants and complete central station installations, although with these the main advantages of the system, namely, the small floor space necessary and complete operation from the front of the board, are not of such consequence as with distributing boards where this is mostly the case.

For the erection and attendance of an installation of this description a maximum width of 8 ft., of which 4½ ft. is for the passage-way in front of the switchboard, completely suffices, as the depth of a normal switch-carriage frame intended for a pressure of 5,000 volts is practically 4 ft., and that of the removable switch carriage itself only about 3½ ft.

High-pressure switchboard installations of the cellular type, for pressures up to 10,000 volts, have been constructed in large numbers by the F.G.L. for electricity works and textile factories, of which several have been in service uninterruptedly for many years.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Guardian Pendant Lampholder.

Messrs. Ward & Goldstone, of Springfield Lane, Salford, have sent us particulars of their new Guardian patent pendant lampholder, of which we give an illustration herewith. This device was described in our last issue, and, as there stated, has been designed to obviate the necessity of using an earth wire. As the figure shows, the flexible cord coming away from the holder passes through a rubber grip before going out of the case, and the lampholder itself is completely covered with wood.

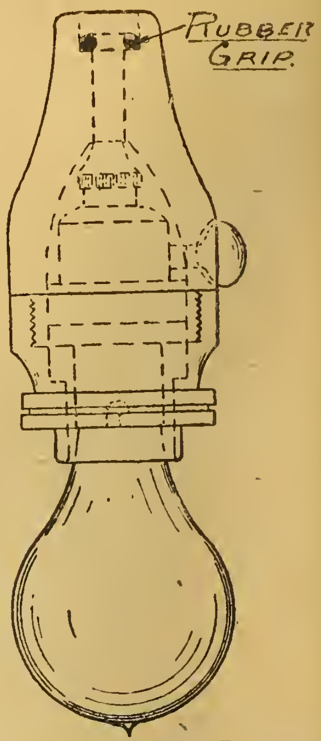


Fig. 1.—Guardian Pendant Lampholder.

"Metfil" Metallic-Filament Lamps.

The original inventors and patentees of the incandescent electric lamp, the Edison & Swan United Electric Light Co., Ltd., of 36 and 37, Queen Street, E.C., have placed on the market a very complete and extensive range of their new British made metallic filament lamps, made at their Ponder's End Works, Middlesex under the name of the "Royal Ediswan Metfil." The company exhibited lamps of this type of their own make at the Franco-British Exhibition, where they obtained the Grand Prix, t highest possible award, for lamps, &c. At the Manchester Exhibition also, Ediswan lamps of this type were on view. Since th the firm have carried on the manufacture and sale of metalli filament lamps, whilst at the same time they have been engaged constant experiment in order to ensure that the new "Metfi lamps should be made with the same care, accuracy, and hi finish that has characterised the firm's carbon-filament lamps.

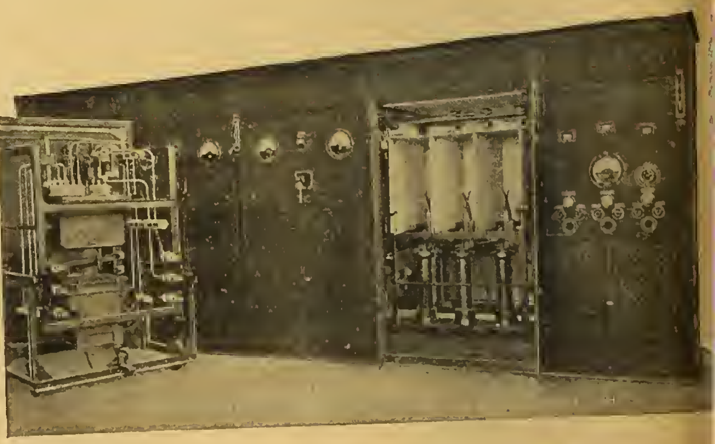


Fig 6.—Cell Open, Showing Lightning Arresters with Resistances.

Whilst the efficiency of the Royal Ediswan "Metfil" lamp m be taken as being as high as that of any other metallic-filame lamp on the market, the useful life is not less than 1,000 hou The lamps do not blacken with use; many lamps that have burn or three or four times the normal life show no traces of discoloration. In addition, it is claimed that the filaments are tough, and not brittle—a characteristic probably due to the special process by which they are made—and will withstand ordinary usage, a matter of considerable importance to both user and electrical contractor. A further point in connection with the ordinary pattern 'Metfil" lamps is that they can be placed in shades of the same size as were previously used for lamps of the carbon type, the bulbs of the standard lamps being of the same shape and appearance as those of their carbon prototypes, as shown in fig. 2.

The filaments are effectively supported throughout their

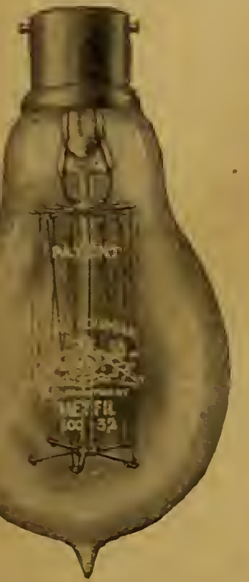


FIG. 2.—"ROYAL EDISWAN METFIL" LAMP.

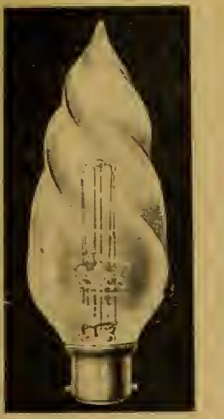


FIG. 3.—"METFIL" CANDLE LAMP.

ength; the lamps can thus be used in any position, even upside down if necessary, as in fig. 3, without fear of the filament breaking or sagging unduly.

The firm have been successful in producing a high-voltage metallic-filament lamp, made in several different candle-powers, suitable for use on circuits of from 200 to 250 volts. A number of varieties of candle, flame, and special-shaped bulb lamps are also listed in the new catalogue, which is issued by the firm, and which contains a very comprehensive range of metal lamps. The 'Metfil" lamp is made for practically every required candle-power and voltage, ranging from small miniature lamps for use with batteries, to the lamps of somewhat higher voltage used in conjunction with Ediswan auto-transformers, and so on through the 100 and 200-volt ranges.

The "Metfil" lamps are graded and marked in British candle-power; this is important, in view of the fact that many metallic-filament lamps are marked in hefners, a light unit of 10 per cent. less intensity than the British standard candle.

Large Chain Drives.

THE WESTINGHOUSE BRAKE CO., LTD., of King's Cross, London, N., inform us that they have just received a repeat order for four more of the exceptionally large chain drives described in our columns about a year ago. Details of the drives supplied by the Westinghouse Brake Co., Ltd., to this one firm (the Kolomna Engine and Machine Works, of Russia) are as follows:—

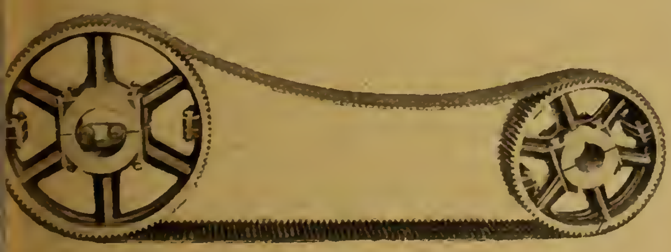


FIG. 4.—WESTINGHOUSE CHAIN DRIVES.

Number of drives..	7	Width of wheels	22 in.
Horse-power of each drive ..	500	Pitch of chain	2 "
Aggregate horse-power ..	3,500	Width of each chain ..	10 "
Outside diameter of wheels..	37,784 in.	Chain speed	1,480 f.p.m.

Each drive consists of two 250-H.P. chains, running on one pair of wheels.

The great range of sizes covered by the Westinghouse Brake Co., Ltd., in the manufacture of chain drives is shown by fig. 4, which depicts a 0·3-H.P. drive inside the bore of the large wheel of a 300-H.P. drive. The latter was supplied to the well-known 'Kodak" photographic supplies manufacturers' Jamestown works, to drive an air compressor from a Corliss engine.

Mining Switch and Fuse Panels.

WE illustrate herewith a new type of switch and fuse panel, which has recently been put on the market by MESSRS. A. REYROLLE AND CO., LTD., Hebburn-on-Tyne, and which displays Messrs. Reyrolle's usual solidity in construction combined with careful attention to convenience and safety. The particular fuse-box illustrated is not intended to be flame-proof, but the firm can, if necessary, supply fuse-boxes with wide machined joints, which render the emission of flame impossible, even should an explosion take place inside the box. The fuses are of the firm's well-known ventilated type, and the oil-switch is non-automatic, but is fitted with a particularly quick break. The handle of the oil switch and the door of the fuse box are interlocked in such a way that the latter can be opened only when the switch is in the "off" position; and while the fuse box is open, it is impossible to close the switch.

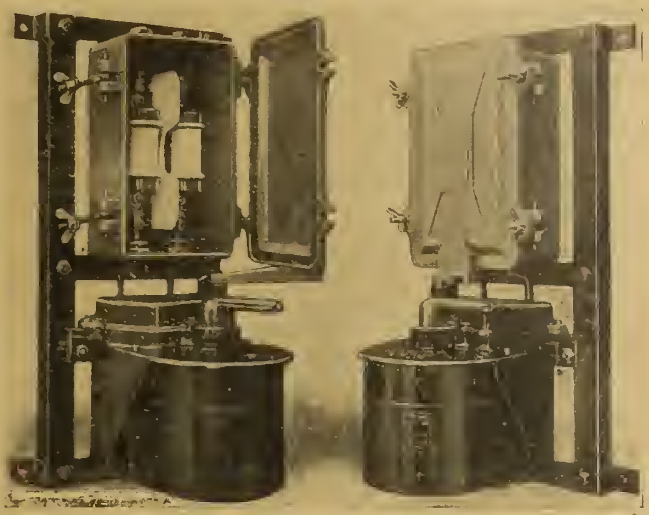


FIG. 5.—REYROLLE MINING SWITCHGEAR.

The quadrant attachment shown on the lid of the distribution box has a slot running its whole length, and forming part of a circle, of which the hinge of the lid is the centre, the radius of the circle being the distance between the hinge and a pin on the oil switch handle, when the latter is in the "off" position. This pin has a certain amount of circular movement, and as it is only in the "off" position of the handle that the position of the pin coincides with the radius of the slot in the quadrant, it is obvious that the two parts, namely, the lid and the handle, cannot work independently of each other.

"Primus" Oil Engine.

MR. E. ATKINSON SMITH, of 70, Victoria Street, S.W., has sent us particulars of the "Primus" paraffin and crude-oil engine, made by Karl Heineman, of Gothenburg, Sweden, for which he is the agent in the United Kingdom. It is claimed that the efficiency of this engine is very high, while it has only three moving parts. The consumption of crude oil, costing 50s. per ton at present, is stated to be only 0·56 lb. per B.H.P.-hour. The engine is of the two-cycle type, and therefore has an impulse every revolution with a single cylinder. Ignition is effected, after the engine is started, by the heat of a bulb on the cylinder head, against which the oil is sprayed by a small pump, the explosions keeping the bulb hot enough for this purpose. Control is effected by varying the stroke of the pump, by hand or by means of a fly-wheel governor. The engine is made in sizes from 5 to 25 B.H.P. with single cylinder. Mr. Smith is agent also for the Pierson 4-H.P. suction gas plant for country-house installations, the engine being of the vertical type.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ECUADOR (*concluded*).

100 centavos = 1 sucre = 2s.

The following goods are free of duty:—Iron frames, beams, columns for construction purposes; coal; cement for building purposes; railway material of all kinds; machinery in general, with spare parts for same, and boilers; iron or steel bridges; iron or steel posts; rails; tiles and tubes of earthenware; lightning conductors; also, with special permit, articles strictly necessary for municipalities for lighting and other public works.

The following pay 1 centavo per kg. gross:—Tubes of china or clay, glazed; pig-iron; resin.

The following pay 2 centavos per kg. gross:—Sulphuric acid; mechanical pumps for water; iron or lead piping not otherwise mentioned; iron or steel in bars, sheets, hoops, flat, half-round, angle or T-shaped; machine grease; paraffin; lead in bars, ingots, sheets and scrap lead; apparatus and materials for electric lights and other electrical apparatus, except chandeliers; refined tallow.

The following pay 3 centavos per kg. gross:—Iron sheets and iron gutters or ridging, corrugated; tin plate, plain, in sheets, zinc in plain sheets or in the rough.

The following pay a duty of 5 centavos per kg. gross:—Machine oil; hydrochloric, rectified phenic, nitric, boric and carbonic acids; elevators; pitch and tar; brass, copper, tin and bronze in bars or unperforated sheets; calcium carbide; bells; wire rope and cable; marble, polished; ordinary glass or crystal ware; crude petroleum.

The following pay a duty of 10 centavos per kg. gross:—Fine crystal ware; india-rubber, manufactured; porcelain articles not otherwise specified.

The following pay a duty of 20 centavos per kg. gross:—Machine belting.

The following pay a duty of 20 centavos per kg. net:—Articles made of steel, iron, tinplate, tin, bronze, copper, brass, nickel, lead, zinc, except those elsewhere specified.

The following pay a duty of 25 centavos per kg. gross:—Apparatus for telegraphs and telephones; chandeliers and candelabra of all kinds.

The following pay a duty of 25 centavos per kg. net:—Machine packing; lanterns; spirit levels.

The following pay a duty of 30 centavos per kg. net:—Oil cans; articles made of rubber, not elsewhere specified; manometers.

The following pay a duty of 40 centavos per kg. net:—Mathematical and other scientific instruments.

The following pay a duty of 60 centavos per kg. gross:—Lamp shades of paper, cardboard or woven material.

Other goods not separately mentioned in the Tariff pay a duty of 30 centavos per kg.

Surcharges amounting to 100 per cent. of the amounts of duties payable are leviable on all goods.

The following wharf dues are also payable:—Articles exempt from import duty, baggage, and all other duty free articles transported on the deck of the vessel without bill of lading, 2 sucres per 100 kg.

Ships, put together, or not, and machinery for the same; small craft; railways and railway materials; machinery, spare parts for the same, and boilers; iron bridges and materials for the same:—If discharged on wharf, 2 sucres per ton; if not so discharged, 1 sucre per ton.

Porterage dues of 2·20 sucres per ton are also levied on imported goods.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,006. "Improved terminals for shunts and other electrical apparatus." Kelvin & James White, Ltd., W. T. Evans and S. B. Wilson. June 28th. (Complete.)

15,081. "Improvements in and relating to electric dynamos and motors." H. B. van Daalen. June 28th.

15,086. "Improvements in apparatus for automatically establishing and cutting off the supply of electricity, gas, or other fluid." J. Hansford and J. F. Wright. June 28th.

15,115. "Improvements in and relating to electric reflector lsmps." C. C. Regnart. June 28th. (Complete.)

15,147. "Improvements in trolley heads of electric tramcars." E, H, Cockshott. June 29th.

15,151. "Improved contact-finger for electrical controllers, switches and the like." R. C. Lyness. June 29th.

15,158. "New or improved method of eliminating or reducing electrostatic electromagnetic induction between contact wires of electric traction systems and adjacent telegraph and telephone circuits." J. Sayers. June 29th.

15,167. "Improvements in telegraphy." L. M. Potts. June 29th. (Complete.

15,182. "Improvements in and relating to flsme arc lamps." F. Smith and F. V. Smith. June 29th,

15,192. "Improvements in the manufacture of metallic filaments for incandescent electric lamps." Societe Francaise D'Incandescence par le Gaz (Systeme Auer.) (Date applied for under Sec. 91 of the Act, July 18th, 1908, being date of application in France.) July 29th. (Complete.)

15,193. "Improvements in the preparation of filaments suitable for incandescent electric lamps." Societe Francaise D'Incandescence par le Gaz (Systeme Auer). (Date applied for under Sec. 91 of the Act, July 18th, 1908, being date of application in France.) June 29th. (Complete.)

15,194. "Improvements in primary batteries." W. A. F. Bleeck. June 29th. (Complete.)

15,203. "Improvements in and relating to the actuation of controllers and the like for electric machinery." H. B. van Daalen. June 29th. (Complete.)

15,208. "Improvements in reflectors or shades for electric lamps." L. Zamboni and C. A. Sterling. June 29th. (Complete.)

15,210. "Improved method for attaching the filaments of incandescent lamps." J. Canello. (Date applied for under Sec. 91 of the Act, July 22nd, 1908, being date of application in France.) June 29th. (Complete.)

15,211. "Improvements in electric switches." W. H. Flood. June 29th.

15,217. "Improvements in brush-holders for dynamo-electric machines." J. S. Highfield. June 29th.

15,251. "Improvements relating to sparking plugs." F. B. Lodge and A. M. Lodge (trading as Lodge Bros. & Co.). June 30th.

15,282. "Improvements in or relating to driving mechanism for petrol-electric apparatus." Felten & Guilleaume Lahmeyer-Werke Akt.-Ges. (Date applied for under Sec. 91 of the Act, July 1st, 1908, being date of application in Germany.) June 30th. (Complete.)

15,287. "Improvements in magazine electric arc lamps." Johnson and Phillips, Ltd., and J. Brockie. June 30th.

15,298. "Improved electric shunt arrangement for watt measurement." C. E. J. O'Keenan. (Date applied for under Sec. 91 of the Act, July 17th, 1908, being date of application in France.) June 30th. (Complete.)

15,317. "Improved electric motor." C. H. Prött. June 30th. (Complete.)

15,319. "Improvements relating to dynamo-electric machines constructed with commutators." R. Pohl and The Phœnix Dynamo Manufacturing Co., Ltd. June 30th.

15,323. "Means for diminishing the field excitation of variable speed electric generators in proportion to their speed of rotation." H. Leitner. June 30th.

15,326. "Improvements in the production of constant potential electric circuits." H. Leitner. June 30th.

15,342. "Improvements in or appertaining to electric terminals or binding screws." G. W. Micklethwait. July 1st.

15,345. "Improvements in voltage regulators for dynamo-electric machines." T. Ferguson. July 1st.

15,351. "Incandescent electric lamp filament packing or transit box." F. Harrison. July 1st.

15,370. "Improvements in and relating to radiators." L. Hodgson. July 1st.

15,371. "Improvements in collector shoes or skates for electric traction systems." R. J. Houghton, P. Allman and W. T. Gray. (Date applied for under Rule 13, June 2nd, 1909. An invention comprised in application No. 12,937, dated June 2nd, 1909.) July 1st.

15,380. "Improvements in or connected with high-tension magneto-electric machines." F. R. Simms and Simms Manufacturing Co., Ltd. July 1st.

15,381. "Improvements in or connected with magneto-electric machines." F. R. Simms and Simms Manufacturing Co., Ltd. July 1st.

15,385. "Improvements in or relating to electric telegraphy." S. G. Brown. July 1st.

15,389. "Improvements in electric ignition apparatus for internal combustion engines." L. A. Hindley, H. D. Hindley and W. Stanford. July 1st.

15,413. "Improvements in and relating to the jointing of electrical conductors." C. Vernier. July 1st. (Complete.)

15,421. "Improvements in and relating to current collecting devices for dynamo-electric machines." British Thomson-Houston Co., Ltd., and W. F. Dawson. July 1st.

15,438. "Improvements in electricity meters." G, Hookham. July 2nd.

15,441. "Improved construction of quick make and break electrical switch." Veritys, Ltd., and W. G. Pipkin. July 2nd.

15,444. "Adapter for converting oil or similar lamps for use with electric light." H, R. Rivers-Moore. July 2nd.

15,475. "Improvements in electrically-operated apparatus for locking railway carriage and other doors." R. B. Nelson, J. Ormsby and E. Nicholson. July 2nd. (Complete.)

15,494. "Improvements in rotary electric transformers and motor generators." Crompton & Co., Ltd., J. C. Macfarlane snd H. Burge. July 2nd.

15,496. "Process for the manufacture of metallic-filaments for electric incandescent lamps." R. Jahoda. (Date applied for under Sec. 91 of the Act, May 10th, 1909, being date of application in Austria.) July 2nd. (Complete.)

15,554. "Improvements in magazine electric arc lamps." C. F. Tubbs. July 3rd.

15,572. "Safety devices for electric annunciators." A. G. M. Cathiar July 3rd.

15,574. "Improvements relating to overhead lines for electric trsction." C. M. E. Priestley. July 3rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Starting of Polyphase Motors. Akt.-Ges. Browu, Boveri & Cie. 20,827. October 2nd. (Date applied for under International Convention, October 3rd, 1907.)

Method of Producing Hot Water by means of Electricity and Apparatus Therefor. G. G. Bell and J. St. V. Pletts. 22,598. October 24th.

Method for Coupling Dynamos and Electric Motors. A. H. Zumsteg and R. E. Zumsteg. 23,800. November 6th.

Control of Railway Traffic by means of the Block Telegraph System of Signalling. W. R. Sykes and C. J. Cooke. 24,030. November 10th.

Metal-Filament Electric Glow Lamp. H. Kuzel. 25,044. November 20th. (Date applied for under International Convention, May 14th, 1908.)

Single-Phase Alternating-Current Electric Motors of the Commutator Type. E. F. W. Alexanderson. 28,189. December 24th. (Date applied for under International Convention, December 26th, 1907.)

Wireless Telephony and Telegraphy. A. W. Sharman. 12,140. June 4th.

Supporting and Insulating Means for Aerial and other Electrical Conductors. G. W. Partridge and P. Dawson. 5,781. March 14th.

Speed Regulation of Induction Motors. M. Stein. 12,326. June 6th. (Date applied for under International Convention, June 12th, 1907.)

Control of Electric Motors. H. A. Mavor and Mavor & Coulson, Ltd. 12,498. June 10th.

Plug or Holdfast for use in fixing Gas Fixtures, Telephones, Mantels, Shelves, Bolt Ends, Stanchions, and all such like articles that require fixing to withstand Strains. J. Taylor. 12,519. June 11th.

Arc Lamps. D. Timar and C. von Dreger. 12,656. June 12th. (Date applied for under International Convention, July 8th, 1907.)

Manufacture of Incandescent Electric Lamp Filaments and Apparatus Therefor. Soc. Francais d'Incandescence par le Gaz (Système Auer). 12,720. June 13th. (Date applied for under International Convention, July 13th, 1907.)

Electric Telegraphy. J. A. L. Dearlove. 13,191. June 20th.

Dynamo-Electric Machines. A. A. Pifer and E. F. Ahlm. 13,743. June 29th.

Sectional Interrupters for the Line Wires of Electric Railways. Albert Thode & Co. 14,366. July 6th. (Date applied for under International Convention, July 9th, 1907.)

Current Collector for use in Electric Traction Systems. A. West. 14,695. July 10th.

Method of and Apparatus for Automatically Igniting and Extinguishing Electric and other Lamps by the Action of the Sun's Rays. Sir H. Norman and T. B. Reader. 17,540. August 21st.

Method of and Apparatus for making Electric Connections at a Distanc at Sea by means of Elastic Impulses or Waves transmitted throug the Water. Klupathy and Berger. 18,025.

Electric Furnace for the Continuous Extraction of Zinc from its Ores E. F. Cote & P. R. Pierron. 18,658. September 5th. (Date applied fo under International Convention, February 12th, 1908. Application fo patent of addition to No. 5,100/07.)

Telephone Instruments. W. Aitken. 19,457. September 16th.

Electrical Propulsion of Ships. Siemens Bros. Dynamo Works and C. A. B. D Koettgen. 21,152. October 7th.

Speed Regulation of Electrically Driven Ring Spinning Frames. Akt Ges. Brown, Boveri et Cie. 22,349. October 21st. (Date applied fo under International Convention, May 27th, 1908.)

Electrical Induction Clutches. A. P. Steckel. 28,180. December 24th.

THE

ELECTRICAL REVIEW.

VOL. LXV. JULY 23, 1909. No. 1,652.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

THE LONDON COUNTY COUNCIL AND TRAMWAYS STREET WIDENINGS.

THE Finance, Improvements and Highways Committees of the London County Council have issued a joint report under date of 2nd inst., on the allocation of cost of tramway street widenings.

We cannot emphasise too strongly the importance of this movement on the part of the L.C.C., as the principles underlying the question of cost of street widenings apply not merely to London, but to the whole country.

We have for many years directed attention to the hardships imposed upon the tramway companies by the exactions of local authorities in using their powers of veto to extort extravagant contributions towards street improvements, and have also shown how in the past the London County Council have, when dealing with their own tramway accounts, adopted an entirely different policy, by relieving the construction accounts of even a reasonable share of the cost of widenings, by charging the bulk to the general improvements account.

In the report before us, the Joint Committee admit that "the question of charging any portion of the cost of improvements to the tramways account has only arisen of late years, namely, since 1899," and they point out that "during the first 11 years of the Council" a total of £6,355,956 was voted upon improvements without any reference to the provision for tramway purposes. Up to 1899 about 30 improvements along tramway routes had been undertaken, and only about one-third of the cost was charged to the tramway account.

The Improvements Committee in 1903 considered that there were three classes of street improvements which had reference to tramways, namely :—

1. Those entirely necessary for the accommodation of the general traffic quite apart from any tramway traffic.

2. Those necessary in order to meet the needs partly of the general through traffic, and partly of the tramway traffic.

3. Those cases where it is quite unnecessary to widen the thoroughfare for the purposes of the general traffic, the existing width being sufficient, and where any widening would therefore be entirely for the assistance of the tramway undertaking.

To these principles no reasonable exception can be taken, and if embodied in an Act of Parliament which would govern the action of local authorities whether in respect to the regulation of their own accounts or their dealings with private undertakings, the grievances so long complained of would cease to exist.

The methods of accountancy hitherto adopted by the L.C.C. gave altogether a fictitious result of the municipal trading in tramway enterprise—a veritable "fool's paradise," from which there appears to be now some prospect of escaping, by a radical reconstruction of the accounts and the adoption of a sounder system in future.

The Finance Committee's report of June 23rd, 1908, contained many items of interest bearing upon the practice of the Council in dealing with street improvements.

In the first place, they referred to the fact that under the London County Council (Improvements) Act, 1900, it was enacted that :—

"In any case, where the Council carry out any improvement of a street in which a tramway is intended to be laid, the Council may, if they think fit, apportion the costs and expenses in such a manner as they may think proper between the improvements account and any separate account which they keep in relation to tramways."

The result of the exercise of this discretion was, as the Joint Committee point out, to apportion the costs *rather as one of policy than of accountancy* (the italics are ours), and hence the methods adopted for proving to the ratepayers that the municipal enterprise was profitable or otherwise according to the proclivities of the party that happened to be in power.

The report refers to the action of provincial local authorities as regards allocation of cost of street widenings connected with tramways, the policy being by no means uniform. Thus, at Birmingham, out of £250,000 the tramway account is charged with £170,000, while at Manchester only £100,000 is appropriated in that way.

As to contributions by tramway companies, the L.C.C. Committee do not appear to be free from the desire to extort payments not based upon the equitable principles involved in their three classes of street improvements to which we have referred, for they argue that the Council and tramway companies, in relation to street improvements in connection with tramways, are not analogous, because, they argue, "the tramway company's main object is to obtain its concession at the lowest possible cost," and they let the cat out of the bag when they add that "the payments made by tramway companies in respect of street improvements are matters of bargain between the company and the local authority, and are not determined on any settled principle."

Thus is the door opened to all sorts of intrigue, and with such a statement from the great local authority of the capital of the United Kingdom, it is time that Parliament intervened and settled the basis upon which this important matter should be dealt with.

The Joint Committee recommend that, in considering the question of whether the tramways account should be required to bear any part of the cost of the street widenings, some guiding principles should be laid down.

Messrs. Peat & Pixley, the accountants to whom the matter was referred, consider that contributions by the tramways should be governed by the "benefit derived or to be derived by the tramways," and the Committee adopt the principle that the proportion of charge should be determined according to benefit, and they add that in determining the amount of contribution "the charges falling on the tramways account for rates on, and maintenance of, the permanent way" should be considered.

This principle should not be lost sight of by tramway companies when making their bargains with the local authorities.

The accountants suggest that expert advice should be obtained to advise the Council—but the Committee would prefer to leave the matter in the hands of their permanent officials, and obtain a joint report on each case, from their valuer, chief engineer, and comptroller, and that this report should be available for the use of the Finance Committee when considering the financial bearings of the proposal.

The recommendations of the Joint Committee are embodied in a series of proposals for consideration by a special body consisting of three members from each of the following committees, viz., Finance, Highways and Improvements, and in amendments proposed, it is suggested that they should be empowered to obtain the advice, or the arbitration, of the chief of the London traffic branch of the Board of Trade, or some other independent authority approved by the Council.

The Technical Journal: Its Work and Influence.

We shall be glad if every reader will make a special point of closely studying the remarks on this subject by Mr. H. M. Wilson, an American editor, that appear on another page of this issue. Mr. Wilson's very interesting views were intended to apply especially to journalism on the other side of the briny, but those of us who, for the greater part of our lives, have followed such matters from behind the scenes, know only too well how aptly they are applicable to the new condition of things that has arisen in this country too during the last few years. The theme of the position, function and influence of the technical press in its relation to and bearing upon modern life, thought, and activity, is a great one upon which we could write the Thames dry, if the British Navy were not there, but we will save our readers that infliction just now. Much might be written on what the trade thinks of the Press and *vice versa* ; the criticisms of our friends and foes alike concerning why we publish this and do not publish that ; the great necessity for the technical Press by sound judgment to act as a corrective of the errors of misguided journalists who labour under either a desire to tickle the fancy or an order to propagate and disseminate a shibboleth ; the mistaken notion that all we, like sheep, have gone astray, and as editors are as easily gulled as an uninitiated public ; the opinion of some that we are philanthropists pure and simple—or ought to be—in business for the fun of the thing ; that we will publish, or ought to do, this, that or the other matter, view, description or opinion for a solatium ; that we are out hunting for "copy," as we were told only last week by an exhibitor's representative, because, forsooth, we have not matter enough to fill our pages in these days when every other man in the profession or industry is a penman ; that we are "stodgy" ; that we have no humour, or too much ; that we give too much matter—that we give too little ; but there, we shall exhaust our ink supply if we even proceed to specify the mere headings of what we would write if we were only to let ourselves go. For the moment we will be content if Mr. Wilson's remarks are read and re-read, and perhaps by some re-read again. We have never thought it necessary to publish sheaves of testimonials like a quack medicine or electric belt vendor, preferring rather to let our work speak for itself, but we are inclined to agree with Mr. Wilson that "the functions, opportunities, and the merits of the technical Press are not as fully understood and appreciated as they might be."

Copper.

Messrs. Merton's circular for July 15th, 1909, shows the imposing figure of 70,450 tons visible supplies, of which 58,100 tons are stored in English ports. Afloat from Chile and Australia the quantities are up to average. The shipment figures for mid-month can hardly be taken as indicating very much, bearing generally no fixed relation to the final figures for the month. Those interested in copper will, however, digest the salient features of the market (*a*) increasing supplies (*b*) maintained price, and make their own deductions.

The *Mining Journal*, in the issue of the 10th inst., reviews the situation for the past six months very clearly. It emphasises this maintenance of prices in the face of large output and low consumption in the States. As pointed out, the price can only be due to (*a*) large deficiencies in Europe which have to be made good ; (*b*) financial support by the owners. The latter supposition, which the *Journal* seems inclined to indicate, would hardly be co-incident with increasing supplies. In a country to which nature has been so generous as North America the revival in trade cannot be long delayed, but it may take another year to develop. In this case copper falls.

What is a Telegraph?

We have always regarded it as somewhat anomalous that in the eye of the law the word telegraph as used in the Telegraph Acts, 1863 and 1869, has been held to include telephone, although the telephone was not invented or contemplated in 1869. A conversation through the telephone was held in the famous Edison case to be a communication transmitted by telegram within the meaning of those Acts. This principle was recently reaffirmed by the House of Lords in the case of the Postmaster-General *v.* National Telephone Co., 1909, 100 L.T. Rep. 658, where it was held that private telephone lines connecting two or more separate and independent persons or businesses, and electric fire alarms (and similar signals, are not excepted from the monopoly of the Postmaster-General.

It is interesting to find, however, that this principle is not to be universally adopted. In a recent Irish case a serious and important question arose as to the meaning of "telegraph," which phrase was used in a contract between the Postmaster-General and a railway company. The contract provided that "the company shall . . . . convey from station to station . . . . free of expense from the Postmaster-General all telegraph materials used—or intended to be used—for the construction, maintenance, repair, or renewal of any of the Postmaster-General's lines of telegraph situate on their system of railway." It was contended that, having regard to this clause, the company were bound to carry all kinds of telephonic instruments, appliances and apparatus. By another clause the company undertook to convey, free of expense, all salaried officers and workmen (except telegraphists) employed by the Postmaster-General in the construction and repair of the lines of telegraph on the company's system. Mr. Justice Dodd held that in construing covenants the fulfilment of the evident intent and meaning of the parties was the design of the Courts, which did not confine themselves within the narrow limits of a literal interpretation. Accordingly, he held that the word "telegraph," as used in the deed, could not receive the same wide interpretation as it had received in England on the construction of the Telegraph Acts, and he declined to accede to the contention of the Postmaster-General. Inasmuch as similar agreements are in force between the Postmaster-General and most of the railways in the country, this decision is likely to be far-reaching in its effects.

The Need for Continuous Progress.

Many people have the notion that those who control large industrial undertakings are able to relax their efforts and have a "good time" when effective working order has been established. No greater fallacy exists : continuous efforts on the part of both staff and workmen are essential to continuous success. There is no standing still, the undertaking which attempts to rest upon its oars falls behind trade competitors who are continuously going forward. We do not mean that every employer is to remain in a state of frenzied exertion, but sustained effort towards improvement must be present amongst a large proportion of the staff and workmen if the undertaking is to keep pace with its neighbours ; neither is it possible or necessary for a manager and his assistants who take over the control of an out-of-date concern to keep up the overwork required during reorganisation. Once an undertaking has been put into working order, provided that efficient methods have been adopted, some relaxation of effort is allowable, and improvements can be quietly taken in hand one by one, but the process must be *continually* going on.

The developments in competitive firms both at home and abroad should be closely studied, with a view to improving upon their practice. The firm that is content cautiously to imitate the lead of its more enlightened contemporaries never scores a conspicuous success. Such undertakings, if carefully managed, may just contrive to show a small profit, but the value of their ordinary stock will usually remain well below its nominal figure, and the results cannot be looked upon as satisfactory.

Conspicuous success is to be met with only amongst those concerns which are constantly initiating new designs and methods under the guidance of sound commercial judgment. This policy ensures the full benefit of the improvements for their initiators, as the effect of all improved designs and methods is to lower prices when the new practice has been widely adopted. This feature does not, however, concern the firm that introduces the innovations, large profits being therefore netted whilst the imitators have to be content with whatever margin remains after the prices have been reduced.

Another aspect is to be found in the value of obsolete machinery. The leading firm, when it has satisfied itself of the effectiveness of some new machine or appliance, can still dispose of its old equipment at remunerative prices, whereas the rank and file will only obtain scrap value for their obsolete plant.

It is to be feared that there is a lack of enterprise in this country as regards the adoption of new methods and designs, and that too many undertakings are contenting themselves with the small profits accruing to those who pursue the cautious policy of imitating their neighbours. On the other hand, certain precautions must be observed in adopting the go-ahead policy, or disaster may follow instead of enhanced profits. The best technical advice must be retained whatever the cost, sound commercial judgment being equally essential. Given these two factors, however, the returns should fully counterbalance the extra risk, and we should like to see a little more enterprise in this direction on the part of the British manufacturer.

The Electric Lighting Acts (Amendment) Bill.

This Bill, which has formed the subject of so much correspondence in our own pages and elsewhere during the last few weeks, was before Standing Committee "C" of the House of Commons on Tuesday last, and after amendments were made to a number of the clauses, it was ordered to be reported to the House. We commence our account of the proceedings on another page of this issue, and hope to bring the same to a conclusion next week. Our report does not yet reach the much-debated Clause (16) which concerns the electric wiring and contracting powers of municipalities, but we regret to state that the Committee saw fit to omit the words "through a contractor, but not otherwise," which were added in the House of Lords. The possibility of this being done was, of course, foreseen, though some of us had hoped that the interests of private enterprise would have not been lightly trampled under foot, allowing municipalities to unfairly compete with sections of their ratepayers. We have received a letter from Mr. E. Garcke since the closing of our "Correspondence" pages, in which he expresses satisfaction that certain alterations, desirable from the point of view of electrical companies, have been made in Clauses 2, 6 and 13, by the Committee, making it unnecessary to further oppose the Bill on the grounds named by him in his earlier communication. His letter will be available in our next issue, together with the conclusion of the proceedings.

ENGINEERING AT THE UNIVERSITY OF BIRMINGHAM.

The University of the Midlands has been called the business man's university, but it is *par excellence* one for engineers, and for the purpose of educating that class of the professional community the greater part of the magnificent pile within sight of the city of Birmingham has been erected.

Details of the power station—a detached block—were given in our issue of August 25th, 1905, but the following additions to the equipment have been made to meet the requirements of the newer blocks and the women's hostel:—A 50-I.H.P. horizontal compound Ruston-Proctor engine drives a 440-volt Westinghouse generator. A 60-KW. three-phase motor (to utilise the available power of the three-phase generator driven by the McLaren engine), drives two D.C. generators, one for each half of the battery. There is a balancing set of two 6-KW. compound dynamos; 20 cells at each end of the battery provide voltage regulation. The wiring of the buildings supplied is carried out on the three-wire system, with 440 volts between the outers. The battery was supplied by the E.P.S. Co.; charging set by Messrs. Siemens Bros.; balancer by the Lancashire Dynamo Co.; cables by Messrs. W. T. Glover & Co.; and the switchboards by Messrs. Morris & Lister.

There are now available for testing several petrol engines, a special test bed having been provided.

Important additions to the smelting section are a Moissan electric furnace and an oil furnace; the latter is the invention of Mr. Ward, a member of the metallurgical staff.

The Mechanical Engineering Department takes up the whole space of Block A, as it is designated. The machine shop is equipped with the most modern types of representative machine tools of British, Continental and American practice. With the exception of a large planing machine, all the tools are group-driven, by three electric motors. The pattern shop is similar in equipment to that of a large works. Above these two shops are the main drawing office and the Hall of Machines. A loom is now being installed in the latter, and it is hoped that in the near future other specialised machines will be housed there through the generosity of manufacturers and private donors, so that the students may become fully acquainted with the latest mechanisms.

The Civil Engineering section occupies about the same space as the Electrical, and is in the same block. On the lower floor is the strength of materials and hydraulics laboratory; here is erected a 300-ton girder-testing machine, by Messrs. W. and T. Avery. There are several smaller testing machines, one of 50 tons, and another—American—of 200,000 lb. The load for the latter is applied by means of a three-phase motor through suitable clutches and gearing, capable of six variations in speed. In the case of the other machines, hydraulic pressure is provided by an accumulator fed by a three-throw pump, driven by a motor on the alternating supply. A motor-generator set of 17 KW. capacity, by the B.T.-H. Co., provides direct current for a 20-H.P. motor of large speed variation, which drives a duplex pump, giving a steady discharge up to 600 gallons per minute, which is led direct to turbines, the maximum pressure corresponding to a head of 250 ft. Other pumps, turbines, meters, pipe lines, and measuring tanks complete the equipment in the laboratory.

The special feature of the University is its engineering side, and the chief section of this side is without doubt that which deals with electrical work. The Electrical Engineering Department covers an area of about 7,000 sq. ft. Students in their third year familiarise themselves with instruments and meters, make elementary tests on the machines in the senior laboratory, and test the electrical properties of iron and other materials. In the fourth year the work is more advanced, and commercial tests are carried out on the various machines and transformers. Thorough tests are also made on the direct-coupled generators in the power station.

A notable feature is the fixing of many of the instruments on small boards, provided with special brass clips, so that they may be suspended from the nickelled-brass instrument rails on the work benches, leaving the latter clear for other apparatus.

At the south end of the senior laboratory is the main switchboard. Direct current at 110 volts and three-phase alternating current at 220 volts and 30 cycles is supplied from the power station. A battery in a room immediately below the main board may be charged from either supply; there are 112 cells of the E.P.S. central-station P type, having a normal discharge rate of 40 KW. at 220 volts. There is also a battery of six cells for obtaining currents up to 600 amperes at pressures from 2 to 12 volts.

The main switchboard, of seven panels, was erected by Messrs. Siemens Bros., of Stafford. It is equipped with various makes of instruments and starters, so that the students may see them working side by side and compare the methods employed to attain the same end. As an instance, there are seven meters of five different makes. Primarily this switchboard is intended for the battery charging, but it also serves to obtain from the batteries various constant supplies which are distributed throughout the laboratories.

The main battery is charged from the D.C. 110-volt supply by a 28-KW. motor-generator set, constructed by the British Thomson-Houston Co., of Rugby. For charging from the alternating-current supply a 30-KW. Brown, Boveri rotary converter receives the supply from an auto-transformer, and an alternating-current booster regulated by a worm and wheel.

In the case of the 220-volt D.C. supply, the variations of battery pressure are compensated by means of a reversible booster with Thury regulation. A 30-KW. motor-generator set, by Messrs. W. H. Allen & Co., of Bedford, enables a 220-volt supply to be obtained while charging the battery, the exact pressure being regulated by the booster.

To give a 50-cycle alternating supply, a motor driving a 25-KW. alternator at 750 R.P.M. is run from the 220-volt supply. This set is by the Brush Co., of Loughborough.

A 30-cycle alternating supply is obtained by running the converter from the D.C. side.

Another set consists of two motors and two alternators by Messrs. Parker, of Wolverhampton. A "Castle" type of D.C. motor with interpoles coupled to a Holmes-Clayton alternator (30-50 cycles star or mesh connected) has recently been installed.

On the same side, but at the north end of the main laboratory, are testing beds arranged to take any class of small motor. The requisite supply can be obtained from special switchboards. Machines of various makes are in use here, including a Rosenberg train-lighting dynamo, a Winter-Eichberg motor, giving a shunt characteristic, and a Deri single-phase commutator motor.

There are two artificial lamp loads: one for direct current up to 220 volts, of 7 KW. capacity; the other of 30 KW. capacity, for direct, single-phase or three-phase currents. At the north end of the laboratory is the workshop, which contains tools for the making and repair of apparatus and fittings required by the department. The eastern side of the laboratory is provided with benches where transformer work, cable tests, and instrument and controlling gear testing may be carried out.

Close to the switchboard is a standardising room, where any of the instruments used may be standardised; if necessary, this can be done when they are in position, by connecting up to "test" terminals provided on each board. Here also is a Duddell oscillograph, and a portable ondograph has recently been acquired for carrying out tests on the wave forms of the machines.

A museum contains samples of essential materials for the construction of electrical apparatus, besides many spare parts for small machines. An interesting exhibit is the first Edison "Z" type machine constructed. Important firms are showing their appreciation of the work done, or likely to be done, by the University by lending machines, instruments, meters, lamps, &c., which are tested by the students. In order that the lectures may be practically illustrated, mains from each supply are led to switchboards, both in the small electrical lecture room and in the large lecture theatre.

The Chemistry and Physics blocks are to contain electrical installations of an elaborate character, so that electro-chemistry and the more theoretical side of electricity may be fully demonstrated and studied.

The fact should not be overlooked that in the set courses for engineering students, instruction in accounting, more especially as applied to engineering, is compulsory. This is a most important point, and will, no doubt, meet with the approval of all commercial engineers.

"C.M.B." PATENT DIRECT CURRENT ROTARY TRANSFORMER.

By J. C. Macfarlane, M.I.E.E., Wh.Sch., and H. Burge, A.M.I.C.E., A.M.I.E.E.

In the following paper the construction is described, and several applications discussed, of a new type of rotary electric transforming machine developed by the authors, for reducing supply voltages for the economical working of metal-filament and arc lamps, for battery charging, gun-fire, and navy-phone circuits, and also for balancing three-wire circuits.

The lines along which this machine has been developed are easily followed by reference to figs. 1, 2, &c.

Fig. 1 shows an ordinary two-pole dynamo-electric machine in which *n* and *s* represent the field poles, and *a a* the main brushes. If cross brushes *b b* are placed on the commutator and short-circuited, and if the primary supply voltage is represented by P, then this may be reduced to any desired value represented by S, depending chiefly on the position of the short-circuited brushes *b b* on the commutator in relation to the main brushes *a a*.

The machine as shown in fig. 1 would have several serious defects, viz :—

1. The presence of the iron poles *n s* immediately over the shorted brushes *b b* would not permit of sparkless commutation at these brushes.

2 It would not be possible to regulate the secondary voltage S, either automatically or by hand.

3. The M M F. of armature reaction would cause a large cross flux to pass through the armature between the shorted brushes across the pole faces, as shown by dotted lines in fig. 1. The armature revolving in this flux would create a large circulating current in the shorted brushes—either causing the machine to race dangerously or lose speed. Such a circulating current would also be very wasteful, and would tend to make one of the short-circuited brushes spark more than the other.

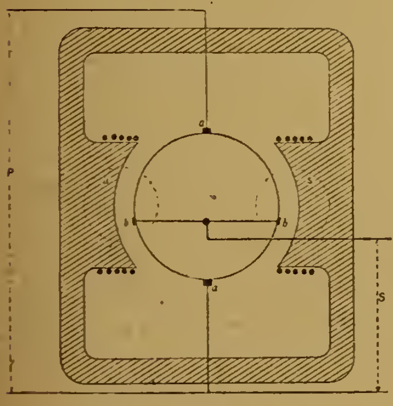


Fig. 1.

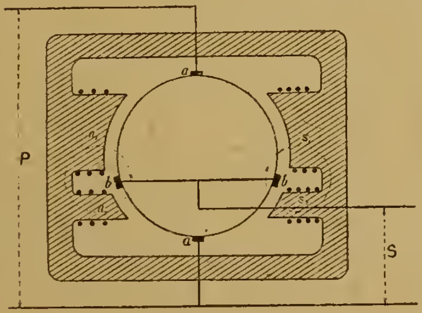


Fig. 2.

4. The weight of the field magnets and space occupied would be excessive.

The method adopted to get over the sparking difficulty has been to sub-divide the poles into two parts, to correspond with the position of the shorted brushes. This step is shown in fig. 2, where the poles are shown divided unequally, as would be required for an unequal division of the voltage.

It will be noted that when the E M F. applied to brushes *a a* is to be split unequally, the field should be divided unequally, and the shorted brushes should divide the armature in a corresponding manner, as this will lead to greater efficiency and economy in material. In reducing from a constant potential of 220 to a constant potential of 50, say, the part pole ratios should be approximately 2 : 1 for maximum economy.

If the supply voltage is constant, and the speed of rotation is to remain unchanged, any increase of flux on one side of the shorted brushes must necessarily take place at the expense of the flux on the other side. In order to regulate the secondary voltage, therefore, or compensate for voltage drop in the converter, the authors provide the machine with a ring wound armature, and entirely isolate the two magnetic circuits from one another. It should be noted that it is quite impossible to get any regulation of the secondary voltage without absolutely isolating the one magnetic circuit from the other, and also impossible to prevent wasteful circulating currents in the shorted brushes. It is obvious that the machine in fig. 2 would be unsatisfactory for two reasons; firstly, because any reduction in the M.M.F. on poles n_1 and s_1 say, and a corresponding increase in n_2 s_2 would have no effect on the quantity of flux passing through the two parts of the armature, thus preventing any alteration to the division of voltage; secondly, the armature reaction flux has still a low resistance path, as indicated by the dotted lines in this figure.

As mentioned above, a variation of the voltage on either side of the shorted brushes cannot take place unless a ring armature is used, due to the fact that the armature conductor of a drum armature spans across the pole pitch.

The construction adopted for completely isolating the magnetic circuits, shown diagrammatically in fig. 3, consists primarily in placing the pole parts n_1 s_1 n_2 s_2 in a vertical position with relation to the plane passing through the shorted brushes. It will be seen from the diagram that the length of the mean resistance path for the flux, due to the armature M M F., is increased considerably, and that as the yoke length is shortened the weight and cost must be considerably reduced.

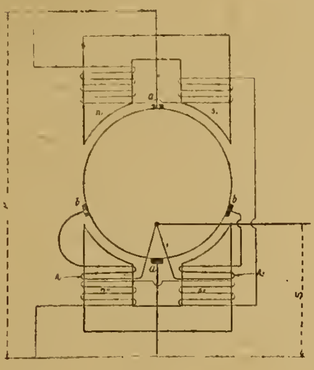


Fig. 3.

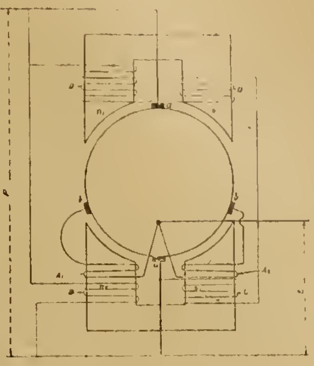


Fig. 4.

Although all the precautions as outlined above were taken in the earlier designs, these machines still gave considerable trouble, due to the short-circuit current flowing through the armature across the shorted brushes. As already stated, this short-circuit current, if not properly controlled, makes the operation of such a machine practically impossible, and it was found in the earlier machines referred to above that there was a very great liability for the machines to take charge and race dangerously, more especially when the secondary voltage was varied between wide limits. This, of course, is due to the fact that the armature reaction, caused by circulating current in this case, may be in direct opposition to the M M F. on the main field poles, resulting in a demagnetisation of these poles, and raising the speed.

To get over this difficulty in the most effective and simple manner possible, the poles are provided with series windings in addition to the ordinary shunt coils, and connected as shown in fig. 3, where A_1 and A_2 represent the series coils. These coils are each connected to one of the shorted brushes and their other ends connected together at one of the secondary terminals of the machine. Under normal circumstances, when there is no circulating current flowing through the armature across the shorted brushes, then each brush and each main coil will be carrying half the secondary load current; if, however, a circulating current arises, it will flow in opposition to the load current in one coil A_1, say, and in conjunction with the load current in the other coil A_2 In effect, therefore, the current in coil A_1 will be less than in coil A_2, and if these coils are suitably coupled up, will have the effect of correcting or preventing the short-circuit current from rising to any considerable value. In other words, as the current in the coil A_1 is less than the current in the coil A_2, the M.M.F. on pole n_2 is less than the M M F. on the pole s_2, and this tends to cause a greater voltage to be generated under the pole s_2 than under the pole n_2, thus opposing the voltage which is creating the circulating current.

A little consideration will show that these balancing series coils can be placed on all the poles, and can be wound, not only to effect the governing of the circulating current, but also at the same time to create either a compounding or differential effect on the secondary circuit.

When these series coils are used, there is no tendency for the machine to race, and the currents coming from each of the shorted brushes are always within 10 per cent. of each other, even when the magnet poles are entirely unsaturated, which would be impossible without these windings.

These converters may be divided into three classes, depending on the use to which they are to be put :—

(*a*) For giving a constant secondary voltage for any value of the secondary current.

(*b*) For giving a secondary current which is to remain approximately constant for a given range of secondary voltage.

(*c*) Machines which are to be used for converting from alternating to direct current, the direct-current voltage being capable of variation without affecting the power factor of the alternating side.

As a general rule, the coupling diagram, as shown in fig. 3, is suitable for machines giving constant voltage. Such machines would be the direct-current equivalent of an alternating-current auto-transformer, but would have the advantage that the secondary voltage could be easily altered at will, independently of the primary voltage, or compounded for voltage drop. As machines of this class, having a capacity of between 2 KW. and 3 KW., will have an efficiency of from 75 per cent. to 80 per cent., it is obvious that their application to transforming the voltage for metallic-filament lamps, has led to very good results in many cases.

For instance, in large shops, hotels and theatres, when the full load can be switched on at once, and kept on for a considerable time, the saving will be something like 70 per cent. in power over the most efficient carbon lamp.

The secondary voltage can be made to vary up or down, either automatically or by hand regulation, to suit the various conditions to which the machines may be applied.

In all the above cases it is desirable to arrange the values of the ampere turns on the poles on both sides of the shorted brushes, so that both poles and yokes are unsaturated magnetically. This permits of good regulation and perfect governing for short-circuit current.

With the poles on the primary side of the shorted brushes, viz., n_1 s_1, absolutely unsaturated magnetically, and the poles on the secondary side highly saturated, it is possible to use this machine by applying a fly-wheel to its shaft, for reducing the voltage from a tramway trolley circuit to, say, 220 or 110 volts, and, at the same time, to smooth out the variations in voltage on the secondary side, so that the machine can be used for supplying incandescent lighting successfully from its secondary terminals. With the usual variation of pressure of a tramway circuit, a practically constant voltage can be obtained at the secondary terminals of the machine.

The machines have also been applied to balancing three-wire circuits with great success, the largest as yet made being two machines for the Calcutta Electric Supply Corporation, dealing with an out-of-balance load of 60 KW. on either side of the middle wire, the voltage of the outers varying from 460 to 580 volts. These machines were required to balance the voltage within 1 per cent. of the mean value on either side of the middle wire at all voltages between 460 and 580. Their efficiency was 94 per cent. on test, which is 4 per cent. or 5 per cent. higher than that obtained with double machines.

The advantages of using such machines as balancers are the small weight and space taken up, absolute reliability, small wear and tear on the brushes and high efficiency.

When used as a balancer, the armature is divided into two equal parts by the shorted brushes; also the polar limbs are all equal in dimensions, the series compounding coils are arranged on all the poles, not only for the purpose of voltage regulation, but also to balance the circulating current across the shorted brushes.

From the foregoing it will be seen that there is an unlimited field for the use of this converter, owing to the high efficiency and small space required.

We will now describe briefly the construction of the machine used for the purposes set forth under heading (*b*), having a constant secondary current over a given range of secondary voltage. The characteristic of the secondary is shown by the curve in fig. 5, and is suitable for supplying a single arc lamp, or two or more arc lamps in series, without the use of steadying resistances.

Fig. 4 shows the winding diagram of the machine arranged to give automatically a practically constant secondary current. On examining this diagram it will be noticed that the shunt windings on the part poles n_1 s_1 are connected between the positive supply main and the shorted brushes, whereas the shunt coil marked B is connected right across the supply mains. The shunt coil C is connected between the shorted brushed and the negative supply main. The series coils A_1 A_2 on the part poles n_2 s_2 are each connected to a shorted brush, in the same way as described with reference to fig. 3, but in this case the series coils A_1 A_2 are so connected that their M.M.FS. oppose the M.M.FS. of the shunt coils B and C. The action of the machine is as follows:—

If the secondary current tends to increase, the opposition M.M.FS. of the series windings A_1 A_2 are increased; which reduces the secondary voltage S, the presence of the separately excited coil B preventing the flux in the poles n_2 s_2 being wiped out altogether. The secondary voltage having dropped, the voltage between the shorted brushes and the positive main brushes must rise, causing the shunt coils D to increase the flux through the part poles n_1 s_1, thereby replacing the flux withdrawn from the part poles n_2 s_2, and so keeping the speed constant.

When under load the armature is divided into a motor portion and a generator portion by the shorted brushes, and the M.M.F. of the motor part will be in opposition to that of the generator part. With a certain transformation ratio these M.M.FS. are equal and opposite, but in the case of the arc lamp converter just described, on approaching the short-circuit condition the M.M.F. of the generator portion is much greater than the motor part, and a cross flux already referred to passes between the shorted brushes, following the path shown by the dotted lines in fig. 1, causing a large parasitic current to flow between the shorted brushes. This cross flux can be neutralised by strengthening the M.M.F. in the pole n_2 and weakening s_2, and the parasitic current traversing the coils A_1 A_2 performs this function to a great extent; but to entirely neutralise the cross flux the authors place the shunt coil B, which maintains its strength throughout, on the pole n_2, and the coil C—which becomes gradually weaker towards short-circuit—on the pole s_2.

These machines are absolutely automatic in their action, and will run for any length of time on open circuit, full load, or with the secondary terminals of the machine short-circuited, for any length of time. They can be worked with perfect safety to the operator, and no damage can be done to the lamp, as the current can never exceed the full-load working current. In cases where the lamp has to strike automatically, this is insured by the fact that when the carbons are brought together there is an instantaneous rush of current of about twice the full load working current, which makes the lamp strike. This current settles down to the full load value in less than a second, and if the lamp does not strike, the machine merely allows normal current to pass through the shorted carbons.

A variation in the secondary characteristic can be produced by inserting a shunt regulator. Similarly, a constant current of practically any value, covering a very wide range, can be obtained for a given range of voltage by merely fixing the position of a shunt regulator handle.

Fig. 5 shows some actual curves taken from a test on a machine. The curve 1 is vertical, and one might suppose there would be instability when working on the vertical part of the curve. This is not the case, as it is quite possible to arrange these machines to work two arc lamps in series. When one lamp only is working, the other being short circuited, the machine is quite stable, and supplies the remaining lamp satisfactorily with the same current, but at a lower voltage. As far as the authors are aware, this is the first time such a result has been obtained.

The various characteristic curves as shown in fig. 5 are produced by altering the resistance in circuit with the shunt coil B, and this being an extremely simple thing to do, such a machine is specially adapted for working a cinematograph, and in fact any kind of projector lamp, because of the ease with which the light intensity can be altered by adjusting the amount of current passing through the arc, 50 per cent. above or below the normal.

It is possible with such a machine to place it at a long distance from the operator, and merely bring two small wires to the shunt regulator at the operator's hand; any alteration to the intensity of the light can be obtained by adjusting the shunt regulator handle.

A cinematograph machine capable of giving a supply of 50 amperes to a 50-volt arc is 22 in. high × 21 in. wide × 14 in. long, and weighs 5 cwts. The efficiency of such a machine works out at from 75 per cent. to 80 per cent. on full load, and it will, therefore, save, when replacing a steadying resistance worked off a 440-volt circuit, about £13 per week; when replacing a steadying resistance worked off a 220-volt supply, some £5 per week, and when replacing a steadying resistance worked off a 110-volt supply, the saving will be about £1 10s. per week. These figures are based on the assumption that the price of current is 3d. per unit, and that the lamps are used for 50 hours per week. The price paid for such an installation, working on these assumptions, will be saved, in the first case in four weeks, in the second case in about 10 weeks, and in the third case in about 35 weeks.

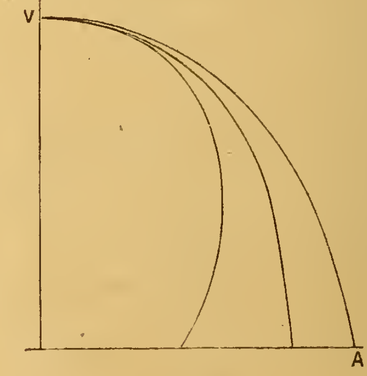


Fig. 5.

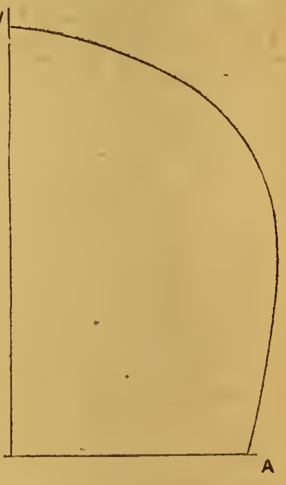


Fig. 6.

In electric welding any of the characteristics shown in fig. 5 will be suitable. The primary supply voltage should be low, for the machine can be made rather lighter, more efficient, and of better proportions, the lower the primary supply voltage.

A very good portable welding set could be made by supplying in conjunction with such a machine, an 60 or 90-volt battery capable of giving high discharges for short periods.

Fig. 6 shows the relationship between the secondary amperes and voltage of a 220-volt machine made for the purpose of supplying two 120-ampere 60-volt arc lamps in series. The efficiency of this machine, when supplying the two lamps in series, was over 92 per cent. The dimensions of the machine are 24 in. high × 22 in. wide × 24 in. long, and it weighs 8 cwt. net.

The weight of the set, and the space taken up, have probably never been reached before within 100 per cent.

The weight and the space taken up are remarkably small, when it is considered that each part of the armature, and each part of the field system has to be capable of dealing with the full primary voltage and the full secondary current at the same time.

Under heading (3) are machines which are used for converting alternating currents to direct currents; these are really the machines which come under headings (1) and (2), supplied with a suitable number of collector rings to suit the number of the phases of the supply. The advantages to be obtained by using such machines for this purpose are as follows:—

The direct-current voltage taken from the secondary is more or less independent of the alternating supply voltage, and can be varied either automatically or by hand without altering the power factor of the alternating current supply to any appreciable extent. It is evident, therefore, that machines of this kind can be used for all the purposes set forth under headings (1) and (2) by applying similar windings to the part poles n_1 s_1 and n_2 s_3, and when supplied with collector rings and a belt pulley this machine is extremely valuable for teaching purposes in technical colleges.

With the cross brushes up such a machine can be used as a direct-current dynamo, a direct-current motor, an alternating-current dynamo, an alternating-current motor, a combined direct and alternating-current dynamo, or a split pole rotary converter. With the cross brushes down it can be used as a direct-current auto-transformer, converting if desired from constant potential to constant current, and again as a rotary converter, converting from alternating to direct current of practically any voltage between given limits.

THE TECHNICAL PRESS.

The following interesting remarks, reprinted from an American exchange, were made by Mr. Hugh M. Wilson, late manager of the *Railway Age* (U.S.A.), at a testimonial dinner recently given to him at Atlantic City :—

"I am proud of the fact that I have been a newspaper man and a publisher. I am proud of the fact that I have been connected with the railway and technical press. I am yet more proud of the friends and acquaintances which that connection has brought to me. I am inclined to think that the functions, the opportunities and the merits of the technical press are not as fully understood and appreciated as they should be. Nor is the ignorance in this respect confined to readers and patrons; some editors and publishers are among the guilty.

"One of the greatest menaces to public sanity and public morality in this country is the jaundiced irresponsibility of a large section of the daily press and of many popular magazines. Under the guise of upholding public morality they are following a policy of commercialism that is frequently conscienceless and that is always dangerous in its tendencies. A great popular journal is not now a great moral force; it is a great commercial enterprise which exploits the poorer classes of the people. As money makers, as manipulators of the public for profit, our 'railway barons' and our 'captains of industry' are mere babes and sucklings in comparison with the men at the head of some of these journals of general circulation. These plutocratic publishers, these moulders of public sentiment, make their money out of advertising patronage—which they can command by reason of enormous circulations. Great circulation is not always compatible with editorial decency and self-respect. These circulations are built, not upon the accuracy of what the papers print, not upon the soundness of the views they express, not upon the mental and moral healthfulness of the information they disseminate, but upon the degree to which the 'human interest' of the reader is stimulated and held. The appeal to the element of human interest is the controlling factor in the business and editorial policies necessary to large circulations. It ruthlessly demands startling 'stories' and picturesque distortions of facts. The truth is nothing; the interest, the thrill, the heart-beat of the reader is everything. Here is a condition that, aggravated by the complexity of modern existence and by the diversity of human knowledge, makes accuracy of statement and the setting forth of facts in their true relations impossible, and, for the purpose of the sensationalist, undesirable. Furthermore, the specialisation of endeavour in all lines of business and thought renders it most difficult for even the best-intentioned editor of a daily paper to do justice at all times. A writer, however facile and quick of comprehension, must be in the atmosphere of things in order to write of them with due regard to truth and proportion. The fundamental facts underlying industrial affairs are elusive, and in times of popular excitement are easily lost to sight. They are liable to be swamped in tides of popular prejudice and plausible special pleading.

"Such, briefly, are the conditions out of which spring the opportunities and the grave responsibilities of the technical press. It should be the work of the technical journalist to rescue the business interests of this country from the riot of ignorance, untruth, half-truth, distortion of facts, sensationalism and crooked thinking—the whole brood of abuses that yellow journalism has introduced into the treatment of serious business affairs. The technical journal may lose much of its force; it may fail of the full performance of its duty; and it may squander its great opportunities by being too narrow in its scope. On the other hand, the readers and the patrons of these journals may make the mistake of minimising their functions and misunderstanding their mission.

"The day has gone when a technical journal can be looked upon as an instrument of charity, as a means for helping the publisher just because he needs the money. It is folly to look upon it as a mere scheme of questioned legitimacy. Likewise it is unprofessional and it is business suicide for the publisher to render only so much service as will enable him to pull the thing through with a satisfactory profit. He must deliver the goods; and when he does deliver the goods, he is entitled to rewards commensurate with the quality of the goods and the completeness of the delivery.

"I think that there is a tendency to make these papers too exclusively technical. I do not mean that the text should be less thoroughly scientific; I mean that the editor should keep in mind the vital fact that while an engineer, for instance, should be a technologist, he cannot be a really great engineer unless he is also a man of affairs. The technical journal of the first class is the companion of the mature man, not of the schoolboy. The engineer, the railway manager, the manufacturer, or the artisan in the shop, who is doing his work in the world is a human being, and oftentimes he is a statesman. To expect this sort of a being to be content with cosines and tangents, with cold-hash reprints, with complex formulæ, with terrifying terminology, with theoretical abstractions, and with these things alone, is a pathetic joke. And the worst of it is, he will refuse to be content with them. These men want practical engineering work, and the activities of their several callings described, discussed and interpreted not alone technically but also in the terms of the social, economic and political purposes of that work and those activities. Engineering and business problems in the final analysis are not mere problems in mechanics or mathematics. They are problems of society; they are problems the solution of which involves the welfare of the human race.

"These considerations, I believe, sanction the proposition that the future of this country, the sane solution of some of its gravest questions, should be powerfully influenced by our technical press. And let me remark in passing that a somewhat extended familiarity with technical journals in other countries, as well as with those at home, impels me to say that our technical and trade journals lead the world. Our large public questions are to a remarkable degree of an industrial nature. The interworkings of political, economic and business forces were never so pronounced in any nation as they are with us to-day. There never was a time when straight thinking, candid investigation, and courageous speaking, were so much needed as we need them now. And they are needed not alone for the regeneration of the common mob. Many magnates have maggots. In my judgment it is the business of the technical journal to take a larger share in this work than it has done hitherto. It should broaden out, and in its endeavour to broaden out it should have generous co-operation.

"Among the technical journals of the country there are none more worthy than those devoted to the railway industry And there are none upon which so great a responsibility rests. The railway problem has almost infinite ramifications, and the railway business is one of infinite complexity. This variety and breadth of interests defines the scope of the journal that would cover them.

"It requires more men, more brains and more money to make a good railway journal than is required to make an equally good paper in any other field of which I know.

"Whatever may be said in derogation of American railways, the fact remains that they constitute, and for the last half-century have constituted, the greatest force in American political, social and material development A foreign observer who visited this country just prior to the meeting of the International Railway Congress at Washington in 1905 made the remark: 'I am not surprised at what you have done here, but I am amazed that you should have done it all in 200 years.' It is the railway that has compressed into one century the accomplishment of ten centuries. The achievements of railway enterprise is the standard by which railway journalism must be and will be measured."

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"E. P." writes:—"A certain supply authority (municipal) has advised its consumers that from a given date the price of current will be raised from what is now averaging 3 8d. per B.T.U. to 8d. flat rate (owing to the use of metal-filament lamps). The circular reads as though it is only applicable to 'those who have installed transformers.'

"(*a*) Can such discrimination be legally made?

"(*b*) In the event of a mixed system, carbon lamps; series wiring and M.F. lamps; and transformers and M.F. lamps, can the supply authorities make separate charges and demand three meter rents?"

⁂ This query raises a point of some interest. Where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the provisional order, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled "under similar circumstances" to a corresponding supply (Electric Lighting Act, 1882, sec. 19). The same Act provides (by sec. 20) that undertakers must not, in making any agreement for a supply, show any undue preference to any local authority, company, or person. Subject to this, they may make such charges for the supply as may be agreed, not exceeding the limits of price imposed by or in pursuance of their provisional order. They cannot prevent any particular form of lamp or burner; but a consumer must not use any lamp or burner which is likely to interfere with the supply to other persons (sec. 18). It is clear, in the first place, that the use of a transformer and metallic-filament lamps by one consumer interferes in no way with the supply to other consumers. That proviso may therefore be eliminated from the discussion. Two further points arise: (*a*) Is supply to a consumer using a transformer and metallic-filament lamps supply "under similar circumstances" to ordinary supply? (*b*) Is a rebate to ordinary consumers an undue preference? If there had been no section in the Act of 1882 to prevent the company prescribing any particular form of burner, it might well be argued that the use of a transformer was user "under other circumstances." But in view of the fact that this proviso is there, the Act must be interpreted accordingly. As to "undue preference," it would seem that a company which specially favoured the use of ordinary lamps would give them undue preference. Metallic-filament lamps were not in use when the Act was passed; and if their user has made it more difficult for the supply company to make a profit, so much the worse for the supply company. This opinion is advanced on general principles, and without reference to any decided case. It would be extremely interesting to hear the result of a test case in the High Court.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Loud-speaking Telephone Receiver.

Mr. N. D. Blagdon Phillips, whose loud-speaking receiver was described in our issue of June 5, 1908, has invented a further improvement. The means by which the movement of the sound-reproducing diaphragm is amplified in the new receiver is illustrated in fig. 1, where F is a piece of ferrotype, actuated by the polarised electromagnet M. To F is attached a fine wire or thin strip W, the other end of which is anchored at B. About the middle of W a spiral spring S is made fast to it, as shown at A, the straightened end of the spring projecting and being secured to the acoustic diaphragm D. It will be obvious that any movement of F will, through W, cause an amplified movement of D. Fig. 2 illustrates an application of this principle; the instrument is shown in elevation, the left-hand portion being in section.

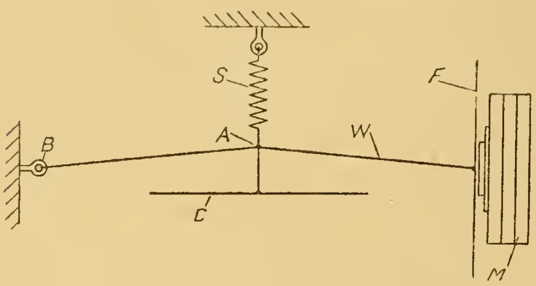


Fig. 1.

In this instrument the fine wire, which was represented by W in fig. 1, is duplicated, W_1, W_2, each operating its own acoustic diaphragm D_1, D_2 and being actuated by attachment to the ferrotype diaphragms F, F; D_1 and D_2 are in proximity, separated only by a thin annulus and clamped together by the rings R, R. A gap occurs in the separating annulus, and a nozzle is attached thereat, through which the sound is emitted. The clamping rings R, R are supported on the blocks C, C.

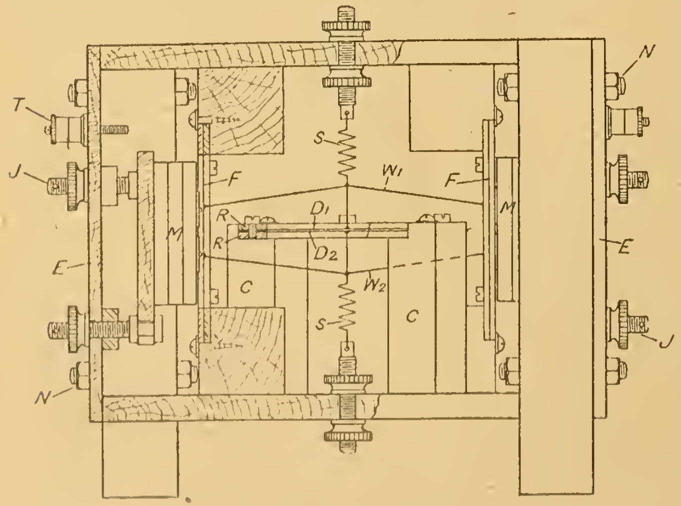


Fig. 2.

The polarised electromagnets M, M are adjustably mounted by the screws J on the wood bases E, E, on which are also placed the terminals T. These bases are held in position by the studs and nuts N, which allow of their being readily removed.

Silvertown Hose: A Large Consignment.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown, London, E., are well known as manufacturers of hose for all purposes. The photograph here reproduced, fig. 3, is of a large consignment of hose for pneumatic drill work,—the 5-in. suction hose at the base being for mine work in South Africa. The Silvertown Co. recently shipped two suction hoses of 24 in. diameter to South America.

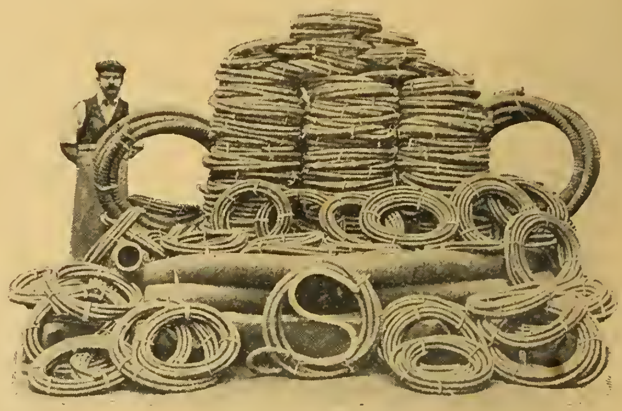


Fig. 3.

The "Facile" Multiple Switch.

Messrs. D. H. Bonnella & Son, Ltd., of 58 and 60 Mortimer Street, W., are introducing a new switch for attachment to electric light fittings having two or more lights, which enables any or all of the lamps to be switched on at will, thus dispensing with multiple wiring to the fitting. In the case of a pendant, for example, the switch is fixed to the ball, and is provided with a handle projecting downwards; by rotating the handle slightly, one lamp (or circuit) is switched on; further rotation brings the second light into action, and so on, while a slight rotation in the opposite direction switches all the lights off with a quick-break and independent motion. The switch is fitted to floor standards, radiators, and other fittings, and serves a purpose which has hitherto been attained, only by round-about means.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Earth Indicating Device.

Referring to "W. H. B.'s" inquiry under the above heading in a recent issue, I think the Marlor and West Leakage Detector and Alarm is exactly what he requires. This is a differentially wound relay with its two coils carrying the main current in the circuit. A leakage on either main disturbs the magnetic balance and operates the alarm. This device, which has been designed for erection on two or three-wire installations, will very shortly be on the market.

L. H. M.

Manchester, *July* 19*th*, 1909.

Discourtesy of a Selected Candidate.

We assume that the column signed by "C. I. E." in your esteemed journal, and headed "Discourtesy *to* a Selected Candidate," had reference to an interview which two of our representatives lately had in London with Mr. . . . .

We had been looking already for some time for a good "designer in switchboards and apparatus," and had decided to offer this position to a gentleman who seemed to have the necessary requirements, and whom we knew from his application to represent us in London. By a pure mistake, it had been neglected to inform him beforehand that the position which we could offer him was on the Continent. Who would describe the astonishment of our representatives when the candidate seemed furious because the position was not in England itself.

It is extremely interesting that this incident—the offer of a position on the Continent to Mr. . . . . (a foreigner himself, as his name would indicate, and most anxious to represent a foreign firm) should be made the cause of his pleading against foreign competition.

Needless to add, that we are very glad that Mr. . . . did not accept our offer.

The International Engineering Co.

Liége, *July* 13*th*, 1909.

The Prevention of Smoke.

Mr. Bennis's letter, published under the above title, calls for little or no comment. Indeed, I fail to quite see the relevance to the heading under which it was printed.

My object in writing the article in question was not to show "how much steam can be got from a boiler," nor "how to burn the largest amount of fuel with a chain grate;" and I certainly do not intend to resurrect the hoary old controversy that has so often raged round the various methods of mechanical stoking, particularly as Mr. Bennis's opinion on this point must of necessity be pledged.

I am quite aware that the method I illustrated and have proved reliable in abolishing smoke, when applied to mechanical stokers, has been patented in many forms "from the early days;" but judging from the tone of Mr. Bennis's letter, the adage that there are none so ignorant as those who won't learn is still quite as true as the method given is efficacious.

The probable causes given by Mr. Bennis for the emission of smoke are evident to the merest tyro, and *are quite superficial*, and seeing that the chain-grate stoker is of the coking type, the last paragraph in his letter is quite illogical and unintelligible.

Wilfred Yorke.

Manchester, *July* 17*th*, 1909.

E.M.F. in a Dead Underground Cable.

I was much interested in the letter by "J. W." *re* the above, and such an experience is, I consider, worthy of being put on record.

The theory, however, of the lead sheathing acting as a pilot from an earth in another district, does not, I consider, account for the jointer receiving a shock off the lead of the cable, because, as I have already explained, the lead sheathing was entirely insulated from earth throughout its whole length, except at the point where the jointer was making contact with it.

Enquirer.

Rating and Taxing of Electric Motors.

I shall be much obliged if you, or your legal contributor, can give me some information as to the proper and legal rating and assessing of motors, steam and gas engines, and how the respective horse-powers are calculated for this purpose.

At the present time, no sooner have I got an electric motor installed in a consumer's premises, than he is met with a demand for the local rate on it, followed up shortly after by the Surveyor of Taxes with further demands; and if the unfortunate user has kept his engine connected up to the gas or steam supply for standby, as is often done for the first few months, at any rate, he finds his rates and taxes doubled.

Again, take another case where it is desired to replace a 30-H.P. steam engine by nine motors on nine separate drives of 10 H.P. each. In this case, owing to the large diversity factor, the average total H.P. required is well under 30, but the motor for each group cannot take account of this, and, therefore, the total H.P. for assessment is 90.

Taking the assessable value as £1 5s. 6d. per H.P., the rates here are at present 5s. 6d. in the £, and on a 10-H.P. motor, the rates levied are £3 8s. 9d. per annum.

This consumer, therefore, having by his conversion to electric driving, increased his available H.P. by 60, is now met by an additional rates bill of £20 12s. 6d. plus taxes, over and above his previous rates, all of which he has to save before he can get any monetary advantage from his electric driving.

I am further informed that a steam-engine user can get an engine assessed at, say, 20 H.P., which with a little speeding up, and, perhaps, increase of pressure will give 30 to 35 B.H.P.

The rates departments are so keen on their pound of flesh, that unless I can find some relief from this difficulty, power supply in this town is likely to come to a standstill just at a time when the outlook appears most favourable.

I can hardly imagine my difficulties here to be unique, and therefore hope that, through your paper, I may obtain some useful information.

I shall be glad to answer any letters from correspondents if you will kindly forward them to me, but for obvious business reasons desire for the present to remain anonymous.

Borough Electrical Engineer (No. 3).

Temperature Errors in Shunted Ammeters.

I have been much interested in the correspondence under the above title in your columns. Your correspondents, however, seem to have overlooked one important point, namely, that, while it is true that if the junction of two dissimilar metals is heated an E.M.F. is thereby produced, at the same time there must necessarily be, somewhere in the circuit, a similar couple tending to produce an E.M.F. in the *opposite direction*, its value again depending upon the temperature. The resulting E.M.F. is consequently solely dependent upon the difference between the temperatures of the "hot and cold junctions," as they are called.

For this reason the question of whether, for example, the connecting lugs are tinned or not is entirely without effect on the readings (contrary to the suggestion of one of your correspondents). Fig. 1 represents diagrammatically the state of affairs in such a case. C represents the end block of the shunt, the dotted line A the layer of tin, and B the busbar or cable connection. There will be an E.M.F. in one direction between A and B, and in the opposite direction between A and C, and since it is clear that both sides of A must be at sensibly the same temperature, however great may be the temperature gradient, these two E.M.F.'s will neutralise one another, and be consequently without effect on the instrument. Such equal and opposite thermo E.M.F.'s exist at a number of points in every system—at every soldered joint in fact—but as they cancel out they may be entirely neglected.

FIG. 1.

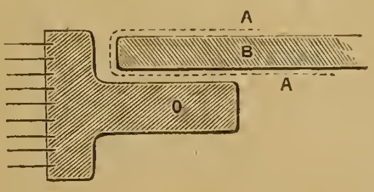
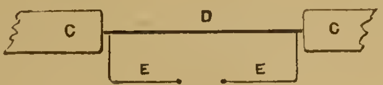


FIG. 2



A consideration of these facts leads to a very simple means of entirely overcoming thermo-electric troubles in shunts. The arrangement is shown in fig. 2, where C C are the end blocks, D the shunt strip, and E E two strips or wires of the same material as D. Into the ends F F of these, the connections leading to the instrument are either soldered or clamped. Whatever the temperature difference between the two ends of D (on which alone the error depends), the points F F will both be at practically the same temperature, and since the circuit F E D E F is composed throughout of the same material, the resulting E.M.F. will be dependent solely on the difference of temperature between the points F F, and will, consequently, be zero, so that the ammeter remains unaffected.

While, theoretically, the wires E E should be attached direct to D, the error introduced by fixing E into the block C instead of to D direct is extremely small, since, in the first place, C and D will not differ much in temperature, and in the second, the difference, whatever it may be, is very largely compensated by the similar difference which exists at the other end of the shunt. It is, moreover, immaterial whether the shunt consist of one strip, as shown in the figure, or of several.

In a switchboard instrument no compensation is, as a rule, found necessary, owing to the extreme smallness of the E.M.F.'s produced. As an example, let us assume the altogether abnormal difference of 100° C. between the cold and hot ends of the shunt. This difference would correspond to one end being in ice and the other in boiling water, and it seems hardly possible to conceive any conditions which could produce such a difference. In any case, if such a temperature did exist the sooner the state of affairs was discovered, owing to the false zero of the ammeter, the better. However, assuming it for a moment to be possible, the resulting E.M.F. in the case of a constantan shunt would be about 0·0035 volts, which, with a drop of 0·1 volt corresponding to full deflection, would mean an error of some 3 per cent., and, as has already been said, this could only be produced by such an utterly abnormal temperature difference as 100° C.

For many purposes, however, such as portable instruments, where the contact surface is often deficient owing to the cables used, and still more for potentiometer work, where the E.M.F.'s to be measured are frequently very small, such thermo-E.M.F.'s are of considerable importance, and have to be eliminated. Two courses are open—one being to use manganin for the shunts, as suggested by several of your correspondents, and the other to adopt the simple method of compensation described above.

Kenelm Edgcumbe.

London, S.W., *July 19th*, 1909.

With reference to the correspondence in your last week's issue, I have much pleasure in supplying the information asked for by Mr. Wright.

The P.D. across the shunt in question with 10 amperes passing is approximately ·008 volt. The temperature of the hot end of the shunt was considerably below red heat, and was only just sufficient to cause the solder (which holds the resistance strip into the lug) to flow, but not enough to cause it to run out.

With regard to the letter from "W.C.," there is one point with which you do not deal in your Editorial note, namely, his reference to "tin." "W.C." evidently thinks that the solder at a mechanical joint has an effect on the thermo E.M.F. of the junction. This, of course, is quite incorrect, because the whole of the solder is at one temperature, namely, that of the junction, and cannot, therefore, produce any P.D.

In my article I mentioned that the surface of the shunt lug was not tinned, but that the copper strip conductor carrying current to the shunt was tinned. I wished to show up the fact that it is wrong to send out resistance shunts with untinned lugs, because purchasers would not care to tin them themselves, and so risk spoiling the shunt by heating it. It is well known that copper surfaces untinned will not remain permanent for any length of time. In this particular case, if the shunt lug had been tinned, the serious heating at the joint would have caused the solder to melt and so automatically seal itself off by soldering the two surfaces together. I should think that it would be better so to design shunts that bad contacts are hardly possible, rather than to leave the contacts in a dangerous state, and provide resistance material which may have no thermo-E.M.F. with copper.

W. Fennell.

Wednesbury, *July 19th*, 1909.

Municipal Trading and the Electric Lighting Acts (Amendment) Bill.

I notice in your last issue that there is another letter from "Contractor." While I admire his "bull-dog pertinacity," I really think it is time to let the matter drop. Someone must have the last word, and I think it is usual for the writer of the article to reply finally to his critics.

With regard to the constitution of the House of Lords, it seems almost unnecessary for me to detail it. It is, however, obvious that the landed proprietors, brewers, railway magnates and capitalists, who go to make up the House of Lords, are not the people to have much sympathy with local authorities. In any case, the matter was disposed of very airily in the Lords, and the Bill was left, as I pointed out in my article, in a totally unworkable form. The formidable list of amendments to the Bill, as published in your last issue, proves my contention that the turn of the local authorities and those practically acquainted with the working of municipal trading concerns, would come in the Commons.

Regarding the compulsory shareholder argument, which is always trotted out on these occasions, I think it worth while to point out that a ratepayer has as much control over the policy of a local authority as a shareholder has over that of a company; both are in the same position; if they do not like the policy adopted by the majority, they must clear out or put up with it. There is this difference, however, that it is possible, and indeed quite usual, for one or two directors to have in their own nomination a controlling number of shares, so that they dominate the company and force their policy upon other unwilling shareholders. With a local authority, councillors cannot vote themselves into power, and must meet the electors every three years. It follows, therefore, that the policy of the local authority is that of the majority of the ratepayers, whereas the policy of a company may be controlled by one man permanently. It must be taken, therefore, in the absence of evidence to the contrary, that where there is a municipal electric wiring department it is being carried on with the knowledge and approval of the majority of the inhabitants of the town in question. I have already shown that the contractors' compulsory contribution towards that department lies somewhere between 4s. 2d. and zero, and will usually be a negative amount, or, in other words, the "Ratepayer Contractor" will receive a small dividend. It is foolish, therefore, to say that the contractor is forced to provide the money which is used to compete against him, as in the ultimate event his dollar would not go very far in establishing a wiring department.

With regard to the misquotations, I showed in my last letter, in italics, the words "Contractor" had missed. I explained their importance and must leave "Contractor's" action to the judgment of your readers.

With regard to his 10 per cent. loss absurdity, I can only repeat that I quoted in my last letter the actual words on the subject from my article. I am pleased to remark he now writes correctly about an *outside* loss, instead of an *average* loss. In reply to his question, I must repeat that the basis on which I fixed a 1d. rate as the maximum of possible loss, was that of my own inside knowledge of municipal matters. I said "the wiring department usually pays, but it cannot very well cost more than a 1d. rate (if it did, the ratepayers would be up in arms)." I refuse to have anything to do with percentage losses and percentage profits. My own wiring department pays, and my Council would not wait for the loss to equal even a 1d. rate, but would close the wiring department the first year in which it did not show a profit; so that contractors in my district cannot complain of having to contribute even half-a-dollar towards the support of the department which competes with them.

With regard to contractors, I have in no way modified my position, as at the very outset I pointed out that gross cases of bad work in this district had forced us to open up a wiring department. In my last letter I pointed out that it was the bad work of some contractors that was responsible for municipal wiring departments in general, and I think other engineers will bear me out in this. I am afraid that "Contractor" is running up against one of the laws of nature, when he suggests that it is not right that the "many should suffer because of the misdeeds of the few." It is a universal experience the many pay a Police rate because of the few who break the law. We are all prevented from enjoying many of the beauty spots of England, because of the few who have abused the privileges granted in times gone by. Wiring contractors suffer to-day as a body, because those responsible for electricity undertakings will not stand by and see these undertakings ruined, just to allow the lower class contractors to have a good time at the expense of the community.

Contractors must realise that their financial welfare is, and must always be, a secondary consideration to that of the supply undertaking. If contractors are unable to deal with their black sheep themselves, the local authorities and undertakers generally will by some means or another prevent these black sheep from injuring the supply undertakings.

Borough Electrical Engineer.

The discussion on the above by "Borough Electrical Engineer" and "Contractor" has degenerated into a matter as to what each said or meant or did not say or mean.

In the smaller towns in the provinces, the private contractors who do wiring, as a rule, consist of firms that were in existence before the inauguration of the public supply of electricity as cycle agents, ironmongers, plumbers, gasfitters, house decorators, hot-water engineers, &c., and have tacked electric lighting on to their other business. This statement may not altogether hold good in the cities and larger boroughs, but it is certainly the condition of things in the small towns.

In the writer's town there are three firms of house decorators, plumbers and gasfitters; two firms of cycle and motor-car engineers; one firm of cycle, motor-car, hot-water and gas engineers; and one ironmonger, that carry out wiring work, while there is not a single firm doing installation work only.

Now these private firms are in business for the making of profits or dividends, and will endeavour to sell to their clients that which most favours this object, caring absolutely nothing for the success or otherwise of the public supply undertaking.

One firm is the sole agent in the neighbourhood for a large gas engine company, and consequently it would be contrary to human nature to expect the firm to advise its clients to adopt electric driving. It cannot be disputed that electric lighting is a serious competitor with other forms of lighting and driving, and even with house decorators, for whilst the decorator was usually sent for annually before the installation of electric lighting into premises, the decorations after the installation last for many years. The writer met with a case only a few days ago where a prospective consumer of electricity was influenced by a house decorator-wiring firm, and has gone on using gas for at least another year. Perhaps "Contractor" will say what he would do in these circumstances! Surely he cannot expect that electrical engineers will calmly put up with this kind of thing!

I believe the only cure for stagnant business is for each undertaking to have powers to sell its own wares, and to exercise those powers to such an extent as is found necessary to protect its own interests.

The Bill, as amended by the House of Lords, gives power to borrow money to carry out free wiring, but, in my opinion, this is very unsound business, and the gas companies are likely to find this out before many years are gone.

In order to please a few contractors, corporations are asked to pile up debt (that everlasting bone of contention), on the installation of wires on private property when it would be just as easy in most cases to get the owner of the property to pay cash.

I have not said anything about the total incompetency of small wiring firms to deal satisfactorily with the application of electricity to driving and other purposes than lighting.

Another Borough Electrical Engineer.

Tramway Sports.—The sixth annual sports and carnival of the Liverpool Corporation Employés' Social, Athletic and Thrift Society, were held on the Tramways Athletic Ground, Green Lane, on Wednesday and Thursday last week. The chief features consisted of the crowning of the Rose Queen (Miss Muriel Hutchinson), the ceremony being performed by the Lady Mayoress (the Hon. Mrs. Chaloner Dowdall); a decorated bijou tramcar, conspicuous upon which were a uniformed motorman and conductor, of six and four years of age respectively; a group of national dancers, and a tableau, "The Arktown Fear-nowt." The hon. president of the Tramways Employes' Society is Mr. C. W. Mallins, A.M.Inst.E.E. (general manager), who was responsible for the designing and carrying out of the carnival arrangements, and he acted as chairman of the sports committee.

MR. BYNG'S LATEST SPEECH: A COMMENTARY.

It is the custom of the chairman of the General Electric Co., Ltd., to annually gather his handful of loyal staff-shareholders around him in Queen Victoria Street and in presence of nearly an equal number of representatives of the Press to deliver his views upon the current position of the electrical industry, as represented by the G.E.C., and to quite incidentally, of course, touch upon some other matters of wider concern. We always hear and read Mr. Byng's utterances with interest, and we believe the electrical trade will be deprived of a highly entertaining item which always comes in the summer months when other things incline to comparative dulness, if for any reason the old pilot of the G.E.C. should think he saw an error in his ways and fall into the less entertaining customs of more orthodox chairmen. We do not apprehend that we are in any immediate danger of that change taking place, and for this year, at all events, we are once again afforded the pleasure of seeing things as Mr. Gustav Byng sees them, for his speech of Monday last to his happy family is fully reported on another page of this issue. The custom of delivering speeches at company meetings is, we believe, one that is somewhat peculiar to this country, and when gentlemen from across the Atlantic have presided over the doings of Anglo-American concerns running here they have not failed to remark upon the difference. We hope that we shall long continue the custom, for although frequently meetings are mere formal affairs, the chairman being guardedly careful that nothing save an amplified statement of the already circulated report shall be vouchsafed unless he is sorely tried by shareholders, there are other meetings at which statements of supreme interest are made which are extremely useful to place on record, both for the immediate "news" purposes of the moment, and for future reference long after they have been uttered and forgotten. Mr. Byng's speeches belong to this latter class, and those who take an interest in the state of the electrical trade might do worse than spend their summer vacation sitting beside the sad sea waves beguiling themselves with copies of the ELECTRICAL REVIEW, containing his addresses of the last six or seven years. We ourselves have spent quite an interesting hour or two with the speeches, and really feel greatly indebted to Mr. Byng for inclining us to make and take advantage of so pleasurable an opportunity.

It should be borne in mind that the results recorded by the directors of the company for 1908-9 are, as to net trading profits and income from investments, £18,448 better than they were in the preceding year. After paying 4 per cent. on its £200,000 first mortgage debenture stock, and 5 per cent. on £250,000 of preference capital, a dividend of 5 per cent. per annum is to be paid on £373,950 ordinary capital. In addition to this, in accordance with its generally prudent policy, the board has placed its additional profit to strengthening the financial position of the company by adding to the reserve account £16,145. This is wise, for in the preceding 12 months the allocation to this account was only £1,974, as fluctuations in the prices of raw materials more or less seriously affected the net result in that year. It will be observed that Mr. Byng in his survey of the past nine years shows how much greater is the margin of security for his preference shareholders than it was nine years ago. He is surprised, in presence of that fact, that the preference shares are quoted at a discount. How far Mr. Byng's apostleship of decadence, and his preachments regarding the impossibility of conducting industries here progressively and with profit, are responsible for the quotation, can only be a matter of mere conjecture, but perhaps the Stock Exchange authorities and investors can be persuaded to evaluate the G.E.C. preference capital at its just figure according to the present balance-sheet, rather than by paying heed to the opinions that may not unreasonably have obtained currency in Throgmorton Street through the circulation of the views of Queen Victoria Street. There can be small doubt that the low prices of electrical securities is responsible to a great extent for the unwillingness to put money into electrical industrial enterprises, but the reasons why electrical prices are low is too lengthy a matter to enter into here. The G.E.C. investments in other companies stand in the balance-sheet at £61,981, and the income on these "does not vary much" and has "resulted in a return of about 10 per cent." Now these investments are partly, it seems, shares in companies selling the G.E.C. manufactures in foreign countries—France is one of them—and the tariff wall there is so high that Mr. Byng complains unceasingly about it, and this year he says the alterations are making the company very anxious. So that Mr. Byng, operating in a Free Trade country, is able to export electrical manufactures into a country which deliberately raises tariffs against him, and yet he succeeds in making a return which does not vary much from 10 per cent. We do not propose to argue the point; we only point it out as an interesting commentary on the speech reported on another page. Pressure of home competition is forcing him to seek orders more and more abroad. We are quite sure that if, on the investment in France, he can make 10 per cent., the game is well worth continuing, and in that way the departments of the works which are not now as fully occupied with business as they might be would be kept in full swing, avoiding that "waste" regarding which the speaker was so illuminating.

Really we think Mr. Byng is like his grumbling agricultural friend when, in presence of a balance-sheet which must make other companies envious, he says, "Generally speaking we cannot be dissatisfied with the year's working." Of course he is not making as high a rate of interest on his investment as he could wish. Who is? When he remarks that his profits "do not come up to the standard of profits obtained by foreign electrical companies working under similar conditions," we are tempted to ask which are these foreign companies working under identical conditions, and confining themselves to electrical manufacturing—but that, too, is too large a question to discuss here. The G.E.C. suffers "as almost everybody does, from a *general trade depression*," but the profits have been assisted by "a steady market," so that when others are looking hopefully for trade improvement, Mr. Byng can look back and remember that when trade generally was at its lowest ebb he could make 5 per cent. and an extra £18,000 for strengthening his financial position. "The working of a large commercial concern like ours shows clearly the effect of Free Trade," says Mr. Byng. It certainly is an interesting illustration!

Mr. Byng says that almost every English factory is at present being worked below its productive capacity. That is no more than one would expect when "general trade depression" has been experienced. Nine out of every ten would say "We could do more work with our existing plant." Yet in the same speech Mr. Byng told us that his telephone factory at Peel Works has had to be extended, that his new Osram lamp works will soon employ over a thousand skilled hands, that the carbon works are largely occupied, and are successfully competing with foreign firms, that batteries, porous pots and dry cells, are made at Witton, that additional plant has been put down at the tube works, that the art metal works are now making electric radiators and stoves and electric light fittings, and that, from the technical point of view, "all our works have done well," the manufacture of big plants having "greatly enhanced the reputation of the Witton electrical engineering works, strengthening their position in the foremost rank of electrical engineering firms." Again, "the working of a large commercial concern like our's shows clearly the effect of Free Trade." Really, Mr. Byng, this does not look very much like "brains and sinews now retrograding in idleness." We do not argue the merits of the question, we are merely quoting Mr. Byng.

It is interesting, in connection with this working of factories below their productive capacity, to draw attention to the remarks made by Mr. W. S. B. McLaren, the chairman of the Electrical Construction Co., Ltd. (see "City Notes" in this issue):—"During the present decade about £7,000,000 had been invested in this branch of the business, the greater part whereof was earning no dividend. . . . . Although there had been a steady and increasing outlet for electrical plant, the power to supply had been grossly in excess of the demand, in consequence of the huge increase of capital."

With a confidence which is all-inspiring, or something else, Mr. Byng demonstrating that there is nothing up his sleeve, propounds his remedy for getting something for nothing—"all this could easily be accomplished," and he is anxious for Mr. Lloyd George to know that a Budget could be framed "which would raise the production of the nation to its full capacity." Be that as it may—Mr. Byng is still at Queen Victoria Street, and there are other bidders for the Chancellorship. Mr. Lloyd George with a characteristic humour might give Mr. Byng a card of introduction to the fallen Chancellor of the Fatherland, who has found even greater difficulties in raising finances.

For the interest of our readers we have given below some extracts from speeches delivered during the last few years at the company's meetings. Some of these will be worth comparing with last Monday's speech, especially the remarks relating to the carbon factory.

Mr. G. Byng's Speech at Annual Meeting, July, 1903. *See E.R., July* 31*st*, 1903, *p.* 191.

The largest amount of the Witton deficit comes from the carbon works, and it is mainly due to what must be called unfair foreign competition. . . . . We started our carbon works because we were entirely depending upon German manufacturers. . . . We are now making carbons equal and even better in quality than the Germans. . . . . The three largest foreign manufacturers have decided to reduce their prices to a level which should be unremunerative to us, and with a view of killing the British manufacturer, are prepared to work at a loss to themselves in this country until they have achieved this object. . . . . The Admiralty, War Office, and many other Government and public bodies . . . . will support us in spite of the price regulated by such indicated foreign policy, and with this help and being able to obtain the raw material at a lower price than the Germans can obtain it, I still trust to be able to keep the carbon factory going until the time comes when the country sees the folly of free imports directed solely against the English manufacturer. This experience of ours in carbons must prove to anybody that the establishing of a new industry in this country is practically an impossibility under the present system.

In reply to a shareholder who asked, "Do you say that these Witton works will not be profitable unless we have Protection?" Mr. Byng said: "If we do not get Protection in a few years' time it will be quite impossible to keep them going, except at a great loss . . . . We are not going to stand a big loss every year for the public benefit. *The carbon works will be shut up unless we get Protection.*"

The Electrical Review in its leader dealing with this speech, wrote, "*Killed industries have a peculiar habit of coming to life again.*" This was six years ago. The carbon works, we are glad to say, are not shut, nor, judging from Mr. Byng's comment of Monday last, are they at all likely to be; Mr. Byng has protected them for himself!

Mr. G. Byng's speech delivered July, 1904. *See E.R., July* 29*th*, 1904.

Speaking of the electrical industry, of which he knew every detail, he would say that he did not believe that the users of electricity would have to pay any higher prices than they were paying now; on the contrary, if they continued free imports, the user would have to pay increasing prices, because the *competition of the home manufacturer would grow less and less.* He could submit proofs of that contention, which would show that in many instances foreigners were obtaining enormous profits through lack of English competition, and that *home competition under Protection would be so great* that it would be impossible for any manufacturer to take more than his ordinary legitimate share of profit.

A shareholder asked—

"Was it to be understood that the policy of the company would fail if we did not have Protection?"

Mr. Byng replied—

"The policy of the company was at present based on the supposition that Protection would come. If it *did not come within five years* they would have to discharge hundreds and thousands of workmen."

The five years have elapsed, the company is still proud of its achievements, and the hundreds and thousands of workmen are presumably still at work.

Mr. G. Byng's speech, delivered at the Annual Meeting in July, 1906. *See E.R., July* 27*th*, 1906.

He could not pretend to be satisfied with the profits which the company had been able to make during the last years. . . Those who knew the inner working of the business could testify that they had no dead weight—there was not a man in their employ who was not a working man. There was not a single machine in their vast factories that did not turn and work during 53 hours of the week. There was not a space in their warehouses that was not utilised. It could not be due to any internal deficiency, to any circumstance over which they had direct control that the capital invested did not produce a more satisfactory return. There must be some other reasons, and one, to his mind, was a most important cause of the present inability of their factories—as, indeed, of many other concerns in the country—to work at an adequate profit. Every one of the articles they manufactured had to be sold here, and everywhere, in competition with international manufacturers. These manufacturers were assisted by their Government—they were not.

At this meeting a shareholder remarked that the company was earning 10 per cent., but did not divide up to the hilt. He thought the chairman took an unduly gloomy view of the prosperity of the industry. He was glad the chairman had recovered his usual health.

We hope that the current year will be even more successful than the past has been for the G.E.C., and that in spite of all its chairman's fears for the general business of the country, he, at least, will next year be able to tell us of still further extending works, more "hands" employed, and bigger profits—to distribute as increased ordinary dividend.

PARLIAMENTARY.

L.C.C. Tramways and Improvements Bill.

On Wednesday, July 14th, the Select Committee of the House of Lords, presided over by Lord Clifford of Chudleigh, commenced the consideration of this Bill. The measure has already passed the House of Commons. Mr. Erskine Pollock, K.C., for the L.C.C., explained that the Bill was unopposed on various points, and he proposed to deal with that section of the Bill which authorised the extension of the tramways down Farringdon Road to a point just by Charterhouse Street. This proposal was opposed by the Great Northern Railway Co., who contended that it would cause a congestion of traffic outside their goods station in the Farringdon Road. Evidence having been given in support of the Bill, the Committee adjourned.

On Thursday, July 15th, the Committee continued the consideration of the Bill.

Evidence was given on behalf of the Great Northern Railway and the costermongers.

The Committee decided to allow the tramway to be constructed down the Farringdon Road to a point just north of Charles Street.

The case was then proceeded with for the reconstruction of the Highgate Hill tramways.

Mr. Pollock, K.C., explained that it was proposed to acquire the existing cable line, under agreement, for £13,000, and to reconstruct it and widen the track in some parts at a cost of £41,000. The proposal was opposed by Mr. T. Bloxham, the freehold owner of Fairseat House, which it was proposed to acquire.

Evidence having been given on either side, the Committee found the preamble proved, but were of opinion that not more of Fairseat House and grounds should be acquired within the limits of deviation than such portion as might be required for the widening of the road.

Mr. Pollock asked to be allowed to consult his clients, and the matter was adjourned.

Other parts of the Bill which are not opposed were formally proved, and the Committee adjourned till Monday.

Gateshead and District Tramway Bill.

This Bill came before Mr. Emmott's Committee of the House of Commons on Unopposed Bills on Thursday, July 15th, the object being to authorise the construction of new tramways, &c.

Mr. Kennedy (Parliamentary Agent) said the Bill had already passed the House of Lords, and had been amended to give effect to several requirements of the Local Government Board and the Board of Trade. There was, however, one clause which Mr. Moon had suggested, which the promoters did not want to insert.

Mr. Moon, K.C. (Speaker's Counsel) said this was a case in which the promoters, who were a tramway company, proposed to take power to substitute for their tramways the trackless trolley system, and if that was introduced, then, under the Bill, the local authority had no power of purchasing the equipment, so that their power of purchase of what was virtually a tramway was practically taken away. He pointed this out, and Mr. Kennedy said he would consult his clients as to whether they would accept an amendment giving the local authority power of purchase, but he now said they would not accept it. He had communicated with the Local Government Board in order to ascertain what the views of that department were, but unfortunately Mr. Boyce was ill, and he had not heard what their views were. He had also communicated with the authorities of the House of Lords, but they were not aware when the Bill passed through their House that the effect would be practically to discharge the power of the local authority for purchasing the equipment. He suggested that they should adjourn the consideration of the Bill until they had consulted the Local Government Board.

Mr. Kennedy pointed out that the clause in question was agreed to by the Board of Trade, and the Bill and clause were in a form which had been agreed to by the local authority, for the powers could only be exercised subject to their consent. The local authority did not want, through that Bill, to be committed to the acquisition of the trackless trolley system. The promoters had, at the request of the local authorities, excluded the clauses from the tramway provisions, and they did not want to be under the obligation of acquiring the overhead equipment. As the clause stood, the company could not install the system without the consent of the local authority, who would be able to make such conditions as they chose with regard to purchase. That would be better than tying the hands of the authority with regard to the future of this system.

The Chairman said it was no use arguing the matter that day, as they were not in a position to settle the clause.

The consideration of the Bill was then adjourned.

Electric Lighting Acts (Amendment) Bill.

Standing Committee C of the House of Commons sat on Tuesday (there not being a sufficient attendance on the day arranged for last week) under the chairmanship of Sir Francis Channing, to consider the above Government Bill.

Clause (1) as follows was agreed to without discussion:—(1) "The Board of Trade may by Provisional Order authorise any local authority, company, or person, who is authorised by the same or any previous Provisional Order or by Act of Parliament to supply electricity in any area, to acquire compulsorily, or to use, for the purpose of a generating station, any land specified in the Order, whether situated within or without the area of supply, and, in the case of a local authority, whether situated within or without their district. (2) For the purpose of the acquisition of land authorised to be taken compulsorily under any such Provisional Order, the provisions of the Land Clauses Acts which relate to the purchase and taking of lands otherwise than by agreement, and to the entry upon lands by the promoters of the undertaking, are, subject to the modifications set out in the First Schedule to this Act, incorporated with the Electric Lighting Acts, as well as the provisions of those Acts already so incorporated by the Electric Lighting Act, 1882. (3) Rules made by the Board of Trade under Sec. 5 of the Electric Lighting Act, 1882, shall provide for proper notice being given of an application for a Provisional Order, by which it is proposed to authorise the compulsory acquisition or use of land for the purpose of a generating station, to owners, lessees, and occupiers of land, and also for public notice being given of the proposal by advertisement."

Clause (2) was as follows:—"It shall not be lawful for any undertakers after the passing of this Act, except with the consent of the Board of Trade, to construct any generating station on any land acquired by them after March 31st, 1909, unless the construction is authorised and the land is specified in a special Act or Provisional Order, and the Board of Trade shall not in any case give such consent until notice has been given, by advertisement or otherwise, as the Board of Trade may direct, to owners and lessees of land situate within 300 yards of the land upon which the generating station is to be constructed, and an opportunity has been given to those owners and lessees of stating any objections they may have thereto."

Mr. A. H. Scott moved, after the word "direct," to add "to the local authority of the district in which the land is situate, and"—

Mr. H. J. Tennant, the Parliamentary Secretary to the Board of Trade, who is in charge of the Bill, asked the Committee not to accept the amendment, which he said was, he supposed, moved in the interests of the inhabitants of a district. The Government did not think it was necessary to give notice of the erection of a generating station to the local authority specifically. If the clause was left as drafted, local authorities would have all the protection they required in their capacity as owners of land.

Mr. Scott said he considered it very necessary that those notices should be sent to the local authority. Mr. Tennant remarked that his hon. friend's purpose was really met by the words in the clause "to owners and lessees of land." That would include local authorities, where they were the owners of parks or other lands.—The amendment was carried.

Mr. Scott next moved to delete the word "land" from the clause and insert "dwelling houses." Mr. Tennant said the amendment was really a restrictive one. Surely where there were dwelling houses there must of necessity be land?—The amendment was by leave withdrawn.

Mr. Scott then proposed to substitute the words "such local authorities" for the word "those" in the clause, and it was agreed to.

Mr. Scott moved to add to the clause, "This section shall not apply to any station for transforming, converting or distributing electrical energy." Mr. Tennant accepted the addition on behalf of the Government, and the clause, as amended, was agreed to.

Clause (3), as follows, was adopted without discussion:—"For the purpose of enabling electricity to be brought into an area of supply from a generating station belonging to any undertakers outside that area, the Board of Trade may by Provisional Order apply to any roads, railways or tramways situated outside that area the provisions of the Electric Lighting Acts which authorise, or enable the Board of Trade to authorise, the breaking-up of any road, railway or tramway, so far as those provisions do not already so apply: Provided that a Provisional Order authorising the breaking-up of roads outside the area of supply shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade in any case in which the consent of any such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the grounds on which they have dispensed with the consent."

Clause (4) is as follows:—

(1) The Board of Trade, unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by private Bill, may by Provisional Order—

(*a*) Authorise any local authority or company to supply electricity in bulk;

(*b*) provide for any supply so authorised being compulsory; and

(*c*) make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a local authority or company are authorised to supply electricity in bulk, including the application to roads, railways, and tramways along the route along which lines are authorised to be laid for the purpose of giving the supply in bulk of the provisions of those Acts which authorise or enable the Board of Trade to authorise the breaking-up of any road, railway, or tramway.

(2) If the Board of Trade refuse to grant a Provisional Order under this section, on the ground that the matter ought to be dealt with by a private Bill, the notices published and served for the purposes of the proposed order shall, subject to standing orders, be held to have been published and served for a private Bill applying for similar powers:

Provided that the applicants for the order shall by notice served in the prescribed manner and within the prescribed time inform all opponents of their intention to proceed by way of private Bill, and, subject to standing orders, the application for a Provisional Order shall be deemed and taken to be a petition for leave to bring in a private Bill, and the applicants shall also give such additional notice (if any) as may be required by standing orders.

(3) The Board of Trade may, if they think fit, by order authorise any undertakers to supply electricity in bulk to any other undertakers upon such terms and subject to such conditions as may be specified in the order, if the supply can be given without breaking up any streets except such as the undertakers giving or the undertakers receiving the supply are authorised to break up; but the Board of Trade shall not in any case make such an order until notice of the intention to make the order has been given by advertisement or otherwise as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected of stating any objections he may have thereto.

Mr. Scott proposed the addition of the following words at the end of Sub-section (*c*):—"Provided that a Provisional Order authorising the breaking-up of roads outside the area of supply of the local authority or company by whom the supply is to be given shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade in any case in which the consent of any such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the ground on which they have dispensed with the consent."

Mr. Tennant expressed his willingness to accept the amendment.

Mr. Abel Smith said it was not clear what the local authority really was.

Mr Tennant said it was the local authority, whoever that authority might be, and not the county authority. In a rural district it would be the rural district council and in an urban district the urban district council.

Mr. Abel Smith: But what about the case of a county borough?

Mr. Tennant replied that it was not the county council.

Mr. Henderson said he did not like the amendment at all. It might very well happen that a small country authority might put great difficulties in the way of a company coming into its area for the supply of electricity, and might be able to stop the public from getting a supply where it was very much wanted. He thought the power should remain with the Board of Trade, as at present.

Mr. Tennant said the answer to that objection was that it was not an absolute consent—only a provisional consent. Sometimes the local authority said that they did not get all they wanted and sometimes it was the undertakers. He wanted to hold the balance fairly between the two. He was informed that the county authority was created under the Act of 1889, so that he did not think there was any ground for fear that their power would be overridden by the urban or rural district authority.

(*To be continued.*)

Third Readings.—In the House of Lords [illegible] the Torquay and Paignton T[illegible] and Hythe Tramways Bill, and the [illegible] were read a third time and [illegible] London Railway Bill passed its [illegible]

Long-Firm Frauds.—At Bolton Quarter Sessions, on July 15th, Thos. Brock Conway, [illegible] and Herbert Bullock, *alias* Johnson, were indicted for [illegible] goods by false pretences, including [illegible] Motor Co., of Manchester. The accused traded at [illegible], Church Wharf, Bolton, under the style of Wilson & Co., and were arrested at Sheffield, where they were carrying on [illegible] name of G. R. Holmes. Bullock was sentenced to 12 months' hard labour, and Conway to nine months.

LEGAL.

Hall v. Marconi's Wireless Telegraph Co.

This case, which came before Mr. Justice Ridley in the King's Bench Division last week, was an action by Mr. H. C. Hall against the defendants for damages for breach of contract. The plaintiff's case was that by an agreement dated April 8th, 1908, when he was retiring from the directorship of the defendant company, the company agreed for certain considerations to allot and issue to him before May 7th, 19[illegible], 10,000 fully-paid shares of £1 each in the company, and to use their best endeavours to procure a quotation for them on the London Stock Exchange. The shares were allotted, but the plaintiff alleged that the defendants, in order to prevent the shares from being sold pending an issue of 250,000 preference shares which they were bringing out, took no steps to get the special settlement till about July 3rd. In the result plaintiff's shares were eventually sold for a price lower than he would have otherwise obtained, and plaintiff alleged that the loss he had suffered was about £2,[illegible]. At the conclusion of the arguments of counsel, his Lordship held that on the construction of the agreement the plaintiff had no case, and entered judgment for the defendants, with costs. His Lordship said he was of opinion that the plaintiff had suffered no damage, as the shares were at the present time at a higher price than they were in May and June.

The Uxbridge and District Electric Supply Co., Ltd.

In the Companies' Winding-Up Court on Tuesday, Mr. Justice Neville heard a motion by the Metropolitan Electric Supply Co., Ltd., on behalf of themselves and all other debenture-holders for the appointment of a Receiver of the Uxbridge and District Electric Supply Co., Ltd.

Mr. Bramwell Davis, K.C., in support of the motion, said that some time ago a petition was presented for winding up the defendant company, and that petition had been granted. A liquidator was appointed who was carrying on the business, but it was felt that the company could only be successfully carried on if fresh capital was forthcoming. Fresh capital could only be raised by a receiver in the debenture-holders' action. The debenture-holders' security had crystallised and a receiver had been appointed, but owing to the liquidation it was necessary before he could do anything that he should be appointed a Receiver of the Court. Counsel understood that the point would be taken that this being a statutory undertaking, no Receiver could be appointed. There was, however, authority against that proposition though, no doubt, with regard to a company having statutory obligations creditors could not obtain a manager.

Mr. Peterson, K.C., for the liquidator, said he did not propose to take that point. His case was that a receiver was unnecessary.

His Lordship said it seemed to him that the only effect of appointing a receiver would be to prevent the liquidator carrying on the business.

Mr. Bramwell Davis said they had no wish to do that, and he did not think the appointment would have that effect. The receiver would only get the net rents.

His Lordship: Then it seems to me the appointment of a receiver is useless.

Mr. Bramwell submitted that it was necessary, in order that the capital required could be raised.

Mr. Peterson did not think that was so, but he was willing that the Official Receiver who was now acting as liquidator should be appointed receiver.

Mr. Bramwell said that would satisfy him, and his Lordship accordingly appointed the Official Receiver to be receiver in the debenture-holders' action until further order.

Consolidated Nickel, Tin and Copper Mines, Ltd., v. Crompton & Co., Ltd.

Mr. [illegible], the Official Receiver, on Friday last delivered his [illegible] judgment in this case, the facts of which and the [illegible] reported in the Electrical Review.

The [illegible], in delivering judgment, said the action [illegible] the plaintiffs against the defendants for [illegible] to supply electrical pumping plant in [illegible] specification which was accepted. The [illegible] for working the Wheal Bury mine [illegible] were to erect on the site [illegible] 1,000 gallons of water per [illegible] 120 ft. Plaintiffs' case was that the defendants [illegible] pump, and failed to do so [illegible] all. Plaintiffs informed the [illegible] that, in his opinion, was clear [illegible] the defendants to Messrs. [illegible] The specification was for plant capable of [illegible] against a total head of 120 ft. [illegible] Plaintiffs had the right to expect, and to [illegible] were offering to them a plant capable [illegible] work, and he (the Referee) [illegible] that was the contract. Defendants [illegible] plant consisting particularly of a [illegible] producer and pump; under the terms of the contract it was to be delivered, erected, and set up not later than May 24th, 1907, and there was to be a forfeit by the defendants of a penalty of 1 per cent. of the contract price (which was £1,640) per week for the first four weeks after the date for completion, and 10 per cent. of the contract price per week afterwards for each week after the date for completion fixed in the contract had passed, and it was also stated in the contract that this forfeit was not to be enforced if the delay was due to causes outside the defendants' control. There was delay, and the point he had then to consider was whether that forfeit he had mentioned was a penalty or liquidated damages. In his opinion it was clearly liquidated damages. The result of delay in delivery as regarded loss and damage being uncertain, plaintiffs had pre-estimated what the amount of the damage was to be. There were expressions in letters in April, 1907, which showed that the defendants were aware that the penalty of delay would be very heavy. Defendants purchased the pump from Messrs. Worthington, a firm of great eminence, but they would not bind themselves to any particular date of delivery. Messrs. Worthington did not make the pump themselves in England, but employed a German firm of manufacturers to make it, and, according to the practice in Germany, part of the work was sub-contracted by the German manufacturers to another firm. Defendants said that the delay which had occurred was due to causes beyond their control. In his (the Referee's) opinion, that was clearly not so, and he therefore found that the delay was not due to causes beyond the control of the defendants.

The learned OFFICIAL REFEREE having referred to the evidence on the question of delay, said he had upon his findings of fact to consider what the damages recoverable by the plaintiffs were. He considered that, with regard to delay up to October 19th, the plaintiffs were entitled to damages in respect of the diminution in value between the installation which they contracted for and the installation which they got. That diminution in value must be, from the evidence that he had received, more or less a matter of conjecture, but he assessed it at £100. He assessed the liquidated damages for delay at £2,200 and a further sum of £500 for damages after the plant was set up. Deducting these sums from certain items in the defendants' counterclaim, which the plaintiffs admitted, there would be judgment for the plaintiffs for £1,738 19s., with the costs of the action.

THE BRITISH ALUMINIUM CO., LTD.

IN the Chancery Division on Saturday, July 17th, MR. KIRBY, on behalf of the plaintiffs, formally applied to Mr Justice Warrington for judgment in the debenture holders' action, Morrison and others v. the British Aluminium Co., Ltd. Counsel asked that the usual accounts and inquiries should be ordered, and also that the trust should be executed by the Court.

His LORDSHIP gave the usual judgment in a debenture-holders' action, including the order asked.

Two petitions, the first presented by Dick, Kerr & Co., Ltd., of London, and the second by A. Schonfield & Co., of Glasgow, for the winding up of the British Aluminium Co., Ltd., were before Mr Justice Neville in the Winding-Up Court on Tuesday last.

MR. MARTELLI, K.C., who represented the first petitioners, said that they were creditors for goods sold and work done to the amount of over £1,000. The Aluminium Co. was incorporated in 1894, and its present capital was £1,300,000. The company had issued two series of debentures; of the first series there was £123,900 outstanding and of the second £875,000 outstanding. In June last the debenture-holders commenced an action to enforce their security, and on June 29th a Receiver was appointed. As regards the company the case was simple. The petitioner's debt was undisputed, the company could not pay, and therefore the petitioner was entitled to a winding-up order. An affidavit had, however, been filed on behalf of the company, in which it was stated that the assets were largely in excess of the debenture debt. The company's business was improving, and a scheme for reconstruction, which he supposed would provide for the payment of the unsecured creditors in full, was in course of preparation. The Receiver had made an affidavit, in which he stated that owing to his recent appointment he had not yet had time to go into the company's affairs. The petition was opposed by a large number of debenture-holders, shareholders, and creditors. Under these circumstances the petitioners, who, of course, were only desirous of obtaining payment, had no objection to the matter being adjourned in order to see if something could not be done, and he was willing that the petition should stand over until the second petition day in next sittings, if the other petition also stood over.

MR. STEWART SMITH, K.C., for the second petitioners, said they were unsecured creditors upon dishonoured bills of exchange, and they had no objection to the proposed adjournment.

Other counsel for creditors and debenture-holders supported an adjournment.

MR. YOUNGER, K.C., for the company, said he could not deny the petitioner's right to an order, but it was essential for the benefit of everyone that some arrangement should be carried out. The company had put in evidence certain facts which showed every indication of its having a prosperous future, and a winding-up was opposed by the preponderance of creditors. The assets of the company were very large—over £2,341,[illegible] [illegible] their works were in a more or less experimental stage. They had, however, turned the corner, and they were now earning sufficient to pay the interest on the debentures. Their business was that of making aluminium by an electrolytic process in which water-power was largely used, and they had now large works on Loch Leven and elsewhere in Scotland. It was thought that the company would be a very great success, but at present, owing to the works taking longer to complete than was originally anticipated, they found themselves in an embarrassed position.

MR. HAMILTON, K.C., for unsecured creditors to the amount of £125,000 odd, also supported an adjournment, and, there being no opposition, his Lordship allowed both petitions to stand over until the second petition day in next sittings.

W. R. SYKES INTERLOCKING SIGNAL CO., LTD., v. MCKENZIE AND HOLLAND, LTD.

IN the Chancery Division, on Thursday last week, Mr. Justice Parker heard this action by which the plaintiffs sought an injunction to restrain the defendants, a Worcester company of signal and railway engineers, from representing that they were licensees of the Sykes patent block and electric interlocking signal patents, or that they were in any way connected with the plaintiff company.

Mr Gore Browne, K.C., and Mr. Shaw appeared for the plaintiffs, and Mr. Mark Romer, K.C., and Mr. Ashworth James for the defendants.

In opening the case, MR. GORE BROWNE said that the plaintiffs were the owners of a system of block and electric signalling, certain patents in respect of which had ceased to exist. At one time the defendants were licensees of the Sykes patents, and were the principal agents for the Sykes system of block and electric interlocking signals. Their rights as to England, however, expired in 1903, and their rights in the Colonies in 1905. In September of 1907 the plaintiffs noticed an advertisement in the *Railway Times* to the effect that the defendants were the sole licensees of the system, and they thereupon wrote to the defendants, who promised that the advertisement should be withdrawn. Consequently, no further action was taken in the matter at the time. In 1908, from communications the plaintiffs had from the Agent-General of New Zealand, they were led to believe that the defendants were still representing themselves as the agents of the Sykes system, and in August of that year they again communicated with them. The defendants replied that through inadvertence the statement complained of had not been removed from the letter paper in New Zealand, but they were cabling out instructions to set the matter right; as, however, they said the Sykes system was no longer in existence, they denied any liability. The matter again dropped, but in November, 1908, the plaintiffs found that the advertisement originally complained of was appearing in the Railway Official Gazette, that advertisement containing the statement that McKenzie & Holland, Ltd., of Worcester, were the sole licensees of Sykes block and electric interlocking signals. Having had the defendants' assurance that the offending statement would be withdrawn in 1907, and finding the advertisement was being continued in 1908, the plaintiffs issued the writ in the present action in December, 1908. They asked for an injunction to restrain the defendants from representing themselves as the sole licensees or licensees of the Sykes patent block and electric signal system, or that they were otherwise connected in business with the plaintiff company.

MR. ROMER said that he admitted that the defendants were not entitled to represent themselves as the licensees of the Sykes patents though he did not admit that the plaintiffs were entitled to restrain them from using the word "Sykes." Under those circumstances he was willing to submit to an order in a limited form, and to pay the costs of the action.

MR GORE BROWNE said the plaintiffs were willing to take an order in the terms offered.

MR ROMER desired to say that the reason the defendants offered to pay the costs, was that they felt it was through their carelessness that the advertisement was not withdrawn, and under the circumstances, the plaintiffs were justified in bringing their action.

His LORDSHIP made an order in the modified terms agreed upon

WORKMEN'S COMPENSATION.

ON Tuesday, in the Marylebone County Court, before Judge Bray Joseph Coffey, labourer, of 16, Ethelred Street, Kennington, applied for an award under the Workmen's Compensation Act, the respondents being the Westminster Electric Supply Corporation. Coffey, it appeared, was engaged, with other labourers, cutting a trench, on December 9th, 1908, in Bryanston Place, W., when he fell into a hole, a depth of some 12 ft., and severely injured his face, arms, legs, shoulder and ribs, which totally incapacitated him from work for a long period. His average earnings were 29s. a week, and half of this amount he now claimed.

His HONOUR awarded the applicant £18 15s., with costs on the higher scale, these not to exceed £15.

Walking Contest.—The employés respectively of the Birkenhead and the Wallasey municipal tramway and electricity departments held their annual walking contest on Saturday last over a course of about nine miles, from the Tramwaymen's Club, Argyle Street, Birkenhead, to the headquarters of the Wallasey tramwaymen in Seaview Road, Liscard. The Wallasey competitors proved the winners.

BUSINESS NOTES.

Restoration of Patent Refused.—The Comptroller-General of Patents has dismissed the application of André Blondel for the restoration of patent No. 15,527, of 1902, for "Improvements in or relating to wireless telephony."

Fire Extinction.—Messrs. Lund Bros. & Co., of 78 and 80, Queen Victoria Street, E.C., the well-known electrical contractors, have sent us particulars of their "Ready" patent system for fire extinction, which is intended for "first aid." Essentially it consists of 40-gallon steel vessels full of water, situated at various points in a building, and provided with hosing and nozzles; these are connected by small copper pipes to a reservoir of compressed air, which is charged by hand, but there is a valve at each water vessel which prevents the pressure being applied to the water until an emergency arises. On opening this valve a 60-ft. jet is produced, lasting for 6½ minutes. Air leakage is prevented by the mode of construction, and an alarm can easily be attached, which rings when the pressure is reduced by bringing the apparatus into operation at any point.

Book Notices. — "Metric Tables." By Sir G. L. Molesworth. London: E. & F. N Spon, Ltd. 1909. Price 2s. net.

"Making Wireless Outfits." By N. Harrison. London: E. and F. N. Spon, Ltd. 1909. Price 1s. 6d. net.

"Circuits and Diagrams." Part II. By N. H. Schneider. London: E. & F. N. Spon, Ltd. 1909. Price 1s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXVIII, No. 7. July, 1909, containing the papers read at the Annual Convention, June 28th—July 1st. New York: The Institute. Price $1.

"The Gas, Petrol and Oil Engine." By D. Clerk. Vol. I. London: Longmans, Green & Co. 1909. Price 12s. 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XIV, No. 3. June, 1909. Chicago: The Society. Price 50 c.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXV. Parts 7 and 8. July, 1909. London: Andrew Reid & Co.

"The Physical Review." Vol. XXVIII, No. 6. June, 1909. London: Macmillan & Co.

Exhibitions.—*Ironmongery and Hardware Trades' Exhibition.*—This Exhibition at the Royal Agricultural Hall, Islington, closes to-day (Friday). There are a few exhibits of electrical and allied interest. Messrs. C. Toope & Son, of Stepney Square, High Street, Stepney, E., have among other manufactures on view, their non-conducting coverings for steam pipes and other hot surfaces, including corrugated asbestos pipe covering, wire space asbestos covering, asbestos coverings for flanges, &c., such as they have supplied for several electricity works, including Wood Lane generating station, and the Stepney electricity works; Messrs. Fredk. Braby & Co., Ltd., of Euston Road, show copper, steel, and aluminium manufactures, and aluminium galvanising paint; Messrs. Palmer & Co., of 35, Vittoria Street, Birmingham, as well as a variety of polishing and plating materials, exhibit their plating dynamos as used in some of the largest works in this country, and their patent "Silverite" nickel anode which is cast in one furnace within another, it being taken out of the inner furnace and poured while in the larger one, the effect being that it wears to a knife edge instead of crumbling to pieces. The Albany Engineering Co., Ltd., of Ossory Road, Old Kent Road, S.E., have a good collection of electric fans of all types, such as they make up to 6 ft. diameter. It is claimed that, owing to the shape of the propeller blades, the air is thrown off the centre, no draft being made at the ends of the fans. The firm's rotary pumps, electrically driven, such as are supplied to the Admiralty and others, are also in evidence. On the same stand, Mr. Wintour H. Phelps, of Teddington, S.W., shows for the first time his electric motor-driven "Nuklena" vacuum cleaner. An interesting exhibit is that of Smoke Consumption Ltd., of 82, Victoria Street, S.W., who show Cowper-Cole's patent "Caloriser" for applying in the furnaces of Lancashire and other hoilers, and give a demonstration by means of a small model furnace, &c., of the smoke consuming capabilities of the appliance. A certain length of the flue behind the bridge is lined with bricks made of a material which becomes incandescent more readily and at a lower temperature than ordinary fireclay. At the end of this space a combustion wall is built right across the flue, having a large square aperture serving as a manhole, and built up of a number of specially-formed "Caloriser" tiles. As the gases evolved from the flue pass over a narrow opening above the bridge, they expand into the large and highly heated space between the bridge and the combustion wall, and become well mixed, owing to the retardation of their velocity before passing finally between the incandescent tiles which form the combustion wall. A large and effective exhibit of gas and electric lighting and bell and other electrical manufactures is shown by Messrs. Falk, Stadelmann and Co., Ltd., of Farringdon Road, E.C.; the "Efesca" metallic-filament lamps making a brilliant display. The Harquin Pendant Co., of 136, Kentish Town Road, N.W., have on show their patent electric pendant and cord-absorbing and other fittings. Messrs. W. Canning & Co., of Great Hampton Street, Birmingham, have a large and well-arranged stand which catches the eye immediately one enters the Hall, where their electro-plating and polishing machines, plating dynamos, motor-generators, electric motor polishers, and other manufactures may be seen.

The White City Exhibition.—We went to visit this Exhibition at Shepherd's Bush the other day, in complete ignorance as to the extent and character of the engineering and electrical exhibits, excepting that we knew that the Simplex Conduits "Electric Home" display was well worth seeing. Our impressions of this we have already published. As to the other exhibits, well—they require only brief mention, for compared to last year, they occupy very little space indeed. By far the largest is that of the Cowper-Coles Engineering Co., Ltd. It is an instructive exhibit of their electro-deposition and electro-galvanising processes, and other plant, and we may allude further to it in a later issue. Messrs. Babcock & Wilcox, Ltd., have a model of their boiler surrounded by a wilderness of open space, which might have been occupied by other stands if, we suppose, exhibitors could have been obtained. Not far away there is a joint exhibit by several contracting firms, showing a section of the Central London Railway tube with a coach standing therein. The Norwegian Nitrate Works, Ltd., of Christiania, are present to draw attention to their manufacture of atmospheric nitrogen by electricity. The Western Electric Co.'s stand consists of a large neat show-case containing specimens of their telephone cables and instruments, and other manufactures. Electric lighting fittings are exhibited by Messrs. Tredegar & Co., and electro-medical apparatus (Holmquist) is displayed by the Regent Electric Co., Ltd. In addition to the foregoing, some other stands were still erecting at the time of our visit—perhaps they will be electrical, perhaps not, and may be they are intended for next year's Japanese Exhibition.

Trade Announcements.—The British Insulated and Helsby Cables, Ltd., of Montreal, have sold their interests in Canada to the Canadian British Insulated Co., Ltd., Montreal.

Messrs. F. C Edey & Co., electrical contractors, have removed from Ludgate Hill, where they have been for the last 16 years, to larger premises situated at 25, Warwick Lane, E.C. Their telephone number is unaltered—viz., "2,547 Central."

The Midland Electric Manufacturing Co., Ltd., of Birmingham, have appointed Messrs. Downes & Davies, 67, Stanley Street, Liverpool, as their sole agents for Lancashire and Cheshire.

Mr. H. G. Nicholls, who has for several years been assistant general manager of the Canadian General Electric Co. and the Canada Foundry Co., has resigned that position in order to go into business for himself. He has organised a company called Factory Products, Ltd., with offices in the Confederation Life Building, Toronto, for the purpose of acting as Canadian selling agents for representative manufacturers.

Mr. H. T. Boothroyd announces that, in consequence of his partnership with Mr. A. M. Hyslop having been dissolved by mutual consent, the business of H. T. Boothroyd, Hyslop & Co. has been converted into a private limited liability company under the title H. T. Boothroyd, Ltd. The management will be under his personal control as sole proprietor and governing director.

To Advertisers.—We occasionally receive advice from visitors who call upon us here, hailing from secluded quarters of the Colonies and other parts, showing that the facilities for gaining information regarding what is going on a few hundred miles away from them are very poor. Indeed, they frequently find in our own pages matter of interest to them relating to doings of their Colonial brethren which has not reached them until we have first published it here. If this applies to editorial matter and among purely electrical men, it also certainly equally applies to advertisements, which aim to reach the men of other industries who cannot be expected to know electrical addresses. The Colonial and foreign reader in a large land such as, for example, Australia, may be in absolute ignorance of the addresses of representatives of British firms who have branches more or less in his vicinity. The point has been mentioned before, and we notice with interest that one of His Majesty's Trade Commissioners for Australia has sent home a suggestion to British manufacturers to which they should give heed in preparing their advertisements for the Electrical Review. He says that where British firms advertise in trade newspapers which circulate out there, it would be of interest to prospective customers if, in preparing their advertisement, care were taken to give the name of the Australian agent, if such there be, together with the telegraphic address and name of code-book adopted. We leave the suggestion with the electrical trade. It is a small thing, but it may mean all the difference in the world between getting or losing a contract, possibly allowing it to go to some more pushful firm in another country instead of coming to the old country.

Annual Outings.—The Bryant Trading Syndicate, Ltd., held the annual outing of their "Metalite" lamp works staff on Saturday last—at the cost of the directors—when about 200 of the girls spent a thoroughly enjoyable day at Brighton. Sports were held during the morning, and some novel and appropriate competitions were introduced, such as the Metalite lamp and spoon race, filament counting race and "potato" race with Metalite lamps instead of potatoes. After dinner, which was partaken of at the Royal Hotel, the managing director, Mr. Joseph Metcalfe, thanked the staff for their loyal service. The prizes were then distributed by Mrs. Metcalfe, who in turn was presented with a beautiful bouquet by the staff.

The staff of the Guildford Electricity Supply Co., Ltd., held their fourth annual outing on Wednesday, 7th inst., when they journeyed to Bournemouth. The party left Guildford soon after 6 o'clock in the morning, and immediately on arrival at Bournemouth partook of breakfast at the Wilberforce Hotel. Dinner was served at the London Hotel, and in the afternoon an enjoyable trip was made to Swanage, where tea was served.

On Saturday, July 17th, the employés of the electric traction maintenance department of the Metropolitan Railway Works, Neasden, went for their first annual outing to Southsea. The party assembled at the Wiltshire Lamb Hotel, where dinner was served, after which various toasts were proposed, and Mr. Onions in his speech remarked that the party was largely indebted to the generosity of the numerous subscribers. A short musical programme, provided by several of the members, followed.

On Saturday last the annual outing of the staff of Mr. W. D. Willson, electrician, of High Street, Croydon, was held, a journey being made to Stafford Woods, near Eden Bridge, by brake, where lunch and tea were served. The company were favoured with splendid weather. An afternoon cricket match and evening sports were, among the day's features, productive of much pleasure. On the journey home the brake was illuminated by Osram lamps.

On Saturday last the employés of Messrs. Rawlings Bros., Ltd., of Kensington and Belgravia, held their annual outing, Pangbourne, the spot selected on this occasion, being reached before 9 a.m. The party was 100 strong. A cricket match between the Visitors and Office Staff *v.* the Works Staff, in which the latter were victorious, together with sports, filled the morning's programme, and at noon the party repaired to Ye Olde George Hotel. The weather being fine, there was no desire to prolong the speech-making after dinner longer than was necessary. Mr. T. S. Rowden proposed the toast of the employés, which was responded to by Mr. F. B. Howard. The chairman, Mr. W. R. Rawlings, in responding to the toast of "The Firm," proposed by Mr. A. Hanham, remarked that owing to the unprecedented pressure of work in the motor department, practically the whole of that branch had had to remain at work, and were unable to be with them. He was glad to be able to report that steady progress was being maintained by the firm, and he could not too often remind them that the interests of the firm and of the employés were identical. Mr. A. Sharp then proposed the toast of "The Chairman and Managing Directors," which was briefly responded to by the chairman. Later, the launch *His Majesty* was boarded, and a most pleasant afternoon was spent admiring the delightful scenery and passing the time with musical and other items. Returning to Pangbourne, tea was served.

Bankruptcy Proceedings. — Arnold Roberts (Roberts Brothers), electrical engineer, Bradford.—A first dividend of 2s. in the £ is payable July 31st at the offices of J. H. Haley, 29, Tyrrel Street, Bradford.

Private Meeting.—W. J. Woodward (trading as the Vulcan Electric Co.), manufacturing electrician, 43, The Broadway, Stratford.—A meeting of the creditors was held on July 15th, when a statement of accounts as at July 9th last was presented. This showed liabilities amounting to £872, of which £308 was due to trade creditors and £521 to cash creditors, the balance of £42 representing claims by workmen. There were preference claims for £16, and after providing for these the assets were expected to produce £85, or a deficiency of £787. It was pointed out that the assets had been written down by no less than 50 per cent. Apparently the whole of the deficiency had arisen during the last 12 months. A balance-sheet was prepared at the end of December, 1908, and this showed that there was little, if anything, wrong with the concern. For the six months ending June 30th of the present year there had been a net loss on the trading of £369. The debtor had no offer to make, and stated that he could not see his way to continue the business. The matter was discussed at some length, and eventually it was decided that the estate should be realised under a deed of assignment. Mr. G. Corfield, of Messrs. Corfield & Cripwell, accountants, Finsbury Pavement, E.C., was appointed to act as trustee in the matter.

First Meeting. — William Thomas Harris (trading as W. T. Harris & Sons), electrical engineer, 460 and 464, Commercial Road, and 47, Emanuel Street, Portsmouth.—The first meeting of the creditors in this case was held on Monday last at the Official Receiver's Offices, Cambridge Junction, High Street, Portsmouth. The Official Receiver stated that there was a reasonable prospect of the creditors receiving 20s. in the £, and there was a proposal to leave the debtor some part of the business. It seemed as though he had had more than he could manage, but he believed the part of the business that it was desired to leave him could be managed by him to his profit. It was a matter for the trustee and the Committee. It was ultimately decided that Mr. E. W. C. Whittaker, of Southampton, should be the trustee, a Committee of Inspection being also appointed, consisting of Messrs. Johns, Grace and Hutchings. The following are creditors:—

Armorduct Manufacturing Co., Ltd., London	£16
Braulik, G., London	18
Bates, W. A., Ltd., Leicester	24
Canning, W., & Co.	32
Grace, Mrs., Ryde	50
Hutchings, C., & Son, Portsmouth	11
Johns, Southampton	100
"Bankers," Portsmouth	297
Ryder, Portsmouth	40
Vacuum Oil Co., Ltd., London	14
Woodgate Bros., Tiverton	19
Palmer Tyre Co., Ltd., London	10
Fully secured creditors	3,150
Preferential creditors for proportion of apprenticeship premiums	55

Annual Holidays.—The Adams Manufacturing Co., Ltd., of Bedford, announce that their works and offices will be closed from Saturday, July 31st, till Monday, August 9th, though a small staff will be retained to attend to matters of urgency.

The Electric and Ordnance Accessories Co., Ltd., of Aston, advise the trade that their works and offices will be closed from the night of Friday, July 30th, until Monday, August 9th, but a small staff will be in attendance to handle pressing matters.

The New Brotherton Tube Co., Ltd., of Wolverhampton, state that their works and offices will be closed for holidays and stocktaking from August 2nd to 7th.

Dissolutions and Liquidations.—The Auto-Claw Co.—The examination of the directors in this matter will be held before the Registrar at the Companies Winding-Up Department, Bankruptcy Buildings, Carey Street, on Tuesday, 27th inst., at 2.30.

Electric Taxicab Co., Ltd.—A meeting is to be held at 7, Hertford Street, Mayfair, W., on August 19th, to hear an account of the winding-up from the liquidator, Mr. W. Milne.

The London Electrobus Co., Ltd.—A petition for the winding-up of this company has been presented by Messrs. Pritchetts and Gold, Ltd., creditors, and is to be heard on July 27th.

Uxbridge and District Electric Supply Co., Ltd.—First meetings of creditors and contributories are to be held at Carey Street, W.C., on July 29th.

The Electrical Works and Development Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. R. A. Boughton, 52, Gracechurch Street, E.C., by August 31st.

Hobart & Ellis and H. M. Hobart, consulting engineers, Oswaldestre House, Norfolk Street, W.C.—Messrs. H. M. Hobart and A. G. Ellis have dissolved partnership. The address of Mr. Ellis, who retires, is now Güterstrasse 274, Basle, Switzerland.

Mountain & Gibson, Ltd.—The petition for the winding-up of this company, which came before the Court of Chancery of the County Palatine of Lancaster on July 8th, was adjourned until July 26th, when, in consequence of the shareholders having on June 30th resolved upon voluntary liquidation, the Court will be asked to continue this voluntary liquidation under the supervision of the Court, instead of making an order for the winding-up by the Court.

Santoni Arc Lamp and Engineering Co., Ltd.—Creditors must send the usual particulars to the liquidator, Mr. W. M. Whyte, 11, Queen Victoria Street, E.C., or to Mr. G. E. Corfield, Balfour House, Finsbury Pavement, E.C., the liquidators, by August 20th.

British Medical Association's Exhibition, Belfast.—Messrs. Siemens Bros. & Co., Ltd., of Caxton House, Westminster, S.W., inform us that they are showing some interesting novelties and improvements in electro-medical and other appliances at the above Exhibition. The most recent advances in X-Ray work have been instantaneous radiography and the production of unidirectional high-tension current without the aid of induction coils and interrupters; both these functions are fulfilled by the new Siemens X-Ray outfit with rotary high-tension rectifier. The outfit comprises a special transformer with sub-divided primary, which is connected direct to an A.C. supply; the alternating current is stepped up to the pressure necessary for the tube, and is then commuted by means of a rectifier, which is rotated by a self-starting synchronous A.C. motor, also connected direct to the mains. Where only a D.C. supply is available, a rotary converter is connected to the mains; this generates alternating current and also rotates the rectifier. The chief advantages of this system are that inverse radiation is entirely eliminated, and the plant provides a large reserve of energy suitable for instantaneous radiography.

Messrs. Siemens are also showing one of their new "G.P." X-Ray outfits, which has been designed to bring the price of such apparatus within the means of the general practitioner, whilst the workmanship and material are very high class. The outfit consists of a 16-in. spark induction coil, spark-gauge, switch-table and Wehnelt interrupter. All the apparatus is mounted on a protective screen lined with lead, and provided with a lead-glass window. Another exhibit in this connection is their so-called Universal and safety protective tube stand, a general utility apparatus for holding the patient securely in the standing or sitting position, and protecting him and the radiographer from the harmful effects of the X-rays, while permitting the free movement of the fluorescent screen or dark slide in any direction in relation to the patient.

Another electrical novelty exhibited by Messrs. Siemens Bros. is their clinical temperature recorder. This consists of a platinum spiral in a quartz tube, known as the "resistance thermometer," which is inserted into a suitable part of the human body; a 4-volt accumulator battery; a regulating apparatus; and a recording milli-voltmeter of the well-known Siemens type, as used for thermo-electrical measurements, &c. The instrument is supplied in two patterns, with suspended or pivoted moving coil, and both patterns can be provided with a slow or quick recording device. With this apparatus, investigations can be made over periods of several days, and continuous curves obtained in order to demonstrate the progress of pathological cases and the effects of the adminstration of drugs, &c.

Messrs. Siemens Bros. & Co. also exhibit radium, radio-active substances with applicators for treatment, and radio-active earth, for local application, &c.

New Tantalum Lamp.—Messrs. Drake & Gorham, Ltd., announce that they are putting on the market a new type of high-voltage tantalum lamp suitable for direct current, 200 to 230 volts, to give 25 C.P. at an efficiency of 1·7 watts per candle. It is supplied in either bell or spherical shape.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Leaflet No. 2,117, giving an interesting partial list of Curtis steam turbines which have either been installed or are in course of construction.

Stolzenberg Patent File Co., 50/53, Bishopsgate Street Without, E.C.—Illustrated leaflet of Stolzenberg roll-top desks, with interchangeable fitments for same.

Vortex Pulley and Belting Co., Tower Royal, E.C.—Reduced price list of "B B" wood-split pulleys.

C. Herrm. Findeisen Maschinen Fabrik, Chemnitz-Gablenz.—Illustrated price list, with letterpress in English and three other languages, relating to electric passenger and goods lifts, travelling cranes, &c.

Messrs. J. H. Heathman & Co., Parson's Green, Fulham, S.W.—New price lists in the firm's well-known style of steps, ladders, tower ladders and other specialities of the same class, for which Mr. Heathman is so well-known.

Premier Electric Heaters, Ltd., Ashley Street, Birmingham.—Two new lists have been issued relating to the Premier flat-irons, kettles, &c. They contain particulars and prices of a number of appliances introduced since the firm's first list was issued. The variety of irons ranges from 3 lb. to 24 lb. in weight, and the other manufactures include a selection of kettles, hot water jugs, hot plates, shaving pots, &c., including some cheap pattern kettles. The heating element is the "Premier" improved strip with simplified means of fixing, which is shown in the lists. We understand that the apparatus is in all cases guaranteed for 12 months.

The London Advertising Letter Co., 10, Charles Street, Hatton Garden, E.C.—Twelve-page pamphlet, giving particulars and prices of "Serchlite" electric signs and electric letters for outside and inside illumination.

Messrs. A. E. Luc. Court & Cie, 88 92, Rue Robert, Lyon.—Illustrated price list in French of the "Erga" electric lifting tackle.

Messrs. Arthur Jopling & Co., 10, Westmorland Buildings, Aldersgate Street, E.C.—List containing a description of Jopling's Sunny flame and Economic enclosed arc lamps, also a 44-page catalogue showing and giving prices of a great variety of electrical devices, such as lampholders, switches, cut-outs, ball fittings, water-tight fittings, flexible wires, bell indicators and accessories, batteries, fans, shades and so on.

Sun Electrical Co., Ltd., Charing Cross Road, W.C.—New catalogue Section L (12 pages) showing and stating prices of a variety of novel and useful designs of glass shades for electrical fittings, including pines for metal filament lamps, silvered glass reflectors, &c.

British Electrical and Manufacturing Co., 1, St. Nicholas Buildings, Newcastle-on-Tyne—Catalogue No. 424 (40 pages) dealing fully in a number of sections with their iron-armoured insulating conduit and fittings, Greenfield flexible steel armoured conductors and flexible cord fittings for the latter, Greenfield flexible steel conduit, single and double strip types, cast-iron outlet and junction boxes and covers, knock-out boxes, and a great variety of other fittings; also a companion pamphlet giving a list of buildings which are wired on the Greenfield system. The company are acting agents in the United Kingdom for the manufacturers of this system, which has been in use in the United States for many years, and on some important installations in this country.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Twenty-page illustrated catalogue and price list of mechanical rubber goods, including rubber sheeting, trolley wheel covering, steam and suction hose, machine belting, corrugated matting, rubber gloves, &c. Copies of the list may be obtained on application by those specially interested.

The A.E.G. Electrical Co. of South Africa Ltd., Carlton House, Westminster.—Batch of lists relating to various manufactures, as follows:—Slow-speed three-phase motors; large three-phase induction motors (outputs 100 to 1,000 H.P.); three, two and single-phase induction motors (7·5 to 100 H.P.); small continuous-current motors and generators (outputs up to 7 H.P. and 5·75 KW.); iron switch cases for pressures up to 7,500 volts; electric annealing and tempering plants; lift controlling gear. All the lists are very complete with tabular information as to weights, prices, &c.

Australia.—The Australian Customs authorities have recently given a decision to the effect that "resistance coils with arc lamps" are to be classified as electrical appliances under No. 177c of the Tariff, the duty being 20 per cent. *ad valorem* on both British and foreign manufactures.

Italy.—A new company has just been formed in Milan with a capital of £[illegible]0,000 and the title La Società Elettrotechnica Commerciale Italiana. The Allgemeine Elektricitats Gesellschaft, of Berlin, is interested in the new undertaking.

LIGHTING and POWER NOTES.

Aylesford.—Messrs. Foote & Milne have informed the U.D.C. that they intend applying for a prov. order for electric light.

Beckenham.—It has been reported to the Council that in two cases, occupiers of houses with free wiring installations have altered the installations by fixing transformers and it has been decided to inform them that if the installations are not reinstated in their former condition within 14 days, or in the alternative the Council's new free wiring agreement is not signed, legal proceedings will be commenced.

Bedford.—A letter has been received from the L.G.B. refusing to extend from 10 years the period for the repayment of the loan recently raised for substituting electric lamps for gas lamps in the street lighting.

Blairgowrie (Perthshire).—Intimation has been received by the T.C. from Messrs. Foote & Milne, London, that they are applying for a provisional order to supply electrical energy within the burgh.

Chile.—The German Consulate in Valparaiso states that the following concessions have been recently granted:—To the Société Anonyme de Métallurgie Electrothermique du Chili, of Combarbalá, to utilise the river Combarbalá for the generation of electric energy; to Messrs. Máximo Schmidlin and Ramon del Cazo, of Santiago, to utilise the river Colina (province of Santiago) for the same purpose; and to Messrs. Luis and Osvaldo F. de Castro and Camilo Edwards of Tocopilla, to utilise the river Loa (province of Antofagasta) for the generation of electric energy to the extent of 15 000 H.P.

Continental Notes.—Scandinavia.—A company has recently been formed with the title Nordiske Bolaget for Metallradlamper to acquire and exploit the Swedish, Norwegian, Danish, and Finnish rights in the "Z" (Zircon-Wolfram) metal filament electric lamps. The new concern is not establishing works on its own account, but has arranged with the Glodlampfabrik, of Stockholm, for the manufacture of the lamps.

The Rjukanfos Co., which was formed not long ago for the purpose of fixing nitrogen from the air, is about to harness the Rjukan Waterfalls, which are the highest in Norway, and well known on account of their beauty. The company has recently ordered electric generators of about 70,000 H.P. in all from the Allmana Svenska Elektriska Aktiebolaget, at about £[illegible]5,555. Tenders were received from all the leading firms in Europe and America, and a similar contract has been given to Messrs. Brown, Boveri & Co, of Baden, Switzerland. The contract comprises the delivery of four double generators and one single generator, each with a capacity of 17,000 H.P.

The complete plant of the Rjukan-Waterfalls will have a capacity of 170,000 H.P., and the electrical power station will probably be the largest in the world.

Austria.—A company has lately been formed in Paris with the title the Küstenländische Gesellschaft fur Hydro-elektrische Industrie to put down plant to utilise certain available water power at Otocac, Croatia, in the generation of electrical energy for lighting and power purposes.

Burslem.—The T.C. has declined to entertain an offer of the Collieries Electric Power Development Syndicate, Ltd., to supply electricity in bulk.

Chippenham.—The T.C. has signed an agreement with the electric lighting company for the establishment of electricity works on the site of the old gas works.

Dundee.—A serious fire broke out at the Corporation's Dudhope Crescent electricity works on Wednesday, the 14th inst.; about 4.45 p.m. smoke was observed issuing through the floor immediately above the basement, and a hurried examination revealed the fact that the distribution cables had caught fire. The staff fire brigade were immediately called out, but so alarming did the situation become that it was thought advisable to call the city fire brigade. Within a few moments of the outbreak, the flames reached as high as the roof, a matter of 40 ft., scorching the wood and breaking almost every pane of glass. Meanwhile, the generating plant had been completely shut down, and within half an hour the fire brigade had the conflagration subdued. An examination showed that the insulation of some 63 cables in the basement had been completely burned away, leaving the bare copper wire, while two engines and dynamos which are at present not in use and were in the basement were also very severely damaged by fire and water. Two rotary converters and certain local sub-station switchgear, recently erected, were situated close to where the fire originated, but, fortunately, no serious damage was done, with the exception of a slight injury caused by the water. As nothing could be done in the way of supplying current again until the damaged cables had been repaired, this arduous task was at once undertaken, and by 9 o'clock the work was so far accomplished as to permit of a supply of current for lighting being provided. After lighting had been supplied, efforts were next directed towards providing for the tramway supply. This was successfully accomplished a little after 11 p.m., while, at the same time, light was supplied to the whole area of supply with the exception of Lochee, which is in the district furthest from the station. The amount of the damage is estimated at £1 400, and it is fully covered by insurance. The cause of the fire is still a mystery, and various theories have been put forward; it has been suggested that it was caused by the presence of an explosive gas in the cable trench, although no report was heard to account for this.

The Corporation Electricity Department is arranging for the lighting and power required at the new submarine depôt. Ten arc lamps will be fitted, and the cabling will amount to £400.

East and West Ashford (Kent).—Mr. Mark Parker, of Dover, intends applying for prov. orders for electricity supply in the areas of the Councils.

Finchley.—At a conference convened by Finchley to consider the Electric Lighting Acts (Amendment) Bill, at which Ealing, East Ham, West Ham, Hornsey, Wimbledon, Barking, Barnes, Beckenham, Bexley, Dartford, Erith, Finchley, Ilford, Leyton, Walthamstow and Willesden, were represented, a resolution was unanimously passed, welcoming the introduction of the Bill, but regretting that by the amendment made in the Bill during its passage through the House of Lords the power to provide and let for hire electrical fittings had been restricted to their provision and hire through a contractor, and expressing the hope that this restriction will be removed when the Bill is considered by the House of Commons.

Greenock.—In connection with the negotiations proceeding between the T.C. and the Admiralty for the supply of electricity for the new torpedo factory, some delay has occurred in the signing of the agreement over a dispute re clause 12, which bound the Admiralty to make a payment of £[illegible] per month in the event of its not being able to take up a full supply from a specified date. The T.C. has agreed to dispense with the stipulation provided the Admiralty consents to give [illegible] months' notice of the date on which it will be ready to take up supply.

Hamilton.—The [illegible] of the representatives of the [illegible] to hold an inquiry into the [illegible] in [illegible] Colliery, Hamilton, in [illegible] explosion while working an electric coal-cutting [illegible].

London.—Marylebone.—At the meeting of the B.C. on July 15th, the Electric Supply Committee reported that, owing to competition with private plants, it had found it necessary to arrange to give special terms to those consumers who had a maximum demand of 50 kw. and upwards, and were prepared to enter into an agreement for at least 10 years. The basis of the agreement would be that payment at scale rates per annum should be made in advance, the remaining charge being 1d. per unit for all units consumed. This arrangement may in the first place result in a small diminution of revenue, but it would not be considerable, and the advantages for the future very great. The scale of charges is as follows:—200 kw. and upwards, £4 10s. per kw.; 175 kw. and upwards, £4 17s. 6d.; 150 kw. and upwards, £5 5s.; 125 kw. and upwards, £5 12s. 6d.; 100 kw. and upwards, £6; 75 kw. and upwards, £6 10s.; 50 kw. and upwards, £7. One penny per unit is to be paid in each of the foregoing cases for all units consumed. The statement of accounts for the year ending March 31st last, shows that in place of the estimated deficit of £[illegible]567, there is a debit balance of £3,930 only, and this notwithstanding £1,163 being spent in opposing Parliamentary Bills. Some 9,000,861 units were sold during the 12 months, the actual increase in sales being 309,7[illegible]0 units, an increase on the estimate of 70,[illegible]61 units. The amount realised from sales to consumers, however, was £4,939 below the previous year's total, but this was due chiefly to reductions in price and a good proportion of new business being [illegible] of the lower class prices of supply. Notwithstanding the increased output, the total expenditure was £6,475 below the estimate and £10,[illegible]7 less than in the previous year. Generation expenses were ·62d. per unit sold, as against ·73d.; distribution cost ·[illegible]51, management cost ·22d, while rents rates and taxes was ·19d. The report proceeds to point out that the maximum load last year was 7,017 kw., but the 12,000 kw. plant installed is capable of dealing with a maximum load of 10,000 kw. The additional capital required for new mains, connections, meters, &c., to deal with this increase, is estimated at £45,000 approximately. Including the last mentioned figure, the capital expenditure (excluding the purchase or goodwill price) works out at £59·5 per kw. installed, a lower figure than in the case of any London undertaking. The report also deals at some length with the necessity, particularly in view of the heavy fixed charges, of increasing the sale of current.

Bermondsey.—The annual accounts of the electricity undertaking for the year ended March 31st last show that 2,78[illegible],583 units were sold during the 12 months, as against the estimate of 3,000,000. The actual income was £[illegible], against the estimate of £21,410. The total net expenditure for the year was £1[illegible],443, which gives the cost of production at 1·5[illegible] per unit sold. The expenditure consequent upon the Grange Road explosion was £176. The estimated quantity of units to be sold, viz., 3,000,000, was not realised, owing chiefly to consumers having reduced their consumption, due, to a large extent so far as public buildings were concerned, to the use of metallic-filament lamps. It was expected that the Tilbury Contracting Co. would take a [illegible] years' supply; it lasted, however, only for 15 months. After paying interest and instalments on loans, the net profit on the year's working amounted to £123, which is to be carried forward to the reserve fund for principal and interest, which will then stand at £[illegible]. It is mentioned that during the quarter ended June 30th, 1909, the number of units sold exceeded those in the corresponding period of 1908 by 1[illegible] per cent.

Kensington.—The Borough Council is to petition against the London Electric Supply Bill, upon the ground that the measure would deprive the Council of the right to purchase the electricity undertakings in Kensington in 1931, a right which was conferred upon the predecessor of the Council, the late vestry, by the legislature, in the session of 1888.

Bethnal Green.—The B.C. has had under consideration the question of a supply of electricity for the borough. Not having an undertaking of its own, the question was debated in committee as to taking a supply from a neighbouring borough, and on Thursday, July 16th, in open Council the Electricity Committee recommended that a supply be taken off the Shoreditch B.C. The recommendation aroused much opposition, Councillor Burton stating that the proposal would bind the Bethnal Green Council for [illegible] years. Eventually the matter was referred back to committee.

Hampstead.—An electrical exhibition is to be held in the autumn. In connection with the street lighting [illegible] incandescent gas lamps are to be converted for electric lighting; the estimated saving is put at 1s. 6d. per lamp.

Manchester.—Another mains explosion occurred on Monday, last week, near the Exchange. It was at first feared that results as serious as in the case of the Victoria Arcade explosion which recently occurred, might ensue, but the electricity department dealt with the matter promptly and cut the supply off. It is understood that, as in the Arcade explosion, a defective joint was the cause of the trouble.

Nairn.—The B. of T. has revoked the 1902 electric lighting order.

Neston.—The U.D.C. has given consent for Messrs. Forw[illegible] & Williams, of the [illegible]ton Hall Estate, to lay an E.L. main [illegible] the new [illegible] and houses being erected.

Newport (Mon.).—Negotiations have taken place between [illegible] and the borough electrical engineer, for a supply of electricity in bulk; if the customer is secured an extension of the Corporation's plant, involving an expenditure of about £70,000, will have to be made. The draft of a proposed agreement has been approved to supply energy to the Cardiff Channel Dry Docks and P[illegible] Co., Ltd., up to December 31st, 1916. It is proposed to convert 1[illegible] incandescent street lamps and 80 flat flame lamps to electricity at a cost of £160. It is estimated that the annual saving will be [illegible] £37 10s. per 100 lamps.

Smallthorne.—The U.D.C. has asked the North-Western Electrical Power Co., and the Hanley and Burslem T.C.'s to quote terms for public lighting at Milton.

Southend-on-Sea.—A loan of £13,715 for electric lighting purposes is being applied for by the T.C.

Southampton.—A Sub-Committee is to report upon a communication from the electrical engineer to the effect that the period for which the Council deferred the question of obtaining powers to carry on free or assisted wiring has practically expired, and urging that every effort should be made to obtain the necessary powers in order to fully develop the undertaking. The Parliamentary Committee is to consider the advisability of taking steps to reconstruct certain portions of the existing tramways at an estimated cost (exclusive of the acquirement of certain properties) of £2[illegible]0. The Parliamentary Committee is also to consider a proposal of the Tramways manager to extend the Shirley line to Anglesey Road at an estimated cost of £520.

Thetford.—The T.C. has asked the Electric Supply Co. to quote terms for lighting the town.

Whitehaven.—The T.C. has decided to submit a tender for lighting the harbour by electricity.

West Calder.—In connection with the new bakery of the West Calder Co-operative Society, a gas-driven electrical generating plant has been installed for power and lighting purposes; the society lights the village streets free of charge.

Worcester.—It has been decided to erect 12 additional arc lamps in the city, and 57 Osram lamps to replace 73 gas lamps. These will give a candle-power of 13,500 against 3,500 by gas, and the alteration will cost £480, which will be met by the Electricity Committee. In order to contribute towards the outlay, the Watch Committee has decided to pay £250 a year for the lighting, against £220 for the gas lamps.

TRAMWAY and RAILWAY NOTES.

Bacup.—The B. of T. inspection of the new electric tramways was made on Tuesday by Col. Druitt. The official and public opening of the Bacup tramways (2¾ miles) to Thornton, near Waterfoot, is fixed for to-day (July 23rd). A banquet follows at the Bacup Mechanics' Institute on the invitation of the Mayor and Mayoress. This completes the electrification of the Rossendale Valley Steam Tramways. The Bacup contract amounted to £36,500, and the Rawtenstall section to £145,000.

Barnet.—The Sub-Committee of the Herts County Council has paid a final instalment of £218 to Messrs. Dick, Kerr and Co., Ltd., in connection with their contract for the construction of a light railway at Barnet. This, with the expenditure previously incurred, makes a total of £22,018, or £28 in excess of the amount authorised by the County Council.

Bradford.—The final balance-sheet of the tramways department shows a net surplus of £15,318, as compared with £17,2[illegible]8 in the previous year; the amount, as usual, goes to strengthen the reserve and renewals fund. Some £20,000 has been appropriated from the account for the relief of the current year's rates, and it now stands at £24,000. The total amount disbursed for repairs and renewals of all kinds during the year reached £31,189, which sum includes a sum of £[illegible]4,000 drawn from the renewals fund, expended on the permanent way.

Continental Notes.—Sweden.—The members of the Government Committee on Waterfalls are visiting Swedish Lapland this summer and inspecting the various waterfalls there. At the same time Director Ofverholm, of the electrical department of the railways, is travelling there with the view of examining the local conditions with regard to the projected working of the railway to Narvik, in Norway, by means of electricity. The director of the Department of Waterfalls, Colonel Hansen, has already expressed himself in favour of the erection of a large power station in Lapland by the Government, and says that this plan will shortly be realised. The energy will be used partly for industrial purposes and partly for supplying the Ofoten Railway with power, when coal will be replaced by electricity.

Turkey.—A new company has lately been formed in Zurich, with a capital of £480,000 and the title La Union Ottomans, to develop electrical undertakings in Turkey and Asia Minor.

Portugal.—The tramway employés who struck work at Oporto, have now arrived at a satisfactory settlement with the company and returned to work.

Dundee.—The gross receipts of the Corporation tramways for the year ended May 15th last were £62,830, and the working expenses, including maintenance of lines, &c., amounted to £41,350, leaving a balance of £21,479. The mileage run was 1,381,242, an increase of 49,690 miles over the previous year, and the passengers carried were 16,658,073, an increase of 481,939. The receipts were £2,257 in advance of last year. The total capital expenditure on the undertaking to May 15th was £337,423.

Handsworth.—The Tramways Committee has submitted the award of Mr. H. Graham Harris, who was appointed referee by the B. of T. to settle the price to be paid by the Council for the part of the City of Birmingham Co.'s tramways in the Council's area. The Committee has approached the company in regard to the lease of the tramways until June 30th, 1911.

Huddersfield.—A movement is on foot on the part of tramway managers to introduce a new type of tramway car, with a view chiefly to the abolition of the confusion and delay arising when outgoing and incoming passengers meet at the same door. Huddersfield Corporation has just decided to try a type designed by Mr. P. Kavanagh, of Liverpool, in connection with an order it is about to place for rolling stock, while both Sheffield and Huddersfield are introducing on their existing cars a novel system of top-deck seating, also designed by Mr. Kavanagh. The leading feature of the car design is an automatically-worked safety arrangement, whereby passengers may enter and leave simultaneously.

Hull.—The report of the Corporation Tramways Department for the year ended March 31st last, shows that some 32,958,883 passengers were carried and 3,379,117 car-miles run. The gross income amounted to £129,899 and the working expenses to £79,765, leaving a gross profit of £50,134; out of this the sums of £13,786 and £9,321 were required for interest and sinking fund respectively, £18,000 was allocated for the relief of rates 1909-10, and the balance of £6,319 was placed to reserve. The department operates its own power plant at a total running cost of £11,722, or ·83d. per car-mile; 4,324,609 units were generated, and an additional 9,440 units purchased from the electricity department. The passengers carried comprised 28,913,755 at 1d. and 4,045,128 at ½d. The department has a reserve fund of £96,163.

Kilmarnock. — The report by the electrical engineer and tramway manager submitted to the last meeting of the T.C., showed that during the past year there was a profit of £148 on the electric light and deficit of £2,009 on the cars. In the course of a long discussion on car fares and stages, it was decided to issue return tickets between Kilmarnock and Harlford.

London.—L.C.C.—The Highways Committee has issued a comprehensive report on the working of the tramways during the period ending March 31st last. From this it appears that at that date the system extended over 127⅝ street miles, being 85⅝ miles electric, and 42 miles of horse lines, all worked by the Council, except two short lengths (¾ mile) in Highgate and Leyton. The capital expenditure on the undertaking, up to March 31st last, was £9,483,562, of which £1,038,971 represents expenditure during the year. The receipts and working expenses during the year were, in the case of electric traction, £1,572,251 and £896,286 respectively; in the case of horse traction, £275,199 and £305,402 respectively, the surplus on the whole system being £645,762, after deducting the deficiency of £30,203 on the horse lines. From this surplus, interest and sinking fund absorb £523,101, and other charges swell the latter figure to £538,192, leaving a net balance of £107,570. In June last the Council decided to provide ⅔d. per car mile for renewals (on the electrical mileage), and this absorbs £88,785, the remainder of the net balance going to the same fund towards deficiencies in past contributions. The total operating expenses for electric traction were 6·74d. per car-mile, as compared with 6·79d. in 1907-8. The number of passengers and the car-miles run were as follows: Electric, 344,705,937 and 31,962,784; horse, 68,207,904 and 7,156,688 respectively.

The Highways Committee recommends that it be authorised to deal with any tenders which may be received during the summer recess in connection with two 1,500-kw. rotary converters for the Elephant and Castle sub-station; also in connection with the reconstruction of the Highgate Hill cable tramways, for which the track work, &c., is estimated to cost £18,920; and in connection with the reconstruction of tramways from Beresford Square to Nile Street, Woolwich, on the overhead system, at a cost of £5,350.

The Highways Committee, in a further report, recommends that authority be sought in the session of Parliament, 1910, for the construction of additional tramways, amounting to 23 miles single line, partly on the conduit and partly on the overhead system, the cost being estimated at £417,080, exclusive of cars, &c.

The Finance Committee reports, in connection with the above, that it has not yet been decided what proportion of the cost of street widenings shall be chargeable to the Tramways Account, and that the financial results estimated for are irrespective of debt charges in connection with widenings, which may in future be charged against tramways account. In view of the large aggregate cost of the street widenings concerned and the fact that local traffic would benefit largely, the Committee considers that the Council would not be justified in proceeding with any of the schemes, unless the local authorities were prepared to contribute one-third of the cost of street widenings, as proposed by the Improvements Committee.

Morecambe.—The T.C. on Monday decided to apply for a loan of £9,000 for tramway purposes.

Rochdale.—The line to Milnrow and Newbey was again discussed at great length by the Milnrow District Council on the 14th inst., and a resolution was passed by the Council in favour of obtaining a prov. order similar to that secured by the Whitworth District Council.

Transvaal.—The Johannesburg municipality is considering a recommendation by the Tramways Committee to spend £100,000 on suburban extensions.

U.S.A.—About 18 months ago the first tube railway under the Hudson River, between Manhattan and Jersey City, was opened for traffic. On Monday last the second pair of tubes were opened, and a third pair, which is being built for the Pennsylvania Railroad, is nearly finished.

Watford.—At a meeting of the Herts County Council on Monday, the Council approved of the estimate of £37,990 for the construction of the Watford Light Railway from the terminus at Callow Land, *viâ* St. Albans Road, Station Road, Woodford Road, Queen's Road and High Street, to a point near the London Road. It also sealed the agreement with the Metropolitan Electric Tramways, Ltd., for a 42-years' lease from August 21st, 1908.

Woking.—The Woking and Bagshot Light Railway Co. has applied to the B. of T. for an extension of time for carrying out the Light Railway Order, 1906. The Woking U.D.C. has decided to offer no objection.

TELEGRAPH and TELEPHONE NOTES.

Imperial Telegraph Rates.—At a committee meeting of representatives of telegraph administrations transmitting telegraph traffic "*Via* Eastern" and "*Via* Teheran" between Great Britain and India, Australasia, and South Africa, Reuter's Agency is informed, the following resolution was approved—namely, "That provided the British, Indian, and Colonial Governments are prepared to take their rateable share of the reduction, the Press rate between Great Britain and India, Australasia, and South Africa be reduced to 9d. per word from August 1st next."

Persia.—According to the *Daily Telegraph*, the telegraph staff of the Indo-European Telegraph Co. in Teheran recently underwent four days of continuous duty under siege conditions. The offices were under fire throughout the entire fighting, and though the windows were barricaded, fragments of shell found their way in, and the whole of the staff were exposed to considerable danger. Fortunately, there were no casualties among the staff of the company, who displayed praiseworthy devotion in grappling with increased traffic under extremely dangerous conditions.

Strike in Mexico.—The telegraph operators of the railroads have struck for higher wages, and against the instructing of Mexican apprentices.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Dakar-Conakry	May 13, 1909	July 18, 1909
Tangier-Cadiz	May 19, 1909	
Cayenne-Salinas	June 7, 1909	June 28, 1909
Assab-Perim	July 8, 1909	
Bolama-Bissao	July 15, 1909	July 15, 1909

Telephonic Communication with the Continent.—The *Times* states that the Postmasters-General of Spain and France have just signed an agreement which will provide direct telephonic communication between the two countries. When the work is completed it will be possible to speak, not only to Madrid, but to almost any town in Spain from either Brussels, Paris, or London. Four new circuits are to be laid—namely, Bordeaux—Madrid, Cette—Barcelona, Bayonne—San Sebastian, and Perpignan—Gerona Each of these four systems will be in direct connection with the whole of the telephone systems of both France and Spain. The Spanish part of the cost will appear in the supplementary estimates; that of France is estimated at £24,000.

Wireless Telephony.—As a result of representations made by the company which supplied the wireless telephone equipment to the United States battleship fleet prior to its cruise around the world, the U. S. Navy Department is making an investigation of the alleged facts upon which a report condemnatory of the wireless telephone equipment was based. Although this report condemned the wireless telephone as useless, an officer on one of the ships has stated that, by its means, conversation could be maintained between ships 10 and 15 miles apart. The guarantee of the company which supplied the apparatus was limited to a radius of five miles, and it is claimed that the system was actually successful over this range.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Altrincham.—July 30th. Electrical installation at the new Higher Elementary Schools, Hale (deposit, £1 1s.). J. Howarth, Clerk, Education Department, Altrincham, Cheshire.

Australia.—MELBOURNE.—August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

NEW SOUTH WALES.—Telephone material for the P.M G. See "Official Notices" to-day.

Barnstaple.—July 28th. Electric light installation at the workhouse and cottage homes, for the B. of G. Workhouse Master.

Blackburn.—July 26th. The Electricity Committee requires tenders for steam coal for the ensuing 12 months.

Bradford.—July 30th. Eight automatic point controllers for the Tramways Department. See "Official Notices" July 9th.

Canada.—WINNIPEG.—August 2nd and 16th. The city of Winnipeg is advertising for tenders for the hydraulic and electric equipment of the generating station now under construction on the Winnipeg River, at Thirty-foot Falls. Some particulars were given in this column on July 2nd.

Dublin.—July 26th. Machinery oils for the Corporation electricity works. See "Official Notices" July 16th.

Edmonton.—July 28th. Private telephone equipment at the infirmary. See "Official Notices" July 16th.

France.—PARIS.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

August 11th.—The Direction de la Manufacture d'Armes at Châtellerault (Vienne) requires tenders for cables, copper wire, and dynamo construction material (11 lots).

August 5th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for telegraph apparatus and accessories; also by August 3rd for a number of tools required to repair telephone and telegraph installations and apparatus.

Germany.—August 4th. The gas, water and electricity authorities in Dresden are inviting tenders for the supply and erection of two 700 KW. dynamos.

COLOGNE.—August 25th. The Municipal Council requires tenders for four electrically-driven cranes.

Hull.—July 28th. Electric and gas light fittings for the new Public Hall of the Corporation. See "Official Notices" July 16th.

Hull.—July 29th. Electric lighting mains extensions for the year, for the E L. Committee. See "Official Notices" July 9th.

Italy.—August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as from home makers for the supply of 100,000 metres of telegraph cable.

August 18th.—The Italian State Railway authorities in Rome are inviting tenders for the supply of six electrically-operated drop hammers.

Keighley.—August 7th. Two 1,000-KW. turbo-alternators with condensers, and two water-tube boilers for the electricity department. See "Official Notices" July 16th.

Leyton.—July 27th. Electric light installation for Sybourn Street School for the U.D.C. Education Committee. Architect, Mr. W. Jacques, 2, Fen Court, Fenchurch Street, E.C. (deposit, £1).

London.—G.P.O.—August 9th. Creosoting telegraph poles for the P.M.G. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Manchester.—July 27th. Lighting cable for the Tramways Committee. Mr. McElroy, general manager.

Pontypridd.—July 27th. One 500-KW. steam dynamo for the U.D.C. See "Official Notices" July 16th.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

West Ham.—The Education Committee is to obtain tenders for installing electric light throughout the Abbey School. The architect's estimate is £375.

CLOSED.

Australia.—According to the *Australasian World*, a tender has been accepted by the Commonwealth Government for a common battery switchboard at Hobart from the Western Electric Co., Sydney, the price being £4,728 for the board and 770 sets of instruments.

Bedford.—The T.C. has accepted the tender of Messrs. Edwin Danks & Co. (Oldbury) for a 30 ft. by 8 ft. Lancashire boiler, with superheater and pipework, for £659 10s.; and of Messrs. W. H. Allen, Son & Co. for condensing plant and pipework for £1,169.

Belgium.—Eight concerns, including Messrs. Bruce, Peebles & Co., of Edinburgh, submitted offers to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the supply and erection of the plant necessary for a transformer sub-station in connection with the Spa-Verviers electric railway. The lowest was that of the Société Westinghouse, of Paris.

Cleckheaton.—The Council has accepted the tender of the Tudor Accumulator Co., Ltd., for the supply and maintenance of a battery of 260 cells with a capacity of 540 ampere-hours.

Egremont.—The tender of Mr. W. Harris, Liverpool, has been accepted for the electric lighting, &c., of the Wallasey Skating Rink Hall in King Street, Egremont, Cheshire.

Ilford.—The U.D.C. has accepted the tender of W. Griffiths & Co. for tramway works in Ilford Lane at £1,465 3s.; and that of Hammond & Miles, Scrafton Road, Ilford, for tramway shed extensions at £1,892.

London.—The Post Office authorities have accepted the the following tenders:—

Supplying and laying feeder cables, Blackfriars, E.C.—Western Electric Co.
Supply and install telephone exchange equipment at Willesden.—General Electric Co., Ltd.
Cable, paper core.—Western Electric Co., Ltd.
Wire, copper, hard-drawn.—British Insulated and Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Richard Johnson & Nephew, Ltd.; T. Bolton and Sons, Ltd.; Shropshire Iron Co., Ltd.; Frederick Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.; John Wilkes, Sons & Mapplebeck, Ltd.
Wire, copper, annealed.—T. Bolton & Sons, Ltd.
Bends, split and couplings.—Jones & Attwood.
Perforators, keyboard, Gell.—Gell Telegraphic Appliances Syndicate, Ltd.
Cable, paper-core.—Callender's Cable and Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.

The Metropolitan Water Board has accepted the tender of Messrs. Glenfield & Kennedy, Ltd., at £450, for electrical water-level instruments and line wiring, &c., for the same, at the Beachcroft reservoir.

BERMONDSEY.—The B.C. has accepted the following tenders for the electricity works:—

Davidson & Co., exhaust fan, £72; Browning & Co., Ltd., forced-draught fan, £19.

STOKE NEWINGTON.—The B.C. has accepted the tender of the Reason Manufacturing Co. for demand indicators, and of Messrs. Crompton & Co, at £150, for the provision and erection at Edwards Lane station of a balancing machine, designed to give increased output from, and to improve the efficiency of, the generating plant at the destructor.

SOUTHWARK.—The B.C. received the following tenders in connection with the electricity undertaking:—

Addition to generating station to be used as a battery room:—

Battley, Sons & Holness		£1,147
F. & H. F. Higgs		1,190
William Downs		1,177
John Marsland & Sons	(accepted)	1,120

Erection and maintenance of battery:—

Hart Accumulator Co., Ltd.		£395
Chloride Electrical Storage Co., Ltd.		390
Tudor Accumulator Co., Ltd.		351
D. P. Battery Co., Ltd.		280
Premier Accumulator Co., Ltd.		263
Electrical Power Storage Co., Ltd.	(accepted)	247 per annum for 15 years.

Supply and fixing of four superheaters:—

Davey, Paxman & Co.		£615
Babcock & Willcox		498
Heenan & Froude	(accepted)	420

110 yards of 3 by ·3 by ·125 paper-insulated and lead-covered cable:—

B.I. and H. Cables, Ltd.		£56
Johnson & Phillips, Ltd.		57
Siemens Bros. & Co. Ltd.		57
Western Electric Co.	(accepted)	56

L.C.C.—The Highways Committee recommends the acceptance of the tender of W. Cory & Son, Ltd., for 130,000 tons of coal for the Greenwich generating station for 12 months, at 11s. per ton, with demurrage at the rate of 2d. per ton for each day after two days.

Maidenhead.—The T.C. has accepted the tender of the Diesel Engine Co., Ltd., for the supply of a 150 KW. Diesel-E.C.C. generating set.

Salford.—The T.C. has accepted the tender at £719 of Cleworth & Robinson for the erection of a battery house and alterations to the existing buildings at the Frederick Road electricity works.

Stretford.—The D.C. has accepted the tender of Messrs. E. Green & Sons, Ltd., for the replacement of the first cold-end group of the economiser, consisting of 80 tubes and boxes, for £144 10s., and for the replacement of any other sections that may be required at £12 10s. each.

Sunderland.—The Corporation has ordered 70 electric tramway meters from Messrs. Chamberlain & Hookham, of Birmingham, at a cost of £3 5s. each. The chairman of the Tramways Committee said the meters would soon pay for themselves by the saving of current which would be effected through the rivalry of motormen in keeping down consumption.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for the extension of the lighting mains at £181.

Worksop.—The U.D.C. has accepted the tender of W. T. Glover & Co., Ltd., for cables, £354.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Monday, July 26th, to Friday, July 30th. At Liverpool. Summer meeting. Reading and discussion of papers. Visits to the Southport Electrified Railway; Liverpool Corporation Electricity Works; Messrs. Cammell, Laird & Co.'s Works; the English McKenna Process Co.'s Steel Rolling Mills; the Mersey Railway Co.'s Generating Station; L. & Y. Railway Co.'s Locomotive Works, Horwich; and Messrs. Dick, Kerr & Co.'s Works, Preston.

NOTES.

The Thwaite Fund: Mr. Carnegie's Donation.—It is with considerable satisfaction that we learn that the Committee of the B. H. Thwaite fund has now received from Mr Carnegie a cheque for his generous contribution of £500. The condition which was attached to Mr. Carnegie's offer—namely, that a further £500 should be forthcoming from subscriptions from those who recognised the value of the services rendered to certain departments of science and industry by the late Mr. Thwaite—has not been complied with up to the hilt, it is true, as the subscriptions did not reach a quite equal sum; but Mr. Carnegie has not allowed the actual cash shortage to stand in the way. He was doubtless influenced in his decision by the successful efforts of the Committee in regard to Mr. Thwaite's son, aged nine, who has been elected to the Yorkshire Society School. If this benefit could be capitalised, it would represent many times the shortage in the subscription total. We understand that arrangements are in progress for placing Mr. Thwaite's daughter in a suitable school. The Committee are desirous of expressing, through our pages, their gratitude to Mr. Carnegie for his generosity and kind consideration, to all who by their subscriptions have helped to make up the required sum, and to those who have so substantially assisted by placing the deceased gentleman's son in the above school. In the last named connection, special thanks are due to Mr George Mellor, the secretary of the Association of Yorkshiremen in London, of which Association the late Mr. Thwaite was a founder.

Quite Right Too.—Hampstead Borough Council had under consideration at its meeting last week the question of employés soliciting from contractors and others subscriptions towards beanfeasts. The obvious objections to the practice were pointed out, and it was resolved to instruct the borough engineer to have notices put up and kept posted in the depot and other places, warning employés that the soliciting or accepting of gratuities of any kind, under any circumstances, is prohibited and renders them liable to dismissal, and that the rule will be strictly enforced.

Electrical Territorials.—The Lancashire Fortress R.E. (Territorials), which absorbed the old Volunteer Electrical Engineer Battalion, left Liverpool on Saturday for the annual camp training. Under the present responsibilities of the corps, Col. Langdon's command, for camp purposes, has been split up this year, and the experience will be, no doubt, of value to the units concerned. One half of the battalion is on the old camping ground over the Mersey, at Wallasey, while the other two companies have crossed the Channel for particular service in Ireland.

Henry Saxon Snell Prize Competition.—The Royal Sanitary Institute has appointed Prof. Henry Adams, M.Inst.C.E., F.S.I., Dr. Louis C. Parkes, M.D., D.P.H., Prof. W. Napier Shaw, D.Sc., M.A., F.R.S., and Mr. A. Saxon Snell, F.R.I.B.A., as the adjudicators for the next "Henry Saxon Snell Prize" Competition, the subject set being "The Principles of Heating and Ventilating Public Buildings." The essays have to be delivered at the Institute, 90, Buckingham Palace Road, by August 31st.

Inquiries.—Makers of the "Climax" carbon-filament lamp are asked for.

Institution and Lecture Notes.—Lecturing on "Steel" to the convention of the Permanent Way Institution at Sheffield on Saturday, Prof. McWilliam, of Sheffield University, referred to the fact that the electrification of railways was resulting in the rapid wearing away of rails, and therefore builders of permanent way would have to come to Sheffield for steel. There was, for instance, manganese steel, which had a very long life, though of course raising the amount of manganese raised the price. Mr Willox, engineer of the Metropolitan Railway, said he thought the addition of silicon in the manufacture of steel had increased the life of the rail 110 per cent.

Institution of Electrical Engineers.—A special general meeting of Members, Associate Members and Associates is to be held at the offices of the Institution on Thursday next, at 5 p.m., for the purpose of considering, and, if approved, of passing resolutions authorising and confirming the action of the Council in borrowing the sum of £26,000 from the Economic Life Assurance Society on the security of the leasehold property of the Institution on the Thames Embankment, and authorising the expenditure of a sum not exceeding £20,000 on structural alterations, furniture, and fittings in connection with the Institution Building, the Council to make such financial arrangements (including the borrowing of money on the security of the Institution Building and of the Institution property in Tothill Street) as it may consider necessary for the purpose.

Institution of Mining Electrical Engineers.—Meetings of the Yorkshire and Notts branches of the Institution will be held tomorrow, July 24th, at the Victoria Station Hotel, Sheffield, and the Welbeck Hotel, Nottingham, respectively, both at 5 p.m. The business on the agenda at each meeting will be the appointment of local officers, &c., and all those locally interested in the formation and progress of the Institution are invited to attend.

Arrangements have now been completed for the important conference to be held in Liverpool under the auspices of the Institution of Mechanical Engineers. Among the papers to be read at the gathering, which begins on the 27th inst., are "Hydraulic and Electrical Appliances on the Liverpool Dock Estate," by Mr. Alaric Hope; and "Electrical Driving in Textile Factories," by Mr. Herbert W. Wilson.

Institute of Metals.—The Institute has just completed the first year of its existence, during which period the membership has increased to more than 500. The first volume of the *Journal* of the Institute is now in the hands of all members, and shortly they will receive notification of the forthcoming Autumn meeting, which will take place at Manchester on October 14th and 15th. A series of about half a dozen papers of great interest will be read and discussed. When Sir William White retires from the presidency at the end of the present year, it is almost certain that Sir Gerard Muntz, Bart., will be nominated to the vacant office. Dr. H. C. H. Carpenter has been elected vice-president.

Portrait of Sir Chas. Bright.—We understand that a number of copies of the portrait which formed the frontispiece of the abridged biography of Sir Chas. T. Bright, by his son, Mr. Chas. Bright, F.R.S.E., recently reviewed in our columns, have been mounted suitably for framing, and can be obtained from the publishers, Messrs. Constable & Co., at a nominal price.

Will.—It is stated in the daily Press that Major W. M. Mackenzie, a director of Callender's Cable and Construction Co., Ltd., and other companies, left estate of the gross value of £26,099, with net personalty £26,173.

Charge of Embezzlement.—It is reported that a recent investigation into the affairs of the Airdrie and Coatbridge Tramway Co., whose headquarters are in London, led to the suspension of Mr. Arthur Delves, who has been manager of the tramways since they were opened some years ago. A Sheriff's warrant was subsequently issued for the arrest of Mr. Delves on a charge of embezzling funds belonging to the company. Mr. Delves gave himself up to the police at Birmingham.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The salary of Mr. Calvert, electrical engineer, of Finchley, is to be increased from £475 to £500 per annum, dating from the 1st inst.

Mr. A. C. Gilling, who for some time has had charge of the Epsom U.D.C. electricity undertaking as acting engineer, has been appointed resident electrical engineer at a salary of £200 per annum, rising by annual increments of £10 to £250.

Tramway Officials.—The Morecambe T.C. on Monday rejected the recommendation of the Tramways Committee to appoint Mr. Carleton, an ex-alderman of the Council, as tramways manager.

Mr. M. Harold Curry, who was appointed assistant manager of the Coventry Electric Tramways Co. in April last, was married on July 1st to Miss J. M. Buffham, of Belsize Park, Hampstead. Amongst the presents was a barometer from the staff of the tramway company.

General.—According to the *Times*, the Council of King's College have elected Mr. C. G. Barkla, D.Sc. (Liverpool), Professor of Physics, in succession to Prof. Harold Wilson, F.R.S., who has accepted an appointment in McGill University, Montreal.

Mr. F. B. C. R. [illegible], of Lincoln, a member of the Electrical Contractors' Association, was married recently to Miss Elsie MacBrair, daughter of the city surveyor of Lincoln.

Mr. T. L. Miller has been re-appointed consulting engineer to the Stretford electricity undertaking for one year from November last.

Mr. George Gregory, late of the General Electric Co., Ltd., and now of the Electric Battery Co., High Holborn, was married last Saturday at St. Andrew's Church, Stoke Newington, to Miss Olive Hawes.

Messrs. James E. Sayers & Caldwell, consulting engineers and electricians, announce that they have removed to new offices at 190, West George Street, Glasgow.

We learn that Mr. A. Henderson (late of Messrs. John Brown and Co., Ltd., Clydebank) has been appointed electrical engineer to Messrs. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, to organise a new electrical department to carry out the electrical work on the new British battleship H.M.S. *Colossus*, which the firm is building.

The *Daily Telegraph* reports that Mr. Thomas Cleghorn Baillie, M.A., D.Sc., at present head of the physics and electrical engineering department at Sunderland Technical College, and assistant-lecturer and demonstrator in physics and electrical engineering at University College, Bangor, has been appointed principal of the Croydon Polytechnic, in succession to Dr. Beckit Burnie, who goes to Brighton.

Mr. H. T. G. Edmonds, of the Mersey Railway power house, Birkenhead, has been presented by the staff with a 400 day clock on the occasion of his marriage with Miss M. E. McFadden, of Higher Broughton, Manchester.

Obituary.—Mr. J. A. Booth.—The death occurred on Sunday, in his 49th year, of Mr. John Alfred Booth, of the firm of Joseph Booth & Bros., Ltd., electrical crane manufacturers, Union Works, Rodley, Leeds.

We regret to see from the *Times* announcements that Mr. John Brailsford Bright, eldest son of the late Sir Charles Tilston Bright, passed away on 17th inst., at the age of 55 years.

CITY NOTES.

Chili Telephone Co., Ltd.

On Thursday last week Mr. George Keith presided over the meeting of this company held at the offices, 42, Old Broad Street, E.C.

In moving the adoption of the report (see Electrical Review, July 9th, page 69) the Chairman said it showed a satisfactory improvement in the company's business, similar to that which took place in the previous year. The currency revenue in Chili had increased about 17 per cent. owing partly to the expansion of business, and partly to the higher rate charged in compensation for the lower value of the Chilian dollar in which they were collected. The proportion of current expenditure to revenue was 48 per cent., or nearly 2 per cent. less than it was in the preceding year. The financial depression through which Chili had been passing since the earthquake in 1906 still continued, and the average of the exchange from the paper dollar was 10d. or about a 1d. less than in the previous year. The result was that the income in Chili after conversion into sterling showed an increase of £3,815, investment and transfer fees had increased £59, while the London expenses and income tax were practically the same as they were last year. There was no charge for debenture interest as was the case in the previous 12 months, and the net profit for the year was £35,327 which with the £2,777 brought forward gave them an available sum of £38,104. An interim dividend which absorbed £6,600 was paid in January, and £17,683 they proposed to place to reserve. The directors now recommended the payment of a final dividend of 5s. per share, which would absorb £11,000, and would make a total distribution for the year of 8 per cent., free of income-tax, and the remaining £2,820 would be carried forward. The sum of £4,288 expended during the year on new stations had been carried to the capital account, and £5,668 on replacement of plant had been taken from the reserve fund. The invested funds, which were taken at cost, stood at £10,329 more. Altogether, he thought he might congratulate the shareholders on the result of the year's business. The company's plant and property at the various centres throughout the country had been considerably extended during the year. Amongst other things, seven new offices had been opened and connected up with the southern district. The currency of the dollar at Chili had fluctuated greatly during the year, and any measure which tended to fix the value of the dollar at a practical figure would be to the commercial and economical interest of the country. The company's relations with the Government and the various local authorities were of the best, and the outlook for the current year was favourable.

The Hon. H. T. Allsopp seconded the motion, and the report was adopted.

Held Over.—Pressure upon our space compels us to hold over until next week our reports of the meetings of the Victoria Falls and Transvaal Power Co., the United River Plate Telephone Co., Ltd., and the National Telephone Co., Ltd.

Prospectuses.—*Sungei Kari (Sumatra) Rubber Estate, Ltd.*—An issue of [illegible] shares of £1 each at par has been offered for subscription this week. The company is acquiring the Estate named, which is situated in the Serdang district of Sumatra. 775 acres out of 1,7[illegible] are planted with rubber trees.

[illegible] Rubber Co., Ltd.—The list closes to-morrow (Saturday) on an issue of 29,000 shares of £1 each.

[illegible] Estates and [illegible], Ltd.—An issue of 229,000 preferred shares of £1 each, [illegible] per cent. cumulative and participating, has been offered for subscription.

Calcutta Electric Supply Corporation, Ltd.—The list was to close yesterday in an issue of [illegible] 5 per cent. cumulative preference shares at £5 each at par. The money is required for mains extensions, and for a new high-tension generating station in the northern district of the city.

Manaos Tramways and Light Co., Ltd.—Offers have been invited for sale of £3[illegible] 5 per cent. first debentures to be applied to extensions and improvements provided for in the concession. A report on the undertaking by Messrs. J. G. White & Co., Ltd., who were interested in the original formation of the company, appears in the prospectus. They state that the amount of £16,500 required for the service of the debentures is covered nearly three times over.

Balap Rubber Plantations, Ltd.—This company, which has purchased the Sungei Duri Rubber Estate, in Wellesley, Straits Settlements, has been offering 31,500 shares of £1 each for subscription.

United Sua Betong Rubber Estates, Ltd.—An issue of 38,000 shares of £1 each has been offered by this company, which acquires properties in the Federated Malay States.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have issued a circular to shareholders, stating that the profits for the first six months of the current year, as shown by the cost sheets, amount to £47,759, which, after including the balance brought forward from last year and deducting interest on loans, debentures, &c., represents a net sum of £41,704. Out of this the directors have decided to pay, on the 31st inst., an interim dividend on the preference shares of 2½ per cent., absorbing £17,187. The balance (£24,516), though subject to deductions for depreciation and a sum to be carried forward, would, in the ordinary state of business, permit the declaration of a small interim dividend on the ordinary shares. In view, however, of the critical position of the coal trade and the possible stoppage of, and damage to, other trades which may follow therefrom, the directors do not think it prudent to deal with the balance before the end of the company's financial year.

London Electrobus Co., Ltd.—According to an article appearing in the *Financial Times* of July 17th, a circular has been privately distributed among shareholders of the above company, putting forward a scheme for reorganisation. It appears that it is not circulated by the company, but by a private gentleman who has received an option to carry out the scheme, and is asking shareholders to subscribe up to 20 per cent. of their present holdings, in his reorganisation syndicate. This option was to expire on Saturday last.

Montreal Light, Heat and Power Co.—A dividend of 1¾ per cent., being at the rate of 7 per cent. per annum for the quarter ending the 31st inst. is announced.

Mather & Platt, Ltd.—The directors have declared an interim dividend on the ordinary shares of 5 per cent., free of income tax, for the half-year ended June 30th last, being at the rate of 10 per cent. per annum.

Anglo-Malay Rubber Co., Ltd.—The directors have declared a first interim dividend of 12½ per cent. (2s. 6d. per share), less income-tax.

American Telephone and Telegraph Co.—According to the *Financial News*, the net earnings for the past six months, after payment of interest and dividends, amounted to $2,462,000, as compared with $[illegible],543,000 for the corresponding period of last year.

Pataling Rubber Estates, Ltd.—The directors have declared an interim dividend of 25 per cent. (6d. per share) less income tax.

Marconi's Wireless Telegraph Co., Ltd.—At a special meeting held last week, the resolution which came before the recent annual meeting, altering the articles so as to enable the directors to pay commission on shares, was approved.

National Telewriter Co., Ltd.—This company held its statutory meeting on 15th inst., at Oxford Court, E.C., Sir W. Treloar presiding.

Chelsea Electricity Supply Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum (2s. per share) on the ordinary shares for the past half-year, payable September 15th.

City of London Electric Lighting Co., Ltd.—The directors have declared an interim dividend of 5 per cent. per annum (5s. per share), less income tax, on the ordinary shares for the past half-year, payable August 4th.

Mexico Tramways Co.—The directors have declared the usual quarterly dividend of 1[illegible] per cent. on the capital stock.

Edmundson's Electricity Corporation, Ltd.

The twelfth annual meeting of the shareholders of the above company was held on Thursday of last week at Salisbury House, Old Broad Street, under the presidency of Mr. P. Debell Tuckett.

The Chairman, in proposing the adoption of the report (see Electrical Review, July 9th, page 68), said that, dealing with the accounts the first item was gross trading profit, and, as compared with the previous year, that was down by the very substantial amount of £5,235. The main cause of this decline was the reduced capital expenditure of the sub-companies, but though it might be regrettable that greater opportunities for spending capital to advantage should not have presented themselves, the mere failure to increase or maintain the trading profit by virtue of such capital expenditure afforded no ground for regret. A further cause of this decline was to be found in the fact that the private lighting department had not done as well this year as last, when it had in hand the completion of a large Government contract. A third cause, which had adversely affected the trading profits to the extent of some £500, arose out of what he could only describe as iniquitous book-keeping by one of the Urban Co. undertakings some years ago. Losses, which should have been disclosed and met at the time, were suppressed by means of fictitious or otherwise improper debits to capital, and they had accordingly to be dealt with now that they had been brought to light. The engineer responsible for these discreditable manipulations was unsatisfactory in many other respects, and, with the book-keeper in question, had long since left their service. Since the accounts were made up, he regretted to say they had reason to fear that a similar state of affairs would be disclosed in the case of another Urban Company undertaking, for the management of which the same engineer was responsible. Interest on temporary loans was up some £400, as was natural owing to the prior lien issue last year. Dividends and interest from investments and advances had increased by £2,124, or 8·3 per cent., an increase which, taking into consideration the prevailing conditions of the past year, must, he thought, be regarded as reasonably satisfactory. The reduction of only £387 in the amount of the Urban Co. guarantee, was the one feature of the accounts which was distinctly disappointing. The gross profits of the Urban Co. increased by £1,667, but this compared with an increase for the previous year of £3,845. The special reason for this decline in the rate of increase was found in the position of two of the company's undertakings, Hawick and Twickenham, which, after consistent progress at the rate of something like £2,000 a year between them, this last year actually contributed £1,464 less profit than for the previous year. In both cases this set-back was due to causes largely or wholly beyond their control. They would notice that the basis, on which the Urban Co. guarantee was calculated, was now set out on the face of the accounts. The net profit of £597 carried to the balance-sheet was, of course, most unsatisfactorily small, providing as it did so bare a margin over the amount of the debenture interest. They knew now, as they knew a year ago, that the company was far from being in the position in which they would wish to see it. Nevertheless, they believed that henceforward the amount of the net profit would steadily increase, and in other respects the company was undoubtedly in a far more satisfactory position than it was. Turning to the balance-sheet, it would be seen that investments and advances had increased by £49,398, whilst the reserve against investments had been increased by £409. This year there was a further item of £26,000, investments in Corporation, Colonial and railway stocks. These consisted of short-dated securities of the highest character, and constituted a temporary investment of their surplus funds. On the other side of the account, liabilities had increased by the amount of the prior lien debenture issue, the expenses of which had been deducted from the balance at credit of profit and loss account, leaving, with this year's addition of £597, a balance of £14,809 to be carried forward. Turning to the schedule of investments and advances, they found that their advances had increased by £36,669, and their debentures by £14,000, whilst their share holdings had decreased by £3,470. The alteration in the amounts of their share and debenture holdings arose out of their recent subscription for Lancashire Power Construction Co.'s debentures. Instead of subscribing for £27,500, the maximum amount which he promised them a year ago not to exceed, they had substituted £1,735 debentures for a similar amount of "B" shares, and had increased their holding in the company by £1,235 less than the stipulated maximum amount of £27,500. With reference to the present position of the Lancashire Power Co., last year's trading showed a loss of £3,809, this year's trading was expected to show a small profit, whilst next year it was expected that sufficient profit would be earned to more than cover the debenture interest. The business was, of course, seriously affected by the strike in the cotton trade last autumn, and continued to be adversely affected by the depression which still prevails in that trade, and in the general trade of the district, largely dependent as it was on the prosperity of that trade. At the moment the company was making neither profit nor loss, but, in so far as it had now eliminated the loss at which it had hitherto been working, he hoped it might be considered to have at last turned the corner. Of the increase of £36,669 in the amount of their advances, the Urban Co. accounted for £32,465, and in this connection he would again like to point out the effect of the adoption of a more liberal depreciation policy by the sub companies in reducing the amount of their advances in the case of the Alderley, Isle of Wight, Lymington and Wycombe companies, in spite of increased capital expenditure by all those companies, whilst similarly in the case of the other companies the amount of the additional advances was reduced below the amount of the respective expenditure. The capital expenditure had increased by £52,081, or by 1·9 per cent., as against £69,065, or 2·6 per cent., a year ago. Lamp connections had increased by the equivalent of 100,144 33-watt lamps, or 8 7 per cent., as against 121,845 or 11·9 per cent. a year ago. In both cases this diminished increase must to some extent be attributed to their policy of restricting free wiring, on which only £3,038 net was expended this last year, as against £8,076 for 1907, and £25,130 for 1906, but the growing use of the new lamps, of which they required a disproportionately increased connection to give them an equivalent load, had, no doubt, contributed materially to bring about this result. Moreover, as time went on, he thought they must expect the business to develop at a somewhat slower rate, since the scope for profitable extension necessarily tended to diminish. In connection with the increase of £6,883 in gross profits, it was satisfactory to notice that with the exception of Frome, which showed a small decrease of £5, and which was one of their least successful and least promising undertakings, Winchester, Salisbury and Newmarket were the only towns which failed to show some progress. These were three of their oldest undertakings, and consequently it had been more difficult in their case to counteract the effect of metallic-filament lamps and the other influences—the fine weather and the bad trade—which had adversely affected their revenues. The outstanding feature of the past year's accounts was to be found in the fact that the increased profits had been derived more largely from reduction of costs than from expansion of revenue, and this in spite of the connection of the equivalent of an additional 100,000 33-watt lamps. This result was due, not to any failure on the part of the new connections to yield an adequate revenue, but to a diminution of the revenue derived from the old connections. The prevailing conditions of the past year had undoubtedly been peculiarly adverse, not only for them, but for almost all similar businesses, and he could assure them that the results realised for the past year had only been realised by the most strenuous and sustained effort on their part and that of the entire staff. These efforts would not be relaxed, but so far as the immediate future was concerned, though he saw no reason to suppose that they would not continue to make steady progress, he thought it would be unwise to anticipate that that progress was likely to be otherwise than slow. Costs were now in most cases reduced within measurable distance of the limit of possible reduction, whilst the increasing use of the more efficient lamps was not at the moment conducive to a rapidly expanding revenue. They were, however, doing their utmost to try and minimise the adverse effect of their adoption by their existing consumers, and this year, at any rate, they had, in cheaper coal, a favourable feature of which they could not be deprived, unless a general coal strike should prevent them from claiming the benefit of the contracts into which they had entered. He would like to say a few words about the work of their private lighting department, which was the original business of Edmundsons 30 years ago, and for which they enjoyed, and, he believed, always had enjoyed, the highest reputation. At the present time they enjoyed a large and valuable connection, and it was through the personal recommendation of former customers that the vast bulk of their orders came, but they felt that, if the business was to be maintained and increased, it was necessary for them to pursue a more active policy, all the more so now that most of the large country houses were already provided with installations, and now that their cost was so much reduced, and they not only needed twice as much work to yield them the same profit, but found every petty wiring contractor all over the country regarding himself as competent to undertake the work. They had, therefore, resumed advertising during the past year to a moderate, and what they believed to be a judicious, extent. Nowadays, the manifold advantages of electric light were generally recognised, but he doubted whether its very moderate cost under existing conditions was as fully realised as it deserved to be. Within the last year or two, thanks to metallic-filament lamps, the material reduction in the cost of a private plant had brought electric lighting well within reach of many people who would not previously have entertained the idea. It was no longer appropriate merely to the large country house. The necessary plant was now so cheap and reliable, the attention required need be so unskilled and trifling that thousands and tens of thousands of comparatively small houses throughout the country might well adopt it. Their's was one of the most intricate and difficult businesses to conduct successfully, with its constantly changing conditions and with the immense amount of detail involved in the adequate and efficient supervision and control of between 30 and 40 stations; and when the work had to be done, as in their case it was essential that it should be done, with a minimum of expense, the difficulty became tenfold greater. It was no easy task to adjust matters so nicely as to combine the maximum of benefit from a centralised organisation with the undoubted advantages of a large measure of local discretion, especially when the majority of the companies in which they were interested had entirely independent boards. In the solution of these and many other problems, Mr. Highfield had been of the greatest assistance to them, and he could not sufficiently acknowledge the debt they owed him for the assiduous care and attention with which he had devoted himself to the task he undertook. Mr. Highfield was a man of exceptional ability, who combined with his well-known technical knowledge two most invaluable qualities, a pronounced commercial sense and a marked sense of proportion, exactly those qualities which were largely lacking in the former management of the company, and he (the chairman) had no hesitation in saying that they were extremely fortunate in having secured his services. He was the very man they needed, and without any disparagement of either Mr. Gripper or Mr. Wigham, both of whom were co-operating with the utmost loyalty in their endeavour to retrieve the mistakes of the past, he felt it was very largely due to Mr. Highfield's inspiration that they were succeeding, as he fully believed, in putting the business on a very much sounder footing than that on which it previously rested; and without his continued help and advice they would be very sorry to have to face the many difficulties, the many new and complicated problems which he did not doubt the future still had in store for them. It was, therefore, with all the greater pleasure that he was able to tell them that he had agreed to give them the benefit of his services for another year at a considerably reduced fee.

Mr. A. A. Campbell Swinton seconded the motion.

Mr. J. S. Highfield, the advisory engineer, addressed the shareholders as to the prospects of the company. He said the policy of controlled decentralisation was working well, and the managers at each of the stations had done good work during the year. He was confident that the policy of concentrating attention on the earning of profits instead of mere running costs and lamp connections had already had a good effect, and he thought they would see increased results in the future. In spite of a slight rise in coal prices, the costs were reduced. The additions to capital account had been kept as low as possible in spite of the increase in connections of about 3,000 kw., or nearly 9 per cent., and of units generated of 2,091,000, or 12·4 per cent. Owing to bad trade, and a fine summer, and an increase in economical habits, most electrical undertakings had had a bad year, but he was hopeful for the future, although there might be a temporary set-back by decreased consumption, owing to the introduction of wire lamps. The electric motor was now used for many purposes, and their engineers had in most cases made themselves familiar with its use in various industries, and they were making a practice of using their experience gained in one town for use in other towns. The stations were run in a most economical manner. The ratio of expenses to gross expenditure was about 47 to 48 per cent. over the whole of the undertakings. The plant was in very good order, and was being well run, and, as a matter of fact, their main difficulty did not lie in their plant or engineering, but in the business management.

Mr. Page said that, notwithstanding the hopeful speeches of the chairman and Mr. Highfield, he contended that the company was in a very bad way, and was worse than it was last year. The capital expenditure last year had been £52,081, while the increased profit from investments had only been £2,123—just 4 per cent. on the extra expenditure. It was plain to him that the company had made no progress whatever. Many of the subsidiary companies were white elephants, and in his opinion the only hope of ever getting better results was for the directors to turn their attention to private installation work. He would like to see a small committee appointed to confer with the board on that question.

Mr. Swan inquired what fee was being paid to Mr. Highfield, and complained that he should still be retained as expert adviser, seeing that he was only appointed for a year. The Scarborough Tramways Co. was one of their most unfortunate undertakings, of which Mr. Campbell Swinton was the engineer. Upon a capital of £100,000 the gross profits last year were £8.

Mr. Hedges said that as a member of the advisory committee who appointed Mr. Highfield, he was clear that his election was only for 12 months. Mr. Campbell Swinton was, he thought, elected to the board to look after the stations, which work, it appeared, was still being done by Mr. Highfield. Mr. Tuckett had done all the work he promised, but he was afraid that the other directors performed very little service, and his feeling was that they should either do more or else give way to others.

Mr. A. H. Barber said he had attended the meetings for many years, and all they heard was recriminations and hopes for the future, but those hopes never seemed to fructify. Mr. Page was the only man who had made any practical suggestion for increasing their profits, and he would like to see him on the board.

The Chairman, in replying on the discussion, said that in no case had the capital of the subsidiary companies been written down, and it would not be politic on their part to advocate such a course, in view of the relation of the companies with the local authorities. It might be advisable to write down their own capital in two or three years' time when the guarantee of the Urban Co. expired. At the present time it was impossible to do anything in that direction, as they were quite in the dark. With reference to Mr. Highfield's reappointment, he could perhaps give them a most conclusive reason for that, viz., that unless they retained his services for another year they could not retain his (the chairman's) services. He thought it was rather hard upon the present board to criticise them for past action to which they were no party. They had come into these rotten companies, and they were determined to get the company out of the ruck in which it had got. The shareholders were taking up a very unreasonable attitude in attacking the board for not having effected revolutions in the course of one year. They had always told them that it was going to be a very hard and a long job to pull the company round. As illustrating the difficulties they had to contend with, there was the case of Frome. There were only 2,500 rateable buildings in the town, and of those 56 per cent. were cottages rated at less than £8 a year, another 16 per cent. were rated at less than £16, and a similar percentage at under £20 a year. It was impossible to get a profit out of a place like that. There was a possibility of a slight improvement, but they could not hope for any radical improvement in such a place. With regard to the private lighting department, the board were doing all they could to push that business, and had resumed advertising to a moderate extent. The position of the company was better than it was, although the progress was slow. He saw his way to finance the undertaking for several years, and it was not in the parlous state that Mr. Page would seem to imagine.

The report was then adopted.

The Chairman, in proposing the re-election of Mr. Campbell Swinton as a director, said that when first appointed Mr. Swinton only accepted the position at the request of the shareholders. It would certainly not be in the interests of the company that he should retire just as he was getting a grip of its affairs.

Mr. Stanley Beeton seconded the re-election.

Mr. Page, as an amendment, moved that a committee of six shareholders be appointed to confer with the board to select a candidate for the vacant directorship.

Mr. Swan seconded the amendment.

Mr. Campbell Swinton said the only reason he accepted a seat on the board was because he was a large shareholder. The remuneration was absolutely ridiculous as compared with the amount of time given to the company.

The amendment was negatived by a large majority, and the resolution was carried.

Electric Construction Co., Ltd.

The sixteenth annual meeting was held on Thursday of last week at Winchester House, E.C., Mr. W. S. B. McLaren presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, July 9th, page 69), said the accounts showed a marked improvement upon those of last year. Indeed, they had to go back to 1904 (when the last dividend was paid on the ordinary shares) to find net profits comparable with those of the past financial year, and, having regard to the general depression in trade and to the continued strenuous competition in the electrical manufacturing industry, they had every reason to congratulate themselves. As an illustration of what this competition meant, he might mention the case of tenders which were submitted recently for the extension of a provincial electric lighting station. No fewer than 33 firms tendered, and in the aggregate 118 tenders were submitted. These ranged from a minimum of £2,751 to a maximum of £4,218, and while he did not suggest that the whole of the difference was represented by the electrical portion of the plant, still, the figures would give some idea of the competition that prevailed. He must repeat what he said last year, that the electrical manufacturing industry was suffering severely from over-production. During the present decade about £7,000,000 had been invested in this branch of the business, the greater part whereof was earning no dividend, and they would realise what this had meant to older concerns like their own, for, although there had been a steady and increasing outlet for electrical plant, the power to supply had been grossly in excess of demand, in consequence of the huge increase in capital. If this unsatisfactory state of affairs prevailed in the industry generally, they would naturally expect him to tell them what justification there was for the hope expressed that the enhanced profits now reported would be fully maintained. During the whole period of this depression, the closest attention had been given by the board and the management to economical production; and, further, they had not hesitated to keep their works up to the highest state of efficiency by installing the most modern labour-saving appliances, and the return on this expenditure left not the slightest doubt in the minds of the directors that the money was well spent. This progressive policy had placed them in a position to produce electrical plant of any size or kind at prices which he was confident were second to none, and, while it was always dangerous to prophesy, still, they had every reason to expect that, in the absence of any further slump in trade or serious cutting of prices, they would be able to submit to them next year results as favourable as those now reported. A glance at the accounts would satisfy them that, if they had not been obliged to pay two years' dividend on the preference shares, the ordinary shares might have received 2½ per cent. The directors and the management would continue to spare no effort to place the company again upon a dividend-paying basis, and they therefore asked them once more for a renewal of their confidence. The accounts did not call for any special comments. On the credit side of the profit and loss account, there was an increase of £5,711 on manufacturing and contracting, and sundry receipts. This was due to causes which he had already described, and was the most gratifying feature in the accounts, as it indicated that, notwithstanding the low prices which had prevailed, they could earn a moderate profit upon their products. If a sufficient volume of business could be obtained, he should have no doubt whatever about their being able to distribute a reasonable dividend on the ordinary shares, and an increase in output is the crux of the situation. Whether that increase would be obtained this year, he could not say. Dividends on shares in other companies shows a reduction of £2,339. The Electrical Power Storage Co., Ltd., in which they were largely interested, had suffered from the general depression in trade, and for the first time for a period of 17 years found itself unable to declare a dividend. The directors of that company reported, however, that there were indications of a revival in business, and it was hoped that this improvement would continue and enable the company to resume payment of dividends in the near future. Their holding in the Madras tramways had yielded a somewhat better return. The directors of that company contemplated a further extension of the tramway, and if that was carried out, the return upon their deferred shares would be materially improved. The debit side of the profit and loss account did not call for any lengthened review. General charges showed a reduction of £458, and maintenance of plant and buildings a reduction of £966. The latter saving was not due to short-sighted economy, the premises having been maintained, as hitherto, in thorough condition, and the cost of providing all new loose tools, or the renewal of same, had in accordance with the company's invariable practice, been debited entirely to revenue. The net profit for the year, after paying £1[illegible],[illegible]50 for debenture interest and crediting £5,000 as formerly to depreciation account, was £10,731 and, after paying a dividend for two years on the preference shares, they would carry forward £3,685 to next year, being an increase of £1,941 on the sum brought in. The profit of £10,731 for the past year compared with £5,932 for 1907-8, and with a loss of £1,442 for 1906 7. The financial position of the company was very satisfactory. They had ample working capital, and were thus able to buy on the most advantageous terms. Indeed, in the opinion of the board, the company's position generally had been greatly improved of recent years and justified them in looking forward to the future with every confidence.

Mr. P. E. Beachcroft, in seconding the motion, said that they could consider the report as satisfactory, and that in these days of severe competition they, at any rate, showed very good progress. Although the figures did not show extravagant profits, they were evidence, he hoped, of better things to come. The fact that they had been able to hold their own showed that the company had the reputation for turning out the best work in their particular trade. He did not know when he had looked with more confidence to the future as he did that day. There was already signs of an improvement in the bad depression which had existed in the past.

The Chairman, replying to a shareholder, said that the general reserve was invested in the business and that £14,8[illegible]8 of invested funds was split up as follows:—£5,000 in 3½ per cent. India Stock, £5,000 3½ per cent. New South Wales Stock and £5,000 at 4 per cent. on deposit with a very rich company in Yorkshire, and they had £124,000 in other companies. They held all the ordinary shares of the Madras Electric Tramway Co., and £12,000 of the preference shares. They were also shareholders in the Electric Power Storage Co. The shares stood in the books at par, but against that they had a general fund of £235,000. It was no business of the company to hold shares, and he hoped that next year those figures would show a considerable change.

The report was adopted.

Chatham and District Light Railways Co.

The directors' report for the half-year ended June 30th, 1909, shows that the receipts were £20,363, and the expenses £12,821, leaving £7,542; less rent of Rochester Corporation lines, £1,872, and interest on debentures, £1,234; leaving £4,437, plus £233 brought forward. Out of the balance the directors recommend the appropriation of £2,940 to dividend at the rate of 5 per cent. per annum on the preference shares, and £1,730 to revenue new account. The traffic receipts show an increase of £1,137 over those for the corresponding period of last year. This, however, is almost entirely accounted for by the fact that the extensions to Strood and Frindsbury were not open for public traffic for the full half-year of 1908. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car mileage.	No. of cars.
December, 1908..	14·48	4,377,745	£22,282	1·22	597,893	45
June, 1909 ..	14·98	4,058,327	19,787	1·18	561,758	45

The General Electric Co., Ltd.

The annual meeting of this company was held on Monday last at 71, Queen Victoria Street, E.C. In moving the adoption of the report (see Electrical Review, July 16th, p. 106) the Chairman (Mr. G. Byng) spoke as follows:—

I beg to submit to you our balance-sheet for the year ending March 31st last. You will be glad to note that we show a larger profit this year than last year. We have written off more for depreciation at our works, and have placed to the credit of our reserve fund a larger sum—over £16,000; the resources of the company and the security of the preference shareholders have thereby been materially strengthened. The margin of such security has more than doubled since the company was incorporated nine years ago—our ordinary shares then amounted to £250,000, whilst to-day these shares, plus the reserve fund, exceed £500,000. I am sorry that in spite of such undoubted security offered, we find our preference shares quoted at a discount; I presume we, in common with others, suffer because Stock Exchange quotations take little heed of intrinsic value, and also because capital is not flowing freely into the best home industrial securities—we reckon ourselves among these. We are experiencing this in many other directions, and [illegible] too much harm to the industries of this country in general, but above all to electrical enterprises. The [illegible] does not very much—it has resulted in [illegible] about 10 per cent. The capital increase shown in these investments is represented by shares in foreign companies, [illegible] to act as our selling agents, as in France, [illegible] South Africa, &c. The pressure of competition at home forces [illegible] more and more abroad. Unfortunately Customs duties [illegible] not only on account of their [illegible], but also on account of their uncertainty, and it would be of [illegible] to us if our Government could enter into commercial treaties with Continental nations, or with any other nations, instead of relying upon the so-called "most favoured nation" clause—a clause which has often acted against us. We are continually menaced by the tariff fighting of foreign nations amongst themselves. The position of a great country waiting for the outcome of disputes between others is exceedingly ludicrous, and puts us at a disadvantage compared to our foreign competitors. After having spent money in pushing our manufactures, the duties are suddenly raised against us. At present the alterations of Customs duties in France are making us very anxious, and we hope that they will soon be settled, one way or another. Sundry debtors and stocks stand at slightly higher figures on account of the larger turnover. Additions to buildings and plant are smaller; the capacity of our works is greater than the demand. From a purely technical point of view all our works have done well; our engineering staff at Witton has especially distinguished itself. We have installed a larger number of big plants—especially a number of turbine plants; they have proved very successful, and have greatly enhanced the reputation of our Witton electrical engineering works, strengthening their position in the foremost rank of electrical engineering firms. Our carbon works are largely occupied with making flame arc carbons. Ours is the only factory in England where such carbons are made; we have succeeded in competing with Continental firms. For this, great credit is due to the energy and skill of the manager and staff of that factory. All our batteries, porous pots and dry cells are now made at Witton. We have added a large welding plant to our tube works, and our art metal works at Sherlock Street, Birmingham, are making heating stoves and radiators in addition to electric light fittings. We have considerably extended our telephone factory at Peel Works, and I am pleased to record that the telephone equipments produced at these works have been adopted by our own and Colonial Governments, and are considered an advance upon those made by the most prominent manufacturers in America and on the Continent. The sale of Osram lamps has been large, and experience has proved that the marvellous economy and durability claimed for this invention is entirely justified. No invention since the advent of electric lighting has produced an equal effect. It may have somewhat disorganised the supply, but, in the long run, the result will be one of the greatest benefit to the whole industry. The factory at Hammersmith is completed, and is turning these lamps out equal in quality in every respect to those produced on the Continent. The process of teaching workpeople in this new industry is proceeding rapidly, and soon we hope to employ over 1,000 skilled hands. We have had exceptional opportunities of comparing the capacity of our English staff and workmen with that of similar German and American organisations. I am pleased to tell you that Englishmen have learned as quickly and as well as their foreign competitors, and in some respects have surpassed them. This is not a biassed opinion of my own, but the actual experience of the engineer who has taught both here and abroad. Generally speaking, we cannot be dissatisfied with the year's working. Our profits have been assisted by the steady market, and the low prices of metals, besides the absence of any labour troubles. At the same time we must not forget that our profits, while they may compare favourably with those of other English concerns, do not come up to the standard of profits obtained by foreign electrical companies working under similar conditions. The foundations of our company are good, and also, I believe, its management; but we suffer, as almost everybody does, from a general trade depression. The conditions of the country and the outlook are, to my mind, far from bright, and it would be wrong for business men to overlook the present symptoms. We have mainly felt them in our efforts to fill our works with sufficient orders so that they can be run at their full working capacity. We have seven large factories, and everyone of them could give an increased output without any material increase of capital or of general expense beyond the payment of more wages. Running at less than full capacity means loss, not only in money, but in upkeep, and in the spirit and skill of both masters and men. We have been compelled in some instances to reduce hands, and to run short hours. That means machinery and buildings idle, managers and workpeole idle. This is waste to our company, and waste to the nation. If that waste could be turned into work, such work would be obtained for nothing. That is the way to get things for nothing. Unfortunately people do not see it. It is simply a question of demand. If that demand did not exist, it could not be helped, but it does exist at our very doors. There is plenty of electrical work to be got if we only keep it in this country, and do not send it abroad. Unfortunately, instead of its being directed into our factories, our national policy deliberately directs it into foreign factories. The working of a large commercial concern like ours shows clearly the effect of Free Trade. I am sure that our own experience is the experience of almost every factory in the country at the present moment. We are all being worked below our productive capacity. If you were to go into any English factory, you would receive in nine out of every ten the same answer, "We could do more work with our existing plant." What holds good of industry, holds good of agriculture—under production rules in field, farm and factory. It is incredible, but a fact as you know, that in spite of this state of affairs we are importing over £200,000,000 of manufactures and agricultural produce every year, every pound's worth of which could be produced here, simply by employing our natural produce, and our brains and sinews, now retrograding in idleness. We are met with the contention that we import all this because it is cheaper. What can be cheaper than getting things for nothing by turning waste into work? That is really the question if gentlemen will only understand it. I say here 200 millions, but it is my firm opinion it is nearer 300 millions every year. It is plain as a pike staff, yet people won't see it. You know that I think all this could easily be accomplished. A budget could be framed which would raise the production of the nation to its full capacity—let Mr. Lloyd George know that—and the objection I have to the budget now proposed is that it does nothing to encourage production at home. On the contrary, it does everything to discourage us by heaping further taxes and expenses upon the producer, and by leaving untaxed the foreign importer who competes with us in our own markets. As an employer representing labour, I protest against this budget. It is futile, and would defeat its own ends after, I believe, causing a great deal of suffering, because it ignores the foremost function of Government to preserve the wealth of the nation by fostering the productive capacity of its people.

Mr. Hugo Hirst seconded the adoption of the report, and it was carried without comment. The resolution declaring a dividend of 5 per cent. per annum was also approved.

Mr. Hirst then proposed the re-election of Mr. E. G. Byng, and gladly took the opportunity of testifying to the great active interest he had taken in the firm, and his share in the management. He was looking forward to his co-operation. This was carried, and the auditors were also re-elected.

Mr. Wood, a [illegible] proposed a vote of thanks to the chairman, remarking that he had come to the meeting of a commercial undertaking and had listened to a semi-political address.

The members of the staff then went back to their various departments and the representatives of the Press dispersed.

City and South London Railway Co.

The directors' report for the half-year ending June 30th, 1909, states that the receipts from all sources have amounted to £[illegible]9,563, and the cost of working has been £29,[illegible], leaving a profit of £[illegible]. Inclusive of the balance brought forward, the net revenue account shows an aggregate total of £50,542. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £24,663. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1 per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £1,412 to be carried forward.

Half-year.	Passengers carried (exclusive of transfers).	Receipts (including season tickets).	Div. per cent. per annum on ordinary.
December 31st, 1906	9,[illegible]	[illegible]	2
June 30th, 1907	1[illegible]	77,[illegible]	2½
December 31st, 1907	10,[illegible],115	8[illegible]	1¾
June 30th, 1908	10,8[illegible]	82,[illegible]	1½
December 31st, 1908	10,[illegible]	81,2[illegible]	1[illegible]
June 30th, 1909	11,[illegible]27,179	84,[illegible]46	1[illegible]
Total since opening	[illegible]	[illegible],772,157	

The directors are glad to be able to point to an increase in the receipts from all sources during the half-year. This result is the more satisfactory in view of the constantly progressing electrification of tramways which connect with and feed those already competing with this company's line. It has also to be remembered that as 1908 was leap year, the half-year now under review was shorter by one day than the corresponding period.

In their Bill of this session the Central London Railway Co. are applying to Parliament for powers to construct a subway connecting the high-level public subways of their Bank Station with the booking hall of this company's station at the Bank, thus furnishing additional access between the two companies' stations and also direct communication with the Waterloo and City Railway. Subject to this power being obtained, an agreement has been entered into for the construction of the subway at the joint expense of the two companies. The St. Swithin's Lane portion of the proposed subway has been withdrawn from the Bill.

Crompton & Co., Ltd.

The directors' report up to March 31st last shows that the depression in trade in almost all parts of the world in which the company does business, and the resulting keen competition, has rendered the obtaining of remunerative orders during the financial year a matter of very great difficulty, and [illegible] work has had to be undertaken at a very small margin [illegible]. The net profit for the year amounts to [illegible] to £31,[illegible]0 for the year ending March 31st, 19[illegible]. After providing for debenture interest and other charges [illegible] in the revenue account, there remains, with the amount brought forward from last year, an available balance of [illegible] the directors propose [illegible] of the [illegible] and to carry the balance forward. The [illegible] additional lamps connected to the mains of the [illegible] undertakings during the year [illegible] an increase of approximately 20 per cent., [illegible]. The guarantee to the [illegible] of the Electric Supply Corporation, which expires in December next, will [illegible], so far as the directors can foresee, [illegible] in the company's interest in the guaranteed company. The dulness of trade still continues, although there are [illegible] of improvement. The directors have in view [illegible] orders which it is hoped will be secured at satisfactory [illegible]. They also have pleasure in reporting that during the [illegible] year a patent has been obtained for a new rotary converter, invented at the company's works. Orders for these machines are now being executed, and it is anticipated that the invention, for which there is a large field, will prove of considerable importance to the company's business. With a view to obtaining fresh capital until such time as the company can profitably reduce its holdings in other companies an offer of short-term notes was made to the shareholders in February last. The directors are now offering elsewhere the balance unapplied for. In order to prevent the possibility of delay in the issue of the company's annual accounts, it is proposed, in future, to close the accounts of the company's foreign branches at December 31st in each year, instead of at March 31st, as at present. This course has the approval of the company's auditors.

Madras Electric Supply Corporation, Ltd.

The directors' report for the year ended December 31st, 1908, expresses regret that the contractors have not yet completed their work, although it was anticipated that everything on the direct-current side would have been finished by February, 1908, and on the alternating-current side for the tramway supply by January 1st last. The buildings and equipment of the main generating station, the sub-station at Mylapore and the tramway sub-station, are now, however, practically finished. The construction of the main generating station had been so far completed on April 3rd last that the company commenced the supply of electricity to the public from the permanent plant, and it is hoped shortly to supply current to the Tramways Company, who have entered into a contract to purchase a minimum of one million units per annum. Agreements for the supply to the Port Trust and to the Government Buildings have been drafted and are now being considered. The grant of the new licences for the supply of current to Fort St. George and to the Port Trust is expected shortly. In anticipation that there would be a large demand for electric fans, to take the place of punkahs, which are used for the whole year in Madras, the directors sent out a considerable number to sell or hire out to consumers. Each fan installed will be a useful addition to the demand for current. The temporary oil-engine plant is now being dismantled, and although the working on this small scale was not expected to be profitable, the Board feel that the expenditure constituted a useful advertisement. The supply to the public commenced with an equivalent of 5,200 8-c.p. lamps connected to the mains. Many applications from other consumers have since been received, and some are already connected. Full particulars will, of course, be furnished in the report next year, but the directors think it right to state that they are quite satisfied with the prospects of the company. With reference to the company's investment in 4½ per cent. preferred ordinary shares in the Madras Electric Tramways (1904), Ltd., it is satisfactory to note that the tramways are doing well, and this company has recently received a dividend at the rate of 5 per cent. per annum (including ½ per cent. out of surplus profits) on these shares.

Direct United States Cable Co., Ltd.

The directors' report for the half-year ended June 30th, 1909, shows that the half-year's revenue, after deducting out-payments, amounted to £56,445 as compared with £51,[illegible] for the corresponding period of 1908, showing a difference of £5,[illegible]77 in favour of the half-year under review. The working and other expenses for the same period, including income tax, amounted to £25,036, leaving a balance of £31,403 as the net profit, making with £4,506 brought forward a total of £35,915. For the corresponding period of 1908, the working expenses and other payments amounted to £24,932. Three quarterly interim dividends of 4s. each per share, amounting to £36,426, have been declared and paid during the financial year, and a final dividend of 4s. per share is now proposed, together with a bonus of 1s. per share (both free of income tax), making with the three interim dividends 4[illegible] per cent. for the year, being a total distribution of £51,603. After transferring £5,000 to the reserve fund account, the balance of £[illegible]596 on the revenue account is proposed to be carried forward. The reserve fund account has been debited with £13,857 for the cost of cable maintenance, and after being credited with interest on the investments, profit on sale of securities, and amount transferred from revenue, the balance now amounts to £510,267.

France.—The report of the Société de l'Energie Electrique du Nord de la France for the last financial year shows a gross profit of £11,[illegible]; the bulk of this has been applied to depreciation, leaving a balance of £7[illegible] to be carried forward. The plant at present in operation comprises two 1,750-kw. turbines and dynamos and [illegible] sets. Plans are now being prepared in respect of a [illegible]. By the end of the present year the company will, it is expected, have an output equal to 1,900,000 [illegible] units.

At the annual meeting of the Compagnie Internationale des Lampes Electriques [illegible], lately held in Paris, a dividend of [illegible] fr. per share was declared. It was stated that the prospects of the company were very bright, all the subsidiary concerns being busily occupied.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum, for the half-year ending June 30th. The share transfer books will be closed from July 24th to August 6th, inclusive.

MARKET QUOTATIONS.

Wednesday, July 21st.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	" Nitric	"	22/-	..
a	" Oxalic	"	28/-	..
a	" Sulphuric	"	5/6	..
a	Ammoniac, Sal	"	42/-	..
a	Ammonia, Muriate (crystal) ..	per ton	£29	..
a	" "	"	£30	..
a	Bleaching powder	"	£5 10	..
a	Bisulphide of Carbon	"	£18	..
a	Borax	"	£16	..
a	Copper Sulphate	"	£18 10	£1 dec.
a	Lead, Nitrate	"	£25 10	..
a	" White Sugar	"	£23 10	..
a	" Peroxide	"	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (75/80 %) ..	per ton	£20	..
a	" Chlorate	per lb.	3½d.	..
a	" Perchlorate	"	3¾d.	..
a	Potassium, Cyanide	"	7d.	..
a	Shellac	per cwt.	70/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	"	£6 10	..
a	" Recovered	"	£5 10	..
a	" Lump	"	£5	..
a	Soda, Caustic (white 70 %) ..	"	£10 15	..
a	" Chlorate	per lb.	3⅝d.	..
a	" Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks ..	per lb.	3d.	..
a	" Cyanide (basis 100 %) ..	"	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£70	..
b	" Wire, in ton lots ..	"	£112	..
b	" Sheet, in ton lots ..	"	£120	..
p	Babbitt's metal ingots	"	£50 to £135	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c	" Tube (brazed)	"	8¼d.	..
c	" " (solid drawn) ..	"	7¼d.	..
c	" Wire, basis	"	6⅝d.	..
c	Copper Tubes (brazed)	"	8⅝d.	..
c	" " (solid drawn ..	"	8⅝d.	..
g	" Bars (best selected) ..	per ton	£70	£3 dec.
g	" Sheet	"	£70	£3 dec.
g	" Rod	"	£70	£3 dec.
e	" (Electrolytic) Bars ..	"	£60 5	10/- dec.
e	" " Sheets ..	"	£77	5/- dec.
e	" " Rod ..	"	£65	5/- dec.
e	" " H.C. Wire	per lb.	7⅞d.	⅛d. dec.
f	Ebonite Rod	"	3/3	..
f	" Sheet	"	3/-	..
n	German Silver Wire	"	1/6	..
h	Gutta-percha, fine..	"	..	..
h	India-rubber, Para fine	"	7/10	1/4 inc.
j	Iron Pig (Cleveland warrants) ..	per ton	48/4	2d. inc.
l	" Wire, galv. No. 8, P.O. qual.	"	£14	..
g	Lead, English Ingot	"	£13 to £13 2 6	2/6 dec.
m	Manganin Wire No. 28	per lb.	8/-	..
e	Mercury	per bot.	£8 5	..
d	Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d	" " " medium	"	2/6 to 4/-	..
d	" " " large ..	"	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	"	1/- to 1/1	..
p	" " rolled bars & rods	"	1/1½ to 1/3	..
p	" " rolled strip & sheet	"	1/2½ to 1/6	..
o	Platinum	per oz.	91/6	variable.
e	Silicium Bronze Wire	per lb.	9¼d.	..
r	Steel Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	"	£130 to £131	£1 inc.
n	" Wire, Nos. 1 to 16	per lb.	1/8½	..
p	White Anti-friction Metals:—			
	"White Ant" brand	per ton	£35 to £60	..
k	Zinc, Sh't (Vielle Montagne bnd.)	"	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Thursday, August 5th.—British Aluminium Co., Ltd.—Further issue of 89,070 ordinary shares of £5 each, fully paid, Nos. 60,001 to 99,070; and 89,070 7 per cent. cumulative preference shares of £5 each, fully paid, Nos. 60,001 to 99,070.

Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Hurst, Nelson & Co., Ltd.—20,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 20,000.

Anglo-American Telegraph Co., Ltd.—After placing £5,000 to the credit of the renewal fund, the directors have declared an interim dividend for the quarter ending June 30th, 1909, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income tax, payable on July 31st. The balance of £24,414 is to be carried forward.

British Columbia Electric Railway Co.—On July 31st, a dividend at the rate of 5 per cent. per annum will be paid on the 5 per cent. non-cumulative preferred ordinary stock for the half-year ended June 30th, together with an additional dividend at the rate of 1 per cent. per annum for the same period.

STOCKS AND SHARES.

Tuesday Afternoon.

MARKETS remain in the condition of stagnation incidental to this period of the year. In the electrical sections there is little going on, and less to write about. With this bid for the enlistment of sympathy from the reader, the placid tale may be permitted to unroll its paragraphic folds.

The Railway dividends are beginning to make their appearance and the Metropolitan Railway has declared 1 per cent. on the Ordinary and 2¾ per cent. on the Surplus Lands stocks. Some of the more eager bulls talked of the dividend being probably 1¼ per cent. on the Ordinary stock, and the price fell from 41¾ to 40¼, the latter still showing a rise on the week. The announcement encourages the hope expressed here some months ago that the initial troubles of electrification are over, and the line is at last on the way towards reaping the reward of its change of system. Districts at 17¾ show no alteration.

East London proprietors are disappointed at the failure of the directors to grapple with the problem of electrification, and the report which came out last Saturday attributes the delay to the board's intention to await results achieved by the London, Brighton and South Coast Railway over its electrified South London section, which, of course, is not yet open for traffic. East London Ordinary keeps about 3⅜, and the junior debenture stocks remain at 22½, 8 and 5 for the "B," "C" and "D" issues respectively.

City and South London Ordinary has risen to 32 upon the issue of a satisfactory report, following upon the increased dividend noticed here last week. The Central London trio continue at their depressed levels, pending the dividend statement.

Quite a storm in a teacup has arisen over the way in which the County of London Electric Supply Company has called up the amounts due on allotment of the new debenture stocks. To save the company a little future trouble hereafter, the first instalment has been called up so as to include the shillings and pence that would have become due on the future payments. This, of course, complicated Stock Exchange dealings rather badly, and the dealers are very indignant about it. Nominally the premium is 3 for the First Debenture, and 2½ for the Second.

The St. James' and Pall Mall Electric Supply Company has declared a dividend at the rate of 10 per cent. on its Ordinary shares, which is the same as usual, and the price has not moved. There is a faint demand for Edmundson's and Urban issues. Edison and Swan were marked back to 5s. middle, and can be bought at a few pence above this price. Crompton's are flat on the issue of a disappointing report. The Calcutta Electric Supply Company has offered its new issue of Preference shares, but at the time of writing it is not possible to give any idea as to what kind of response has been received from the public. Victoria Falls Preference are a trifle harder upon the statement that the company has accepted the offer of a substantial bonus to expedite delivery of current to one of its mining company customers.

Canadian General Electric has risen to 121, and Mexican Light and Power Common is up to 71, the group as a whole being decidedly better. Nevertheless, there seems an uneasy feeling lest the damage on the dam of the Mexican Light and Power property may turn out to be more costly than even the £40,000 at present estimated. Rio Trams are 90, and Sao Paulo 150½.

Good buying of Anglo-American Telegraph Deferred has hoisted the price to 17, the quarterly statement out a few days back being the inspiration for the rise. The figures are satisfactory enough, but to touch the Deferred stock is to embark upon a lively gamble. Other telegraph issues have been almost stationary. National Telephones are good, both the Preferred and Deferred stocks showing rises.

British Electric Traction Ordinary were done at 10s. on Monday, and the Preference slipped back another 2s. 6d., to 2½. British Columbia Preferred stock is rather better. A little business is being done in London United Tramways issues. London General Omnibus stock has slumped to 20. A movement is on foot to induce shareholders of the Electrobus Company to support an agitation, but perhaps the unfortunate shareholders will be best advised to let ill alone in this instance. A noticeable advance amongst the Miscellaneous divisions is one of 3 points in Electric Construction Debenture stock.

Metropolitan Railway Co.—The directors recommend a dividend upon the ordinary stock for the past half-year at the rate of 1 per cent. per annum, (against ½ per cent. at this time last year), carrying forward about £4,000. Dividends on the surplus lands stock will be at the rate of 2¾ per cent. per annum, carrying forward about £1,000.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations July 13th.	Closing Quotations July 20th.	Business done week ended July 20th, 1909.		Rise + or Fall −	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾— 3½	2¾— 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96	92 — 96	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143½–144½	113½–144½	..	..	..	5 10 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	8¼%	8⅞%	8½%	£3 4s.	57 — 59	58 — 60	..	..	+1	5 6 1
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100½–101½	101½–102½	102½	100½	+1	5 17 1
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	16 — 16¼	16¾— 17	17 1/16	16⅝	+ ¾	2 4 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102½–104½	..	..	+ ½	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 15 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	89¾	..	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8⅛— 8⅞	8 3/16	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	17⅝	17½	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 8 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	3 16 8
60,710l	Direct United States Cable	20	4¾%	4⅝%	4¾%	4¾%	12¾— 13¼	12¾— 13¼	13	12 11/16	..	6 8 5
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	127 —130	125 —128 xd	126⅝	125	..	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85½— 87½	84½— 86½ xd	85⅞	85	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock, Red. ..	Stock	4 %	4 %	4 %	4 %	104½–106½	104½–106½	106	105	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½— 12	11½— 11¾	11 9/16	11½	− ¼	5 19 2
762,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102½–104½	103½–105½	104¼	..	+1⅛	3 15 10
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	10⅝	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼— 13¾	13¼— 13¾	13⅜	..	..	4 7 8
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	25¾— 26¼	25¾— 26¼	25½	..	..	6 17 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	18 %	18 %	13 %	13 %	51½— 53½	51½— 53½	52⅝	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	23/32— 27/32	11/16— 13/16	15/9	15/7½	− 1/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	13/16— 15/16	13/16— 15/16	..	..	..	5 12 11
3,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 109½	108½ —110	109½	108½	+ ½	5 9 1
3,725,060	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	124 —126	125½ —127½	126¾	125	+1½	4 14 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	10¾	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 9/16 — 5 13/16	5⅝— 5⅞	5 25/32	5 21/32	+ 1/16	4 5 1
[illegible]	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	98	..	..	3 12 2
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99⅝	99½	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	26/6	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 — 1⅛	20/7½	..	− 1/16	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	85 — 87	85½	..	− 1	4 12 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99 — 101	..	..	..	3 19 3
11,889l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98½–100½	98½–100½	..	..	..	4 9 7
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	130	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	7⅛	7 1/16	..	5 12 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	5¼	5 3/16	..	4 13 0
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½— 14	13½— 14	13 13/16	13 9/16	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101½–103½	101¼	..	+ ½	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½— ⅝	½— ⅝	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼— 8¾	8¼— 8¾	..	..	..	6 17 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½–102½	100½–102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations July 13th.	Closing Quotations July 20th.	Highest	Lowest.	Rise + or Fall −	Present Yield per cent.
820,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9 3/16— 9 7/16	9 3/16— 9 7/16	9⅜	9 7/32	..	9 6 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	91 — 92	9 ¾ - 91¾	91½	90¾	− ½	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	20 %	4½— 4⅝	4½— 4⅝	87/6	8 /3	..	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	⅛— ⅝	⅛— ⅝	..	..	..	60 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1 — 1¾	1¼— 1¾	30/-	..	+ ⅛	43 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	2½— 3½	3 — 3½	..	..	+ ¼	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs, ..	100	..	5½%	5½%	5½%	94 — 99	94 — 99	..	..	..	5 11 1
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	143 —147	..	..	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —124	122 —126	125	..	+1½	4 15 8
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —113	107 —110 xd	108¼	108	..	4 10 11
233 [illegible]	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	101 —104 xd	..	..	..	4 6 7
188,801	British Electric Traction	10	8 %	Nil	Nil	..	½— ⅞	½— ⅞	15/-	10/-	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅜— 2⅞	2¼— 2¾	51/3	47/6	− ⅛	1 10 11
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	86 — 90	89	88	..	5 11 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	66 — 70	66 — 70	..	..	..	6 8 7
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼— 6⅝	6¼— 6⅝	..	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,911l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,0[illegible]6,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 3	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜— 4¾	4⅜— 4¾	95/-	..	..	6 6 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
360,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	98½	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9¾— 10½	9¾— 10½	10⅜	..	..	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5½	5⅛— 5½	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104 —106	103½ –105½	..	..	..	4 4 11
491,222	Cape F. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅞— 2	1⅞— 2	38/6	37/6	..	6 0 0
710,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —106	103 —106	..	..	..	4 4 11
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	61 — 63	61 — 63	61½	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	84¾	..	..	4 14 2
551,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	82¾	81¾	..	5 11 1
1,4[illegible]	City and South London Railway	Stock	1¾%	2⅛%	2⅛%	1½%	81 — 82	81½— 82½	..	..	+ ½	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	1 — 1½	½— 1	20/-	18/9	− 5/16	15 0 0
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	91 — 94	91 — 94	..	..	..	5 6 5

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* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 13th.	Closing Quotations July 20th.	Business done week ended July 20th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	..	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 — 102	99 — 102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	¼ — ½	⅛ — ⅜	..	..	— ⅛	25 0 0
17,139	Do. "A" shares, 01—017,189	5	4⅛%	4⅛%	2½%	..	1½ — 2½	1½ — 2½	..	..	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 7/16 — 1 11/16	1 7/16 — 1 11/16	..	..	..	8 7 2
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛ — 7½	7⅛ — 7½	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 — 103¼	102 — 108	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11¾ — 12½	11¾ — 12½	12¼	..	..	6 5 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 7/32	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 — 107	105 — 107	..	..	..	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %		14½ — 15¼	14½ — 15¼	..	..	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	8 %	8 %	Nil	2 — 3	1½ — 2½	..	..	— ½	Nil
899,930	Do. do. 60,008 to 100,000	10	3 %	8 %	8 %	Nil	3½ — 4	1½ — 2½	..	..	- 1¾	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1¾ — 2½	2 — 2½	40/-	..	+ ¼	12 0 0
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	63 — 67	65 — 68	66½	66	+1½	5 17 8
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	39½ — 40	40¼ — 40¾	41⅝	39¾	+ ¾	1 4 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	68 — 70	68 — 70	68½	67	...	8 13 7
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17½ — 18	17½ — 18	17 11/16	17⅝	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝ — ¾	⅝ — ¾	1/-	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	16/-	15/6	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32 — 27/32	23/32 — 27/32	..	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	96½ — 98½	95	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	131 — 134	130 — 132	132¼	130¼	—1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91½ — 93½	92½ — 94½	93¾	93¼	+1	5 5 10
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	1/16 — 7/16	3/16 — 5/16	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	33 — 34½	33½ — 35	..	..	+ ½	5 1 10
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 — 103	99 — 101	..	..	..	3 19 3
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	102 — 103	102½ — 103½	10¼	10½	+ ½	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88½	87½	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	37 — 39	37 — 39	87	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¾ — 3¼	2¾ — 8¼	..	..	..	7 7 4
245,495	Do. % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	76 — 80	76 — 80	78¾	78½	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	8 — 8½	8⅛	..	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 — 100	97 — 100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅜	3⅞ — 4⅜	86/3	85/-	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	5 5 11
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	8 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 — 103	100 — 103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10 31/32	10¾	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 12¾	12 — 13	12¾	12 9/16	+ ⅛	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 — 124	121 — 124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 — 102	99 — 102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	8¼ — 3¾	3¼ — 3¾	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 1 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	3⅛ — 8⅝	8⅛ — 8⅝	..	..	..	5 14 8
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	10 31/32	10¾	..	5 6 8
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	103 — 106	103 — 106	104¾	104¼	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 — 103	100 — 103	101¾	100¾	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	59 — 62 xd	..	..	..	7 5 2
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	85½ — 88½	85½ — 88½	..	..	..	5 13 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 — 101	98 — 101	..	..	..	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5% Gold Bnds.	..	..	..	..	5 %	97½ — 100½	97½ — 100½	98⅝	98½	..	4 19 6
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅞ — 7⅜	6⅛ — 7⅝	..	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 — 100	97 — 100	..	..	..	3 19 8
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	8 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5⅛ — 5⅜	5 5/16	..	..	5 11 8
282,555	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4½ — 4⅝	4¼ — 4⅝	90/-	..	..	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	97/6	..	..	4 10 0
235,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 — 108	105 — 108	..	..	..	4 3 4
248,000l	Do. 8½ % Mort. Deben. Stock Redem.	Stock	8½%	8½%	8½%	8½%	83½ — 86½	83½ — 86½	83¾	83½	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	82 — 84	83½	83⅛	..	6 1 11
18,565,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	65 — 68	68 — 72	71	65	+3½	4 17 3
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 — 108	103 — 107	106	..	—1	6 10 10
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	88 — 89	87½ — 89½	89⅝	88⅝	..	5 12 4
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	92 — 96	94 — 97	..	..	+1½	4 12 9
120,491	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4¾ — 5¼	4¾ — 5¼	..	..	..	2 7 8
131,000	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½ — 12½	11¼ — 12¼ xd	..	..	..	5 14 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	92 — 95 xd	..	..	..	4 4 3
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	28/3	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 — 1 3/32	31/32 — 1 3/32	20/-	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 — 105	102 — 105	103¼	103⅜	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	9 1/32	..	..	6 13 4
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	7 7/16	..	..	4 18 4
150,000l	Do. do. 8½ % Deb. Stock Red.	100	8 %	8½%	8½%	8½%	84 — 88	84 — 88	..	..	..	8 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2¾ — 8⅛	2¾ — 3⅛	..	..	..	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 — 103	100 — 103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¾ — 2¼	1¾ — 2¼	..	..	..	11 2 2
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	25/32 — 27/32	¾ — ⅞	16/10½	16/3	..	5 19 5
110,000	Westminster Electric Supply, Ord.		18 %	12 %	10 %	10 %	8¾ — 9¼	8⅝ — 9⅛	..	..	— ⅛	6 11 2
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	4⅞ — 5½ xd	5	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend,

Bank rate of Discount 2½ per cent., April 1st, 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1909.

The June returns of electrical business show a slight improvement over the previous month's figures.

The exports, with a total of £270 268, are barely a thousand pounds ahead of the amount recorded in May. The imports, totalling £158,119, as against £122,762 in the previous month, make a better showing, comparatively, although only slightly above the monthly average of 1908. The re exports amounted to £12,034, as compared with £10,023 in May.

For the sake of comparison with previous years' returns, in the case of the exports, it is interesting to note that the total business, less telegraphic, amounted to approximately £250,000 for the month—the highest amount yet recorded, and comparable with a monthly average of £213,000 in 1908. In connection with this it may be observed that telegraphic exports fell some £30,000, and electrical machinery improved by £20,000 as compared with the May figures, while the cable export was also higher.

In the import section the improved total is largely attributable to increased telegraphic and telephonic importation. There was also a £7,000 increase in the value of lamps sent into this country, but a fall of £5,000 in cable imports

Japan was the most prominent purchaser from this country, and Germany the largest importer, as usual, during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	710	829	174	96	67	4,606	...	56	...	93	106	6,737
Germany	224	2,572	17	102	47	909	...	8	80	87	448	4,494
Netherlands and Java	377	179	34	10	13	909	...	...	...	81	...	1,603
Belgium	113	171	6	50	89	813	16	50	...	135	233	1,676
France and French Indo-China	81	85	39	474	78	1,511	...	37	...	182	2,516	5,003
Switzerland	19	...	12	...	...	29	...	...	...	48	...	108
Portugal, Madeira, Azores & Portuguese Africa	225	79	...	88	27	2 892	25	157	...	157	80	3,730
Spain and Canary Isles...	139	...	99	211	...	400	1,520	14	...	...	2,420	4 803
Italy and Austria-Hungary	321	...	8	...	205	1,381	749	5,520	...	39	...	8,223
Greece, Roumania and Turkey...	86	...	...	106	8	65	125	32	...	12	66	500
Channel Isles, Gibraltar and Malta	79	36	21	47	137	78	4	...	...	12	27	441
U.S.A., Philippines and Hayti...	882	...	...	104	61	137	...	...	94	...	748	2,026
Canada	865	2,733	194	564	190	8,820	35	30	...	833	4,929	19,193
British West Indies and British Guiana ...	...	21	20	131	13	50	...	87	...	58	...	380
Mexico, Nicaragua, Ecuador. Colombia and Venezuela	...	...	28	10	406	58	...	...	...	13	18	533
Bolivia, Peru and Uruguay	106	56	199	137	3	404	660	13	...	5	784	2,367
Chile	52	...	222	340	123	6,741	1,747	46	83	533	37	9,924
Brazil	168	173	83	178	1,368	8,511	...	110	21	6	1,246	11,684
Argentine	957	15,149	963	845	341	4,184	1,413	585	80	1,445	675	16,637
Egypt	10	461	109	...	5	423	...	4	...	805	46	1,863
British West Africa	196	28	6	11	...	39	...	53	...	96	101	530
Cape of Good Hope	259	382	303	61	151	1,612	24	1,580	13	...	...	4,385
Natal	1,037	3,012	223	480	49	5,228	...	18	56	30	285	10,418
Rhodesia, Orange River Colony and Transvaal	542	1,500	186	415	183	5,400	...	519	79	...	...	8,824
Zanzibar, Brit. East Africa, Mauritius and Aden	153	165	40	112	44	157	42	...	...	17	39	769
China and Siam	688	41	110	108	17	2,669	964	101	...	7	603	5,308
Japan and Korea	157	19,371	646	...	432	23,868	3,224	...	...	1,450	92	49,240
India	2,004	4,483	1,178	1,127	654	10,422	950	664	302	1,728	2,988	26,500
Ceylon	24	223	10	21	...	43	66	58	...	127	16	588
Straits Settlements and Fed. Malay States	95	767	51	104	41	1,318	...	115	17	121	204	2,833
Hong Kong	136	511	...	196	...	177	3	11	14	113	39	1,200
West Australia	747	22	...	79	52	527	...	...	...	...	74	1,501
South Australia	192	774	239	31	40	2,050	...	3	...	2,434	...	5,763
Victoria	618	2,586	86	338	58	860	...	312	...	9,226	59	14,143
New South Wales	2,303	1,326	144	565	594	7,092	62	193	...	178	660	13,117
Queensland and Tasmania	...	124	...	27	65	1,513	...	60	...	45	262	2,096
New Zealand	291	1,466	206	459	2	7 516	106	348	...	22	512	10,928
Total, £	14,856	59,325	5,656	7,627	5,583	113,412	11,735	10,784	839	20,138	20,313	270,268

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		£
Norway, Sweden and Denmark	...	...	28	220	9	702	1,268	489	36	4,291		7,043
Germany	622	12,698	1,427	30,684	1,622	19,707	1,888	698	4,886	15,547		89,779
Holland	...	285	...	3,213	...	...	...	...	30	...		3,528
Belgium	356	1,184	26	...	16	1,754	12	45	189	11,141		14.723
France	147	...	765	2,584	886	174	60	1,817	2,607	7,791		16,831
Switzerland	...	147	52	8	200	552	10	8	13	904		1,894
Italy	56	559	...	...	...	209	...	...	...	354		1,178
Austria-Hungary...	23	220	12	206	...	87	...	10	3,106	355		4,019
United States	2,804	588	1,684	732	379	10,249	1,910	302	101	234		18,983
Total, £	4,008	5,681	3,994	37,647	3,112	33,434	5,148	3,369	10,968	40,617		157,978

Additional imports: Spain, carbons, £77; Canada, lamps, £57; N.S.Wales, electrical machinery, £7.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	1,366	307	...	1,744	...	1,363	...	269	379	6,606		...

Total Exports: £270,268. Total Re-Exports. £12,034. Total Imports: £158,119.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

OVERHEAD MAINS.

By WILLIAM COPELAND.

To erect overhead mains on straight roads and good ground is not a matter of great difficulty; but to erect overhead mains in shipyards, dock estates, railway goods sidings and such places is a different matter altogether, and not so simple. There are many difficulties to overcome—*e.g*, the ground where the poles are to be erected is generally built-up ground and not set, and there is often great trouble experienced in staying, there being no room to do this on account of the railroads. Another trouble which is often come across in such places is that distribution is made from certain points; the strain on the poles of three or four heavy mains all going in one direction is great, and not easily dealt with and nothing looks worse than unsightly poles on electric distribution systems.

When commencing to erect overhead mains in the above-mentioned places, the best way is to walk over the ground and make a plan of the positions of the poles, or drive wooden pegs into the ground where the poles are to be erected; after doing so, plan out how the mains are to be run, taking particular care to note where the strain is likely to be, the number of mains on each pole, and where telephone guard wires are to be erected.

When erecting mains in such places, I should recommend poles of not less than 24 ft. from the ground level to the first arm. Wooden poles are to be recommended on account of cheapness. They should be of red fir, free from large knots, and creosoted, and care should be taken to select them with a good taper. When erecting the arms, cap finial and earth wire, care is to be taken that all are connected together at the top, and the wire brought down to the bottom of the pole, and twisted two or three times round the butt to make a good earth.

Wooden arms of sound oak, well seasoned, are to be recommended rather than iron arms when using bare copper mains. Where there is any likelihood of any strain on the insulator, twin oak arms should be fitted on the pole, each fitted with an insulator on each side of the pole to take the strain, and when heavy mains are erected, the arms ought to be strengthened by an oak lath erected in a perpendicular position between the arms on each side of the pole; do not use iron, it is expensive to maintain.

For foundations on such places, concrete is not good on account of so many alterations occurring; it is too expensive to take out the poles, which have to be cut down and spoiled. The best and cheapest way I have found to erect poles in these places is to dig a hole about 6 ft. deep or so, according to the height of the pole, and have four 9-in. wooden deals 5 ft. long placed vertically at the sides of the hole, then place the pole to be erected in the centre of the hole, fill into the hole about a foot of earth, and place a 9-in. deal on each side of the pole, a tight fit. Afterwards fill in the earth and ram well up to 5 ft., then place a 9-in. deal on each side of the pole, a tight fit, and afterwards fill in the earth and ram well up to the ground level. I have found this to give every satisfaction where heavy strain has come on the pole. Where this is likely to be the case a good way is twin a pole and so erect them that the poles are at an angle to each other, so as to divide the strain equally between them; do not erect the poles in parallel. I have had experience in such places with heavy mains, to erect four poles and found they are better on an angle than square.

Insulators and bolts should be strong; $\frac{3}{4}$-in. bolts are considered quite small enough. Guards need not be used when wooden laths are employed. The P.O. insulators have been greatly used, even for high voltages, but the binders are some trouble and expensive to maintain, and are not to be relied on.

I have invented a bindless and practically unbreakable insulator, which can be used for any class of wire or cable. It can be employed for aluminium wires; with a porcelain cover, such an insulator is badly needed for such wires, as great troubles are experienced owing to the action of the binders on the aluminium wire. The insulator is carried on an ordinary bolt which has a square collar, in order to hold or turn it by means of a key or otherwise. The body is a porcelain insulator with the usual sheds, and has a horizontal groove round it which contains the wire, the latter projecting somewhat from the groove. In the top of the insulator is a screwed socket for a stud bolt, this socket being entirely separated from the socket for holding the bolt by a sufficient thickness of porcelain. The stud bolt has an ordinary right-handed screw on each side of a central collar, and there is a cap which can be made of porcelain, or of cast-iron or other like metals. This cap is provided with two slots, so that it can pass over the wire when placed in position, and comes down tight on to the wire. The cap and insulator are preferably somewhat conical in shape, but the cap is rounded at the top.

The mode of erection is as follows:—The bolt being screwed into the insulator in the usual manner, and the stud being also screwed into the insulator, the bolt is put in its supports, but not tightened up. The line wire is placed in the groove, and the cap dropped over, resting on the stud. The cap is now held by the hand and guided centrally, and the bolt turned round until the upper screw of the stud screws tight into the cap and holds the latter tight against the wire.

The wire is now firmly fixed. There is a special value attached to this insulator, for it can be used for a shackle insulator or on a curved or straight line, which is a great consideration when erecting overhead mains in such places; one class of insulator is all that is required.

Bare copper wires are recommended for mains; they are approved of by the Board of Trade, and are much cheaper and lighter, and stand the atmosphere much better; insulated wires are expensive to purchase, not so easy to work with, and carry coal dust, snow and ice, which all give trouble.

When using bare copper mains, do not use the arc lamp poles to carry them, as they are dangerous to pass through when attending to the arc lamps.

Connections from the mains should be made of bare copper, preferably solid copper wrapped with Blackley tape and varnished; these are more suitable to withstand the winds. It is not uncommon to use insulated wire with coils of a pretty spiral form, about twice the length they should be, and when the wind blows a few weeks afterwards the connections break and the lights go out. Bare copper connections are much stronger, and will last for years if properly made.

When a number of connections are taken off the mains and the mains are long, a joint box or double-pole or triple-pole switch should be used for testing purposes, &c., and on larger installations the ring type of mains is a good idea, and has been found to be very valuable. A main starting from the sub-station is run round the estate and back to the sub-station, with a switch half-way to break the ring, and say, two or three more switches in the ring, as the case may be. In the case of a breakdown only one-third of the system or so, according to the number of switches used, is out of use at a time until all is repaired.

A German Congress.—We are informed from a Continental source that the next International Congress of Mining, Metallurgy, Applied Mechanics, and Practical Geology will be held at Düsseldorf in June, 1910. This is at the invitation of the representatives of the Westphalian mining industry, which was issued at the last Congress, held at Liége in 1905. The programme of proceedings is at present in course of preparation, and will include visits to various institutions and places of interest in and around Düsseldorf, in addition to the usual papers. Any persons interested may obtain further information from the Arbeitsausschus des Internationalen Kongresses Düsseldorf, 1910, Düsseldorf, 15, Jacobistrasse, 3 and 5.

Peculiar Accident to a Tungsten Lamp.—Our contemporary, *Electricity*, of Milan, publishes an account of a curious occurrence which happened to an 80-watt tungsten lamp, simultaneously with a flash of lightning which blew the safety fuse. A shock was observed at the lamp, which could not again be lighted up. The glass bulb was pierced by a body evidently directed from the inside; this was obvious from the appearance of the hole in the glass. The metallic filament was broken on every side, and the hole in the glass was apparently made by one of the metallic supports, which must have been projected from its place with considerable force.

THE ELECTRO-MECHANICAL PROPULSION OF SHIPS.

By A. P. CHALKLEY, B.Sc.

Ever since the steam turbine became an important factor in marine work some years ago, the question of its economical adoption for moderate speed ships has been receiving the attention of engineers, not only in this country, but also on the Continent and in America, and it would be idle to deny that no satisfactory solution has yet been found. The difficulty, in a few words, lies in the fact that the steam turbine must run at a high speed, and the propellers at a low speed of rotation, for good efficiency, and therefore for turbine boats of 20 knots or under, if the turbines are running at their most economical speed, the propellers are proportionally inefficient, and *vice versa*.

In the ordinary direct drive (*i.e.*, with the turbines coupled direct to the propellers) for these boats, a compromise has invariably had to be effected, giving a maximum combined efficiency which is much less than the maximum efficiencies of the turbine and propeller if both are run at their most suitable speeds. The obvious means of remedying this state of affairs is to devise some satisfactory low-speed turbine or an efficient high-speed propeller, neither of which has yet been accomplished, and at present the best results have been obtained by the combination of high-pressure reciprocating engines and low-pressure turbines, driving separate propellers. This arrangement has given an undeniably better steam consumption than the pure turbine drive for intermediate speed boats, but it is naturally heavy and costly, and it is doubtful if it will be widely adopted.

The comparative lack of success of this expedient has led many engineers to turn their attention to the design of a practical means of gearing the propeller and turbine shafts so that the turbine spindle and propeller may each run at its proper speed. Mechanical gear, while not absolutely impossible, has to overcome enormous obstacles, and the only really possible suggestion in this direction is the use of magnetic clutches, in which the teeth are never actually in contact, the magnetic field created by the driving wheel causing the driven wheel (keyed on to the propeller shaft) to revolve without friction. It may safely be said, however, that after prolific experiments on the part of many investors, this idea has been quite abandoned, at any rate for the present.

It is, however, in the electro-mechanical system of propulsion that the greatest hopes are now centred, but it is unfortunate that a considerable bar to its development is due to the fact that marine engineers in general know little of electrical work, while electrical engineers are likewise unacquainted with sea-going conditions.

The broad principle of electric propulsion is as follows:—The prime mover, instead of driving the propeller shaft direct, is coupled to an electric generator, which transmits its power to motors coupled to the propellers, the speed in each case being that for maximum efficiency, the whole arrangement practically consisting of a system of electric gearing. At first sight it might appear as if this would largely increase the weight, cost, and complication of the installation, but, as will subsequently be shown, the exact opposite is the case.

Considering the relative aspects of a moderate speed boat with direct turbine drive, and secondly, with electro-mechanical propulsion, we have, in the first instance, heavy low-speed uneconomical turbines, a large boiler plant, and a great length of propeller shafting, while the "astern" turbines add considerably to the weight and cost, and decrease the efficiency. In the second case, while there are the generators and motors to allow for, the lessened steam consumption due to the higher efficiency of the turbines, which, of course, would run at their most economical speed, the smaller boiler installation, the absence of astern turbines and propeller shafting, and the decreased size of valves, pipes and all auxiliaries, actually would bring about a reduction in cost and weight of the whole equipment. These facts will be elucidated by figures which obtain in practice after some of the systems have been described.

About nine or ten different proposals for the electric propulsion of ships have been brought forward, and many of them patented; two of them have been tried practically, while of the others several designs are now being prepared, so that rapid developments are to be anticipated very shortly. Mr. Parsons, the inventor of the steam turbine, was quick to recognise the unsatisfactory results with intermediate speed turbine boats, and his system of electric propulsion was one of the first, and it should apparently give the highest economy in steam consumption that is possible with any combination. His idea is to combine high-pressure turbines or reciprocating engines with low-pressure turbo-generators, the steam, after passing through the main propelling engines, being delivered to the turbo-generators, which are, of course, quite disconnected from the propeller shafting. The generators deliver their power to electric motors on the propeller shafts, which thus aid the main engines. The hopes for this system are based on the well-known economy of the low-pressure turbine, and it is certain that if it were adapted to existing cargo steamers, by placing turbo-generators between the reciprocating engines and the condensers, and coupling motors to the propeller shafts, the saving in coal consumption would be sufficient to cover the cost of the extra plant in four or five years at the outside. In this arrangement direct current would be used, probably at 200 volts, and series motors would be employed for the drive. To this there are objections, inasmuch as commutators at sea are to be avoided, for there is little doubt that they would cause trouble, and, moreover, since direct-current turbo-generators are unsatisfactory above 1,000 KW., the size of boat to which this system is applicable would not be more than about 5,000 tons. Of course, turbo-generators of 2,000 KW. can be relied upon if two tandem armatures are used, but it is vastly improbable that marine engineers would agree to this arrangement for sea use. The lay-out with this system is not particularly convenient, and the saving in space and weight would by no means be as great as is possible with a purely electrical drive, because the main propelling machinery would be on the same heavy scale as for the direct drive; also the size and cost of the auxiliaries would be only slightly diminished, and the same propeller shafting would still be necessary. The arrangement is shown diagrammatically in fig. 1 in which *a* is the high-speed reciprocating engine from which the exhaust steam is taken by the pipe *d* into the low-pressure turbine *c* driving the dynamo *f*. The current from the generator is delivered to the motor *h*, mounted on the propeller shaft *b*, the controlling switchgear being arranged at any convenient position in the engine room. A point of difficulty which would arise with this system, is the question of the steam pressure at the entrance to the turbine to give the most efficient results, and this is a more complex matter than appears at first sight. Turbine engineers would favour a pressure of at least 15 lb. per sq. in. absolute, and many would advise as high as 30 lb. absolute, and yet for a recently-built ship with direct drive, and a combination of reciprocating engines and low-pressure turbines, the pressure at the turbine stop valve was 10 lb. absolute. It is evident under these conditions that a vacuum of at least 28 in. is essential, and it is feasible that the economy obtained in such ships may be due to the excellence of the condensing plant rather than to the inherent advantages of the system.

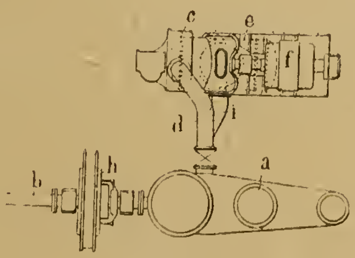

Fig. 1.

A somewhat similar arrangement to the Parsons is that proposed by Messrs. Brown-Boveri, shown in fig. 2, in which the three propellers 1, 2, 3 of a triple-screw boat are driven direct by slow-speed turbines T, T^1, T^2.

A single and separate high-pressure turbine T^3, running at high speed, drives the generator G, from which power is taken to the motors E, E^1, E^2 on the main propeller shafts. This is, of course, only a minor modification of existing practice, and the gain in economy in ordinary cases would not be great, since the inevitable cause of overall inefficiency still remains—*i.e.*, slow-speed turbines coupled direct to the propeller shafts. The chief object, however, in this case is to promote ease of manœuvring and efficiency at cruising speeds, when the motors alone would be utilised to drive the propellers, the rotors of the main propelling turbines revolving idly in their casings.

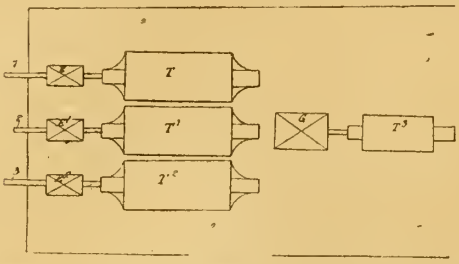

Fig. 2.

It is, therefore, to battleships that this system would be most applicable, since the greater part of their existence is spent in steaming at cruising speed, and, moreover, the motors would give an excess of power in emergencies.

Coming, now, to the purely electrical propulsion, the suggestion of Messrs. Siemens, illustrated in fig. 3, was one of the first to be patented, and the fact that so many of the great firms and engineers are working on the subject is a sound proof (if one be needed) of its great possibilities. In this arrangement, as might be expected, knowing the faith which Siemens and other German manufacturers place in the commutator motor, alternating-current series motors are proposed.

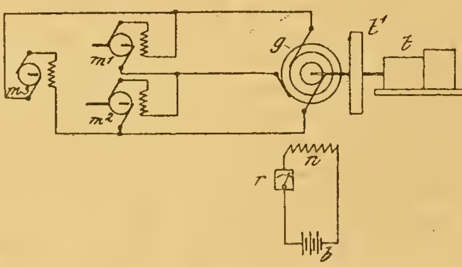

Fig. 3.

The high-speed turbine *t* drives a direct-coupled three-phase alternator *g*, and the current from the three phases is used to run three single-phase commutator motors m^1, m^2, m^3, which drive the propellers direct, being placed as near the extreme end of the boat as possible. The excitation for the main generator or generators is provided from a battery *b*, a rheostat *r* being in the field circuit for regulation.

Electrically the system seems very interesting, and there is no doubt that the series alternating-current motor possesses some advantages for marine work, but one cannot help thinking that the designers had little cognisance of general marine work, for it is practically certain that if electric propulsion is to be completely successful on a large scale, commutators will have to be dispensed with. The trouble they cause, even on the comparatively small generators used for lighting and power purposes on ships at the present time, is quite sufficient to prevent marine engineers from employing them on a more extended scale.

A promising and more practical arrangement is that designed by Mr. Mavor, the motor he proposes to employ being shown in fig. 4. The motor consists of three parts—the stator, the rotor, and the spinner, which is mounted on bearings, and is free to revolve between the rotor and the stator, so that the arrangement is virtually a pair of concentric motors, the spinner being the rotor of one and the armature of the other.

The windings of the rotor and the secondary (or outer) of the spinner are both of the squirrel-cage type, while the primary (or inner) of the spinner consists of an ordinary three-phase winding, which, like the stator, receives its current from the generator. The value of this motor lies in the fact that three widely different speeds may be obtained with practically no loss of efficiency, as will be seen from the following description. The spinner in every case simply revolves without doing work, and the only loss created is the almost negligible amount due to bearing friction. At full speed the spinner and rotor rotate in the same direction, at lowest speed in opposite directions (the change being brought about by means of a reversing switch), and an intermediate speed is obtained by stopping the spinner altogether.

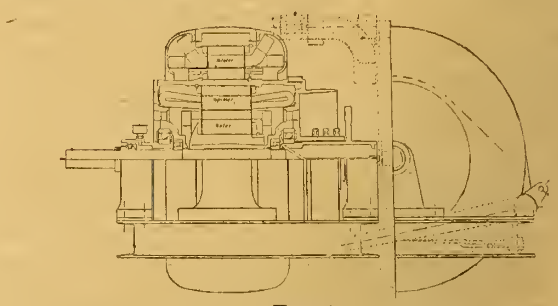

Fig. 4.

For further variations of speed the generators might be slowed down to some extent, though this is not a means to be adopted when avoidable, especially when steam turbines are the prime movers, though it would not be so disastrous with oil or gas engine plants.

The lay-out for Mr. Mavor's system is excellently planned, after the style of land installations, the turbo-alternators being placed directly over the condenser, and the air pumps (electrically driven) alongside. In fact, the general rules for central station equipment might well be followed in this case.

It may be mentioned that motors of this type are already in operation for some land purposes; probably there is a wide field for them for such work as driving rolling mills, winding engines, &c., though it must be admitted that their relatively large diameter may be disadvantageous in marine work, particularly for shallow draught steamers.

(*To be concluded.*)

THE STORES DEPARTMENT.

By J. C. PETERSEN, A.C.I.S.,
Chief Clerk and Commercial Assistant, Corporation Electrical Supply Department, South Shields.

Perhaps in many cases this important department is not given the attention and supervision it merits, and therefore it is quite possible that economies could be effected in some cases in this branch of an electricity supply undertaking. It may be no uncommon event to discover, when stocktaking, material in a perished condition, and various articles far in excess of the immediate requirements, whilst others are obsolete, simply owing to the fact that too little attention has been paid at the time of ordering to the probable amount or quantities likely to be used. Therefore, it is necessary to have certain rules with regard to sending in requisitions for stores, &c., and the consequent ordering of the goods and material.

All books relating to the Stores Department should be kept by the clerical staff at the general office, and not by the storekeeper. Suitable slips containing records of all requirements and goods received should be sent in daily by the storekeeper to the general office, for entry into the respective books.

The storekeeper should be provided with a duplicate book for his requirements; one copy will be retained in the book, the other forwarded to the general office; these slips should be filed in numerical order for easy reference. Under no consideration whatever should goods be ordered unless such a requisition is received from the storekeeper, giving full particulars of the goods and of the quantity required, and stating also the quantity then in stock. No orders should be sent out except through the general office, unless the case is one of extreme urgency, when the requisition should be sent in immediately thereafter, stating thereon the reason why the goods have been ordered direct and not through the general office. The official order should then be forwarded, confirming the order from the stores department. It will thus become known that an official order must be obtained covering all supplies, and in the event of the same not being received in due course, firms supplying goods will soon communicate with the department responsible for the issue of the official order, particularly if the rule is that all order numbers should be quoted on the invoice; thus all goods ordered other than through the general office, if not followed by an official order, will be brought to notice by suppliers, and steps can be taken to prevent a repetition.

A "Requisition Book" should be kept at the general office; this should be on the loose-leaf principle, but need not be an expensive book, one of the cheaper kinds of post binders will suit equally well. All requisitions should be entered therein as received.

Ruling of Requisition Book.

Date.	No.	Requis tions.	Sent in by.	Stock in hand.	Date order'd	Date received.

The quantity of stock in hand shown on the storekeeper's requisition should be entered up in the column provided for that purpose; these items should be daily checked with the stock book. By this means a constant check is kept on the stock, and any deficit is at once discovered, it being then an easier matter to trace such discrepancy than it would be if discovered only at the end of the year when stocktaking. Further, this method tends to prevent the ordering of any undue quantity of material, as on reference to the stock book the usual quantities ordered at one time are observed, also the quantities used over a certain period, and if the amount requisitioned seems large, the matter can be taken up with the storekeeper or the superintendent in whose department the particular stock referred to is employed.

This requisition book, of course, applies not only to stock, but to all requirements.

The official order book, the order forms of which are in duplicate, should be written up daily from the requisition book, and the orders duly signed by the chief official of the department before sending them out.

As the goods are delivered, the storekeeper will send in slips giving full particulars as to quantity, &c., how delivered, and distinctive numbers of drums, packages, or cases; the dates of these slips are then entered up in the "date executed" column in the requisition book, and the slips are copied in detail in the day book, and filed in chronological order. As the orders are completed on each sheet in the requisition book, the sheets should be transferred to the back of the book and placed in numerical order. Thus all orders not executed can be seen at a glance. Orders may be sent out and not thought of again until the goods are required; but with a requisition book as described, all the sheets containing uncompleted orders being in the front of the book and the completed orders at the back, it is only a matter of minutes for a clerk to run over the sheets, see date ordered, and, if necessary, write and ascertain the reason for delay in delivery.

Ruling of Day Book.

Date.	No. of drum or case.	When returned.	Quantity	Description of goods.	From.	Date certified for payment.	How sent.	Stock book page.

As in many municipal undertakings, personal accounts are not opened in the ledgers for stock purchases, nor is it necessary, owing to the fact that these purchases are more or less of the nature of cash purchases, the accounts being paid monthly; therefore great care should be taken in checking invoices, in order that there may be no possibility of goods being paid for twice. If the following system is adopted it will obviate any chance of such an event, and will, moreover, be a check in other directions, as no doubt the reader will perceive.

The invoices should all be stamped with a rubber stamp similar to the following—

Received D. B.
Examined O B
Certified
Date

and first checked with the day book. If the delivery is proved, the date should be written therein in the column "Date certified for payment"; and then the line "Received" on the stamped impression on the invoice should be initialled, and the number of the page of the day book entered thereon. The invoice should next be compared with the official order book, the calculations and prices checked, and, if correct, the line "Examined" should be initialled and the order number be inserted thereafter. The departmental date stamp should then be stamped on the duplicate order, and the invoice be certified by the chief official on the line provided for that purpose, and forwarded to the accountant's department for payment.

If this method is strictly adhered to, the genuineness of the invoice is proved—first, by proof of delivery in the day book; secondly, by reference to the duplicate official order; moreover, as this duplicate is stamped when the invoice is certified for payment, and the column opposite the goods in the day book is marked with the date of certification, it is practically impossible for a mistake to be made and goods certified for payment twice, nor is it possible to pay for goods not received; further, this system leaves open very little scope for fraud.

As before pointed out, it is advisable for all stock books to be kept at the general office. The storekeeper will, of course, receive an order before handing out any stores. This he will enter on the "Stores issued sheet," together with the works order, which will appear on his order. He may use one column for engine oil, another for cylinder oil, and so on, retaining one column for sundries; the sheets for the inside and outside departments are kept separate, the department they appertain to being marked on each sheet. The rate and cash columns will be dealt with at the general office. The superintendents will sign each sheet referring to

Ruling of Stores Issued Sheets.

Store Sheet.

.... Department. Week ending .... 190 .

	W.O.	Rate.	Amount.		W.O.	Rate.	Amount.

their respective departments, and the sheets should be sent in weekly to the general office, together with the orders. A clerk will then check the sheets with the orders, thus proving that nothing on the sheets has been issued from the stores without an order signed by the superintendent interested or other responsible official.

The Stock Book.—The "loose-leaf" is undoubtedly the class of book that should be used for this purpose. Its advantages over the fast-leaf book are briefly: no indexing required; sheets arranged in alphabetical order; accounts always in the same order, no transferring when sheets are full; quantities used over corresponding periods can be seen at a glance. This book is also preferable to the card system of stock-keeping, as the cards have to be taken out of the tray for each entry and then re-inserted; moreover, the tray is cumbersome when in use on a desk, the book being certainly more convenient for handling.

Ruling of Stock Book.

Minimum amount

Date.	D.B. Page	Received.	Rate.	Amount.	Date.	Issued.	Rate.	Amount.

It will be noticed that each account has a cash column, and the reason for this in a quantities record book is that as the same classes of material or stores are often purchased at different prices, for instance, on the expiration of a contract, it is difficult without the aid of this column for the clerk to know what quantity should be booked out at the various prices. The clerk pricing out the "stores issued sheets," sees from the stock book the quantity to be issued at a certain rate; thus, when the "stores ledger" is posted from the stores issued sheets, the correct value of the goods or material is entered, and the stock in hand shown by the stores ledger will agree with aggregate balances of the stock book.

Ruling of Meter Stock Card.

Meter number Size Voltage
Make
Date received into stock

Date issued.	Index.	To.	Date returned.	Index.

Reverse Side.

Installed dates.	....	......	......	......
Tests. .... By				
Returned dates.	....	....	......	......
Tests. .... By				

With regard to the meter register, there is no doubt in this particular instance that the card tray system is the best, as, owing to the constant change of meters, it has been found that a book soon gets, more or less, into a complicated state, whereas with the card tray all particular makes of meters can be kept together, according to their sizes, and also in numerical order. The following is a brief description of the method:—The tray should be divided into two portions by the aid of guide cards, one for meters issued, the other for meters in stock; each of these divisions should be further sub divided into the different sizes by suitable guide cards, and divided again by further guides, according to their respective makes. The meters should then be arranged in numerical order, according to the maker's number. Of course the numbers will not run in consecutive order, but if cards are filed with, say, the smallest number first and so on, any particular number can be easily referred to.

These cards will record the history of any particular meter since its purchase, and not only answer for the purpose of a stock account, but also contain records of tests and records of return and re-issue.

Stocktaking.—After this has been duly taken, an important item is the adjustment of each stock account where necessary. When comparing the actual stock with the book stock, an account of all excess issues should be taken; the value of these items should be debited to stock account, and credited to the account or accounts the material is usually charged to, and deficits of stock should be debited to the account usually charged to and credited to the stock account. The excess issues or deficits should then be adjusted in the stock book, the accounts balanced, and the balances carried forward. Thus at the commencement of the new year the stock book will show the actual amount of stock in hand on each account, and the aggregate value of the same will agree with the total amount returned as "Stock in hand."

The German Lamp Taxes.—The Reichstag has adopted by 185 to 160 votes, on first reading, the proposal to levy taxes on gas and electric lamps. A petition presented against the scheme by the Society for the Protection of the Economic Interests of German Electrical Engineering, points out that the tax on arc lamp carbons amounts to 8½d. per kilogramme on carbons not exceeding the price of 1s. 6d. per kilogramme, and to 1s. 2¼d. per kilogramme for all others. In the opinion of the society this represents a favouring of glow lamps. The tax on incandescent gas lamps is to be 1¼d. each, and on electric glow lamps of from 100 to 200 watts consumption, 6d. each, with 3d. extra for every additional 100 watts or portion thereof. On this basis a light of 500 candles and 1,000 hours' duration would be taxed to the extent of 1s. 6d. in the case of incandescent gas lamps, 1s. 3d. in that of electric glow lamps, and 5s. in that of arc lamps. With a light of 1,000 candles and 1,000 hours, the tax would be 3s. on incandescent gas lamps, 2s. 6d. on electric glow lamps, and 8s. on arc lamps with pure carbons, and 10s. 7d. with "effect" carbons; and a light of 2,000 candles for the same number of hours would involve a tax of 6s. for gas, 5s. for electric glow lamps, and 11s. 7d. for arc lamps with pure carbons, and 11s. 6d. with "effect" carbons. These figures, in the view of the society, show that arc lighting in Germany will be rendered impossible from an economic standpoint, thus causing severe prejudice to the carbon-making industry. In order, however, to prevent this injury as far as possible, the society suggested that a differentiation should be made between pure carbons and "effect" carbons, the former to be taxed at 2½d. and the latter at 7½d. per kilogramme. The society also proposes that taxation should be effected on the basis of the book-keeping. This would be readily possible, as at present there are only 5 arc-lamp factories in Germany, and 30 glow-lamp factories, all of which keep their books on a strictly commercial basis. The number of Government officials to control the taxation and the incidental expenses would be considerably reduced by the adoption of the manufacturing and sales books as the basis, and in this way, the society concludes, the deficiency in revenue arising from the differentiation between the two classes of carbons, instead of differentiation between the sale prices of the maker, would be recouped. During the discussion in the Reichstag before the first reading of the Bill was carried, one of the members stated that the Siemens & Halske Co. delivered 60,000 glow lamps daily; that the supervision of these lamps, from the point of view of candle-power in watts, would require 100 Inland Revenue officials in these works alone; and that the shipping companies would procure their supplies of lamps from England if the taxes were imposed.

COST OF LIVING IN CHILE.

By C. A. SMITH, A.Am.I.E.E.

Under this heading, it is believed that some reliable information concerning the climate, the cost of living and life in Chile, would be of interest to some of the readers of the Electrical Review.

When one turns up his map of South America, and looks at this strip of territory, narrow out of proportion to its length, one marvels at its curious shape; as it reaches from Cape Horn to Peru, through 38° of latitude, for a distance of about 4,250 km., while not exceeding 300 km. in width. Being bounded on the east by the lofty and often snow-clad Andes, and on the west by the breezy Pacific Ocean, one can well understand why there are such decided differences in aspect and climate.

On the whole, the climate of Chile is temperate, but there are local seasonal exceptions. The proficient engineer with plenty of grit, wishing to try his luck in Chile, will have splendid opportunities with plenty of variety, but he must not attempt it on "spec." If sent, maybe, by some nitrate firm, mining company, or, perhaps, for a railway scheme, he must not become disheartened to find himself in the North on the *pampa*, where it never rains and no blade of grass grows, and there is only desert and little else but one's own company. The climate here is considered temperate (20° C. summer maximum and 14° C. winter minimum). If he goes further into the interior where the country is more elevated, greater heat and cold will be experienced, as the thermometer may stand at 55° C. in the sun in the morning, and at zero at night. Or, perhaps, he may go up into the mountains some 2,000 metres or more above sea level, which is generally to the taste of those who like a rough free life.

As a contrast, in the Southern provinces the country is all green, as the rainfall is heavy; in Valdivia, for instance, it rains one-third of the year. Going still further south to the Straits of Magellan, a promising mining district, the country round is covered with snow through June and July, and the weather generally very cold.

In the Central Provinces where the largest towns are situated, and where there are extensive agricultural, wine-growing and copper-mining interests, the climate is delightful.

It is assumed that the interested persons are men sent out on a three or five years' agreement to take up responsible positions. In the first place, it is understood that no one would be so foolish as to accept terms other than upon a sterling basis, because the Chilian currency is for ever varying in value, and has during recent years suffered considerable declination. At the present time the sterling equivalent of the *peso* is 10d., and upon this value the following items are based.

In the second place, it is not advisable for a single man to accept a lower commencing salary than £250 per annum, while it should be mentioned that most of the men known to the writer earn from £300 and upwards, and in the case of managers and chief engineers, most of whom are married, these receive £500 and above. The values assigned to salaries, however, will vary with the locality; for example, in the north where life is trying and monotonous, and cost of living much higher, or again in the extreme south where it is disagreeably cold, higher salaries should be expected than for the central parts of the country where living is cheaper and life more enjoyable.

In considering the case of a married, man who would search for a comfortable house, nine times out of ten he would not find one suitable to his taste and pocket, as the majority of houses are too large and highly rented. For houses of similar sizes, the rents in Santiago and Valparaiso are twice what they would be in London, and with many discomforts thrown in. It may be taken, however, that for a six-roomed house or flat in Santiago or Valparaiso, the rent is from $140 to $350 per month, and Iquique or Concepcion $120 to $200, according to locality.

Board and lodgings for a bachelor living either with a family, or with chums, runs from $120 to $200 per month; this will include a light breakfast, lunch at mid-day, and dinner in the evening. Of course, wines and spirits are extra. Living in a hotel, which is generally considered only a temporary expedient, costs from $8 to $25 per day, but if for an extended period, less.

A good brand of whisky costs about $78, and Chilian wines $10 to $18 the case; one pays 30 cents for a half-bottle of native beer. Havana cigars range from $40 to $85 per hundred, while English imported tobacco costs $12·50 to $16 the lb.

Generally speaking, one wears the same kind of clothing as at home, excepting, perhaps, additional thinner summer suits, &c., and those residing in the cities find it convenient to have a smoker or swallow-tail for social occasions. A warm overcoat will be appreciated on winter evenings, and a soaking rain-proof coat for wet weather. The natives, when riding on horseback, use a *manta* for warmth or a *poncho* for wet weather; both of these garments are obtainable here.

Clothing is dear in Chile, and at the present rate of exchange a suit may cost anything from $130 to $230, according to the locality and tailor. A pair of imported boots will cost from $35 to $42, while the native article (of variable quality) will cost $25 to $35. Heavy boots for Chile are a mistaken idea.

Imported hats are also dear, a bowler costing $20 to $28 and a straw brimmer about $10. Shirts will run to from $50 to $60 the half-dozen, while collars reach $20 to $26 the dozen.

Doctors' fees are $5 in the consulting room, and when called, $10 per visit. It is advisable to be vaccinated before coming to the country, as small-pox is generally prevalent.

One's washing account may range from $10 to $20 per month.

Domestic servants, who are usually looked upon as a necessary evil, earn from $25 to $35 per month (the much-abused maid-of-all-work is not known here), and do as little as possible for it.

There is an English Social Club in most of the principal towns (the entrance fees being about $100 and subscriptions equivalent to $96 or $120 per annum), also the usual athletic clubs. One can have plenty of shooting and horse riding, the last-mentioned sport being the most indulged in, as it affords a splendid opportunity for knowing the country, and in many instances forms the only means of locomotion, the country roads being often impassable to wheel traffic. The price of a decent horse ranges from $200 to $400, and the keep $40 to $60 per month, while a good English saddle costs $250.

Travelling by rail is comfortable, and one-third the price of travelling in England when considering first-class in each case. One never travels second-class, while third is unmentionable.

It will be interesting to add that the old sea trip from Liverpool to Valparaiso *via* Straits of Magellan is about 9,600 miles, and usually takes five weeks; a first-class passage costs £65, and second-class, £30. A much quicker and cheaper route is *via* Buenos Ayres and thence over The Andes by train, which will see one through the journey in 24 days, and cost £52 10s.—viz., sea passage £39 and £13 10s. first-class fare over the mountains. This route, however, is only open to traffic from the beginning of October to about the middle of May. In taking this picturesque trip the traveller is carried over the *cumbre* of the cordilleras, 3,900 metres above sea level; 50 kilos is the free luggage allowance with an excess charge of $6.30 for every 5 kilos or fraction thereof.

Another convenient route is *via* Panama and the United States, the trip from New York to Valparaiso costing £55 17s., and takes 19 days.

Chile is very cosmopolitan, and as soon as the home sickness has worn off the new-comer quickly settles down to enjoy an easier and freer life than at home; it is advisable at first to live with a native family for a while, so as to learn their language, which is essentially Spanish, and easily mastered.

Prosecution.—A band of Aberdeen youths has been heavily fined for placing a piece of wire round the telegraph wires between Aberdeen and Ballater, causing a delay and interruption for about 50 minutes.

PROCEEDINGS OF INSTITUTIONS.

The Electrification of Steam-Driven Non-Reversing Rolling Mills.

By W. F. Mylan, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Leeds, May 5th,* 1909.)

It is estimated that in Europe at the present date there are upwards of 230 electrically-driven non-reversing mills in operation, the horse-power of the motors used exceeding a total of 200,000 h.p.

A large number of electrically-driven rolling mills are in commercial operation in this country, giving every satisfaction to the proprietors and justifying their conversion. As a consequence, and following on the data obtained from actual installations, the electric driving of rolling mills is now quite past the experimental stage, and it is not only possible to estimate with certainty the size and every feature of an equipment, but to determine very closely the actual cost of operating under any stated conditions.

In estimating for the electrical equipment of an existing steam-driven mill it is usual to take a series of continuous indicator diagrams of the engine, the mill for the time doing its hardest work. Care must be taken not to place too great a reliance on the horse-powers as calculated from such diagrams. Allowance must be made for the increased output and heavier duty required of the motor, and it is better to estimate the horse-power of the motor by calculating the work it will be called upon to do from the data already obtained under the same or similar conditions.

A properly designed fly-wheel is of great assistance in reducing the size of the motor and enabling it to get over the peak loads without absorbing too great a current from the line.

The time taken to extract the energy from the fly-wheel is usually considerably shorter than the time required to return the same amount of energy to it, assuming that it is desired to maintain the demand from the line as nearly constant as possible. In the perfect case the light-load period is equal to or greater than the overload period. The use of a fly-wheel for levelling the output demanded of the motor is not generally practicable if the time in rolling one pass exceeds about 30 sec., and in such cases the introduction of a heavy fly-wheel would be open to very serious objections, inasmuch as the motor would, after a certain point in the pass, have to pull the fly-wheel round in addition to supplying the power required for rolling. This is the case in rolling long bars, rails, &c., and here a comparatively light fly-wheel is desirable, levelling only the smaller peaks and variations in the load, the motor being designed to deal with the main peaks without any external assistance.

In those cases where a heavy fly-wheel is employed with the object of relieving the strain on the motor it is usual to employ an automatic device to ensure that the fly-wheel carries its fair share of the load. With direct-current machines the motors are always compounded, but to further increase the strength of the field use is made of a separate excitation, which increases the field current, so reducing the speed still further and obtaining a return of the fly-wheel energy during the correct period. With alternating equipment a slip regulator is employed, automatically introducing a resistance in the rotor circuit at times of heavy load; the resulting effect, however, is the same and is independent of the electrical characteristics of the installation. As a general rule it can be stated that, with a properly designed fly-wheel, the fluctuations of load are only one-half of what they would be were the fly-wheel effect not utilised.

The proper place for the fly-wheel is, of course, on the highest running shaft; but this is not usually feasible, and consequently it is generally found that the fly-wheel is fitted on a motion direct geared to the mill, thus preventing the extra strain on the motor and its gears or ropes.

Fly-wheel equalisers are occasionally employed to level up the demands on the power supply, but these are open to the same limitation as the direct use of a fly-wheel, and necessitate the motor being made large enough to deal with the maximum overload.

In merchant mills it is an advantage and practically a necessity to be able to vary the speed of the mill motor. With a d.c. power supply this is a comparatively simple matter, the speed variation being obtained by means of field regulation only. The only practical way of reducing the speed of an a.c. motor is either by the introduction of resistance into the rotor circuit, or by choosing a suitable number of poles to run at two or three speeds with economy. In the first case, speed reduction is obtained by means of, usually, a liquid type of controller, and over a very wide range, but with serious loss in efficiency; in the second case, a special controller grouping the stator windings in a suitable manner will give only two, or at the most three speeds, but give them with an efficiency only a few per cent. below the maximum. An attempt has been made to overcome the difficulty by adopting in cases where a speed reduction is desired a device in which the motor shaft carries a three-step rope pulley, and the necessary lengthened shaft is supported at its free end by a pedestal bearing, the whole being carried on a base plate mounted on slide rails. In the event of a different speed being desired, the motor bedplate is slacked back, the ropes are changed to the desired group of pulleys, and the motor is drawn back to tighten up the ropes. In order to carry this alteration through in the minimum possible time, a small motor is usually fitted to operate the sliding baseplate screws, and under such conditions it is remarkable what a short space of time is required to make a change. In an installation of this character the men are accustomed to make the change in some three or four minutes, this time representing the period under normal circumstances and without any special effort.

In the large majority of cases it is impossible to direct-couple the motor to the mill, and some form of speed reduction is essential. Where the motor can be direct coupled it is advisable, with the view of reducing the sudden shocks and strains on the motor, to introduce a flexible coupling. Ropes have the same effect as the flexible coupling in the case of the direct-coupled motor. The bearings of motors used in rolling-mill work should be of more massive construction than is usual, and thoroughly well lubricated.

Owing to the heavy and frequent overloads that the motor must deal with, the shaft must be stiffened and the end windings of the motor properly braced to prevent distortion. Where slip-ring motors are employed, the rings should be of ample section. Occasionally one meets motors where the smallness of the rings has a serious effect in very much reducing the overload capacity of the motor, owing to the smallness of the rotor currents which can be dealt with without excessive sparking and heating at the rings.

A great feature of any electrical equipment is the ease and absolute certainty with which the control of the motor is effected. The provision of a suitable outfit of recording instruments is to be recommended. Such an outfit should consist of a recording ammeter or wattmeter, showing the momentary fluctuations in the load on the motor, and an integrating wattmeter totalling up the power taken over a certain period. By keeping a correct log of these data it is easy to determine accurately the cost of rolling each particular section. A circuit-breaker should always be provided in the main circuit of the motor, with overload and no-volt release. The provision of a no-volt release is important, as this allows of the fitting of emergency switches, allowing the mill to be quickly stopped in case of necessity from any of several points. These switches open-circuit the no-volt release coil of the breaker, thus opening the breaker and cutting off the supply of current from the motor. For starting large motors, from all points of view a liquid controller is to be recommended. Large controllers of this pattern are usually fitted with cooling coils, the consumption of water for this purpose being about 3·3 gallons per hour per horse-power dissipated. For the best results the temperature of the resistance liquid should be between 60° C. and 80° C.

The following figures represent the actual ascertained consumption from certain mills, as determined by careful calculation and observation made over a long period:—

Re-rolling 90-lb. rails of section 16 lb. per yard, each piece 30 ft. long, required 56 units per piece. Total output of mill 4,800 pieces per 12 hours. Small mining rails rolled from billets 5 in. × $5\frac{3}{4}$ in. and weighing from 900 lb. in the case of 28 lb. per yard rail to an average of 650 in the case of 18-lb. rails required as follows per ton rolled: 28 lb., 38 units; 24 lb., 42 units; 20 lb., 45 units; 18 lb., 48 units. Smaller rails of 12-lb. and 8-lb. section require from 49 to 54 units per ton rolled.

Girders 11 in. × 6 in. can be rolled for about 50 units per ton.

Channels averaging $1\frac{1}{2}$ in. × $\frac{3}{4}$ in. × 2 in. require 66 units.

Angles $3\frac{1}{2}$ in. × $3\frac{1}{2}$ in. × $\frac{5}{8}$ in. from 800-lb. billets require 50 units.

Sheets (iron)	8 ft. 3 in.	× 33 in.	× 0·064 in.,	95 units per ton.
	8 „ 0 „	× 48 „	× 0·080 „	70 „ „
	10 „ 0 „	× 48 „	× 0·067 „	80 „ „
	10 „ 0 „	× 48 „	× 0·125 „	60 „ „
	9 „ 6 „	× 42 „	× 0·09 „	84 „ „

Breaking down 10 in. × 1 in. × 12 ft. brass ingots into strip about No. 8 gauge, 86 units per ton.

Rounds and squares: $\frac{7}{8}$-in. rounds can be rolled at between 40 and 36 units per ton. The mill output is between 22 and 30 tons per shift. Average billet, 28 in. × $4\frac{1}{2}$ in. × $4\frac{1}{2}$ in.

$\frac{13}{16}$-in. round bars required same power. Output of mill, 46 tons per shift.

Bars 1·2 in. and 1·7 in. diameter from billets 5 in. square require 38 and 40 units per ton. In this case the 1·7 in. bars were much shorter than the 1·2 in. bars, and consequently the consumption appears high.

As the torque exerted by the electric motor is maintained absolutely constant at a predetermined value and is quite independent of the momentary position of the motor, it is possible to run the mill at a considerably higher speed than formerly, and a better product with more uniform finish results. In one instance the speed of the mill has been twice increased without any difficulty being met with in handling the material. In rolling at the increased speed, it is found that though the speed is higher the rolls run more evenly, and the material coming away at a steady speed is quite easily caught and controlled when leaving the rolls. After a short time the men get accustomed to handling the product at the higher speed, and if on piecework prefer it, as enabling them to earn more money in the shorter time.

Due to this constant turning effort of a motor as compared with that exerted by a one or two-crank steam or gas engine, the electrically operated mills are very free from stalling; when a tendency to stall does occur, the motor slows down, and extra energy is obtained from the fly-wheel and from the line, automatically tending to get the material through the rolls.

The efficiency of the electrically operated mill estimated from the actual cost of rolling as compared with steam-driven mills is beyond dispute. In this connection it should be borne in mind that the actual decreased power costs in rolling are not due so much to the fact that it is an electric motor doing the work, but that the electric motor enables one either to purchase power at low rates from one of numerous supply companies who operate in all large industrial centres, thus shutting down the wasteful steam boilers and local electric plant, or, in the case of a number of mills, to concentrate the power plant at one spot, generate in bulk at the lowest possible cost, and distribute the power to the exact points required, with an economy unapproachable by any other system.

The extreme simplicity of the control, and the ease with which it is possible to make electrical apparatus practically fool-proof, reduce the labour costs considerably, and this, coupled with the impossibility of an electrically-driven mill racing, renders less frequent the stoppages for broken couplings, pinions and rolls. Such troubles are inseparable from a steam-driven mill, and are a constant source of annoyance, as well as a big loss, not only due to increased upkeep but to time lost by the mill having to stand whilst the repairs are carried out.

A very material saving in floor space is certain where a mill is converted to electricity, and this is a great advantage, as it enables the space around the mill to be used for the more rapid handling of the material required to feed the mill, and for the disposal of the finished product. Very often the motor can with advantage be installed below the floor level, the only gear on the shop floor being the comparatively insignificant control gear.

An electrically-operated mill has, in any case, less stand-by losses, and in the case of the motor fed from a supply company's main, none at all. In comparing the cost of rolling under the two systems (steam and electricity) this point is important, as in one case the losses are very serious and add largely to the total cost of rolling a certain output.

Where a motor is employed for driving a mill, a great advantage accrues through being able to start up immediately, and a further reduction in cost of rolling is obtained through less labour being required to handle the same material. A motor requires only intermittent attention, and with emergency devices for stopping, it is not necessary to have an attendant standing by continually.

Finally, on the question of capital cost, which, as in all engineering problems, has to be considered, speaking generally the actual electrical equipment of a rolling mill is at the worst only equal to, and in the majority of cases considerably cheaper than, the corresponding steam equipment. If, however, electrification involves either the putting down of generating plant or the extension of an existing plant, then there is no question that the electrification of the mill will entail the expenditure of a larger sum of money than that involved by putting down a new steam plant, and in such cases one must look in other directions to justify the conversion. Usually in any works having a rolling mill there are a great number of auxiliaries on which the existing drive can, with considerable economy, be replaced by introducing the use of a motor, and it is the extra and more even load due to these motors that will justify the installing of generating plant of capacity sufficient to carry the load on the mill and in addition that due to the auxiliaries. It would be impossible to run a plant feeding one mill only, and to generate with economy, unless some other load less variable was also to be obtained, and consequently in such a case it is necessary to consider the broader scheme if any benefit from the electrification is desired. In the case of the works where plant is already installed, and a comparatively cheap extension is all that is necessary, the problem is much simpler, and there is no difficulty in making out an excellent case for electrification.

Supply companies in many areas are a ready source of power. In one instance, with power at 0·85 per kilowatt-hour, a saving of over £3,000 was made on one year's working, more than paying for the cost of the equipment. The crux of the whole question of rolling electrically is whether or not a reasonably cheap source of power is obtainable either from a private generating station or from an outside source, and this obtained, electrical rolling will be found to be considerably cheaper than steam.

Mr. Wilson Hartnell, in opening the discussion, said that the economies shown were not solely due to the electric drive—some had arisen from its replacing steam gear that was rather antiquated. The ropes used were convenient, but involved a loss of, say, 7½ per cent. of power. Cut geared wheels were now obtainable of large size. The capital to be sunk to drive rolls by electric motors was much less than that required for a steam plant; steam plant for directly driving reversing rolling mills was especially costly. As an instance, an engine at Sheffield of 8,000 H.P., with three cylinders, made only a few revolutions backward and forward each time an ingot of steel was rolled.

Mr. C. A. Ablett thought that Mr. Mylan had rather underestimated the number of rolling mills which were driven electrically on the Continent of Europe; one firm alone had installed nearly 200 motors for driving non-reversing rolling mills, the aggregate power being nearly 200,000 H.P., and he believed that the total number of non-reversing rolling mills on the Continent of Europe which were electrically driven came to nearly 400. In the case of a large reversing rolling mill which was being built for a plant near Middlesbrough, the mill motor would give about 10,000 H.P. under normal conditions of operation, and was supplied by a fly-wheel converter set; as this fly-wheel served to neutralise the variations in load, the motor which drove the fly-wheel converter set had a capacity of only 1,800 H.P., and under normal conditions would take considerably less power than this from the power house. With regard to economy, a large electrically-driven reversing rolling mill had recently been set to work in Germany, where the motor was capable of giving 10,000 H.P. at 30 R.P.M.; this was, he believed, the largest reversing rolling mill motor in the world. The firm who owned this mill stated that the adoption of the electrical drive had saved them 1s. in the ton rolled over the previous steam engine, and had enabled the output to be increased 30 per cent. With reference to the figures given, when the units per ton rolled for a given section were stated, the elongation should also be stated, as when the section was rolled from a large billet the power taken was naturally more than when it was rolled from a small one. In the case of the 9 ft. 6 in. × 43-in. sheets, he could supply the size of the billets, which were 7·9 in. square, weighing 388 lb. each. Referring to the slip regulator employed with an alternating equipment, the speed of the motor must fall by some value up to 10 per cent. in order that the fly-wheel effect might be beneficially utilised, and while this fall in speed could be attained with the compound-wound motor without any loss of power, in the three-phase motor a loss was necessarily involved. It was sometimes stated that the use of the automatic slip regulator enabled the losses which occurred in the slip resistance of a three-phase motor to be reduced, but practical experience had shown that no appreciable reduction could be effected. He was entirely in agreement with the author as to the desirability of using liquid controllers for starting three-phase motors, but if a liquid controller were used with a large direct-current motor, considerable trouble would occur, due to the electrolysis of the plates and of the liquid.

Mr. A. J. Cridge said that a mill motor supplied from the Sheffield Corporation's mains was of 350 H.P., 2,000 volts, two-phase, 50 periods, running at 490 R.P.M. The motor drove three sets of rolls, two by rope and one by belt transmission. A 4-ft. pulley on the motor was belted to a 10-ft. pulley on the 8-in. mill, and a 4 ft. 6 in. pulley was roped to a 14-ft. pulley on the two 10-in. mills. Roughly, 30 to 40 tons of ingots of various sizes passed through the mill daily, with an average consumption of 1,000 or 1,100 units per day, so that the energy used worked out at from 25 to 30 units per ton.

Mr. E. S. Saunders said that direct driving was the most efficient way to drive a mill, and need not necessarily involve extra capital cost. Referring to emergency devices for stopping, there was a case in Sheffield where a steam-driven mill was working, which was fitted up lavishly with these devices. One day the engine commenced to gain speed, eventually running away and bursting its fly-wheel, with disastrous results. Not one single man had the common sense to use the emergency stops. Such an occurrence could easily be guarded against with electrical drives by means of automatic circuit-breakers.

Mr. T. Harding Churton said the relative advantages of direct drive, and driving through gear, were mainly a question of expense. In the case of driving by gear, a relatively high-speed motor might be employed, which was both more efficient in running and less expensive in capital outlay. Against these advantages had to be set the power lost in the gear, but this might be entirely balanced by the difference in the relative efficiencies of the high-speed and low-speed motors. The question depended partly on the price paid per unit for the power, and upon the load factor of the machine. As to the efficiency of rope driving, he was inclined to think that the 7½ per cent. loss that had been mentioned was higher than it should be for a well-designed drive. He noticed that the three-phase induction motors mentioned in the paper were all of the wound-rotor type, whereas, in his opinion, the machine with the short-circuited rotor was pre-eminently suitable for this kind of work wherever the heavy starting current would not seriously affect the voltage of the supply. He knew of motors of this type of 50 to 60 H.P. being used for this purpose, connected to power companies' mains, and giving satisfactory results.

Mr. H. E. Yerbury asked why there were only three direct-current motor installations, and 26 two and three-phase systems mentioned in the table.

Mr. W. F. Mylan, in reply, said that the use of direct-coupled motors was not entirely a question of capital expenditure. Under certain conditions it was practically impossible for the manufacturer—at any rate, at the present time—to build a satisfactory low-speed A.C. motor, the large number of poles necessitating a very large diameter and a very narrow machine, with a low efficiency and a very bad power factor. It was far better to sacrifice a little in efficiency and to use a high-speed motor and gear, than to lose in the power end due to the efficiency and through extra loss in the line, which was introduced by having a motor with a low power factor. Manufacturers had not introduced a motor of low speed and having a really good power factor and efficiency. In Sheffield the supply authorities refused to allow a motor whose power factor was below their standard to be connected at all. In the case of a motor for direct coupling there was a great difficulty in getting the makers to give a motor which would have a power factor within the limits prescribed—namely, 80 per cent. or more on full load. The speed was about 200 R.P.M., and the horse-power about 70. Even at this comparatively high speed it was impossible to get the manufacturer to guarantee absolutely that it would give a power factor approaching 80 per cent. In the case of direct-current motors, this objection did not hold good. If they were prepared to pay the price they could get a motor of any speed and with good electric and mechanical characteristics. The subject of waste heat was receiving much attention in some quarters, especially at Newcastle.

Marvels of Magnetism.—In the *Dublin Evening Telegraph* of the 10th inst., there appeared illustrations, in connection with an article on the electromagnet, showing magnets lifting hot iron, and "lead refuse." It is true that hot iron can be lifted if not too hot, but there are limits even to the capabilities of the electromagnet, and we thought that everyone knew that magnets had no dealings with lead.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

EGYPT.—Electrical and similar materials pay a duty of 8 per cent. *ad valorem.* The value on which duty is calculated is the value of the goods at the port of entry in Egypt.

ERYTHREA.—A written declaration, in Italian, must be presented for all goods imported. This declaration must contain the surname and Christian name of the consignee or his representative, the place from which the goods proceed, the number and kind of the packages with their marks and numbers, the description of the goods for each package, with indication of the quality and quantity, and this latter must be given both in figures and letters. The duty on electrical and similar goods is 8 per cent. *ad valorem.* The value taken is the value of the goods in the country of origin, increased by all expenses incurred up to the arrival of the goods at the port of Massowah.

ETHIOPIA (ABYSSINIA).—A duty of 10 per cent. *ad valorem* is levied on goods imported into Ethiopia. This duty is levied on the cost price of the goods at the place of origin or manufacture as appearing in the declaration for the Customs, with the addition of freight, insurance and commission necessary for the importation of the goods as far as the place of introduction.

FALKLAND ISLANDS.—Electrical and similar goods are admitted free of duty. No person may use or establish any apparatus or installation in connection with wireless telegraphy without a licence from the Governor.

FIJI ISLANDS.—The following are free of duty:—Iron and steel rails and fishplates, switches, crossings, turntables and parts thereof, and bolts and nuts imported with and belonging to the same; electrical machinery; steam engines, oil engines and boilers; steel railway sleepers; water and wind motors; articles imported as the property of and for the use of the Pacific Cable Board on allowance by the Governor in Council; plain wire, black and galvanised.

The following duties are payable:—

Galvanised iron in bars, hoops, rods, sheets, or corrugated	£3 per ton.
Iron, black, in bar, hoop, rod, sheets or plates ...	£1 10s. per ton.
Iron, pig and scrap	£1 per ton.
Oils (not kerosene)	9d. per gallon.
„ in bottle	12½ % ad val.
Resin	2s. per cwt.
Steel	12½ % ad val.
Wire rope	£3 per ton.
Articles not specially mentioned in the tariff ...	12½ % ad val.

No person may use or establish any apparatus or installation for the purpose of electrical communication by wireless telegraphy without a licence from the Governor.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,578. "Improvements in or relating to electric switches." J. A. Kennedy, MoGreoor. July 5th.

15,580. "Improvements connected with the attachment of telegraph and similar line wires to insulators." W. E. Bandfield. July 5th.

15,605. "Improvements in electric arc lamps." Siemens Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, July 6th, 1908, being date of application in Germany.) July 5th. (Complete.)

15,647. "Improvements in and relating to the manufacture of electric carbons." R. Lessing. July 5th.

15,650. Improvements in electrical indicators." Hon. S. P. Bouverie and W. R. Rawlings. July 5th.

15,670. "Improvements in and relating to electrical and other recording and measuring instruments." E. S. Heurtley. July 6th.

15,672. "Improvements in apparatus for controlling and operating the points of electric railways and tramways." A. Lustgarten. July 6th.

15,681. "Improvements in electric switches." B. Thomas and E. Thomas. July 6th.

15,682. "Improvements in electric collectors." B. Thomas and E. Thomas. July 6th.

15,714. "Improvements in electrical water level indicators." The Hon. S. P. Bouverie and W. R. Rawlings. July 6th.

15,737. "Improved method of securing metal contacts to carbon electrodes." S. Benko. (Date applied for under Rule 13, December 28th, 1908. An invention comprised in application No. 28,290, dated December 28th, 1908.) July 6th. (Complete.)

15,771. "Improvements in dynamo-electric machinery." A. H. Midgley and C. A. Vandervell. July 6th.

15,795. "New or improved protector for insulators on telegraph or telephone posts and the like." F. Stevens. July 6th.

15,800. "Improved continuous-current dynamo-electric machine." R. Wallwork, C. H. Wallwork and B. J. Shillito. July 7th.

15,802. "Improvements in or relating to electric ignition apparatus for internal combustion engines." B. Brooks and F. H. Alston. July 7th.

15,803. "Improvements in or relating to the electric ignition systems of internal combustion engines." B. Brooks and F. H. Alston. July 7th.

15,854. "Improvements in electrical mercury switches operated by a vehicle passing along a railway." Siemens Bros. & Co., Ltd., and L. de M. G. Ferreira. July 7th. (Complete.)

15,862. "Improvements in electrical block signalling systems." E. A Richardson. (Date applied for under Sec. 91 of the Act, July 11th, 1908, being date of application in France.) July 7th. (Complete.)

15,867. "Improvements in and relating to the manufacture of filaments for electric lamps." A. Bourdos. July 7th.

15,880. "Improvements in or relating to electric arc lamps." H. J. J. Jandus, Jun. (Date applied for under Sec. 91 of the Act, May 26th, 1908, being date of application in Germany. An invention comprised in Application No. 7,471, dated March 29th, 1909.) July 7th. (Complete.)

15,881. "Improvements in or relating to electric arc lamps." H. J. J. Jandus, Jun. (Date applied for under Sec. 91 of the Act, July 1st, 1908, being date of application in Germany. An invention comprised in Application No. 7,471, dated March 29th, 1909.) July 7th. (Complete.)

15,889. "Improvements in automatic electric regulators, output adjusters and the like." H. Leitner. July 7th.

15,891. "Improvements in generators for wireless telegraphy and telephony with continuous oscillations." E. Huth. July 7th. (Complete.)

15 918. "Improvements in or relating to what is known as photo-telegraphy." T. T. Baker and Pictorial Newspaper Co., Ltd. July 7th.

15,929. "Improvements relating to electrical testing apparatus." T. E. Gambrell and C. T. Gambrell. July 8th.

15,960. "Improved electrolytic cell." J. F. Flood. July 8th.

15,978. "Improvements in or relating to electric signalling systems for railways and the like." J. D. Taylor. (Date applied for under Sec. 91 of the Act, January 30th, 1908, being date of application in United States.) (An invention comprised in application No. 1,788, dated January 25th, 1909.) July 8th. (Complete.)

15,980. "Improvements relating to telegraphy." B. Davies and A. R. Hardie. July 8th.

15,981. "Improved method and means of producing synchronism between the rotation of a controlling machine and the rotation of one or more electrically-driven machines." E. L. A. Lertourne. July 8th. (Complete.)

15,985. "Improvements in sparking plugs for internal combustion engines." R. Bosch. (Date applied for under Sec. 91 of the Act, March 1st, 1909, being date of application in Germany.) July 8th. (Complete.)

15,991. "Improved electric locking and unlocking device for locks." G. Sahmer. July 8th. (Complete.)

16,004. "Improvements relating to electrically-controlled pneumatic dispatch tubes, cash railways, and the like." C. W. Bluemel, E. A. Bluemel, F. H. Bluemel (trading as Bluemel & Bros., C. W. and P. R. Shill.) (Application for Patent of Addition to No. 3,770, 1908.) July 8th.

16,029. "Improved unidirection current dynamo-electric machine." R. Wallwork, C. H. Wallwork and B. J. Shillito. July 9th.

16,039. "Improved means for electrically igniting miners' safety lamps." J. Prestwick. July 9th. (Complete.)

16,095. "Improvements in electro-magnetic clutches." C. W. Hill. July 10th.

16,112. "Antiseptic telephone mouthpiece." B. Archer and J. De Coster. July 10th.

16,114. "Improvements in the controlling mechanism of automatic electric lifts." Electromotor Equipment Co., Ltd., and T. Meacock. July 10th.

16,146. "Preparation of material for the construction of fold up boxes for holding incandescent electric lamps." M. I. Cooper. July 10th.

16,155. "Improved device for automatically stopping electrically driven rotary printing presses when the folding cylinder is choked." F. N. Pickett and Adams Manufacturing Co. July 10th.

16,167. "Improvements in or relating to the control of induction motors." M. Milch. (Application for Patent of Addition to No. 1,457, 1907.) July 10th.

16,170. "Improvements in alternating current dynamo-electric machines." L. J. Hunt and Sandycroft Foundry Co., Ltd. July 10th.

16,174. "Improvements relating to enclosed electrical machines." H. A. Mavor and Mavor & Coulson, Ltd. July 10th.

16,175. "Improvements in or relating to what is known as photo-telegraphy." Pictorial Newspaper Co., Ltd., and T. T. Baker. July 10th.

16,177. "Improvements in and connected with telegraphic recorders and relays." A. Orling. July 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electric Meters. J. P. Winn. 4,666. March 2nd.

Alternate Current Motors. V. A. Fynn. 10,611. May 15th.

Safety Devices for Electric Heating Apparatus for Liquids. British Prometheus Co., G. Cooper and F. C. Sharp. 10,680. May 16th.

Method of and Means for adjustably Suspending Electric Incandescent Lamps. C. E. Heldbek. 12,736. June 13th.

Electro-magnetic Power Velocity Ratio Devices particularly applicable for Driving Automobiles and the like. A. H. Midgley and C. A. Vandervell. 12,738. June 13th.

Automatic Cut-out Device for Electrical Conductors in Tramway Systems. M. G. Newbould. 13,048. June 18th.

Electric Transformers. Akt.-Ges. Brown, Boveri & Cie. 13,092. June 19th. (Date applied for under International Convention, June 28th, 1907.)

Party Line Telephone Selectors and Cut-outs. H. D. Williams. 13,101. June 19th.

Electric Insulator. C. M. Graham. 15,341. July 20th.

Automatic Electric Switches. W. J. Davy. 15,936. July 27th.

Starting Switches for Electric Motors. E. Garside. 16,126. July 29th.

Electric Voltage Regulators. British Thomson-Houston Co. (General Electric Co.) 16,299. July 31st.

Electrically-operated Apparatus for Controlling the Movements of Points or Switches on Tramways or Railways. E. M. Munro and H. I. Rogers. 17,112. August 14th.

Electric Ignition Appliances. A. M. Low. 18,628. September 5th.

Method and Apparatus for Adjusting Electrical Resistances. O. Cox. 18,925. September 9th.

Electrical Recording Instruments. H. Bevis and J. W. Penicud. 20,633. October 1st. (Post-dated February 12th, 1909.)

Electric Switches. B. R. Koc. 20,708. October 1st.

Electrical Alarm Clocks. D. H. Smith and L. A. Hearin. 22,263. October 20th.

Electric Candle Fittings. H. Hirst and J. H. Collings. 23,116. October 30th.

Electrical Instrument for Pyrogravure and Surgical Purposes. P. Berville. 24,815. November 18th.

THE
ELECTRICAL REVIEW.

VOL. LXV. JULY 30, 1909. No. 1,653.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1909 EDITION
H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

THE STRIKE CLAUSE.

WITH rumours of a coal strike in the air, it is necessary for many a manufacturer to see whether there is a strike clause in his contracts.

The possibility that delay may be caused by a strike has compelled contractors to insert a clause by which they are excused from liability for such delay as may be attributable to stoppage of work by the men in furtherance of a trade dispute. The growth of trade unionism has rendered this course absolutely essential, for if the men knew that by ceasing to work they could involve the employers in an action for breach of contract, they might press this advantage, with disastrous consequences.

Questions of some nicety frequently arise as to the interpretation which must be put on a clause of this kind, as it is not usually confined to strikes, but applies also to "lock-outs, labour disputes and other stoppages." The doctrine of *ejusdem generis* is generally applied by the Courts in order to place some limitation upon the meaning of the word "stoppages."

In the case of Stephens *v.* Harris (56 L.J., Q.B. 616) it was held that the term "strike" in a charter-party must be used in the ordinary sense of a strike against the employers. The abandonment of their work by miners through dread of cholera does not bring the charter of a ship within the exception in a charter-party against "hands striking work."

In Grant *v.* Corridale (9 A C. 470) the question was whether loading was prevented by frost in such a way as to excuse the charterers. It appeared that by a charter-party a ship was to proceed to Cardiff, East Bute Dock, and there load in the customary manner, from the agents of the freighters, a cargo of iron. "Cargo to be supplied as fast as steamer can receive, ... time to commence from the vessel being ready to load and unload and 10 days, on demurrage, over and above the said lay days at £10 per day. Except in case of hands striking work, or frosts or floods, or any other unavoidable accidents preventing the loading . . . in which case owners to have the option of employing the steamer in some short voyage trade until receipt of written notice from charterers that they are ready to resume employment without delay to the ship." The ship arrived at the East Bute Dock and loaded part of her cargo. A frost then set in, and made a canal which communicated with the dock impassable, so that the remainder of the cargo, which was ready at a wharf on the canal, could not for several days be brought in lighters to the dock. The cargo could not have been brought into the dock by carting or otherwise at any reasonable expense. The dock itself was not frozen over, and if the cargo had been in the dock the loading might have proceeded. It was decided that the frost did not "prevent the loading" within the meaning of the exception.

Engineering contracts usually contain a condition binding the contractor to complete the works within a fixed time; and when an allowance is to be made if the works be delayed by reason of any inclement weather, alteration, or causes not under the contractor's control, or in case of strike or lock-out affecting any of the trades concerned, it is advisable, instead of stipulating that the contractors are then to complete the works within such time as shall be reasonable, to provide that the contractors shall do so within such time as the engineer shall consider to be reasonable, and shall from time to time in writing appoint. This object may be effected by adding the following proviso to the well-known forfeiture clause: "Provided always that, in case the contractor shall be prevented from complying with this agreement, the engineer may extend the time for the completion of the works for such reasonable period as he may think fit, and shall in writing certify to be necessary."

A case before Mr. Justice Wright in 1904 involved a novel point—namely, whether a holiday arbitrarily taken by the men without the consent or interference of their employers is a "stoppage" within the meaning of the ordinary strike clause in a charter-party. In the case in question (*in re* an arbitration between Allison & Co. and Rose Richards) the facts were that the plaintiffs entered into a charter-party to carry coal on their steamship to Leghorn. The "lay days"—*i.e.*, days within which the loading was to be complete—excluded delays occasioned by strikes, lock-outs, and also Good Friday and Easter Tuesday and certain other holidays. The colliers belonging to the colliery from which the coal was taken gave notice that they would work on Good Friday and the next day, but that they would take the Wednesday after Easter Monday as a holiday, and on that day all work was stopped. This Wednesday was not expressly referred to in the charter-party. The plaintiffs brought suit to recover demurrage on account of the work not being prosecuted on Wednesday. It was submitted on their behalf that the refusal of the men to work on that day could not be said to be a strike by the men, inasmuch as there was no dispute with the masters, the latter doing nothing either by way of approval or disapproval. The fact that Good Friday and Easter Tuesday were expressly mentioned in the contract made it plain that it was intended that days not so mentioned, such as Wednesday, should be excluded. Mr. Justice Wright, however, refused to adopt this view. In giving judgment he said :—"This was not a holiday recognised by the masters, nor is it within the exception contained in the charter-party. On the point that it is a cause 'beyond the charterer's control' there is little authority beyond the case of Richardson *v.* Samuel. Literally, of course, this was such a cause, but it was there held that the cause must be *ejusdem generis* with the causes enumerated in the charter-party. I am inclined to think, however, that a holiday taken by the men without the concurrence of the masters is sufficiently *ejusdem generis* with stoppage of work caused by a dispute between masters and men, and, perhaps, of strikes; and that it is therefore within the exception." His decision was subsequently affirmed by the Court of Appeal.

It follows from this that the declaration of stop days by workmen is a matter for which their employers cannot be held liable, if they are protected by a clause similar to that above described.

Electricity and the Production of Pig-Iron.

The formation of a company for the purpose of laying down electric iron-works in Sweden reminds us at the same time of a new field for the application of electrical machinery, and of the possible menace to our manufacture of iron and steel offered by the electric furnace in conjunction with cheap water-power.

We understand that electrical energy for these works is to be supplied for about 30s. per annum per horse-power, a price which cannot be approached by the largest and most modern steam or gas generating stations, as, even if fuel cost nothing at all, the heavier capital and attendance charges would increase the cost of energy to more than double this figure. Yet we find electric furnaces in operation for the manufacture of steel where the necessary power is developed from steam or gas.

At first sight a far higher efficiency would appear to belong to the existing method of burning the fuel direct in a furnace, and generally speaking, such is the case, but the difference in the ultimate results is not sufficiently marked to counterbalance other advantages in the manufacture of special steels; and as regards the production of pig-iron, the electric furnace bids fair to be a commercial success where cheap water-power is obtainable.

Fortunately, perhaps, for the conservation of our iron and steel industry, the number of situations where water-power can be produced and sold for 30s. per H.P.-year is limited, and as the demand rises the value of the water rights is likely to increase. Then again, the necessary supplies of raw materials must be cheaply available, together with transport facilities for the finished product, and we doubt whether the number of sites meeting these requirements is sufficient to cause any alarm in this country. On the other hand, a start is being made, and there is little doubt that when the scarcity of fuel causes a rise in price, countries possessing cheap water-power will have a distinct advantage over their less fortunate neighbours as regards any manufactures which require electric current.

In the meantime, British capital may be profitably employed in exploiting suitable water-powers in Norway, Sweden, Canada and elsewhere, whilst our manufacturers of turbines and electrical apparatus ought to be able to secure a large proportion of the orders for the requisite machinery.

The Tying Clause in Agreements Relating to Machinery.

A case which is reported in a recent number of the *Law Reports* throws some light upon the validity of the "tying clause" in agreements for the lease of machinery. It appears that in 1903 and 1904 a company known as the United Shoe Machine Co., of Canada, leased certain machines made and used for certain processes in the manufacture of shoes to one Brunet and others. Each agreement of lease contained a clause which prohibited the use by Brunet, in the manufacture of shoes, of any machine not leased by the company. Some additional leases were granted to Brunet by other persons for certain ancillary processes in the same manufacture. The company, relying on the tying clause, called upon Brunet to remove these machines, and upon his refusal, brought an action in the Supreme Court of Quebec to compel him to discontinue the use of these machines. Brunet pleaded that the company, by false representations that they were patentees in respect of their machines, had induced him to take the leases, and that the covenants therein, by reason of their unjust and oppressive nature, and of the practical monopoly which the appellants had acquired in Canada in the manufacture and supply of shoemaking machinery, were in restraint of trade. The Supreme Court in Canada came to the conclusion that the company had made the alleged representations, and that, as the tying clause was in restraint of trade, each agreement containing it was void.

The Privy Council, however, has reversed this decision, holding that as the respondents had not repudiated the leases after discovery of the alleged false representations, but had continued to work the demised machines and paid the royalties reserved, they had elected to treat the leases as subsisting, and could not afterwards avoid them. It was held also that the covenants were not in restraint of trade. The shoe manufacturers of Canada were at liberty to hire or not to hire the appellants' machines on the applicant's terms as they pleased. "If," says Lord Atkinson, in expressing the opinion of the Privy Council, "the monopoly established by the appellants and their mode of carrying on their business has oppression, as is alleged (upon which their Lordships express no opinion), then the evil, if it exists, may be capable of cure by legislation or by competition, but in their view not by litigation. It is not for them to suggest what form the legislation should take, or by what methods the necessary competition should be established. These matters may, they think, be safely left to the ingenuity and enterprise of the Canadian people."

Attempted National Boycott.

The Dublin Industrial Development Association is one of the most active of those bodies which think that they are serving the National cause in the best possible manner by promoting the grand internal mutual sustentation scheme, as practised by the well-known islanders who lived by taking in each other's washing.

This Association is always "wanting to know" why such and such an article used by public institutions is not made and bought in Ireland, and it uses every means to persuade those who let contracts that they will be benefiting themselves and everyone else in Ireland (except, let us hope, the Interloper!) if they stipulate that all materials are to be Irish made.

As a trade organisation, we believe that the Association is doing good work, in which case its existence is justified; but it is not possible in reason to carry on a propaganda of such a nature without a suspicion of terrorism, which, as we all know, is a weapon used largely for other so-called national purposes in the same country.

We do not believe that the industrial re-development of Ireland, which is being fostered with extraordinarily gratifying results by the real Irish patriots, can be helped in any degree by the restriction of competition which lies at the root of the activities of the Dublin Industrial Development Association, and it will surprise no one to hear that the L.G.B. is advising those public bodies which show a desire to act up to the ideals of the Association that they may get themselves into serious trouble. In a case reported recently, for instance, the Guardians of a certain Irish Union are warned that the L.G.B. may be obliged to refuse recoupment upon expenditure on annual supplies, for which competition was restricted to Irish firms only, and to declare any of the contracts to be null and void.

The D.I.D. Association advised the Irish public boards that no action could be taken by the L.G.B. auditor in the matter of Irish tenders being accepted, so long as the advertisements for tenders and the tender forms themselves stipulated for Irish goods, but the L.G.B. holds that public bodies cannot safeguard themselves in the manner described.

The "General Consultant."

Probably no class of engineer is more subject to the attacks of ignorant critics than the consultant, his lack of intimate acquaintance with the special points of all kinds of machinery being frequently held up to ridicule.

In this connection we are dealing more particularly with what may be called the "general practitioner," who is called in to give advice upon prime movers of all descriptions and over a wide range of mechanical appliances.

The specialist in motor-cars, electricity generating stations, gas engines, &c., should, of course, be well posted in the details of the work he undertakes, but the consulting engineer who is appealed to by the general manufacturer, estate agent and the like, can only have a more or less superficial knowledge of the widely varying subjects upon which his opinion is sought. Such a man, if he be wise, will never give verbal advice; he requires time in which to think matters over and to consult data which he has gradually accumulated from different sources.

Two most important endowments for the general consultant are: first, an instinct telling him where his information is incomplete or out of date; secondly, the ability to make use of the requisite data when obtained.

A sound general engineering training and some elementary knowledge of science are necessary, but it is impossible for any one man to carry at his fingers' ends all the special points pertaining to every prime mover or machine used by the man or firm that seeks general advice.

An accumulation of useful data is absolutely essential to the success of any consulting engineer, whether he be a specialist in one branch or willing to give an opinion on general engineering matters.

Text and pocket-books, although they have their uses, are not sufficiently up-to-date for reference on many important points, and it is necessary to supplement them by a store of personally selected cuttings and notes.

In addition to the information which comes from any work undertaken, many useful tips may be gleaned from the technical Press, more especially from the papers read before the various engineering institutions and the discussions thereon. The discussions should receive particular attention as they are contributed to by experienced men who often give the results obtained in everyday practice. Then, again, several journals make a feature of practical difficulties and their solution, these columns being largely occupied by the suggestions of practical men who have no other opportunity of giving publicity to their opinions.

Independent tests on machinery form another source of valuable information, but careful judgment must be exercised in separating the "wheat" from the "chaff," as many reported trials are undertaken for the express purpose of puffing some particular appliance, unfavourable figures being suppressed.

By these means, with the help of a good system for storage and indexing, an engineer can compile an up-to-date reference bureau suited to his particular needs, and of far more value than any collection of text and pocket-books.

Finally, the general consultant may be strongly recommended to study the financial side of engineering problems, together with local conditions, as these features are of the utmost importance to the success of any new scheme. Money is often spent on elaborate devices upon which the capital charges and maintenance more than counterbalance any saving in fuel or labour. It should always be borne in mind that a complicated arrangement of plant which may be right and proper under one set of conditions will often be a commercial failure for an apparently similar purpose.

Natural Power.

Surprise is often expressed at the small extent to which natural power from rivers, winds and tides, is made use of in this country. A river or stream appears, at first sight, to be an almost ideal source of power, but when the commercial aspect of the problem is studied, certain serious drawbacks are discovered.

Unless favoured by exceptional natural conditions, the capital cost for a water turbine installation is far in excess of that involved by the use of steam or gas; but a more serious difficulty is the uncertainty of the supply of power during droughts or floods.

As regards uncertainty, wind and tidal power compare favourably with that derived from a river or stream. It might be supposed that no source of power could be more uncertain than the wind, but when statistics are examined we find that storage for a few days will provide for any calm periods likely to occur.

For small powers, the modern wind motor is likely to come into extended use.

If some method of energy storage much less costly than the secondary battery could be developed, almost unlimited water-power would be available from the rise and fall of the tides, whilst large wind engines could then successfully compete with power produced from oil or coal.

PROTECTION OF OPERATORS FROM SHOCK.

By S. LEES.

The new Home Office electricity regulations will doubtless be the means of rousing in many quarters a proper sense of responsibility, where formerly, utter indifference to the protection of plant operators existed.

Although, of recent years, there has been a gradual tendency in some of the better-appointed stations, at least, for the greater protection of operators from risk of shock, yet the general impression still remains that direct current can be handled with impunity.

Most forms of protective guards, other than floor-insulating devices, consist of a system of metal guards, usually of the woven-wire or perforated-sheet variety. These types of guard are cheap and easily fitted, and make a good enough job where appearance is of secondary importance. Where the latter condition is a desideratum, as, say, in engine-room work, the conventional bright guard railing is most commonly used. This practice, which, from time immemorial, has obtained in the fencing-in of almost every kind of running machinery, and particularly steam plant, has been religiously followed in the case of electrical machinery and apparatus, and one sees, even at the present day, electrical plant being installed with the same arrangements of guard railing as were in vogue over a decade ago. A case in point is a modern central station, where two similar generating sets are fitted with metal guard railing. While in one set the railing is little over knee high, in the other set scarcely an effort is required to get under the *fence*. Another case is where the guard railing is placed so near to the commutators and other live metal work in the vicinity as to render its presence a standing source of danger to the operator. If some form or other of guard railing is considered necessary for central station plant, then additional means should be provided whereby the operator is assured of more adequate protection when working on live metal, as, for instance, when carrying out some urgent repair or adjustment, or, when giving the constantly required attention to a running commutator.

With a view to avoiding eventualities of the kind mentioned, some time ago the writer had insulating sleeves of vulcanised fibre tubing fitted to the guard railing of a number of direct-current sets. As a rule, it will generally be found to provide sufficient protection if the highest or top runs of the guard railing are insulated, and it is obviously better to take the sections of rails adrift to effect the conversion, instead of splitting the fibre tubing.

THE IMPOSSIBILITY OF ALL "GETTING ON."

[COMMUNICATED.]

If the more responsible and better-paid appointments were given away strictly in age order, the process of rising from a junior to a senior position would be a very slow one, as the upward movement could only occur in response to the death or retirement of those at the top. Yet from our earliest infancy we are all urged to put forth our best efforts to "get on," and people who have been successful are never tired of telling those below them that they must not only do the work they are paid to do, but as much more as physical strength and the demands for sleep will permit.

Those of us who have been "through the mill," and who look back upon a more or less successful career, must be impressed with a feeling of great thankfulness that the above advice is not generally acted upon. If it were, business life would be so strenuous that only the young and strong could survive, and the differences in competency—now accentuated by idleness, devotion to sport, hobbies, &c.—would be very much lessened. This feature would have the effect of decreasing the value of merit in favour of promotion by influence, as small differences in ability are apt to be overlooked where influence is concerned.

British workmen long ago realised the danger of competition amongst themselves, and combined to secure higher wages and better conditions. It is a question whether the office and works staffs are not drifting towards a condition which will require some similar form of protection, this condition being nearer at hand in the manufacturing branch of electrical engineering than is the case with any other industry.

Boards of directors are continually grumbling at what they are pleased to term "unproductive" expenditure in the works upon draughtsmen, cost clerks, &c., whose work is every whit as essential to the manufacturer as that of the men who attend machine tools or assemble the finished product.

This dissatisfaction on the part of the directors passes downwards until it reaches the heads of departments, who are responsible for the number of assistants employed, with the result that every artifice is introduced to get more work out of the staff, so that a less number may be required. In the drawing office overtime is instituted, whilst other members of the staff who have defined duties to perform can only get through them by working long after recognised hours. As regards holidays, the principle has long since been accepted that those who are left behind must do their own work and those of their *confrères* who are away; in other words, no holidays are really given at all, each man having to do as much work as if he continued right through the summer without a break.

If these severe conditions entailed additional pay, as is the case with the workman, they would not carry with them such a sense of injustice; but, unfortunately, the contrary may almost be said to obtain, staff salaries having shown a strong tendency to decrease of late years, excepting for those at the very top.

If combination ever takes place amongst office and works staffs with a view to ameliorating the conditions indicated above, it is to be hoped that this object will be achieved without engendering that feeling of antagonism towards the employers which has been such a conspicuous feature in connection with trade unions.

On the other hand, one employer cannot afford to make concessions alone, and the whole body of employers would only yield to strong pressure. Furthermore a feeling of mutual respect always follows a tough struggle, and cannot be aroused by any other means.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Increased Output of Boilers.

Referring to your leading article of the 9th inst., the advocates of complicated boilers can have no knowledge as to the very small margin of possible improvement that is left with the simplest of all boilers, when correctly fired.

The Lancashire boiler is a standing contradiction of all theory that advocates high gas velocity and obstructed flow of gas. Its perfectly plain, unobstructed, large diameter flues transfer some 70 per cent. of the total available heat; the remainder of the work is done in bottom and side flues of large unobstructed areas. Yet the escaping gases are generally reduced to within 250° F. of the temperature of the steam in the boiler, and no addition to the heating surface would cool the gases much further; the only method left is to use an economiser, having a far lower temperature than that prevailing in the boiler.

Water-tube boilers of the simplest types also leave no real margin for improvement in efficiency when correctly fired; but they usually have far more total heating surface than the Lancashire boiler employs to reduce a given volume of gases down to the same practicable limit of temperature.

Normal rates of combustion, say 20 to 30 lb. of coal per sq. ft., have been found the most economical, all things considered; but there is no difficulty in raising the output by burning more coal; and as you point out, an increase in the furnace area is a far more practical method than forcing the rate of combustion. But a very practical objection is that forced duty of boilers reduces the reserve of steam and water, and is very apt to lead to wet steam and consequent loss of superheat. *Other things being equal*, the higher the gas velocity, the less must be the time available for heat transfer; and there is ample evidence that an increased gas velocity always involves a loss in efficiency, and never a gain. At the same time, the influence of gas velocity is quite trifling in comparison to the influence of temperature difference on heat transfer. If the combination is kept constant, viz., if the admission of air per lb. of combustible is unchanged, then the rate of combustion can be doubled, and the boiler will absorb very nearly the same proportion of heat from the doubled volume of gases at doubled velocity, without any considerable rise of final temperature. But if the increased volume is due to admission of excess air, then the reduced temperature difference involves a very serious loss, both in the temperature and in the volume of the escaping gases. The theory that an excess of air in the furnace gases does not seriously diminish efficiency, is opposed to all experience.

The justification of mechanical firing and mechanical draught is that they permit a much better regulation of air and fuel than is practicable with intermittent hand firing, thus improving boiler efficiency and increasing the output per pound of coal burnt.

But it is very doubtful if it pays to work boilers at high duties, in view of the importance of dry steam; and it is very certain that nothing whatever can be gained by abandoning simple and accessible boilers for complicated ones, or by neglecting the really important question of correct firing methods, in the illusion that there is any other way of improving boiler efficiency.

Scrutator.

New Home Office Regulations.

The letter of Mr. Conradi in your issue of the 16th inst. misses the point. He refers to the class of fittings now flooding the market, as a direct result of the Regulations, which are specially constructed to avoid the necessity of the earth wire. My letter had reference to the still more numerous class of fittings already in existence which do require an earth wire, and which the Regulation No. 13 is obviously framed to deal with. Mr. Conradi might do better if he had another look at the Regulation in question.

F. Johnston.

Holywood, *July 20th*, 1909.

Cost of Living Abroad.

I shall be greatly obliged if you, or one of your correspondents, will give me some idea of the cost of living on the West Coast of Africa (Gold Coast).

High Tension.

[One who has been there on several occasions informs us that in coast towns the minimum cost of living is about £20 per month; in the interior it is very much greater.—Eds. E.R.]

Electric Lighting Legislation.

Referring to my letter, which you were good enough to insert in your last issue, I am glad to be able to report that, as a result of the efforts which have been made, substantial amendments have been obtained in the Bill now passing through Parliament.

Clause 6 has been altered so as to make it quite reciprocal between local authorities and companies.

Clause 13—relating to audit of accounts—has been struck out, and the following clause has been substituted:—"The Board of Trade shall from time to time make a return to Parliament giving such particulars as they may think proper with regard to the reports made by any auditors appointed by them to audit the accounts of any undertakers, and any action taken on such reports by the Board and by the undertakers."

Clause 2 has also been amended with regard to substations.

The Bill passed the Standing Committee yesterday, and until we see a revised print we cannot be sure that all points have been satisfactorily met, but it is believed that there will be no further necessity to oppose the passing of the Bill.

The Bill is not entirely satisfactory, because many important matters referred to by the Select Committee of 1898 have not been dealt with, but the Bill contains some good points, and the particularly dangerous clauses have, it is hoped, been satisfactorily amended.

E. Garcke.

London, W.C., *July 21st*, 1909.

Preference to Home Manufacturers on Public Contracts.

I understand that Germany has legislation which enacts that Government, municipalities, and such corporations as tramway, railway, gas and water companies, enjoying public charters, must up to a certain margin favour the home manufacturer. As this country seems to be very undecided about the substitution of tariffs for the old Free Trade policy, the present Government might well consider the question of introducing legislation on similar lines.

The new British patent law dealing with manufacture is of the nature of a retaliatory measure, drawn up on similar lines to that of Germany, and it certainly looks as if it is going to be a help to industries in England. If the Government would now pass a law providing for preference being given to home manufacturers in all public contracts, it would be a helpful measure, and the Continental people could not complain, as it would be merely copying what they have done. Such legislation would be likely to have a far-reaching effect, because Colonial Governments would very likely follow suit; the sentiment favourable to home manufacturers is very pronounced, as shown by preferential tariffs.

I am doubtful of the wisdom of this country going in for wholesale tariff reform, but surely few people could object to legislation such as is indicated above.

Some may say that it would be simply tariff reform under another name. Very well, they can call it what they like; I simply put it forward as a method of recording and fixing by law a sentiment which already exists.

E. K. Scott, A.M.Inst.C.E., M.I.E.E.

Orpington.

Earth-Indicating Device.

With reference to "W. H. B.'s" inquiry and the letter addressed in response to the same in the current number, respecting the Marlow & West leakage detector and alarm, we beg to hand you under cover herewith particulars of our automatic earth leakage switch, which you described in your columns some few months back. If your correspondent will furnish us with particulars and exact details of what he is in need of, we shall be happy to go into the question with a view to meeting his requirements.

Nalder Bros. & Thompson, Ltd.
F. H. Nalder, *Managing Director.*

London, E.C., *July 26th*, 1909.

Peculiar Accident to a Tungsten Lamp.

If the glass bulb was pierced by one of the metallic supports being projected from its place with considerable force, as suggested in the description in your issue of 23rd inst., this incident appears inexplicable; but if we may imagine the bulb to have had a film of moisture on the outside at the time, it would form a condenser of practically the Leyden jar type, and under such conditions it is quite conceivable that a spark between the metal filaments forming the inner and the film of moisture forming the outer coating might pierce the glass. I have not read the account in your Milan contemporary, and do not know whether lightning actually penetrated to the electric light system, or whether the blowing of the fuse was due merely to a surge caused by a flash striking some neighbouring place, but from the fact that the fuse was blown it is obvious that a rush of electricity—or, in other words, a wave of very high potential—passed along the wires, and the spark at the lamp end, given a film of some kind on the exterior, would appear to be a natural consequence. It would not, I think, be difficult to pierce the glass of a Leyden jar under such conditions.

Sir Oliver Lodge has shown that a remarkably long spark can be obtained at the far end of two leads owing to the surging effect of a discharge, and I described and reproduced experimentally, in a lecture before the Royal Engineers at Chatham in 1906, a case where a fire was caused in a building near a lighthouse that was struck by lightning. In this case the lead was a gas-pipe passing underground, but rising inside a corrugated iron building, and the insulator pierced was air instead of glass; but the principle involved was practically the same as what I suggest may have happened with the lamp.

Alfred Hands.

London, E.C., *July 24th*, 1909.

[Our information is limited to the particulars contained in the extract from our contemporary. If Mr. Hands's explanation is the correct one, the incident forms an excellent testimonial to the efficiency of the insulation of the wires and fittings employed.—Eds. E R.]

The Prevention of Smoke.

Our Mr. A. W. Bennis is away on holiday at the present time. Meanwhile we think we may say, on behalf of Mr. Bennis, that it appears to us that Mr. Wilfred Yorke's letter was written under misapprehension, and the more particularly we feel this to be the case as we are not willing to attribute to him wilful sophistry.

Pro **Ed. Bennis & Co., Ltd.**
E. M. S.

London, S.W., *July 23rd*, 1909.

What is a Telegraph?

The Postmaster-General seems to take upon himself to decide that a telegraph is the same thing as a telephone whenever it suits his purpose to do so. When I was living in Kent, in a village that had no telegraph office, the P.M.G. agreed to establish one on my guaranteeing a certain sum per annum towards the expenses. When the office was opened it was found to contain a telephone instead of a telegraph, with the result that innumerable mistakes occurred. On one occasion a friend of mine telegraphed to his son in South Africa "Await letters." The code word actually transmitted stood for "Come home at once." This was considered an excellent joke, but I wrote to the General Post Office calling attention to the wording of their contract, in which they undertook to supply a telegraph, and complained that this part of the contract had not been adhered to. It was pointed out to me that by the decision of the Courts a telephone and a telegraph were held to be the same thing. I was quite familiar with the decision in the case of the Postmaster-General *v.* National Telephone Co., and that it was on this decision that the P.M.G. relied. I asked if it had ever been decided that the two instruments were the same, except for the purposes of the Postmaster-General's monopoly? I have never been able to obtain an answer to this very simple question. The recent decision of Mr. Justice Dodd, which you quote, goes some way towards supplying the answer.

Wilson Noble.

Wokingham, *July 26th*, 1909.

Chichester Electrified.

I have always regarded your paper as one of the principal champions of the industry upon which we are all dependent. I must, therefore, express my surprise at your publication of anything which might be used to the detriment of a new undertaking.

Among engineers, the value of the criticism of these gentlemen, whose time might be much better employed in looking after their own business, will be easily appraised, but in the eyes of laymen, even mud sneeringly thrown from behind the stone wall of anonymity will often receive notice.

It speaks well for the organisation of the intelligence department of our friends the gas company, that the letters in your columns have already found their way into our local paper (copy enclosed under separate cover); but for this fact, no notice would have been taken of such unworthy criticism.

I am interested to hear from "Not too Cheap" that our supply is dependent on a single feeder cable. He is evidently ignorant of the use of distributor cables when brought into the works, and of the fact that, in well-designed systems, a separate duct is usually provided for additional feeder cable when the load warrants the additional expenditure. This knowledge may help him when he is called upon, if ever, to design a scheme.

If your correspondents really desire information on any other points, if they adopt the usual professional and gentlemanly course they will write direct to the consulting engineer, who will no doubt courteously satisfy them that every necessary precaution has been taken.

R. V. Weare,
Resident Engineer.

Chichester Electricity Works,
July 22nd, 1909.

[We hardly need say that in publishing the letters in question we had no wish or expectation to injure the Chichester undertaking in any way, and we are surprised to learn that they have been used for that purpose. As regards the broader question, our correspondent would ask much if he were to claim for his, or any, works immunity from criticism; but the critics ought to make sure of their ground before taking up the cudgels.—Eds. E.R.]

The Steamcubator.—We have received a pamphlet and illustration of this new appliance, which is made by the Steamcubator Engineering Co., 30, Cross Street, Manchester. Essentially it is a steam drier applicable to Lancashire boilers. It consists of a helical coil of steam pipes placed in the back end of each flue and extending for a length of about two rings of the Adamson type. The end of the helix nearest the furnace is fed by a centrally placed horizontal pipe, which is brought from the steam main. The rear end of the helix is connected to the dry steam main. There are shown nine complete coils in each helix, and it is claimed that a boiler thus fitted will be increased 50 per cent. in steaming capacity *under average working conditions.* The italics are ours. We do not deny the statement, because we do not know what is intended to be conveyed by average working conditions. It is also *claimed* that coal may be economised to the extent of 30 to 40 per cent.

The fact that we mention this *claim* will not, we trust, be taken as marking our belief in the statement. The apparatus is at most a superheater of somewhat limited surface. It will probably dry the steam, but we do not look for much superheat from it, and the statement of fuel economy is therefore much too high, in our opinion. We presume it is a draughtsman's error, but should point out that the flue tubes are not such as are usual in Lancashire boilers, and the coils would be much smaller than are shown in the illustration. They would also be better exposed to the heat than they would be as shown. We cannot see why, if steam is raised to an extremely high temperature, it should be less chemically active with iron when in large volume, than when in small volume. Nor will the effect be any different on the engine cylinders, &c. Temperature is temperature, whether in 1 on in 41 cb. ft. of steam.

We say nothing against the apparatus as such; but we think the claims and statements in the circular should be considerably modified, for they are practically impossible and too general. Suppose we take a boiler having an efficiency of 75 per cent.; let us add to this the 30 per cent. economy that is claimed for the new device, and we get 97·5 per cent. of thermal efficiency, leaving 2½ per cent. for radiation losses, chimney gas temperature, and imperfect combustion. Next take a boiler with an efficiency of 40 per cent., and add the new apparatus; the new efficiency will be 52 per cent. These two statements show the uselessness of such generalisations as are put forward with the positiveness of dogma. Assume that the fuel saving is measured by the engine duty; then too much is claimed for superheat, especially in the absence of any independent figures as to the degree of superheat that the apparatus will give.

TRADE STATISTICS OF JAPAN, 1908.

The following figures, showing the imports of electrical and similar goods into Japan during the year 1908, are taken from the recently issued official trade statistics. The figures for 1907 have been added for purposes of comparison, and notes of any increases or decreases are given:—

	1907. Yen.	1908. Yen.	Increase or decrease. Yen.
Lubricating and other heavy oils.—			
From Great Britain ...	10,165	19,787	+ 9,622
" Germany	10,298	54,549	+ 44,251
" United States ...	580,807	841,646	+ 260,839
" Other countries ...	1,331	10,513	+ 9,182
Total ...	602,601	926,495	+ 323,894
Galvanised-iron wire.—			
From Great Britain ...	16,818	30,589	+ 13,771
" Germany	1,187,109	1,533,081	+ 345,972
" Belgium	106,055	31,975	— 74,080
" United States ...	109,664	93,782	— 15,882
" Other countries ...	7,275	48,673	+ 41,398
Total ...	1,426,921	1,738,100	+ 311,179
Iron and steel (plates and sheets).—			
From Great Britain ...	5,366 714	3,248,599	— 2,118,115
" Germany	687,046	881,335	+ 194,289
" Belgium	1,252,023	556,318	— 695,705
" United States ...	206,734	153,838	— 52 896
" Other countries ...	32,041	13,783	— 18,258
Total ...	7,544,558	4,853,873	— 2,690,685
Rails.—			
From Great Britain ...	483 688	384,793	— 98,895
" Germany	1,679 110	2,193,132	+ 614,022
" Belgium	379,134	85,637	— 293,497
" United States ...	1,371,016	2,407,884	+ 1,036,868
" Other countries ...	15,554	—	— 15,554
Total ...	3,828,502	5,071,446	+ 1,242,944
Building materials and posts for electric and like materials.—			
From Great Britain ...	1,251,814	1,974,779	+ 722,965
" Germany	16,434	321,454	+ 305,020
" Belgium	7,103	5,611	— 1,492
" United States ...	887,285	1,535,354	+ 648 069
" Other countries ...	16,251	30,969	+ 14 718
Total ...	2,178,887	3,868,167	+ 1,689,280
Submarine and underground cables.—			
From Great Britain ...	567,888	254,528	— 313,360
" France	106,263	—	— 106,263
" Germany	619,662	156,902	— 462,760
" United States ...	39,188	8,847	— 30,341
" Other countries ...	143	—	— 143
Total ...	1,333,144	420,277	— 912,867
Insulated electric wire.—			
From Great Britain ...	647,297	860,872	+ 213,575
" France	104,710	108,736	+ 4,026
" Germany	124,072	229,309	+ 105,237
" Italy	17,687	18,980	+ 1,293
" United States ...	234,403	228,680	— 5,723
" Other countries ...	1,399	275	— 1,124
Total ...	1,129,568	1,446,852	+ 317,284
Railway passenger cars, goods trucks, and parts thereof —			
From Great Britain ...	642,804	550,466	— 92,338
" Germany	8,952	88,027	+ 79,075
" Belgium	16,812	43,756	+ 26,944
" United States ...	350,300	759,070	+ 408,770
" Other countries ...	2,645	2,169	— 476
Total ...	1,021,513	1,443,488	+ 421,975
Parts of electric cars —			
From Great Britain ...	27,012	65,291	+ 38,279
" Germany	46,550	17,993	— 28 557
" United States ...	478,034	378,751	— 99,283
" Other countries ...	6,936	—	— 6,936
Total ...	558,532	462,035	— 96,497
Steam engines.—			
From Great Britain ...	727,159	1,058,431	+ 331,272
" France	74,250	—	— 74,250
" Germany	31,220	98,635	+ 67,415
" United States ...	513,906	593,371	+ 79,465
" Other countries ...	3,633	16,229	+ 12,596
Total ...	1,350,168	1,766,666	+ 416,498
Gas engines, petroleum engines, and hot-air engines.—			
From Great Britain ...	431 855	668,059	+ 236,204
" Germany	34,333	236,234	+ 201,901
" United States ...	66,899	50,413	— 16,486
" Other countries ...	16,390	11,920	— 4,470
Total ...	549,477	966.626	+ 417,149
Steam turbines.—			
From Great Britain ...	655,896	511,072	— 144,824
" Germany	33,699	67,315	+ 33,616
" Switzerland... ...	1,427	28,891	+ 27,464
" United States ...	309,058	135,521	— 173,537
" Other countries ...	5,887	7,615	+ 1,728
Total ...	1,005,967	750,414	— 255,553
Electrical machinery.—			
From Great Britain ...	707,513	667,038	— 40,475
" Germany	293,482	676,674	+ 383,192
" Belgium	10,590	26,104	+ 15,514
" United States ...	1,526,874	2,339,523	+ 812 649
" Other countries ...	4,478	11,837	+ 7,359
Total ...	2,542,937	3,721,176	+ 1,178,239
Steam boilers.—			
From Great Britain ...	1,212,933	1,155,978	— 56,955
" Germany	4,746	56,236	+ 51,490
" United States ...	236,543	118,813	— 117,730
" Other countries ...	10,007	690	— 9,317
Total ...	1,464,229	1,331,717	— 132,512
Lifting machines.—			
From Great Britain ...	717,238	845,797	+ 128,559
" Germany	220,036	191,442	— 28,594
" Belgium	6,217	10,447	+ 4,230
" United States ...	129,647	91,492	— 38,155
Total ...	1,073,138	1,139,178	+ 66,040
Caoutchouc and gutta-percha, crude.—			
From British India ...	53,106	35,720	— 17,386
" Straits Settlements ...	315,265	205,161	— 110,104
" Dutch India	133,486	335,545	+ 202,059
" Great Britain ...	97,684	184,293	+ 86,609
" Germany	11,357	8,022	— 3,335
" United States ...	145,841	101,291	— 44,550
" Other countries ...	13,975	16,546	+ 2,571
Total ...	770,714	886,578	+ 115,864
Belting for machinery.—			
From Great Britain ...	333,455	244,983	— 88,472
" Germany	174,062	198,495	+ 24,433
" United States ...	92,784	57,680	— 35,104
" Other countries ...	10,583	7,470	— 3,113
Total ...	610,884	508,628	— 102,256

The exports of electric dynamos and electric motors from Japan in the years 1907 and 1908 were as follows:—

	1907. Yen.	1908. Yen.	Increase or decrease. Yen.
To China	60,766	105,564	+ 44,798
" Kwantung Province...	112,205	129,319	+ 17,114
" Corea	70,739	79,909	+ 9,170
" Other countries ...	1,479	3,281	+ 1,802
Total ...	245,189	318,073	+ 72,884

Yen = 2s.0½d.

Home they Brought her Warrior, &c.—A consulting electrical engineer of well-known convivial habits met an old college mate, and wishing to keep up the friendship made in their youthful days, he addressed his old comrade in these terms: "Whenever you are in town, come and put up with me. No matter what the time may be, if I am not there just go in and make yourself at home. I shall be sure to turn up before daylight." Some little time afterwards the chum arrived in the West-End about midnight, and, remembering the cordial invitation, sought out his friend's diggings. A dim light flickered in the hall, and he gave the bell a long, long pull. Quickly he found himself faced by a landlady of stern and terrible aspect. "Does Mr. Watt live here?" he inquired in a faltering voice. "He does," retorted the she-dragon in a withering tone; "and you can just bring him right in!"

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Motor-Starting Switch for Printing Machines.

Particulars of a new type of motor-starting switch for use with printing machines have been sent to us by the Adams Manufacturing Co., Ltd., of Bedford, which embody novel and ingenious features.

Every printer's engineer knows that the starting of printing presses is very hard on the switchgear, on account of the constant "inching" which is necessary when preparing the press, which causes injurious arcing on the contacts of the starting switch, with the result that ordinary starting switches are soon destroyed, and even though renewable contacts may be used, the renewals are so frequently required as to become a nuisance, as well as a very serious expense.

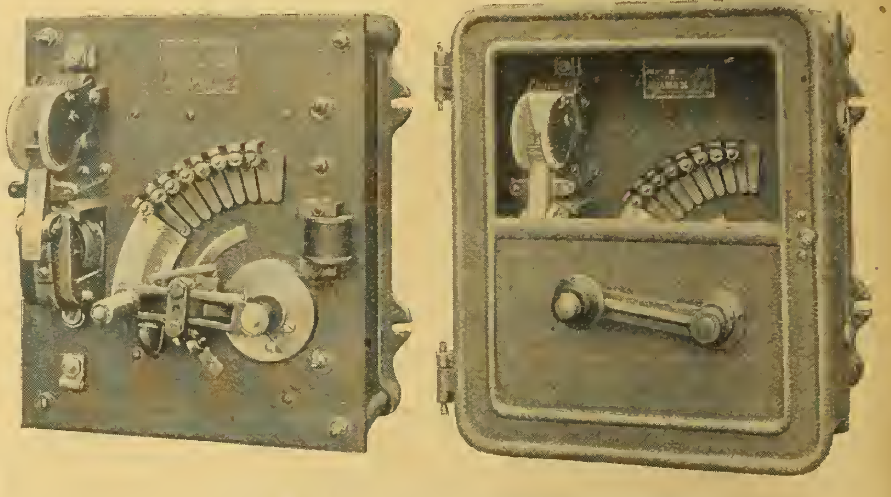
To prevent this injurious arcing all sorts of devices have been employed. The most successful is to use self-acting motor-starting rheostats, in which the motor circuit is always made and broken by means of a solenoid controlled switch which has carbon contacts for circuit breaking, as well as a magnetic blow-out. For small flat-bed presses, however, the initial cost of self-acting motor starters is often considered prohibitive.

With the object of rendering ordinary hand-operated starters suitable, such devices have been employed as carbon auxiliary contacts, magnetic blow-outs, and interlocked solenoid switches, &c. These devices protect only the first step, whereas the minder, whose eyes must be on the machine and not on the starter, pulls the handle, when inching, over to the third or fourth contact, or perhaps further, and in moving it back draws a destructive arc across the starter steps.

As will be seen by the illustration, the new "Igranic" switch employs an interlocked magnetic circuit maker and breaker; but the essential merit of the arrangement consists in the fact that, no matter how far the operator pulls the handle over in a forward direction, the slightest backward movement instantly opens the circuit-breaker; consequently, no arcing can occur on the starter steps, because they are "dead."

The circuit-breaker has carbon contacts and a magnetic blow-out, and will open the circuit an indefinite number of times without receiving injury. With this starter, therefore, "inching" may be practised to an unlimited extent; in fact, a recent extended trial in a large printing works, under ordinary working conditions, left the contacts as good as new.

In addition, the interlocking of the circuit-breaker with the starter makes it impossible to close the motor circuit except with all the starting resistance in circuit, so that the motor receives proper protection, and the starting switch is claimed to be practically "fool-proof."



Igranic Motor-Starter for Printing Machines.

Gas-Engine Economy Calculator.

We have received from the Key Engineering Co., Ltd., 4, Queen Victoria Street, E.C., a remarkable device, to which it is not easy to give a simple title. Its nature will be better understood if we first explain its purpose. In their recent paper before the Institution of Electrical Engineers, Messrs. Leonard Andrews and Reginald Porter showed that the question whether steam or gas engines should be used for the generation of power depended largely upon the answer to a further question—whether the saving in fuel consumption effected by using gas engines was sufficient to show a good return upon the additional capital outlay involved. This return will be governed by three considerations: the additional capital involved (under average conditions, from 30s. to 50s. per B.H.P.), the cost of fuel delivered on site, and the average hours per day that the plant is run at full load. The calculator before us is designed to solve this problem in a few seconds—given the data required for the purpose. We find, for instance, that if the extra capital cost per B.H.P. is £3, the cost of coal 6s. per ton, and the average hours of full load per day three, the return on the extra outlay is only 5 per cent.; but if the extra cost is £1, the cost of coal 15s., and the full-load hours eight per day, the return is no less than 100 per cent. Examples are given with the calculator to show its uses; it can, of course, be used to determine any one of the four quantities when the other three are known. One example shows that if interest and depreciation has been fixed at 10 per cent, and if the plant runs at full load 12 hours per day, with coal at 9s. per ton, it is cheaper to use gas engines, even if steam plant can be obtained for nothing. The device is decidedly ingenious and interesting. The principal assumptions upon which it is based appear to be that the cost of repairs, labour, stores, &c., will be approximately the same in either case, and that the fuel consumption of a gas installation will be at least 1 lb. per B.H.P.-hour less than that of the most economical modern steam installation. After that it is plain sailing. Whether these assumptions are wholly valid or not, and whether the considerations mentioned suffice upon which to base a final decision, are questions beyond the scope of this column.

THE JAPANESE MARKET FOR MACHINERY.

The Japanese firm of Mitsui & Co., which is very largely interested in the import and export trade of Japan, recently established a branch at Hamburg in charge of Herr H. Nölke, an engineer who is well acquainted with the conditions prevailing in Japan, and who has issued a work dealing, among other matters, with that country as a market for German machinery. Herr E. Schiff discusses the work at some length in a recent issue of the *Elektrotechnische Zeitschrift*, and an abstract may be of interest also to English readers. In the first place, Herr Nölke shows how unfavourable to Germany are the trade statistics in relation to the imports of machinery into Japan. The figures quoted by him show that for 1907 the share in the total imports of machinery held by Great Britain was 55 per cent., that of the United States was 31 per cent., and that of Germany was 12 per cent., whilst the German share in locomotives and wagons was particularly insignificant. The author mainly attributes this position of affairs to the fact that England and the United States were the technical instructors of Japan, Germany not having been ripe enough for the purpose at the beginning of the technical development of Japan 35 years ago. As a consequence, the leading positions are mostly occupied by technical men who have been educated in England and the United States; the Japanese engineers speak English, as the doctors and lawyers—and perhaps also the higher officers—speak German. In this way the products of English-speaking competitors have conquered the market, many English and American works directly possessing a monopoly. Another reason for the trade situation disclosed is that German manufacturers do not accommodate themselves to the export conditions. The manufacturer principally limits himself to giving the sole agency for the whole of Japan to a German firm domiciled in that country, without making sufficient inquiry into the conditions. Such firms in this way often become the sole representatives of too large a number of engineering works, and they, moreover, sell, if they can be more successful with them, English and American machinery also. The resulting inconveniences have already unpleasantly surprised the Japanese authorities. These representatives are mostly not experts, but they deal with everything whereby money can be earned; and only two or three employ a German engineer. They are for the greater part located on the coast at Yokohama or Kobe, and know neither the country nor the people thoroughly; they do not get any further than their offices and clubs. Business in Japan, as in China, is conducted with the natives through a native employé, who attends to it in the way established by tradition, but which is wholly insufficient for technical transactions, whilst the experienced Japanese technical men prefer to devote themselves to the juvenile industries of the country. But as technical manufactures are mostly purchased by English-speaking engineers, it is easy to negotiate directly with the Japanese. Nevertheless, a technical representative, in order to be able to form an opinion on the determinative conditions, must know the country and the people, and above all, the language; but very few fulfil these requirements. It is indispensable that representatives should not only be domiciled on the coast but also in the interior, and Tokio and Osaka come into consideration as the two principal industrial cities. A single representative for the whole country is quite insufficient, as 20 hours are occupied in journeying from Kobe to the most important mining district—Kiushiu—and even two days are required to proceed from Yokohama to the coal fields on Hokkaido or to the large copper mines.

The Germans fear, foolishly as Herr Nölke says, the competition of the Japanese in the markets of the world, and in many quarters difficulties are placed in the way of the latter if they wish to visit German industrial works. Such mistrust is, however, wholly unjustified from the standpoint of those who desire to do business with the Japanese, for the purchaser must have an opportunity to see and to make comparisons. The author praises the Siemens-Schuckert works, from a general point of view, as an exception in reference to their Japanese organisation. Herr Schiff adds, from his own experience of two years ago, that as a result of an inspection of the workshops of the Allgemeine Elektrizitäts Gesellschaft, Japanese engineers ordered a complete central station on the basis of prepayment, and that the readiness with which the company has always shown its works has been rewarded 100 times over. He also states—and he speaks for many—that he knows what remembrance is cherished of works which refuse to allow an inspection. Herr Nölke then submits material, showing how German works have lacked consideration in their attitude towards prominent Government engineers when paying visits, the result being that large orders have been placed in England and the United States. Such cases naturally become known, and they restrain visits to Germany and cause injury to German industry as a whole. The author proceeds to indicate that the fear of Japanese competition is unjustified, for that country will be compelled for a long time yet to devote its capital mainly to the direct utilisation of its natural resources, and consequently not to technical manufacturing. Notwithstanding the enormous promotion of new undertakings since the war, involving a total of £200,000,000, only three or four machinery works have arisen. Japan will therefore still be dependent upon the imports of such products for a long time; but Japanese competition could not be excluded in perpetuity, and by adopting the methods outlined the Germans are only attending to the business of their rivals.

The author makes various suggestions for the promotion of the export of German machinery. In the first place, the manufacturer should ascertain which of the articles he produces are the most efficient for the market, and calculate that he can only stand the test with them, thus particularly specialising for the export trade. He must also support his representative more strongly than in the markets where his manufactures are already introduced. But, above all, he must dispatch his own engineer to Japan, whilst small works should combine for this purpose, although limiting the number of the works and restricting them to one branch—as, for instance, to the textile department, mining, &c. As to the question of a representative, the manufacturer is advised not to decide before sending out his engineer, but only after the latter's inquiries into the local conditions and persons have been made. At present American and English engineers are to be found in large numbers, and also those from works which are already introduced, but German engineers rarely arrive in Japan. Catalogues must be compiled in the English language with code words, and with the English system of measurement, and containing large patterns; the additions for freight and duty, and the bulk and weight of the packed goods are to be shown. Herr Nölke advises against always making offers to all inquiring intermediaries, as in this way the Japanese import houses and the ultimate purchasers would be crowded with repetitions of the same offers and be overloaded with the work of examination. Still less should the manufacturer comply with the request to grant commission to each export intermediary on obtaining the order, for these firms—even the representatives—as a rule limit themselves by no means to watching over the interests of a single manufacturer. The manufacturer should therefore not let any restriction be placed upon the right to make offers to several import houses.

The conclusion of understandings between competitive German manufacturers is recommended by Herr Nölke, who expects that considerable advantages would be derived from the formation of export syndicates. It also appears to him to be desirable for the German Government to dispatch experts as far as they are technically, commercially and sufficiently experienced in reference to the conditions of the country, and that they should remain there long enough to make themselves personally known in the determinative quarters. In conclusion, the author emphasises the importance for German industry of the Japanese International Exhibition, which it is proposed shall take place in 1912.

LEGAL.

Armorduct Manufacturing Co., Ltd., *v.* A. Fernhead.

In the City of London Court recently, before his Honour Judge Lumley Smith, K.C., plaintiffs sued defendant, of Caledonian Road, N., for £8 5s. 11d., for electrical goods and fittings supplied. The claim was admitted; but the defendant counterclaimed for £6 13s. 6d., the price of electrical radiators supplied to the plaintiffs. Defendant said that in February, 1908, he saw the plaintiffs' sales manager about the radiators, and he agreed to take them. They were sent as samples on sale or return, but plaintiffs must pay for them now, because they kept them for 10 months and sent them back damaged. Judge Lumley Smith said he supposed if the plaintiffs had returned the radiators in a fortnight the defendant would have taken them back. The defendant thought he might. Dwyer, plaintiffs' traveller, said they were waiting for months for the invoice in respect of the radiators. That was why they kept them so long, as they did not know what they were to be charged. They had never given a specific order for radiators. It was quite a well-known practice in the electrical trade for goods to remain as long as 12 months in shops on approval. The defendant said that was not so as applied to radiators. Had the goods been electroliers he would have been willing to let the plaintiffs have them for nine months and then to take them back. The sale of radiators was a season's trade. Mr. Mahaffy, who appeared for the plaintiffs, said it was very useful for men like the defendant to show their radiators in showrooms such as those of the plaintiffs. Judge Lumley Smith said that when goods were sold on sale or return, the property passed to the buyers if they did not send them back within a reasonable time or give notice that they would not have them. There was a little difference where goods were sent in to be shown. He was satisfied that the goods were sent in to be looked at, to get orders from, and not to be bought or sold. The counterclaim therefore failed. Judgment for the plaintiffs on claim and counterclaim, with costs.

General Electric Co., Ltd., *v.* Bridges.

In the City of London Court, on Thursday last week, before Mr. Registrar Wild, a claim was made by the General Electric Co., Ltd., against Mr. W. T. Bridges, of Walthamstow, for the sum of £1 8s. 2d.

Mr. Strouts, solicitor, who appeared for the plaintiffs, said the question in dispute was one of trade discount. The defendant was a draper, and had brought certain Osram electric lamps from the plaintiffs, and he claimed to be entitled to a trade discount. The defendant, however, not being an electrician, was not entitled to the discount. It appeared that on previous transactions the discount had been allowed to the defendant in error. Washington, the plaintiffs' ledger clerk, said that the defendant was supplied with electrical goods in November and December last to the amount of £4 14s. 6d. Invoices were sent in for that amount. Off that sum there was a discount allowed to those in the trade. On the occasions when discount had been allowed to the defendant, the plaintiffs were under the impression that he was an electrician. The electric lamps in question, it was presumed, were for his own use. If he was entitled to any discount, he had deducted 33⅓ per cent., but the plaintiffs could only allow 20 per cent. discount upon Osram electric lamps. The defendant said he was perfectly willing to alter the rate of discount which he claimed to be entitled to. For a long period (over several years) he had been trading with the plaintiffs. He had been supplying electrical goods in fairly large quantities to theatres and private consumers. He had had correspondence with the late manager of the plaintiff company's lamp department, and had been negotiating with him regarding further business he was trying to get for the plaintiffs. It was distinctly understood that he had been acting with the plaintiffs' late manager as the agent for the plaintiffs, and working as their agent he did not do that for nothing. The drapery goods business was only part of his trade.

The Registrar said he saw by the correspondence which the defendant had had with the plaintiffs that they had been acknowledging his right to discount; it was rather late now to say he was a draper, and therefore not entitled to it. The plaintiffs' witness said that if the defendant had used the lamps in the way of trade, they were prepared to allow him 20 per cent. Eventually judgment was entered for the plaintiffs for 11s. 2d.

"Z" Electric Lamp Patent Action.

In the Chancery Division on Friday, July 23rd, Mr. Justice Warrington heard a summons in an action of the Z Electric Lamp Manufacturing Co., Ltd., against Marples, Leach & Co., Ltd.

Mr. Colefax, for the plaintiffs, said they asked by their summons that the defendants should be ordered to give further and better particulars of the objections that had been delivered by them to the action, which was a patent action. There was an allegation that the specification of the plaintiffs' invention was misleading, and another that the directions were insufficient. The defendants also said that the invention was not a proper subject matter for letters patent. He wished to know against which of the claims of the plaintiffs was that objection urged.

Mr. T. Terrell, K.C., for the defendants, said there were three claims, and they were all exactly in the same boat. There was no invention. It was the same as if he said there were no eggs in that basket, and then he was asked to give particulars of the eggs that were not there. How could he give particulars of nothing?

After hearing counsel on both sides in regard to certain points, His Lordship dismissed the summons with costs, adding that there was really no necessity for it, as the particulars delivered were substantial. He gave the plaintiffs leave to appeal on the ground that particulars in a patent action were of some importance.

New System Private Telephone Co., Ltd., *v.* Summers.

This action came before Lords Justices Vaughan-Williams, Moulton and Buckley on Tuesday last upon an appeal by the plaintiffs from an order of Mr. Justice Coleridge in Chambers, refusing the plaintiffs their costs of a summons for a Receiver to enforce a judgment obtained in respect of a telephonic service.

The action was brought in the Mayor's Court, and judgment was obtained for £22 9s. 7d. That judgment was not satisfied, and finding that the property of the debtor was at 18, Berkeley Street, out of the jurisdiction of the Mayor's Court, the plaintiffs obtained a transfer of proceedings to the High Court, and execution was levied under a writ of *fi fa.* The Sheriff upheld that the bulk of the goods at Berkeley Street were claimed by a furniture company, and what remained were not sufficient to satisfy the costs of the execution. The plaintiffs thereupon obtained leave to serve and did serve, the defendant with a summons for the appointment of a Receiver by way of equitable execution. Before that summons was heard, however, the debt was satisfied, and the Judge, confirming an order of the Master, refused the plaintiffs the costs of that summons on the ground that no Receiver was appointed and the summons was unnecessary.

The appeal was argued by Mr. Montague Lush, K.C., and Mr. Newbolt for the plaintiffs; Mr. McCall, K.C., and Mr. Colam, for the defendant, were not called upon.

Their Lordships dismissed the appeal, holding that as the debt was paid before the summons was served on the defendant, the plaintiffs should have taken steps to have it withdrawn. The only costs they could have been entitled to were the costs of issuing the summons; these were in the discretion of the Master, and they could not hold that he had exercised his discretion improperly.

London Electrobus Co., Ltd.

In the Companies' Winding-Up Court, Mr. Justice Neville had before him on Tuesday last a petition by Pritchetts & Gold, Ltd, for the compulsory winding-up of the London Electrobus Co., Ltd. Mr. Manning appeared on behalf of the company, and asked for an adjournment, which was assented to, and his Lordship directed the petition to stand over until next sittings.

Post Office Telephone Agreements.

The Postmaster-General sued Mr. H. J. Benjamin, Elgin Court, Maida Vale, on the 23rd inst., in the City of London Court, to recover £1 8s. 11d. for telephone calls due in excess of the minimum charge.

Mr. McIntyre, on behalf of Sir Robert Hunter, solicitor to the Post Office, said that under the agreement the account of the competent officer was evidence of the calls due. He produced that.

Defendant said he disputed the figures. He thought the calls ought to be proved, and not merely a certified copy put in. The agreement was entered into upon the presumption that a fair and accurate account would be kept. That had not been done.

Judge Lumley Smith said it was to avoid having to prove the calls that the Postmaster-General tied up the public who used the telephone with the conditions. It was impossible to "get round" the agreement.

Judgment for the plaintiff, with costs.—*Financial Times.*

Ward & Goldstone *v.* J. R. Norris & Co.

At Salford County Court on Friday, before Judge Parry, Messrs' Ward & Goldstone, electrical engineers, of Springfield Lane, Salford, sued Messrs. J. R Norris & Co., electrical engineers, of Oldham, for £2 12s 6d., the value of telephone cable made to order. It appeared that the order for the cable was given by telephone, but the plaintiffs demanded the payment of an account in respect of a previous order. Defendants thereupon cancelled the order, but in the meantime the cable had been made. For the defendants it was submitted that the plaintiffs could not recover, as they only accepted the order conditionally. When the order was given plaintiffs wrote:—"We thank you for your order for telephone cable, which is receiving our prompt attention, but we shall be unable to send this until we receive your overdue remittance." The Judge said this meant "no overdue remittance, no telephone cable." He found for the defendants.

Companies' Consolidation Act, 1908.

Before the Stipendiary Magistrate at Liverpool on July 21st, arising out of the winding-up order of H. R. Jones, Wilson & Co., Ltd., electrical engineers, Liverpool, Mr. Hugh Rowland Jones, residing at 24, Belgrave Street, Liscard, Cheshire, was summoned by the Deputy Official Receiver (Mr. T. W. J. Brittain) for having failed to comply with Sec. 147 of the Companies' Consolidation Act, 1908, requiring him to submit a statement of the affairs of the company under the winding-up order. Mr. A. T. Miller prosecuted, but defendant was not present, nor was he legally represented when the case opened. After hearing the particulars the Stipendiary inflicted a fine of £10 and 9 guineas costs. At this juncture the defendant entered the Court, and the case being reconsidered, he pleaded that he had done his best. The Magistrate retorted that it was all due to laziness. Eventually the summons was disposed of on the payment of costs, the fine being remitted.

Re Mountain & Gibson.

In the Chancery Court at Manchester, on 27th inst., the matter of the winding-up of Messrs. Mountain & Gibson, Ltd., electrical engineers, of Bury, was mentioned. It came before his Honour Vice-Chancellor Leigh-Clare at Liverpool a fortnight ago, when a question was raised as to whether the winding-up should be compulsory or under supervision. Mr. Kerr now stated that the petition had been amended, and asked for a supervision order, and there was no opposition to it.

Mr. Abbott, on behalf of a number of creditors, applied to the Court to appoint Mr. William Whittaker to act as joint liquidator with Mr. Bowden, with a committee of inspection. These proposals had been approved at a statutory meeting of the creditors.

The Vice-Chancellor made the order.

Consolidated Nickel, Tin and Copper Mines, Ltd, *v.* Crompton & Co., Ltd.

In the King's Bench Divisional Court on Wednesday, before the Lord Chief Justice and Justices Darling and A. T. Lawrence, this action was mentioned, when,

Mr. Abel Thomas, K.C., on behalf of the defendants, asked for a stay of execution.

The judgment of the Official Referee was given in our last issue.

The Learned Counsel said that there were at least five different questions of law upon which the defendants wished to appeal. He was prepared to bring the money into Court at once. This was a case where a stay should be granted, especially when they remembered that the plaintiffs had no money in the bank as far as defendants knew, and no property that they could see, while their registered offices were in Guernsey.

The Court granted the stay and ordered that notice of appeal should be given this week and the money paid into Court. The costs of the application would be costs in the appeal.

BUSINESS NOTES.

Consular Notes.—France.—The British Vice-Consul at Bayonne reports that there are two points of that town which might be joined by an electric tramway; also an electric tramway between Bayonne and Cambo, a growing watering place about 12 miles distant, serving two or three intermediate villages, would probably yield interesting profits, the more so as there is available water power.

The British Vice-Consul at La Rochelle reports that the scheme for the supply of electric light and power to the town and environs is nearing completion, the power station and distributing cables having been completed.

Madeira.—The British Consul at Madeira reports that for the last two years it has been frequently mentioned that a telephone system is to be begun, but although a small amount of money was voted as a commencement, nothing has been done. Telephones are very badly needed, and if properly managed and financed the installation would probably be a success. There are coaling firms, wine houses, banks, sugar and flour mills whose trade is extensive, besides some three or four hotels, and a residential colony of visitors during at least six months of the year, all of whom the Consul thinks might be counted upon as subscribers. It was rumoured at the beginning of 1908 that a British company was to take over the present electric lighting company and erect a new and up-to-date installation, in fact, a member of an electrical firm from the United Kingdom was in Madeira for some time endeavouring to arrange matters, but the scheme seems to have completely fallen through on account of financial difficulties; towards the end of the year the matter was further discussed with a firm in Madeira, but, from all accounts, nothing was done. What electric lighting there is, is bad, and there is certainly much room for improvement.

Liberia.—The British Consul at Monrovia reports that the hinterland of Liberia is known to contain large quantities of rubber, some good, some bad. About 22 different kinds of trees and vines produce rubber of a more or less saleable quality; 16 species of rubber have been classified. Among these species are to be found the *Funtumia africana* and the *Funtumia elastica*. Up to the time of the recent fall in the price of rubber, 4s. to 5s. per lb. had been obtained for the *Funtumia elastica*, and the *Funtumia africana* may realise 1s. 6d. per lb. The price of rubber has lately risen. The collection of rubber seems to be growing increasingly popular amongst the natives of the country. The Liberian Rubber Corporation have obtained certain rights over the collection of rubber in the Republic. One of the principal difficulties in the way of collection of this rubber is the disturbed state of the interior. Until order is brought out of the existing chaos in the hinterland, commercial enterprise in the interior will continue to be jeopardised and interfered with.

Canary Islands.—The British Consul in the Canary Islands reports, that it is probable that before long a system of wireless telegraphy will be installed between those islands and Europe, Cape Colony and South America. Santa Cruz de Tenerife is to be the main station in the islands, and communication is to be established (1) with all the adjacent islands, (2) with Cadiz and thence to Paris, (3) with Casablanca and thence to Paris direct, (4) with Pernambuco and thence to Buenos Aires, (5) with a station in Senegambia, probably Dakar, and thence to Cape Town. The work is to be undertaken by a combination of two companies engaged in the promotion of wireless telegraphy, one of them being registered in Paris with a capital of 1,250,000 francs, and the other in Madrid with a capital of 1,000,000 pesetas. A site for the installation in Santa Cruz de Tenerife has been granted by the authorities, and Las Palmas has followed suit, not only with a grant of land, but also with a loan of 20,000 pesetas. The conditions of the loan are that it is to be repaid in 10 years, and the works are to be handed over to the Spanish Government at the end of 20 years. It is said that communication between Tenerife and Cadiz will be established shortly. It is possible that the distance between Tenerife and Pernambuco may be too great for practical success, and in that case an installation will be set up in St. Vincent.

Dissolutions and Liquidations.—Crown Plating Co., Salford.—The partnership between J. A. and F. H. Dewhurst, 24, Chapel Street, Salford, has been dissolved by mutual consent, as from July 19th. Debts paid by F. H. Dewhurst.

Eldon Electric Co., Ltd., Newcastle-on-Tyne. (In voluntary liquidation.)—Meeting of creditors on August 5th.

Seymour Motor Co., Liverpool.—Messrs. A. C. Whitney and J. H. Sutherland have dissolved partnership; Mr. Sutherland will carry on the business under the same style and at the same address.

Enright & Thompson, London.—Messrs. J. S. Enright and F. Thompson have dissolved partnership. The business will be carried on by Mr. Thompson.

Trade Announcements.—Messrs. I. Frankenburg and Sons, Ltd., of Salford, Manchester, have appointed Messrs. Watson & Whyte, 19, Waterloo Street, Glasgow, as their agents in Scotland for the sale of rubber-insulated and bitumen cables.

We learn that the sole control of sales in the eastern hemisphere of the "Schureman" switchgear has now passed into the hands of the Adams Manufacturing Co, of Bedford, and 106, New Bond Street, London. The "Schureman" switchgear is entirely of the self-acting type, and includes automatic starting switches and controllers for pumps, lifts, air compressors, hydraulic accumulators, printing presses, and for remote control of motors performing all kinds of duty.

The Globe Name-Plate Co., Ltd., have removed to more central premises at 20, High Holborn (32-35, Gray's Inn Chambers), W C., owing to extended business.

Mr. Jens Orten-Boving, M.I.M E., announces that he has taken into partnership Mr. Douglas Spencer and Mr. P. R. Cobb. The style of the firm will henceforth be Jens Orten-Böving & Co. From Monday last, July 26th, the address of the firm is 9½, Union Court, Old Broad Street, London, E.C.

Book Notices.—*A Comedy of Ambition.* By Adam Gowans Whyte. London: Andrew Melrose. Price 6s.—A lady reader would no doubt open this book at the chapter headed "Mrs. Gell's Secret," and having read that, might think she had discovered the author's secret too. In this she would err, for neither the success of the book nor its plot depends upon this secret, although it undoubtedly adds to the piquancy of the story. John Gell, the hero of the book—if we can call him a hero—is an idealist with a super-sensitive conscience. Trained for the church, his faith, originally of a narrow Presbyterian order, is considerably shaken up in Germany, where he goes to finish his theological studies. Forsaking the church, he enters the political world, and suffers many rude awakenings, not only in connection with men but with women also. A considerable portion of the narrative is concerned with the opposition to an Electrical Power Bill promoted by the father of the girl Gell hopes to marry. Gell, being something of a Municipal Socialist, throws himself wholeheartedly into the opposition camp; the reader is let into the secrets of the wirepullers, and obtains many illuminating peeps behind the scenes, learning also a good deal about the conduct of newspaper campaigning. The author has evidently peered deeply into the sea of human emotion, and he describes what he has seen there in language that is always refined, and distinguished by a literary grace which makes it a pleasure to read for its own sake. The interest is well maintained, and it is difficult to put the book down once it is begun.

The Hughes and Baudot Telegraphs. By Arthur Crotch. London: S. Rentell & Co. Price 1s. 6d.—In many respects this is an excellent little work, and one which will be appreciated by telegraphists and others connected with the telegraph administration of this country, as it deals with types of printing telegraphs which, though not by any means in their embryo stage, are increasing in their practical application in this country, at any rate, and are likely to become much more widely used. Though professedly dealing only with the two appliances or systems mentioned, the now defunct Morse multiplex of Delany and others, together with the ingenious duplex multiplex, are, by way of introduction to the Baudot, also briefly touched upon. The descriptions given are, in general, quite accurate and reliable and the illustrations good. As a suggestion, however, it may not be amiss to point out that, in explaining a complex system like the Baudot, a fuller skeleton outline, as a preliminary to details, would considerably assist the reader and render the description easier and more readable. In other words, the subject might be presented more or less as it evolved itself in the mind of the inventor, who must of necessity have conceived the fundamental principles before working out even the simpler details. Though this method has been adopted to some extent in the work, it could be greatly improved in this respect. A brief description of the arrangement of circuits for traffic to which the Baudot lends itself would have formed a useful supplement, had space permitted. The book is a useful one, and can be thoroughly recommended.

Neuere Elektrophysikalische Erscheinungen. By Ernst Ruhmer. Berlin: F. & M. Harrwitz. 1907. Teil I: Fortschritte auf dem Gebiete der Telegrafie und Telephonie.—This work of some 213 pages covers the principal developments in the domain of telegraph and telephone science in recent years. It is well and copiously illustrated with 215 figures. Some of the older automatic and multiplex systems of telegraphy, including the Wheatstone, Delany, &c., are first touched upon, followed by a full and concise description of the Pollak-Virag Morse recording and writing telegraphs, the Murray and Siemens & Halske typewriting systems, &c., with practical information regarding the capabilities and outputs of some of the principal or most successful of these recent telegraph methods. Among numerous others, the telautograph receives notice. Developments in cable telegraphy next claim attention. These are followed by a section dealing with recent telephone appliances and methods, Poulsen's telegraphone, and the Pupin system of loading telephone lines as practically developed by Messrs. Siemens & Halske in Germany. Automatic telephone switching systems are considered, but somewhat curiously the common-battery system is left out. The work collects together in a concise form the cream of recent practice and developments in the telegraphic engineering world. The work will amply pay for perusal by any who are interested in systems of telegraph working, and should serve to convert those who may have formed the impression that telegraphic developments, apart from wireless telegraphy, have reached a period of stagnation. Apart from any question of usefulness or otherwise of many of the recent systems described, the ingenuity and resource displayed in the details of construction are well worthy of study.

Universal Directory of Railway Officials. 1909. London: Directory Publishing Co., Ltd. Price 10s.—This useful directory, which is now in its 15th year, needs little in the way of commendation. It contains particulars of the staffs of practically all the electric tramways in the United Kingdom, as well as of the railways of the world, and includes an official section giving the names of authorities having to do with railway and tramway matters, benevolent societies, &c., in this country. Besides the entries under the railway headings, there is a personal index of railway officials in alphabetical order.

"The Law Affecting Engineers." By W. V. Ball. London: A. Constable & Co., Ltd. 1909. Price 10s. 6d. net.

"Boletim do Ministerio da Industria, Viacao e Obras Publicas," Brazil. Vol. I, No. 1. April, 1909. Rio de Janeiro: Offices of the Directoria da Estatistica.

"Die Transformatoren." By Dr. G. Benischke. Brunswick: Friedr. Vieweg & Son. 1909. Price M. 9.

"Aero Manual." London: Temple Press, Ltd. 1909. Price 1s. 6d. net.

The Land Transport Exhibit at Brussels.—There are good prospects of an effective display being made at the Brussels Exhibition of British exhibits connected with land transport. Models at least will be shown by all the great railway companies, both of engines and of signalling apparatus, foreign lines having something still to learn from British railway engineers. There will also be a strong and, it is hoped, a comprehensive display of British-made motor-cars. These have the highest reputation abroad, especially for their qualities of durability and cheap running; and this being the most important Continental exhibition since that of Paris nine years ago, it is desirable that the headway made by the trade in the interval should be demonstrated clearly. There will, of course, be no such drawbacks at Brussels as Mr. S. F. Edge complained of before the International Exhibitions Committee with reference to that occasion. British cars will be effectively and fairly shown, and will not suffer from the presence of what were known at the Paris Exhibition as "freak exhibits." It is worth remembering, too, that the industrial conditions of Belgium are in many ways so similar to our own that there is a good market for motor-wagons and other heavy vehicles.

Graphite Patent for Disposal.—Particulars are given in our advertisement pages of a patent for the manufacture of graphite, the owners of which desire to sell or lease it.

The "Z" Lamp in Austria-Hungary.—A company has recently been formed, with the title "La Société des Lampes Electriques 'Z' pour l'Autriche-Hongrie," to acquire the Austrian and Hungarian rights in the electric lamps of the Société Internationale des Lampes Electriques Zircone-Wolfram. Works for the manufacture of the lamps have been established at Reverete in the Southern Tyrol, and these are now in operation. The sale of the lamps in Austria and Hungary is in the hands of the Union Imprese Elettriche, of Trente.

Meldrum Destructor.—On July 21st a new refuse destructor installed by the Gainsborough U.D.C. was brought into use. The plant is a two-cell Meldrum destructor of the back-feed type, capable of efficiently destroying 1½ tons of general house refuse per hour, the heat being utilised for raising steam in a Lancashire boiler 30 ft. × 7 ft., working at 150 lb. per sq. in. pressure. It has been erected under the supervision of Mr. S. W. Parker, engineer and surveyor to the Council, by Messrs. Meldrum Bros., Ltd., of Timperley, Manchester.

Bankruptcy Proceedings.—Bridgewater & Wright, York Road, King's Cross, electrical engineers.—At the London Bankruptcy Court on July 21st, a sitting was held for the public examination of Mrs. Charlotte Rix in relation to this failure. The statement of affairs filed under the proceedings showed gross liabilities £878 (unsecured £760), and assets valued at £826, or sufficient to yield a surplus of about £60 after payment of all the debts. Questioned by Mr. W. P. Bowyer, assistant Official Receiver, Mrs. Rix stated that she understood that in January, 1907, her step-brother, Frederick Alexander Wright, purchased the above business for £1,000. He died in the following March, leaving her as sole executrix and universal legatee. In that capacity she carried on the business with a view to its sale as a going concern, but in the beginning of last March the plant, stock and effects were sold, partly under a distress and partly under an execution. Beyond signing cheques, witness had taken no part in the conduct of the business, which was left to the management of Mr. Bridgewater. That gentleman was not a partner, although the trading style was Bridgewater & Wright, he having acted merely as manager for her late step-brother. In all, witness had only received £10 from the business for her personal needs, although the books showed a debit of £303 to her account. Of that sum, £184 was paid to her solicitor, Mr. Cotton, and the balance represented liabilities upon the estate of the deceased. Witness was utterly unable to explain why the business had proved insolvent. She never saw the books, and throughout relied entirely upon Mr. Bridgewater and her solicitor. She had been living upon rents from house property belonging to her and profits from a boarding house which she had conducted. The business cheques were sent down to her for signature by Mr. Bridgewater. It was in pursuance of her solicitor's advice that she continued the business with a view to its sale as a going concern, and it never struck her that she was embarking upon a dangerous course by so doing. Her late brother was the trustee under the will of Capt. Wright, another half-brother to witness, who left three boys and about £1,400 worth of property. Part of that property was invested in a leasehold house at Chiswick, and on the advice of her solicitor, £300 was raised on the lease and used to keep the business going. The witness was also examined regarding a sum of £340 in which she was jointly interested, and which had also been absorbed in the business. The examination was concluded.

William Thomas Harris (trading as W. T. Harris & Sons), electrical engineer, 460 and 464, Commercial Road, and 47, Emanuel Street, Portsmouth, Hants.—This debtor attended at the Court House, St. Thomas Street, Portsmouth, on Monday last, for his public examination before Mr. Registrar Renny. The liabilities were stated to be £3,150 in respect of fully secured creditors, and £55 due to three others in respect of apprenticeship premiums and payable in full, leaving £678 to rank for dividend. The debtor stated that if he could realise his stock and plant at anything approaching their value, he would be quite solvent, and have a surplus. His stock in trade and trade fixtures he valued at £775, but stated that they cost him nearly double that sum quite recently. The book debts were estimated to realise £123. Debtor estimated the realisable value of his assets at £899, which, if attained, would leave him a balance of £166. Replying to the Official Receiver, debtor said he started business in 1899, and was in receipt of a pension of £42 12s. He had a capital of £700. He had never been in difficulties with his trade creditors, nor had he been pressed by any of them. During the whole course of his trading he had never had any proceedings taken against him for the payment of money. Debtor attributed his position to a loss he sustained in the taking of a garage in Emanuel Street. A trading account for the past year shows the gross profits to have been £916 13s., but the trade expenses had amounted to £907 4s., leaving a net profit of only £9 9s., which, added to his pension, amounted to £52, against bad debts £80 18s., and housekeeping expenses £104. The stock in trade, plant, machinery, &c., were of the value of £960, but, if separated, it would probably not realise more than £550. The examination was closed. Messrs. E. Whittaker and C. Watts have been appointed trustees.

Lancelot Walter de Grave (trading at L. W. de Grave and as Degrave & Co. and as Squire & Co.), 19, Queen Street, Derby, electrical engineer, &c. This debtor appears to have been in business for about 10 years, having commenced with a free capital of £100, and he attributes his present position to lack of capital and bad trade. The accounts filed show unsecured liabilities £271 12s. 6d., and net assets £162 19s. 1d., or a deficiency of £108 13s. 5d.

C. Scott Snell, civil and electrical engineer, 25, Victoria Street, S.W., filed his petition on July 19th, and a receiving order was made. The first meeting will be held on August 9th; public examination, September 7th.

G. Sutcliffe (trading as G. Sutcliffe & Co.), Abertillery.—A first and final dividend of 3s. 1d. in the £ has been declared, payable on July 28th last.

Tantalum Lamps.—Messrs. Siemens Bros., Tyssen Street, Dalston, inform us that they are placing on the market the new high-voltage "Tantalum" lamp for direct current, which, as mentioned in our last issue, will give 25 c.p. at an efficiency of 1·7 watts for all voltages between 200 and 240. The general appearance of the lamp is similar to that of the 32-c.p. high-voltage "Tantalum" lamp. Messrs. Siemens Bros. are issuing a new leaflet (14 B) dealing exclusively with this lamp, and will be pleased to supply it to electrical contractors. They also inform us that, owing to the exceptionally large demand, they have been compelled to obtain a fresh supply of their "Satisfied Consumer" adhesive labels, which are becoming known to the trade as "stickybacks," and are supplied free of charge to the electrical contractor; they are suitable for attaching to correspondence, packages, &c., providing him with a means of keeping "Tantalum" lamps before his clients.

Catalogues and Lists.—Messrs. L. Andrew & Co., 2, Carr Street, Blackfriars, Manchester.—Wholesale price list of insulating materials for electrical purposes—ebonite, fibre, presspahn, mica, &c.

Messrs. Victoria Dynamo and Motor Co., Craven House, Kingsway, W.C.—Leaflet relating to a.c. motors, two and three-phase, 50 cycles, type D, in sizes from ¼ to 85 h.p.; while particulars are given of 33 different combinations of speed and output, with the efficiency, power factor, &c., for both slip-ring and squirrel-cage types, the shipping weights, &c., are given in a short and handy list of 18 items. Starting devices are also listed. A separate leaflet gives particulars and prices of a series of electric pulley blocks, for hand or electric travelling, or suspension from a crane hook, controlled from the floor level.

Messrs. Cookson & Co., Albion House, 59 and 61, New Oxford Street, W.C.—Leaflets relating to their patent electromagnetic sorting machines, of which a new pattern has been designed taking only 100 watts for excitation, "Cookson" storage batteries, plates and accessories, and motor-car lamps.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—Price list No. 17 of d.c. moving-coil instruments, round dial and sector, horizontal and vertical edgewise, portable, and combined ammeter and voltmeter patterns, as well as separate shunts, &c. The shunts are of an alloy which does not form a thermo-couple with the terminal blocks, so that false readings are avoided.

The Edison & Swan United Electric Light Co., Ltd., Ediswan Buildings, Queen Street, E.C.—Leaflet No. S. 2,157, giving particulars and prices of their latest patterns of fittings for ships, mills, collieries, &c., and all-porcelain fittings for chemical works and similar places.

Mr. C. Schniewindt, Neuenrade, Westphalia.—Leaflet relating to "thorn" dowels—an ingenious type of metal dowel, in which the insulator and the dowel are both locked in place with a single nail; various patterns of tapped dowels with screws, rosettes, cleats, &c., for surface wiring are listed.

Messrs. J. H. Holmes & Co., Portland Road, Newcastle-on-Tyne.—List No. 107 just issued, containing illustrations of a number of interesting electrical plants installed by the firm for engineering works, shipyards, railways, and dockyards. One half of the publication is occupied with tabulated details of such plant, supplied to a large number of customers in these classes.

Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Forty-page well-illustrated publication wherein are given some notes about the company and a brief description of the works, followed by a selection of half-tone views of P.D.M. plant installed in large central stations, and electrical equipments for lighting and power in factories, for pumping, mining, engineering, wood-working, textile and other purposes.

Mr. D. C. Bate, 40, Brazennose Street, Manchester.—Leaflet describing the Blake microtector antiseptic telephone cap, for which Mr. Bate is sole agent for Lancs., Yorks., and Cheshire.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, N.—Card describing the Westinghouse silent rocker-joint chain drive (Morse patents), ¼ to 500 h.p.

Mr. Haydn T. Harrison, 11, Victoria Street, S.W.—Catalogue of street lighting apparatus and accessories, including a number of fittings specially suitable for lighting with tungsten lamps, up to 1,000 c.p., and for converting gas lanterns to electric. Some useful tables and data are included.

Annual Holidays.—Messrs. A. Seage & Co., London, W.—Works and offices will be closed from noon Saturday, July 31st, until Monday, August 9th, 1909.

Messrs. Everett, Edgcumbe & Co., Ltd., Collindale Works, Hendon, N.W.—Works and offices will be closed from Saturday, July 31st, until Monday, August 9th. A small staff will attend to urgent correspondence.

Messrs. Mirrlees Bickerton & Day, Ltd., Hazel Grove.—Works and offices will be closed from noon Saturday, August 7th, until Monday morning, August 16th. A small staff will be in attendance to deal with urgent correspondence.

Messrs. Newtons, Ltd., Taunton.—Works and offices will be closed from July 31st to August 4th inclusive.

The Crypto Electrical Co., London, S.E.—Works and offices will be closed from 12 30 o'clock Saturday, July 31st, until Monday morning, August 9th. A portion of the staff will be at the offices to deal with urgent correspondence.

Cowper-Coles Exhibits at the White City.—A new company has been formed, entitled "The Cowper-Coles Engineering Co., Ltd.," with a working capital of £40,000, and offices at 82, Victoria Street, S.W. It is a private company, formed to develop the business of Sherard Cowper-Coles & Co., Ltd., and no issue will be made to the public. The company has a large exhibit of its special products and apparatus at the White City. The now well-known sherardising or "regenerative" process forms a leading feature; the merits of this system of coating steel and iron with zinc are becoming widely appreciated. The direct production of copper sheets, tubes and wire by the Cowper-Coles centrifugal electrolytic process is also well represented, and Mr. Cowper-Coles's metallic parabolic mirrors for searchlights, coated with alternate bands of gold and silver, are shown; it is claimed for these that the gold mirror gives a remarkable power of penetration, while its combination with silver gives a beam of exceptionally dazzling effect for military purposes. Numerous other exhibits of electro-deposited metals are shown, including iron, as well as a welding machine for aluminium wires, patent ventilators, and the "caloriser," a device for ensuring the complete combustion of smoke in steam boilers, for which high qualities are claimed.

Sales.—Messrs. Benjafield & Wood will shortly sell by auction, at Lincoln, an electrical engineer's manufacturing plant and stock. Messrs. Fuller, Horsey, Sons & Cassell offer for sale a modern electric power plant. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Beckenham.—The Council had before it this week a proposal to improve the gas lighting of Shortlands district with inverted burners at a cost of £3 7s. 6d. per lamp of 120-c.p. The proposal has been adjourned in order that the Electricity Committee may consider and report whether it can provide equally efficient lighting with metallic-filament lamps at lower cost.

Bury (Lancs.).—The T.C. has applied to the B. of T. for permission to utilise overhead lines for the transmission of energy to the Bolholt Bleachworks.

Buxton.—The U.D.C. has applied to the L.G.B. for a loan of £500 for mains and services.

Cape Colony.—On July 1st the Cape Town Corporation electricity department took over the responsibility of supplying energy in bulk to the Cape Government Railways, and the Table Bay Harbour Board. The supply to the Cape Town Post Office is also taken from the Corporation through the Railway switchboard. Cables have been laid in duplicate by the Corporation, both to the Railway and Docks switchboards, in order to provide against a breakdown. For the purpose of the extensions a large quantity of new plant has been installed, the whole of the additional machinery being of British manufacture. The engines are by Belliss & Morcom, and are directly coupled to Siemens alterators generating two-phase current at 2,200 volts. The engines are capable of giving a continuous output of 600 B.H.P., with an overload of 25 per cent. for two hours. The boilers were supplied by Babcock & Wilcox, and the condensing plant by W. H. Allen, of Bedford. There is also a booster (by the Phœnix Co., Bradford), for raising the pressure from 440 volts to 550 volts for working purposes at the Docks. A battery station has been erected at the Docks, and equipped by the Chloride Co. The switchboard was supplied by Siemens Bros., and is of the remote control pattern. In addition to the two steam-driven alternators, there is a motor-generator so that when the lighting load at the Railway and Docks is small, the load can be supplied from the alternator of this motor-generator; this plant was supplied by the General Electric Co., of London. The old battery station at Dorp Street has been dismantled, and a new battery shed erected and equipped, adjoining the Central Electric Light Works. The total cost of the extensions amounts to about £25,000.

Castleford.—The U.D.C. has decided to object to the application of the Electrical Distribution of Yorkshire, Ltd., for a year's extension of the electricity prov. order, which expires on August 2nd, "by reason of the neglect of the present holders, and that other and better arrangements might now be possible." The Wakefield and District Light Railway Co. having intimated that it was in a position to supply electricity at short notice, the Council has asked the company to submit details and a scheme.

Continental Notes.—Norway.—The municipality of the town of Kragerö, has resolved to erect a municipal power station, from which the town is to be supplied with energy for electric lighting. The power required, about 700 H.P., will be supplied from the generating station of the Norwegian Electrical Co., at Valsfos, about 11 miles from the town, and will be transmitted through the carbide factory belonging to the firm and situated in the town. The price stipulated in the contract, per horse-power per annum, is 50 kroner (£2 15s.). It is proposed to raise a loan of 150,000 kr. (£83,500) for the cost of the work. The municipality of Harstad, in the North of Norway, has adopted a similar course; power will be obtained from a waterfall at Gausvik, about 17 miles from the town, belonging to a manufacturing company, from which the town has secured up to 1,000 H.P.

Regarding the supply to Bergen, of electric power, the Municipal Board has decided in favour of plans which have been worked out by a committee with the view to harnessing the falls of the Samnanger River. The work is to be started at once, and a sum of one million kroner (£55,555) has been voted for commencing the work by harnessing the first fall, which is estimated to yield 7,000 H.P. at a total cost of 2½ million kroner (nearly £140,000).

Portugal.—The new central electric lighting station on the Tagus, of Compagnie Reunies Gaz et Electricité, of Lisbon, is now practically completed, and will shortly be inaugurated. The plant comprises 10 Belleville boilers, a 1,500-KW. Parsons steam turbine and Brown-Boveri alternator, a similar set of 1,750 KW., and two smaller sets of 750 KW. capacity each. The old Boa Vista power station, which has a capacity of 1,060 KW., will in future be used as a transformer station, for converting the alternating current from the Tagus station to continuous current. The capacity of the two plants is about 9,000 H.P. The company last year supplied current to the extent of 4,048,000 units, an increase of 836,000 units over the preceding 12 months. The mains now extend over 240 km., a supply being given not only to the whole of Lisbon, but along the coast as far as Mont Estoril, a distance of 25 km.

Germany.—A central station is to be established at Rudolstadt for the electric lighting, not only of that town, but also the neighbouring one of Saalfeld. The Siemens-Schuckert Co. and A.E.G. are interested in the undertaking.

Cuba.—It is announced on the authority of the Belgian Legation at Havana that private people have obtained concessions for electrical supply undertakings at Colon and Cienfuegos; in neither case has municipal sanction been obtained.

Derby.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £7,300 for electrical purposes, made up of £5,000 for mains, £500 for services, £900 for motors, £100 for radiators, £500 for transformers and chambers, and £300 for pipe lines, these amounts being for one year's requirements only, and the greater part being in connection with the supply of power. There was no opposition.

Edinburgh.—The last year's surplus on the electric light undertaking amounted to £2,071. It was proposed, at a meeting of the Corporation Electric Lighting Committee, that this sum be applied towards the redemption of the capital debt on the undertaking, but another motion to apply it towards the relief of the rates was carried. The charge for lighting is to remain unaltered.

Fleetwood.—Messrs. Broadstone, Ltd., of London, have informed the U.D.C. that they intend applying for a prov. order for electric lighting.

Gillingham (Kent).—A special meeting of the T.C. was held on July 23rd to consider the appointment of an expert to investigate the E.L. undertaking. A list of 12 experts was submitted, but the question of an appointment was deferred to give the L.G.B. an opportunity of considering the report of the borough electrical engineer, Mr. Chalmers, which the Board had not seen when it arrived at its recent decision with regard to the loan of £5,000.

Greenock.—The burgh electrical engineer has prepared an interesting report on extensions necessary at the power station, in view of the applications for current by the Admiralty for the new torpedo factory and by Messrs. Scotts' shipbuilding and engineering company. The latter firm having secured the contract for the building of one of the new Dreadnoughts, is making considerable additions to its power-using plant, and is prepared to enter into an arrangement with the T.C. to purchase the whole of the energy required for the purposes of its business under certain conditions, the first being that the rate for the first 500,000 units per annum should be 1d. per unit, for the next 500,000 units, nine-tenths of a penny, and for all in excess of one million units per annum, eight-tenths of a penny. The engineer reports favourably on the proposal, and deals with proposed extensions to the generating plant to meet the increased supply to Scotts' works and the Admiralty factory. He estimates the cost of this extension at about £10,000, which sum does not include the cost of the cable to the torpedo factory or Messrs. Scotts, which he places at £2,150 to the former and £420 to the latter, making a total for the whole extension of £12,482. It is understood that the offer of the British Westinghouse Co. has been conditionally accepted for providing the whole of the engine room plant for the extension at a cost of £4,300.

Llandudno.—The experiments conducted by the Lighting Committee as to the relative advantages of electricity and incandescent gas for lighting the Promenade, terminated last week, when the Council, on the recommendation of the Committee, decided to adhere to electricity for the present.

London.—Fulham.—The borough E.L. engineer having reported favourably on the changing-over of the Town Hall installation from carbon to metal-filament lamps, has been authorised to carry out the work at a cost of £208. The present cost of lighting is £417 per annum, and the estimated cost, after the change-over, is £184.

The Electricity Committee having tried metal-filament lamps for lighting Fulham Palace Road, in lieu of the present arc lighting, recommends that the whole of the lighting in that road, also in High Street, Fulham, should be converted at an estimated cost of £507.

Stepney.—The B.C. is to enter into an agreement with the Poplar B.C. for a minimum supply of 500,000 units by September 30th, by a continuous 250-KW. load, at a price of ·3d. per unit for energy supplied untransformed at the Limehouse sub-station. The supply is required during the transfer of certain plant from the Osborn Street station to the new building at Blyth's Wharf.

Poplar.—The fifth annual report of Mr. Horace Bowden on the work of the electric supply department for the past year shows a net revenue of £37,810 and a gross profit of £18,342; after meeting loan charges amounting to £14,662, and allowing for certain minor additions and deductions, the net surplus was £3,218. During the year 5,845,692 units were sold, including 1,083,523 units for private lighting; 3,972,099 for power and 789,690 units for public lighting. The average prices received were: private lighting, 3·337d.; power, 1·057d., and public lighting 1·5d. per unit; and the total works costs amounted to ·799d. per unit, with a load-factor of 23·83 per cent. and a maximum load of 2,800 KW.

New South Wales.—The Newtown Municipal Council has had under consideration the question of electric lighting, Major Cardew having reported on the matter.

The Moree Municipal Council has applied for permission to borrow £3,900 for public and private electric lighting work.

The last portion of the Sydney City Council's electric lighting plant has recently been converted from single to three-phase by Messrs. Noyes Bros., Ltd.

New Zealand.—The Wellington Municipal Electricity Department earned some £44,321 last year, and after meeting financial charges, &c., there was a surplus of £4,272.

Northampton.—The Markets and Town Hall Committee has recommended the T.C. not to proceed with the scheme for generating electricity for lighting the Town Hall and offices, on account of the expense, which is estimated at £2,134, exclusive of the provision of a building for the plant. With a view of reducing the present cost of lighting, 4½d. per unit with an annual consumption of from 16,000 to 17,000 units, metallic-filament lamps are to be experimented with as renewals are required.

Penzance.—The B. of T. has informed the T.C. that it is intended to revoke the E.L. order granted to a company in 1904, and the Council has decided to take no action in the matter.

Preston.—The T.C. has been recommended not to purchase the undertaking of the National Electric Supply Co., Ltd.

St. Ives.—Messrs. Foote & Milne have informed the T.C. that they intend applying to the B. of T. for a prov. order for E.L.

Sheffield.—On July 21st a L.G.B. inquiry was held relative to the application of the T.C. for a loan of £56,000 for electricity purposes. There was no opposition. It was mentioned that the T.C. was seeking to extend the mains to Tinsley with the consent of the Yorkshire Electric Power Co., in whose area the district is.

Stoke-on-Trent.—The L.G.B. has declined at the present time to sanction a loan to the T.C. of £650 for the installation of a water-cooling plant at the electricity works.

Stourbridge.—The Midland Electric Corporation for Power Distribution, Ltd., is about to commence the laying of mains in the town, and it is anticipated that a supply of energy will be available by October. For private lighting the price will be 4d. per unit, less ½d. per unit for prompt payment of accounts; and for shops, public houses, and other places where there will be long-hour lighting, the discount will be 1½d. per unit.

Sutton (Surrey).—In regard to the recent proposed increase of charge for current by the South Metropolitan Electric Lighting and Tramways Co., the Town Clerk has been instructed to write to the company, that it appeared to the Council that the Board of Trade could be approached with reference to the reasonableness of the charges for current, but that before considering this it was suggested that a friendly conference with the company upon the matter, at which the views of the various interested parties could be given, might be advisable.

Swanage.—Messrs. Foote & Milne, Ltd., have given the U.D.C. notice that they intend applying for a prov. order for electric light.

Transvaal.—The Nylstroom municipal authorities are arranging to install electric lighting. The directors of the City Deep, Ltd., have offered a handsome bonus to the Victoria Falls and Transvaal Power Co., Ltd., to supply power this month, *i.e.*, three months ahead of the specified time.

A special report of the Select Committee on the Transvaal Electrical Energy Private Bill, recommending that the proceedings of the Council on the Bill be suspended, and resumed in the following session, has been adopted by the Legislative Council.

Uxbridge.—The Board of Guardians at its last meeting considered matters in relation to the lighting of the workhouse. The chairman (Mr. Stilwel) said the medical officer had reported in favour of electric lighting. He (the speaker) was of opinion that gas was the cheaper, but that electricity would be the better both as regards the purity of the atmosphere and the cost of keeping the establishment clean. Mr. Houlder pointed out that up to the present they had received no estimates as to the cost of the suggested alterations in the lighting. Mr. De Salis said that the electric lighting company charged 5d. per unit, and he suggested that the Guardians could generate electricity at a very much cheaper rate. He moved "That subject to the cost being hereafter approved, it is desirable that a system of electric lighting should be installed, the light to be generated by a plant owned by the Guardians." Mr. Bailey pointed out that gas was supplied to the workhouse at 3s. 3d., which, considering that the price in London was 3s., was very fair. The company had even promised a reduction on the 3s. 3d. Mr. De Salis's proposal was rejected by 7 votes to 4, and a committee was appointed to go into the whole question and report to the Board.

Walthamstow.—The electrical engineer has prepared a report with regard to the proposed extension to Highams Park. He estimates the total cost at £6,828 made up as follows:—Converting plant at works and transformer sub-station, £2,060; high-tension cable and spare conduits, £2,554; distributing cables, £2,214. The last mentioned amount would cover the laying of distributing cables in 13 roads. He did not think the revenue to be derived during the first two or three years would meet the loan repayments and interest on the outlay, but ultimately as the district developed, there appeared to be no reason why it should not be financially successful. The Electricity Committee has decided in favour of adjourning the consideration of the matter for two months, and has also adjourned the consideration of the conversion of the whole of the street gas lamps, excluding those in Highams Park, to electric light. In regard to the last-mentioned scheme the electrical engineer is to submit a detailed report to each member of the Council. A special meeting of the Committee is afterwards to be held to go into the matter.

West Ham.—The report of Mr. A. H. Seabrook on the working of this undertaking to March 31st last shows a credit balance of £3,854 on the year's working, an improvement over the previous year of £8,522, which is attributed to the increased power business. The revenue from lighting actually decreased from £23,996 in 1907-8, to £22,784, due to well-known causes, but there was an increase in power revenue of nearly £8,200. The output for the year amounted to 15,522,065 units, as compared with 11,299,783 units in the previous year. The former amount includes 1,928,528 units for lighting, 785,157 for public lighting; 8,190,453 for power and heating; and 4,617,927 units for traction. As regards the output for power, this shows an increase of practically 100 per cent., the motors connected increasing from 445, of 6,224 H.P., to 833, of 8,683 H.P. The maximum demand on the station was 6,100 KW., and the load factor 29·1. The total revenue amounted to £67,202, and the gross profit to £33,365, or 7·78 per cent. on the capital. The total works costs fell from ·72d. per unit in 1908 to ·52d. per unit in the past year; while the average price during the past year for all classes of supply amounted to 1·02d. per unit, and for individual supplies was as follows: Private lighting, 2·72d.; public lighting, 1·53d.; power, ·591d.; and traction, ·997d. per unit.

TRAMWAY and RAILWAY NOTES.

Continental Notes.—NORWAY.—In Drammen, at the Christianiafiord, a company has recently been formed for the purpose of building a new electric rail-less tramway. Nearly the whole of the share capital, which is fixed at about £8,000, has been subscribed for, and the work will be commenced in the near future.

HUNGARY.—An electric generating station is about to be established in the town of Czinkota for the supply of the current required for the local electric tramway.

AUSTRIA.—A public service of electrical motor vehicles on the Mercedes-Electrique-Stoll system has just been inaugurated between Liesung and Kalksburg, a distance of about 2 miles. The cars take the necessary current from overhead conductors.

GERMANY.—A project has been brought forward in Germany for the construction of a suspended electric railway between the island of Nordeney and Norddeich, which is the present starting point for steamers to this island in the North Sea. By this means the sea journey by ship would be avoided, and a connection established which would permit of the passage from the terminal railway station on this part of the Continent to the well-known seaside resort being accomplished in the course of a few minutes. The length of the proposed railway would be about 6·2 miles, and the line would be carried on concrete columns arranged on the sandbanks of the shallows. It is intended to provide a double track and a 10 minutes' passenger service of trains in operation only during the day, whilst the line would be exclusively used for the transport of goods in the night. The estimated expenditure on the construction of the railway, which would be furnished with power from the Wiesmoor electricity works, shortly to be opened, is put at £100,000. It is assumed that the Government would financially participate in the undertaking, as its execution would render a large outlay on harbour and railway works at Norddeich quite unnecessary.

TURKEY IN ASIA.—A third line of electric tramways has just been completed and put in operation in the town of Bayreuth.

FRANCE.—The first section of the electric funicular railway from Le Fayet to the summit of Mont Blanc was opened to the public on July 25th; the section reaches to Col de Voza, 5,495 ft. altitude, covering some 7½ km, with grades of 1 in 5 to 1 in 12. The line is constructed in the open, and work is to be commenced shortly on the next section, 8 km. long, to Tete Rousse, 10,300 ft. high.

Devonport.—In April last the Corporation issued summonses against the Devonport and District Tramways Co. for failing to run a service which had been prescribed by the Corporation upon the tramways in the borough leased by the Corporation to the company, and also for failing to run certain workmen's cars on such lines. Before the summonses were heard, the company applied *ex parte* to the Divisional Court for a rule of prohibition to prevent the magistrates from hearing the summonses. The Corporation, on the 14th and 15th ult., showed cause against the rule being made absolute, when the Divisional Court gave judgment in favour of the Corporation, and discharged the rule with costs. The company gave notice of appeal from this decision. We understand that the notice of appeal has now been formally withdrawn by the company, and that the summonses will come on for hearing before the Devonport magistrates.

East London Railway.—The directors' report for the half-year to April 30th last, touches on the question of electrical working, as usual. It is pointed out that as the Brighton Co.'s Victoria-London Bridge line is not yet working, no data as to the comparative cost of working the overhead and third-rail systems are yet available, and therefore the directors are unable to make any suggestion as to electrification at present.

Ilford.—For the first year since the tramways were laid down in 1903, the working (during the past twelve months) has resulted in a loss. This was due to the motor-'bus competition, owing to which an increased service of cars was run on the High Road and Ilford Lane route. There was an increase of expenditure of £1,020 caused solely by this increased service, while, on the other hand, there was a decrease on receipts of £526. These two figures had turned the net profit of £1,401 in 1908 into a net loss in 1909 of £1,431. For the three months ending June there had been an increase in the revenue of £600, there being also a decrease in car-mileage and current consumed.

Keynsham.—The Bath Electric Tramways Co. has applied to the B. of T. for an extension of three years for the construction of the tramways to Keynsham.

Liverpool.—The City Council has received for consideration a recommendation from the Tramways and Electricity Committee that a supplementary estimate for £11,112 be approved for the doubling of the tramway lines, &c., in Netherfield Road.

Liverpool-Southport Railway.—Through the breakdown of a H.T. cable at the Formby generating station of the Lancashire and Yorkshire Railway, traffic on the electrified section of the railway between Liverpool and Southport was disorganised for some time on Thursday morning. The supply of current between Formby (which is near to Southport) and Liverpool was cut off, but the railway staff made temporary arrangements for the conveyance of passengers by using steam engines, and in the course of the day the cable was repaired, traffic being resumed on Friday morning.

New South Wales.—The Sydney suburban authorities have been invited to join a movement with a view to persuading the Government to consider the advisability of electrifying the whole of the suburban railways.

The Railway Commissioners have now decided to electrify the Newcastle tramways.

Portsmouth.—The Tramway Committee has found that the result of the year's working is a profit balance of £2,297, which has been arrived at after every charge on the undertaking has been liquidated, allowing for interest and sinking fund and putting aside the usual amount of £10,900 for maintenance and £2,500 for insurance. The Finance Sub-Committee is to consider the question of the disposal of the balance, which may be applied to the relief of the rates.

The Mayor of Portsmouth (Councillor J. Baggs) acted as tramway motorman on Tuesday last week, when he drove the gaily-bedecked car containing the members of the Corporation over the extension of the tramways from Fratton Bridge to Milton. Afterwards his Worship drove the whole of the way from the Milton terminus to the Town Hall, where the party adjourned to the Banqueting Room and were entertained by the Mayor to lunch. This extension has been finished, and is now working, before the provisional order authorising its construction has been granted, and there has been a saving on the estimated cost of over £3,000. The total cost of the work was £11,341 16s. 4d., and the estimate was £14,407. The saving was in the cost of materials.

Tasmania.—The Launceston City Council, having failed to come to an arrangement with the London syndicate for the construction of the tramways, is taking a poll of the citizens, with a view to obtaining sanction for itself to construct and work the lines.

Transvaal.—An electric railway between Johannesburg and Pretoria is being advocated locally.

West Australia.—A loan of £30,000 is to be obtained to extend the Fremantle Municipal electric tramways.

West Bromwich.—The Highways Committee of the Corporation has issued a report dealing with certain matters in dispute between itself and the South Staffordshire (Lessee) Co. regarding the working of the tramways in the borough. The Committee claims that, by an agreement which the Town Council entered into with the company in December, 1905, and in consideration of a number of concessions, including the substitution of another system for the Quin cut-out system, the running of a less frequent service, and also of smaller cars, the company covenanted to take from the Corporation a minimum supply of electrical energy of 900,000 units per annum instead of a minimum of 300,000 units per annum at the prices fixed by the lease, this minimum to be continued during the term of the lease. The company had ever since that time had the benefit of the concession made by the Council, but they had refused to execute the agreement on the ground that it was not part of the arrangement that they were to pay for a minimum supply of electrical energy equal to 900,000 units per annum at the prices fixed by the original lease during the remainder of the term of the lease. The Committee states that it has no hesitation in declaring that the increase of the minimum supply was an important factor in persuading it to grant the concessions asked for by the company. The Committee, having received this definite refusal on the part of the company to complete, has instructed the town clerk to write to the tramways company requiring the agreement as settled by him with the South Staffordshire Tramways (Lessee) Co. to be sealed within 14 days, or in default, to take proceedings to compel them to comply with the terms of the original lease.

TELEGRAPH and TELEPHONE NOTES.

Australia.—It is probable that the Eastern Extension and China Telegraph Co. will soon pick up their cables between Low Head, Tasmania, and Flinders, Victoria, thus leaving the telegraphic business in the hands of the Commonwealth Administration.

Brazil.—A new radio-telegraphic installation has been erected on the Morro da Babylonia, Rio de Janeiro, on the Telefunken system. The station is 250 metres above the sea-level, and has a radius of 200 km.

Cheaper Cables.—The British, Indian and Australasian Governments having agreed to bear their rateable share of the reduction, the tariffs for Press telegrams exchanged between Great Britain and the under-mentioned countries, *via* Eastern or *via* Indo, will, from the 1st prox., be reduced as follows:—India and Burma, to 9d. per word; Ceylon, to 9½d. per word; Australia, Tasmania and New Zealand, to 9d. per word. The rates to South Africa have also been reduced by about 3d. a word.

France.—In appointing M. Millerand as Minister of Public Works, the new Government has placed him in direct personal control of the Department of Posts and Telegraphs, which was previously headed by an Under-Secretary of State, M. Simyan being the last to hold that appointment. M. Millerand states that his first aim will be to reorganise the telephone service, and to promote the adoption of a measure determining the exact status of State employés, particularly of civil servants.

Telegraphic Interruptions:—

Tangier-Cadiz	May 19, 1909
Assah-Perim	July 8, 1909

Wireless Telegraphy.—Referring to the decision of the Government that it was desirable that, at any rate, the principal wireless stations for communication with ships should be not in private hands, but in the hands of the Government, Mr. Buxton recently remarked that no licences for such stations had been given or promised for more than three years from the present time, and therefore in any case the Government would be able to take the service into its own hands. "But I think it would be desirable," he added, "to anticipate that date and take over the stations at once if it is found possible, as I hope it may be, to make an arrangement for that purpose which will be acceptable to the Marconi Co. and other interests concerned."—*Daily Telegraph.*

Referring to the negotiations mentioned by Mr. Buxton, having for their object the acquisition of the Marconi wireless stations round the coast, the deputy-manager of Marconi's Wireless Telegraph Co. pointed out to the Press Association that the licences were originally granted for eight years, and as the company had "provided a thoroughly efficient public service during the past five years," and was still in a position to do so, it was hardly reasonable to suppose that Mr. Buxton, three years hence, would desire to give effect to his suggestion, which would practically amount to confiscation of the company's property. Mr. Marconi stated that the offer made by the Post Office was so inadequate that the directors of the Marconi Co. decided that it could not be accepted.

The arrangements hitherto in force for the transmission of radio-telegrams to his Majesty's ships through coast stations have been discontinued, and the Post Office will no longer accept such telegrams.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — MELBOURNE. — August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

NEW SOUTH WALES.—Telephone material for the P.M.G. See "Official Notices" July 23rd.

Ballinasloe. — September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" to-day.

Canada.—WINNIPEG.—August 2nd and 16th. The city of Winnipeg is advertising for tenders for the hydraulic and electric equipment of the generating station now under construction on the Winnipeg River, at Thirty-foot Falls. Some particulars were given in this column on July 2nd.

Cleckheaton.—The U.D.C. wants tenders for the purchase of two battery regulating switches. See "Official Notices" to-day.

France.—PARIS.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

August 11th.—The Direction de la Manufacture d'Armes at Châtellerault (Vienne) requires tenders for cables, copper wire, and dynamo construction material (11 lots).

August 5th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for telegraph apparatus and accessories; also by August 3rd for a number of tools required to repair telephone and telegraph installations and apparatus.

Germany.—August 4th. The gas, water and electricity authorities in Dresden are inviting tenders for the supply and erection of two 700-KW. dynamos.

COLOGNE.—August 25th. The Municipal Council requires tenders for four electrically-driven cranes.

The Stadtisches Maschinenbauamt, Cologne, is inviting tenders until August 25th for the supply of four electrically-operated cranes.

Italy. — August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as from home makers for the supply of 100,000 metres of telegraph cable.

August 18th.—The Italian State Railway authorities in Rome are inviting tenders for the supply of six electrically-operated drop hammers.

Keighley.—August 7th. Two 1,000-KW. turbo-alternators with condensers, and two water-tube boilers for the electricity department. See "Official Notices" July 16th.

London.—G.P.O.—August 9th. Creosoting telegraph poles for the P.M.G. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Salford.—August 9th. The Corporation wants tenders for the purchase of a steam dynamo of 120 KW. See "Official Notices" to-day.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

August 27th.—Tenders are invited by the Direccion General de Obras Publicas, at Madrid, for the taking over of a concession for the building and working of a system of electric tramways in Barcelona. A deposit of 40,596 pesetas must accompany the tender.

Turkey.—The Ministry of Marine, in Constantinople, invites tenders for the supply of electrical apparatus for the Imperial fleet. Inquiries should be addressed to the Conseil de la Marine, Constantinople.—*B. of T. Journal.*

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" to-day.

CLOSED.

Bedford.—The Electricity Works, Cauldwell Road, Bedford, have placed an order with Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, for one pair of "Bennis" 1909-model high-duty coking stokers and self-cleaning compressed-air furnaces for an 8-ft. Lancashire boiler.

Belgium.—Four concerns submitted tenders for the extension of the electric lighting undertaking in the town of Tongres, the lowest being that of the Compagnie Belge Siemens-Schuckert, of Brussels.

Birmingham.—The District Drainage Board has accepted the tender of Messrs. Crompton & Co. for a motor and pump for the Saltley pumping station, at £877; and that of the General Electric Co., Witton, for similar plant at the Minworth station, at £423 10s.

Cape Colony.—*African Engineering* states that Henley's (S.A.) Telegraph Works have received an order for some cables in connection with the lighting of Green and Sea Points, Cape Colony. Messrs. W. T. Glover & Co., of Manchester, are supplying the overhead wires for the same lighting.

Dudley.—The Springsmire Electricity Works have placed an order with Messrs. Ed. Bennis & Co., Ltd., Bolton, for one pair of "Bennis" stokers and compressed-air furnaces for a Babcock boiler.

Greenock.—The Corporation has placed a contract for one 1,000-KW. turbo-alternator, one 750-KW. alternator, high-tension switchboards, and two 450-KW. rotary converters and sub-station switchboard with the British Westinghouse Electric and Manufacturing Co., Ltd.

Ilford.—The Education Committee has accepted the tender of Mr. Edgar Porter, of 221, High Road, Ilford, for the electric light installation at the new schools at Goodmayes, at £333 8s.

Llandudno.—The Tramways Co., for which Messrs. Stephen Sellon & Partners are consulting engineers, has awarded a contract for seven Warner trucks (non-parallel axle), with 10-ft. wheel base, to Messrs. Mountain & Gibson, Ltd., of Bury, Lancashire.

London.—The L.C.C. has accepted the tender of Messrs. Hurst, Nelson & Co., Ltd., for the supply of a special truck, fitted with two sets of mechanical brakes, &c., for use on steep gradients, at £247, with £40 for extra work if required.

Contracts have been placed with Messrs. G. Hayward & Co., Ltd., for the supply of 10 travelling platforms for painting cars at the Holloway car-shed, and 41 movable platforms for cleaning cars at Norwood car-shed; with the British Westinghouse Co. for repairs to that company's motor-generators at an estimated cost of £2,163; with Messrs. Cammell, Laird & Co., Ltd., for steel tires, at £2,473 15s.; and with Messrs. Hurst, Nelson & Co., Ltd., for 260 destination indicator boxes for cars, at £799 10s.

STEPNEY.—For the supply of cable required at the Blyth's Wharf station, the Electricity Committee recommends the acceptance of the tenders of (*a*) W. Geipel & Co. for 30 yd. 0·3 sq. in. paper-insulated cable, at £30 5s. 7d., and 110 yd. 0·05 sq. in. rubber-covered and fireproofed cable, at £20 6s.; (*b*) Baxter & Caunter, 300 yd. 1·0 sq. in. rubber-covered and fireproofed cable, at £270.

FULHAM.—The B.C. has placed an order through the architect, with Messrs. Higgins & Griffiths, at £57 10s., for special electric light fittings for the new central library. The order for the plain electric light fittings is to be placed by the electrical engineer at an estimated cost of £142 10s., so that the Council may get the benefit of the discount.

Northampton.—The T.C. has accepted the tender of the Premier Accumulator Co. for 12 new sections for the battery in connection with the tramways, at £33 18s. per section.

Rotherham.—The T.C. has accepted the tender of Halley's Engineering Co. for a motor tower wagon for the tramways, at £685.

Rugby.—The U.D.C. of Rugby (per Messrs. Tinkers, Ltd., Hyde) has placed an order with Messrs. Ed. Bennis & Co., Ltd., Bolton, for one "Bennis" coking stoker for a Cornish boiler.

Southport.—The Education Committee has accepted the tender of Messrs. R. A. Ault & Sons, of Talbot Street, Southport, for electric bells for the schools, at £35.

NOTES.

City and Guilds of London Institute.—The report of the Council for the past year contains a brief account of the relations between the Institute on the one hand, and the University of London and the Imperial College on the other, as well as of the two latter to one another, a matter which is now under the consideration of a Royal Commission. Representations have been made to the University regarding the holding of a Degree Examination in Engineering common to all classes of students, regardless of the character of the courses of instruction they have undergone, a circumstance which reacts unfavourably upon the curriculum of the Central Technical College, and tends to produce uniformity of teaching, to the detriment of specialisation and originality. To correct this, the Board of Studies has recommended that special examinations of the students of the Central Technical College shall be held by the University examiners, in association with the Professors of the College and with direct reference to the courses given.

The Council refers with regret to the death of Prof. Ayrton, who was appointed on the staff of the Institute in 1879, and led the way in the development of technical training in electrical engineering. Mr. T. Mather, F.R.S., was appointed acting-professor in his stead.

The transfer of the first-year instruction in Physics and Chemistry to the Royal College of Science has set free space in the Central Technical College for engineering work, and has enabled special courses of post-graduate work in Railway Engineering to be organised, special series of lectures being given in these courses by Mr. H. S. Brown and Mr. Philip Dawson.

The number of students attending the Central Technical College in the session 1907-8 was 438, compared with 457 in the preceding year; of these, 113 followed the course in Electrical Engineering, as compared with 126 in the previous year, and 222 took Civil and Mechanical Engineering. At the end of the session, 91 students received the Diploma of Associate, and of these some 14 continued their studies at the C.T.C. Mr. R. E. Neale gained the Siemens Memorial Medal and Premium in Electrical Engineering. Twenty-three students obtained the degree of B.Sc. (Engineering), in the University of London.

The equipment of the engineering department of the Technical College, Finsbury, has proceeded during the year; the electrical department has been re-arranged and the equipment extended. Of a total of 186 day students attending the College, 76 followed the Electrical Engineering Course; 298 evening students attended complete or special courses.

As the result of the session 1908-9, the Council has awarded the Diploma of Associate to 98 matriculated third-year students of the Central Technical College who have completed a full course of instruction as prescribed by the Council—65 in civil and mechanical engineering, 28 in electrical engineering, and five in chemistry. The Siemens Memorial Medal and Premium has been awarded to Mr. F. H. Bramwell. Certificates have been awarded to 20 matriculated third-year students who have completed a full course of instruction at the Central Technical College and to 59 students who have completed a full course of instruction at the Technical College, Finsbury.

English Craftsmanship.—The Council of the Association of Teachers in Technical Institutions, acting on behalf of members of the Association who are teachers of artistic trades and crafts, has passed a series of resolutions embodying reforms which the latter consider urgently needed in the interests of English craftsmanship. The following main divisions have received attention: The standard of work; the relative amount of hand and machine work in each craft; the conditions of apprenticeship and the existing means of training apprentices; the work of existing evening trade classes; and the need or otherwise for day trade schools.

The Association holds that, if the standard of English craftsmanship is to be maintained, it is imperative that boys should be trained in the principles and practice of the crafts. At present this type of training is non-existent. The London Artistic Trade and Craft Teachers therefore strongly urge that national and local education authorities should provide this training; and that the establishment of day trade schools is the only satisfactory method of accomplishing this work.

Apprenticeship in London in the artistic trades and crafts has almost ceased to exist, and where it does exist, there is no guarantee that boys will be properly taught the trade at which they are working. For reasons of economy, masters generally train a "one-process" boy, and such training is held to satisfy their legal obligations.

The training of boys under the present industrial conditions would be better carried on in day trade schools than in shops. The trade schools would discover the boy's natural bent, and by directing it and giving the boy a definite purpose in life, would prevent wastage. Time spent in the schools should count as part of apprenticeship, or be accepted in place of apprenticeship, the boy going into the craft as an "improver."

Every parent should have the opportunity of providing a training at a day trade school for his children, should he desire it.

It is strongly urged that all teachers in trade schools should have had workshop experience; that the want of academic or technical certificates should not be a bar to the appointment of a good teacher; and that heads of trade schools and heads of departments should be men of reputation in some trade or profession other than the teaching profession.

The Section also strongly urges the desirability of appointing advisory committees (where such are not in existence) to each trade school, such committees to include representatives of employers and craftsmen.

Evening trade classes have done, and are doing, valuable work, though often at the sacrifice of necessary recreation and sometimes of health. The Section therefore urges the establishment of earlier evening classes for the younger boys, pending the establishment on a large scale of day courses of instruction. At these evening classes there should be adequate provision in the way of scholarships and free places.

The Retort Courteous.—A metropolitan technical journal recently received from a country firm the following note:—

"Dear Sirs,—This day we have placed an order for an advertisement with your Mr. Smart, thanks to his consummate impudence. Where on earth did you pick him up?"

As Mr. Smart had only just commenced his duties, and all his predecessors had canvassed the firm in vain, his employers were naturally desirous of questioning him on this charge of "consummate impudence."

"Well," said the young traveller, "you advised me to adapt myself to circumstances, and to meet probable customers with their own weapons. In this instance the manager apparently ignored me for several minutes, and then he roared out: 'Now, young fellow, what blood-sucking firm do you represent?' I handed him your business card, and replied: 'These bleary-eyed vampires!' and it seemed to tickle him immensely."

The S.P. Surface-Contact System.—At the works of the J.L. Manufacturing Co., Ltd., Southall, a demonstration was given on Saturday, the 17th inst., of the new surface-contact system known as the "S.P." or "Simplex." The patents for this system were taken out by a Russian named Mr. D. Suchostawer, and are owned by the S.P. Syndicate, Ltd., who have made a working arrangement with the J.L. Manufacturing Co., Ltd., for the hire of their tramcar and experimental track, with a supply of current at 500 volts. The J.L. Manufacturing Co., Ltd., did all the necessary constructional work of fitting this up on the S.P. system. The demonstration was entirely successful, the car being driven round the track, and stopping, starting and reversing with ease. The lights and indicating apparatus on the car showed that a constant and steady current was collected from the studs, and no live studs remained on the passing of the car, a feature of safety which the syndicate claim as peculiar to their system.

The principal features of the system consist of the magnet carried on the car—extending for nearly its whole length—with a flexible iron-wire skate, and studs provided with mechanism of a new design. The iron stud has a central brass stem, round which there is an iron plunger, which is attracted upwards towards the top of the stud when the magnetised skate makes contact with the latter. Two brass arms carrying at their outer ends carbon contact blocks are connected to the plunger, and when this is attracted, the blocks are brought into contact with either side of a lug screwed on the live wire. Flexible conductors carry the current from the carbon ends to the brass stem of the stud. The studs are set about 6 ft. apart, and the skate is nearly twice this length, so that there is no interruption to the collection of the current. The iron frame of the stud-box helps to complete the magnetic circuit through the outer poles of the magnet, and thus increases the force with which the plunger is attracted. It is claimed that it is almost impossible for the mechanism to make and to maintain contact with the live wire after the car has passed; but a pilot brush is provided behind the skate, connected with an alarm bell, to give warning if a stud should remain alive. The construction of the box, which has a movable frame resting in a fixed frame with a close-fitting machined joint, is such that the movable part can be taken out with ease. The depth of the box is but little more than that of the rails. The live wire is laid in an earthenware trough, filled up solid with bitumen except at the boxes. In reports on the working of the tramway at Southall, Mr. H. M. Sayers and Mr. H. C. Furniss speak very highly of the behaviour of the system and of its simplicity.

The German Lamp Taxes.—The proposed taxes on gas and electric lamps have now passed through all their stages, and will come into operation on October 1st; the annual yield to the State Treasury is expected to amount to £1,000,000. It has been left to the Federal Council to determine the manner in which the taxes are to be levied, although regulations on the subject have yet to be issued. It is possible to levy the import in two ways; either by the use of a banderole or paper strip placed round the articles, or by means of the so-called hook tax. If the Federal Council were to adopt the former method, which is considered to be scarcely worthy of assumption, an army of inland revenue officials would be necessary to exercise control, as there are from 40,000 to 50,000 dealers in the country. As to the application of the tax in general, it is understood that the lamp makers will charge the tax to the merchants, who in turn will make consumers pay it. It has yet to be settled whether the Government will compel manufacturers to pay the tax in advance or whether the latter will be granted a respite. The difference between the two systems is of importance, in so far as prepayment would involve makers in a loss of interest. The introduction of the tax at the beginning of October will result in an increase in prices to the public. Carbon-filament lamps up to 15 watts will then be sold at 1s. 9·6d. each, as compared with 1s. 9d. at present; metallic-filament lamps up to 15 watts, which have hitherto been available at 2s. each, will be 2s. 1·2d., and incandescent gas mantles will be sold at 4·2d., as against 3d. at present.

Electrical Fatalities.—An inquest was held on Monday at Manchester on the body of John Davies (35), of Peel Street, Pendleton, an employé at the Manchester Corporation Electricity Works, Stuart Street. On the 22nd inst. one of the engineers told deceased to remove two transformers from one end of the spark-gap gallery to the other, and deceased came into contact with a live stud.

Mr. H. Lamb, acting resident engineer at the works, explained that the transformers were used for the purpose of reducing from high pressure to low pressure. At the time of the accident there were about 3,750 volts on the spark-gap. Davies had taken one transformer to its place and was returning for the other. Around the spark-gap there was a guard in the form of a rail. Deceased had gone inside the rail instead of keeping outside.

John Wall, labourer, said they had got one transformer in position and were on the point of fixing the second. The transformer was between him and the deceased, whom he saw suddenly lift up his hands above his head and fall unconscious to the ground. In answer to the Coroner, witness said he thought Davies had gone inside the rail because it was easier, though witness did not see that there was any necessity to do so.

The sub-station attendant said he was on a gallery above, when he saw deceased walking along inside the rail. He was going to warn him, but had not time before the flash occurred, when he saw deceased roll over.

Dr. Telford said death was due to suffocation, that being the ordinary kind of death when high electric currents passed through the body.

Mr. Pearce (chief of the electricity department) was asked by Mr. Gibson if there was any more modern system existing than the one of the Manchester Corporation. Mr. Pearce replied that he did not know of any or that there was any more recent design. As a matter of fact, the design at the works in Stuart Street was the "last say" in the matter of spark-gaps. There was only one small spot on the stud unprotected. The Coroner: But what about a glass screen round the stud? Would that not be a safeguard?—If you had these studs covered up, you would be introducing new dangers. Glass is altogether out of place in connection with high-tension apparatus, and if a man wants to make a thorough investigation of them, he is in considerable danger in taking the covering away, for the sparks must be seen.

The Coroner pointed out to the jury that, as the deceased had worked there for nearly four years, he ought to have known better than to go inside the rail.

Mr. Brocklehurst expressed sympathy with the deceased's relatives, and said that anything the Corporation could do to relieve their burden in the way of compensation would be done.

A verdict of "Suffocation due to electric shock" was returned.

An inquest was held on the 23rd inst. at Ystradgynlais, touching the death of David Davies (24), who was killed on the previous day at Yniscedwyn Colliery.

Mr. R A. Gower, electrician, said that on examination of the spot immediately after the accident occurred, he found a broken cable, evidently the result of a fall of stones.

The jury returned a verdict of "Accidental death from electrical shock."

A New Aluminium Combination.—The first practical step in connection with the proposed revival of the international aluminium syndicate has been taken, by the arrival at a complete agreement of the representatives of the French producers at a conference held in Paris on July 19th. It is now intended to approach the Aluminium Industry Co., of Neuhausen, with the object of coming to a fresh understanding which, if concluded, will probably foreshadow the re-establishment of the syndicate. The Paris conference was the second of the kind. The announcement of the first conference has already led to considerable dealings, on the one hand, in the shares of the Swiss company at Zurich, which advanced by 10 per cent. in the four days ending with July 16th, whilst a further result is afforded by a report from Mannheim to the effect that the German merchants have just raised the price of aluminium by from 4s. to 5s. per cwt., up to 64s. per cwt. It is not known for the moment whether the

French companies have yet made any advance in the price of the metal, but it is understood that the demand has grown in recent months, whereas a sudden decline took place in 1907 and continued during 1908, although it has to be borne in mind that the productive capacity of various countries has been largely increased in the past two years. The stocks of two French companies are reported to have been cleared, and apparent confirmation of the expansion in requirements is shown by the circumstance that the exports of aluminium from France in the first five months of this year amounted to 617 tons, as compared with only 126 tons in the equivalent period in 1908.

The Eight Hours' Day.—An evening contemporary states that after an extended trial the eight-hours' day, which Mr. Arthur Chamberlain established in connection with Kynochs (Limited), has been discontinued, the company being handicapped in competition with rivals.

Institution and Lecture Notes.—American Institute of Electrical Engineers.—The twenty-sixth annual convention was held at Frontenac, N.Y , on June 28th to July 1st, and according to the *Electrical World*, was one of the most pleasant recorded. The total attendance numbered 252. President L. A. Ferguson opened the convention and delivered his presidential address, after which the President-elect, Mr. L. B. Stillwell, was installed in the chair. He stated that the Institute numbered about 600 members, and 6,000 associates. Emphasising the importance of electrical engineers taking part in public affairs, he declared that a broader training in the "English branches" was essential; intellectual mechanics could be had in any number for small salaries, but the demand of the time was for men who were capable of doing real engineering work, and presenting the facts in a clear and comprehensive manner. A large number of valuable and interesting papers were read and discussed.

Institution of Municipal Engineers.—The first annual general meeting of the Institution will be held at Durham on Saturday next week; the members will be received at the Town Hall by the Mayor, and after the presentation of the annual report of the Council, Mr. Horace Boot's paper on "The Design and Requirements of Electric Power Works," which was presented at the general meeting on April 24th last, will be discussed. Other papers will follow, and at the conclusion of the meeting the result of the ballot for election of the Council for the year 1909-10 will be announced.

On the 17th inst. about 30 members of the Rochdale and District Motive Power Mutual Improvement Society visited the works of Messrs. Ed. Bennis & Co., Ltd, Little Hulton, Bolton. They were conducted through the shops by Mr. A. W. Bennis and shown the different branches of coal and labour-saving apparatus in their various stages of manufacture.

North-East Coast Institution of Engineers and Shipbuilders.—The address of the Institution has been changed to Bolbec Hall, Westgate Road, Newcastle-upon-Tyne.

Institution of Mechanical Engineers.—This year's summer meeting of the Institution, covering four consecutive days, opened at Liverpool on Tuesday at the Municipal Central Technical School, under the presidency of Mr. John A. F. Aspinall (president), of Manchester, and in the papers which were submitted, the application of electricity to engineering was not neglected. The papers prepared were:—"Locomotives Designed and Built at Horwich," by Mr. Geo. Hughes, of Horwich; "Advance of Marine Engineering in the Early Twentieth Century," by Mr. Arthur Maginnis, of Liverpool; "Reinforced Concrete," by Mr. Arthur G. Anden, of Liverpool; "Indicating of Gas Engines," by Prof. F. W. Burstall, of the Birmingham University; and "The Electrical Operation of Textile Factories," by Mr. Herbert W. Wilson, of Liverpool. It had been announced that Mr. Alaric Hope, of Liverpool, would contribute a paper on "Hydraulic and Electrical Appliances on the Liverpool Dock Estate," but the subject was not included in the final programme. The local arrangements have been in the capable hands of Mr. Thos. L. Miller, M.I.E.E.

In a lengthy review Mr. Arthur J. Maginnis, M.Inst.C.E., expressed the opinion that there would soon be an extensive application of electric power direct to the propeller shafts. Among the advantages likely to accrue from the adoption of direct electrical shaft drive, it was mentioned that reversal of the propeller with full effective power is readily effected, and that the design of plant, steam and electric, can be so modified as to enable the naval architect to make better and more profitable arrangements for passenger and cargo space. Owing to the fact that lower boiler-pressure can be used by the steam turbine generator, it was anticipated that the weights of the steam and electric plants together would not exceed that of the present system of reciprocating machinery, and that the first cost would average about the same. Of the advantages of this system, one which would commend itself to the navigating department, was the possibility of obtaining the long-looked-for apparatus to control the movements of the propellers direct from the bridge. Another advantage lay in the fact that electricity, like steam, was capable of being readily applied to all the other requirements of shipboard—steering, windlass and winchwork—combined with the further advantages of more economical distribution, and giving a simple and agreeable artificial light throughout the vessel. Anticipating the contention that if turbine machinery had been the great success claimed for it, it was not necessary to add further complications by introducing the electrical drive, he replied that it was not proposed to use electric drive on fast vessels (naval or mercantile), but to apply it to the slower-going cargo tramps. Should this system of main electric drive come about, it might safely be said that a new era of electric navigation was about to dawn, and one promising great results. For instance, the continued decrease in the boiler pressure as commenced with the steam turbine, would no doubt be further continued, and even lower pressures could be made use of, which would largely decrease the weight of boiler installations, and so cheapen the first cost. Through the fact of the greater portion of the machinery being electrical rather than mechanical, the heavy weights of such moving parts as pistons, piston and connecting rods, slide valves, link motion, eccentrics, &c., would be done away with, and so render the outfit and overhauling of the electric boat (propelled by electricity generated on board by steam) more simple and more easily effected than on the steam-propelled craft at present in use.

Lancashire and Cheshire Municipal Tramway Managers.—The quarterly meeting was held at the Town Hall, Birkenhead, on July 16th. The Mayor and the chairman of the Tramways Committee received the members, and after the ordinary business had been completed the members were conducted over the car depôt, workshops and generating station by the chairman of the Tramways Committee and Mr. W. Wyld, the general manager and engineer of the tramways. The members, with the chairman and members of the Tramways and Electricity Committees, afterwards partook of tea at the invitation of the Mayor (Mr. Councillor McGaul). It was decided to accept the invitation of Mr. T. J. Kendrew, the general manager of the Southport Corporation tramways, to hold the next meeting at Southport, on October 15th next.

Pour Rire.—The young son of a well-known London electrical contractor was at school one day last week, and his teacher was trying to explain to him the meaning of the word "recuperate."

"Johnny," she said, "when night comes your father returns home tired and worn out, doesn't he?"

"Yes, ma'am," assented Johnny.

"Then," continued the teacher, "after four or five days of hard work, and being more or less run down, he spends the week-end out of town. What does he do?"

"That," replied Johnny meditatively, "is just what Ma wants to know!"

The British Association at Winnipeg.—The provisional programme of the proceedings of the Engineering Section, which commence on August 25th, is as follows:—

Address by the President, Sir W. H. White, K.C.B., F.R.S.
Second Report of the Committee on Gaseous Explosions.
"The Work of the British Association Committee on Gaseous Explosions," by Dugald Clerk, F.R.S.
"The National Trans-Continental Railway," by Duncan MacPherson.
"International Electrical Standardisation," by Ormond Higman.
"Improvements in the Navigation of the St. Lawrence," by Lieut.-Col. William P. Anderson.
"The Behaviour of Ductile Material under Torsional Strain," by C. E. Larrard.
"Hydroplanes, or Skimmers," by Sir John Thornycroft.
"Great Engineering Works on the Canadian Pacific Railway," by J. E. Schwitzer.
"The Distribution of Dielectric Stress in Three-phase Cables," by W. M. Thornton and O. J. Williams.
"The Engineering Works of the Panama Canal," by Col. Goethals.
"Losses from High-Tension Overhead Lines due to Brush Discharge," by E. A. Watson.
"On the Calculation of the Charging Currents in Three-Core Cables and Overhead Transmission Lines Supplied with Three-Phase Currents," by E. W. Marchant.

Mr. W. A. Price is the secretary of this Section.

Preservation of Wooden Poles.—At the annual convention of the Association of Railway Telegraph Superintendents at Detroit last month, a paper on the "Preservation of Poles" was presented by Mr. H. P. Folsom. According to the *Electrical World*, the paper opened with a discussion on the cause of decay of poles at the ground line. The conclusion was that it is the result of a fungus growth, and that the germ attacks the pole from the outside. The paper was largely devoted to a description of a patented method for arresting the decay of poles, and full details were given as to its application. Briefly, a hole about 14 in. deep is dug about the pole, a layer of Portland cement is placed at the bottom of the hole, and the surface of the pole is cleaned to a point somewhat above the level of the ground. Next a jacket made from a sheet composed of asbestos and asphaltum is placed about the pole, leaving an annular space about 2 in. deep, which is filled with a germicide in a dry state mixed with sand. The germicide consists of slacked lime, common salt and a small quantity of sulphate of copper. Around the top of the jacket a cap or collar of Portland cement is formed, this being reinforced, if desired, with old telegraph or telephone wire. This collar protects the chemicals and jacket from the action of the rain and snow, and also protects the pole against grass fires. It is stated that the chemicals are slowly dissolved by the natural moisture in the pole, and pass into the same by the action of capillary attraction, thus destroying the fungi and wood-eating insects. A gang of three men can treat from 20 to 30 25-ft. poles per day at a cost of about 75 cents to $1 per pole, including royalty. Very large poles costing from $50 to $75 have been treated at a cost ranging from $1.50 to $2.50. It is stated that poles thus treated when they were partially decayed have, after nine years, shown no increase of decay, and that the protecting device is still in good condition.

(*Continued on page* 183.)

THE WORKS OF THE G. WEYMOUTH PROPRIETARY CO., LTD., MELBOURNE.

By J. H. DAVIES.

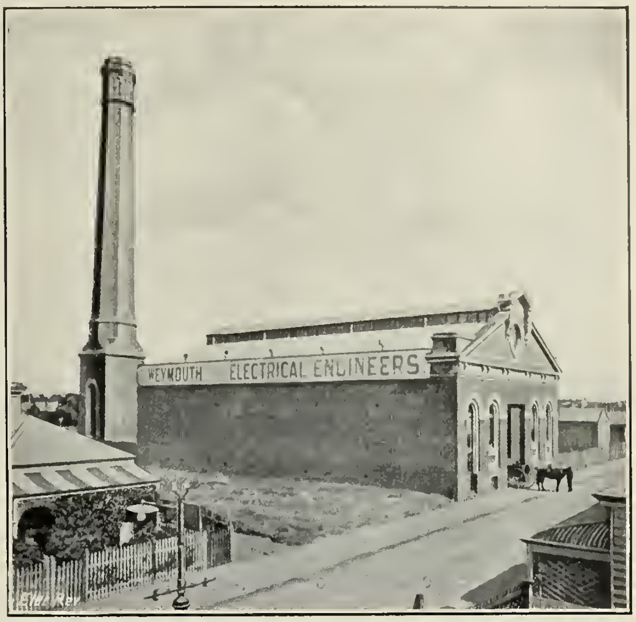


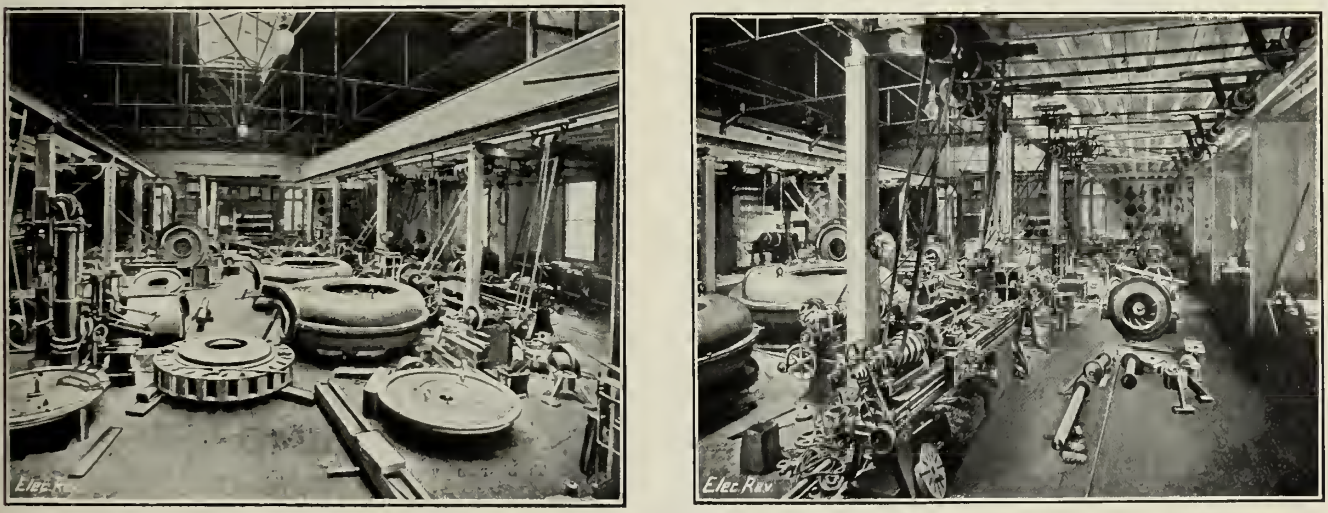
Fig. 1.—The Works of the Weymouth Proprietary Co., Melbourne.

These works are situated at Richmond, about three miles from the city of Melbourne proper.

The company's history dates back about ten years, when it was founded by Mr. G. Weymouth, who is still its managing director, and is a native-born Australian, who obtained his early training with the Austral Otis Engineering Co., of Melbourne, and was subsequently for some years in the service of Messrs. Siemens and Messrs. Johnson and Phillips, in England.

Since the time of its foundation the firm's business has continuously progressed, and it is now the most important electrical manufacturing business in Australia. A very wide range of work is carried out, including direct-current and polyphase generators and motors, transformers and switchgear of every description. The company does not, however, limit itself to electrical work only, but engages also in the manufacture of water turbines, centrifugal pumps, small steam engines and engineering work of a general character.

Figs. 1, 2, 3 and 4 are various views of the works at Richmond. To prevent any misconception, it should be explained that the smoke-stack visible in the view of the exterior of the works is accounted for by the fact that the building was previously the generating station of the A.U. Alcock Co., one of the early companies, whose business was absorbed by the Electric Lighting and Traction Co. of Australia, now called the Melbourne Electric Supply Co.



Figs. 2 and 3.—Interior of the Weymouth Works.

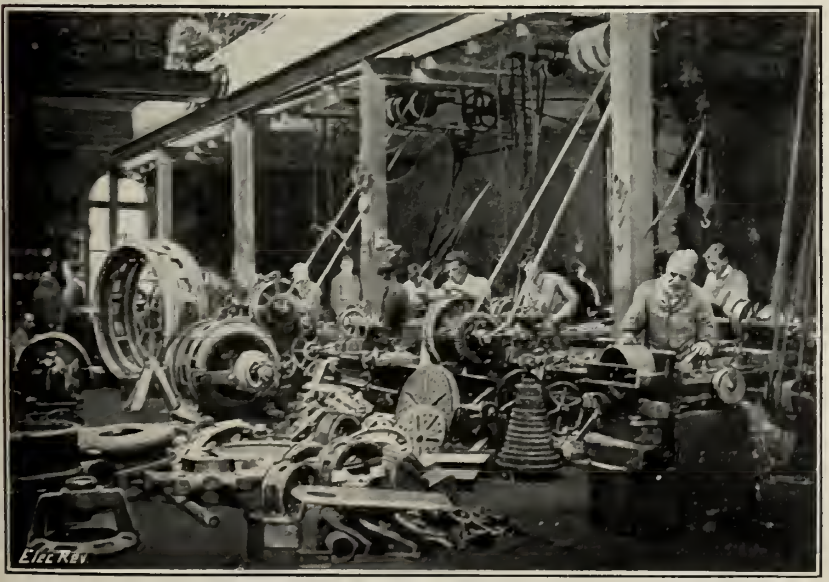


Fig. 4.—Machine Shop, Weymouth Works.

The shops are driven throughout by 440-v. 50-cycle single-phase induction motors, driving on to short countershafts for groups of small machines, and to individual machines in the case of larger ones. Energy is taken from the mains of the Melbourne Electric Supply Co.

The illustrations of the interior of the shops show some examples of the work which is handled in them. The switchboard and winding departments are situated one on each of the two galleries which extend the entire length of the building (one on either side of it), and immediately above the small machine shops. All the winding of small machines and former-coil winding is thus done in a situation where there is no risk of damage to the insulation from flying pieces of metal.

The combined unit, fig. 6, is typical of the D.C. sets supplied by the company, this being a 60-KW. engine and generator; fig. 6 also illustrates the company's polyphase motors up to 200 KW. attached to winding and hoisting apparatus and to a treble ram mining pump, with a capacity of 6,000 gallons per hour, against a 1,000-ft. head. The company also build high-lift turbine pumps, and, indeed, quite a speciality is made of electrical machinery and equipment for mines, such work including complete power plants, winding engines, locomotives for underground hauling, ventilating and pumping plants.

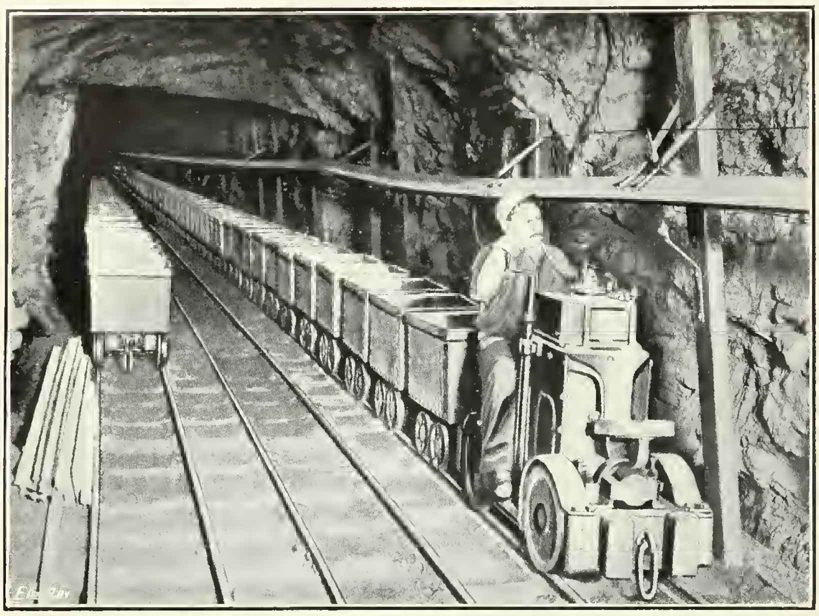
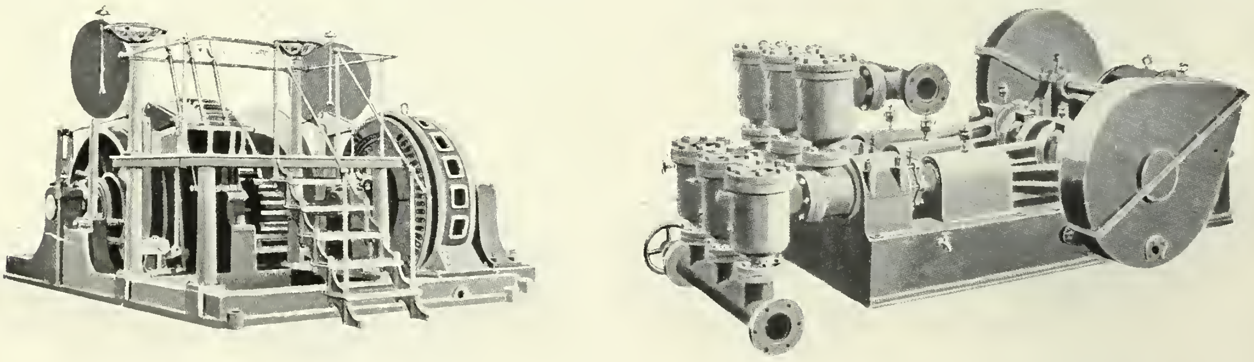
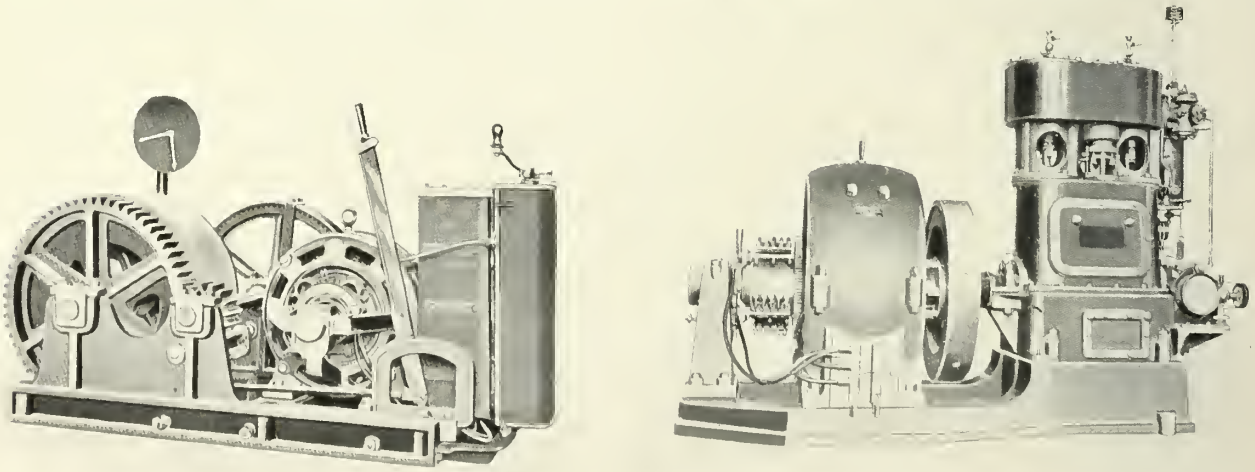


Fig. 5.—Electrical Mining Loco., as Supplied to the Australian Mines.



200-H.P. three-phase winding engine.

Treble-ram pump driven by 45-H.P. polyphase motor.



20-H.P. three-phase electric hoist.

60-KW. engine and generator.

Fig. 6.—Examples of Work Carried out by the Weymouth Co., Melbourne.

A typical winding plant is illustrated in fig. 6; this is driven by a 200-H.P. three-phase motor, and has a lifting capacity of 7,000 lb. at a speed of 500 ft. per min.

Fig. 5 is a view of an underground train of trucks used for the carriage of wash-dirt from the workings to the mine shaft. The electric locomotive is one of the Weymouth Co.'s standard 10-H.P. direct-current type, of which a large number have been supplied to various mines in the Commonwealth. The locomotive is built to go into a standard mining-cage 5 ft. × 2 ft.; it weighs 32 cwt., and will haul 60 trucks of wash-dirt at 5 to 6 miles per hour.

Among the electrical contracts passing through the shops at the time of our visit were:—

A 120-KW. 4,400-volt asynchronous generator, direct coupled to an "Allen" high-speed engine, complete with the necessary switchgear, for the Prahran City Council destructor works. The engine will be controlled by a governor which comes into operation if the overload speed of the generator is exceeded, the ordinary regulation depending on the steam available from the destructor works. These works are close to the generating station of the Melbourne Electric Supply Co., to which company the power generated at the destructor works will be sold in bulk. A complete underground haulage plant for the Duke and Main Leads Consols Gold Mining Co., together with a 50-H.P. motor for driving the puddling machines, were also in hand.

In addition to the electrical work, some large pumping plants for irrigation were in course of construction, and parts of large centrifugal pumps will be noticed in the views of the machine shops, from which some idea of their actual dimensions may be gained. These were being made for the water supply department of the Victorian Government, who had given the Weymouth Co. orders for five sets. Three sets are each of a capacity of 1,500 cb. ft. of water per min., against a 95-ft. head, with a guaranteed efficiency of 80 per cent, and each pump was to be driven by a 360-h.p. triple-expansion high-speed engine. The other two are designed for 6,000 cb. ft. of water per min., with an 18-ft. lift, the guaranteed efficiency being 73 per cent. These would also be driven by triple-expansion engines. All these turbine pumps are made under an arrangement with the owners of the Smith-Michell turbine pump patents.

In drawing this article to a close, the author would express his thanks to the management of this company, through whose courtesy he was enabled to compile the foregoing notes.

THE MARKLISSA POWER TRANSMISSION PLANT.

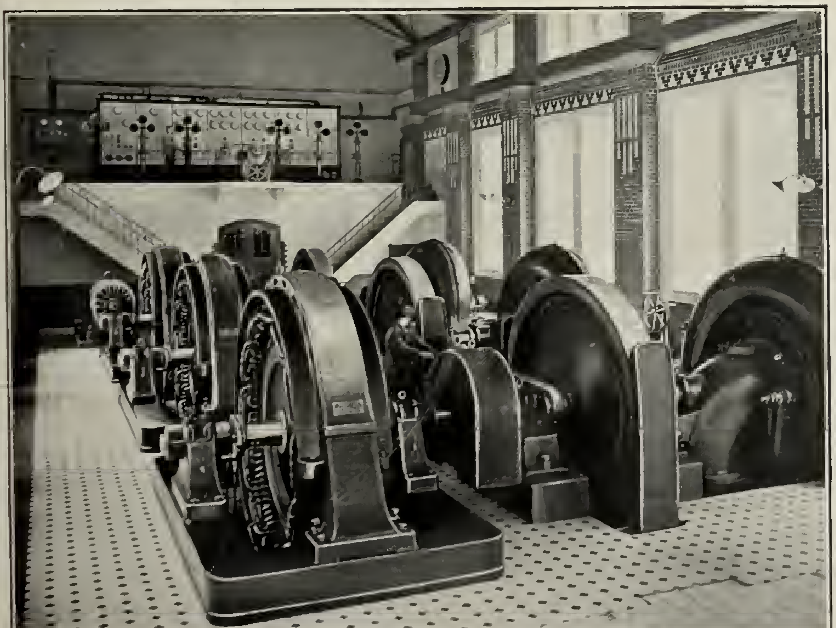
By H. ALFRED GRADENWITZ.

An interesting hydro-electric plant utilising the stored-up water of the River Queis (a tributary of the Bober) has been installed in connection with a reservoir of 15,000,000 cb. m. capacity, situated about 3 km. up-stream from the town of Marklissa. This reservoir was constructed in view of the tremendous inundations occurring in the region of those rivers, which in 1897 during the space of 24 hours occasioned damage of 10,000,000 marks.

Hydro-electric works in connection with this reservoir have been utilised for a short time for supplying light and power to some neighbouring places situated within 14 km. distance, and the power house is eventually to be connected by a transmission line about 30 km. in length, to a proposed larger hydro-electric station at Mauer, for utilising the stored-up water of the Bober in a reservoir of 50,000,000 cb. m. capacity. This larger power station will also be connected with a steam-operated power house at Waldenburg, situated a further 64 km. distant, thus providing a reserve both to the hydraulic and steam stations, while affording a possibility of supplying electrical energy to intermediate places.

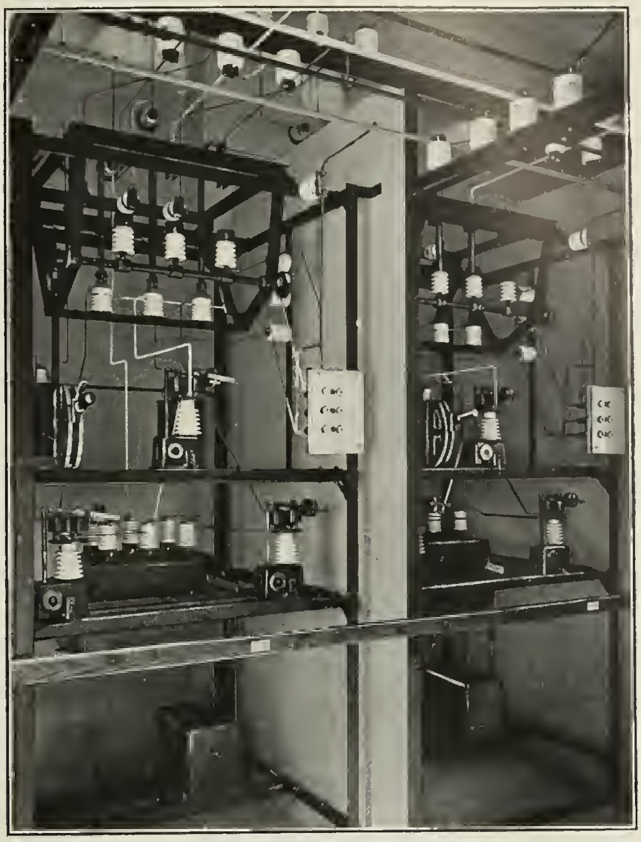
The Marklissa power house is situated about 100 m. below the reservoir embankment, and is supplied with the water required for operating the turbines through two underground conduits that terminate immediately behind the embankment, and within the power station, combine in a conduit 1·7 m. in diameter, whence pipes lead to each of the turbines.

The preliminary equipment of the power station comprises three Francis turbines, supplied by Messrs. Voith, of 715 h.p. each, at 375 r.p.m., and working under an average head of 26 m. In addition to these, there have been installed a small exciter turbine of 35 h.p., and an exciter converter of 64 kw. After its ultimate extension, which is to be carried out during the current year, the power house will comprise five similar turbine sets, of a total output of 3,575 h.p.



Interior of the Marklissa Power House.

The generators and switchboards have been constructed by the Siemens-Schuckert Works. The generators, which are coupled to the turbines through an elastic clutch, are designed for an output of 620 k.va. generating three-phase alternating current at 10,000 volts pressure, with a frequency of 50 cycles per second; they are provided with 16 poles on the rotor.



Switch Cells, Marklissa Transmission.

The electrical energy generated at the power house is transmitted without the intermediary of any transformers, over three transmission lines, viz., to Marklissa (3 km.), Lauban (11 km.), and Greiffenberg (14 km.) respectively. At the receiving points the pressure is reduced to 220 and 120 volts respectively.

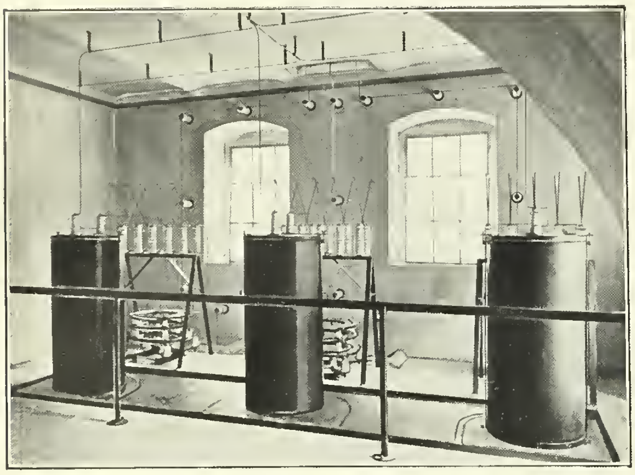
Another power transmission line, and the switchboard controlling the lines connected to the Mauer power house, has been recently completed. With a view to the considerable distances, the pressure in connection with the Mauer and Waldenburg transmission lines, is to be raised by two 750-k.va. transformers from 10,000 to 20,000 or 30,000 volts.

Special care was bestowed on designing the switchgear in such a way as to allow of its being readily supervised, while providing for safety.

A pilot motor, fitted to the turbine regulators, is used to regulate the load on each machine.

Oil switches were used exclusively, owing to the considerable pressure surges liable in the switching off of high-pressure currents with the aid of ordinary switches; these oil-switches are provided with electrical remote control. One of our views represents the switch cells used for the Marklissa and Lauban transmission lines, showing, in the upper portion, the time relays used to switch in the motor—situated in the lower portion—for actuating the oil switch, arranged in the centre of the cell. There are two self-contained systems of bus-bars, which can be coupled by means of a hand-operated switch.

In order to afford a reliable protection against excess pressure, a combination of reaction coils, horn spark gaps, oil resistances and water-jet earthing devices was used. One of our views shows the arrangements chosen in connection with the Mauer transmission line, the oil resistances being visible in the foreground, and the horn spark gaps and corresponding reaction stage coils farther back.



Line Protective Devices, Marklissa Transmission.

A special telephone plant has been provided for connecting the power station to the townships of Greiffenberg, Mauer and Hirschberg. As the low-pressure transmission lines are arranged on the same poles with the high-pressure lines, special safeguards had to be provided for avoiding leakage.

Water-level gauges on Siemens & Halske's system, indicating and recording the water level by means of floats and contact devices, are provided to indicate the level in the reservoir as well as the amount of water entering and leaving.

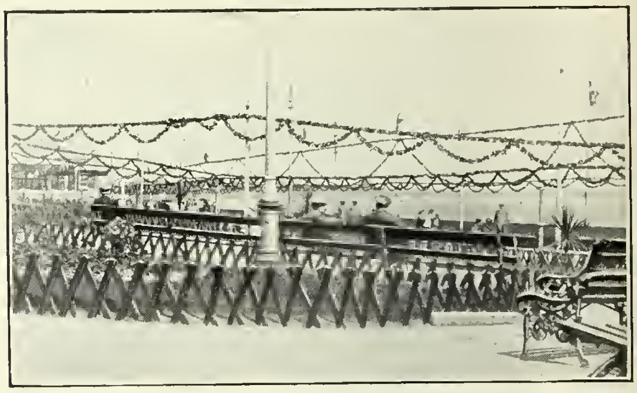
ELECTRICAL ILLUMINATIONS AT BRIDLINGTON.

Bridlington, that watering place on the Yorkshire coast which is year by year increasing its popularity in all parts of the country, has just made another addition to its already lengthy list of attractions. This takes the form of a scheme of electrical illuminations on the Royal Prince's Parade, which, by the way, belongs to the town, and the innovation, which is said to be the first of its kind in the country, is being closely watched by other seaside resorts.

The question of illumination has worried the Parade Committee for many years, and no satisfactory solution of the difficulties was forthcoming until Mr. A. J. Beckett, the borough electrical engineer, was called in to give his advice. Mr. Beckett sought to devise a scheme which should provide an artistic daylight decoration, independent of the night effect, and he has attained success by utilising thousands of yards of artificial foliage, coloured green, which presents a natural and pleasing appearance to the eye, Nature having been copied as closely as possible. The main promenade is decorated so as to form a continuous canopy 200 yds. long, and the grass plots and side walks are outlined with festooned garlands, the whole being in harmony with the general arrangement of the gardens and grounds.

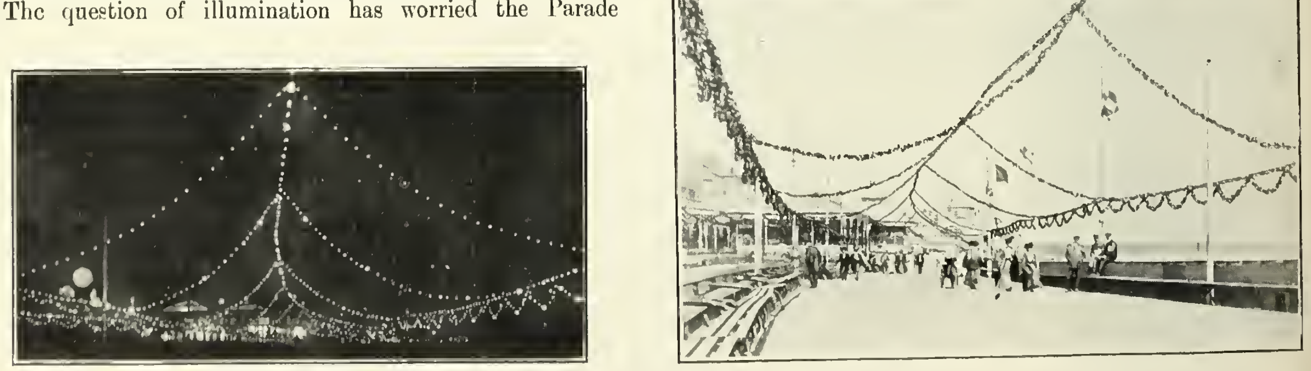
The electrical wires are carried along the foliage, with a $2\frac{1}{2}$-c.p. electric lamp, alternately red, white and blue in colour, at every foot. There are 6,000 of these lamps, with special china waterproof miniature high-voltage lampholders, which are enamelled in green to harmonise with the foliage, and are entirely concealed during the day. The lamps are coupled up in sections by means of patent china couplings, and are run in series of 16 lamps, 14 volts per lamp, on a voltage of 220. This obviates any trouble arising through malicious damage to the lamps, for a broken lamp simply means a small section of light cut off, and not a blown fuse.

The work, which necessitated the use of about six miles of cables and wires, has been carried out by Messrs. Waring and Gillows, Manchester, who worked out the combined design according to the general scheme suggested by Mr. Beckett. The opening ceremony was a great success. It was performed by the Mayoress (Mrs. C. G. Southcott), who was afterwards presented by the Parade Committee with the silver switch which she had used.



Bridlington by Day.

The photographs used in this article were taken by Messrs. R. Spurr & Son, Bridlington.



Bridlington: The Parade at Night and in the Daytime.

Malden.—The Council, on Monday evening, considered a report from the Parliamentary Committee to the effect that it had interviewed the Electricity Committee of Wimbledon Corporation with regard to the supply of electricity to Malden. Wimbledon required a guarantee against loss, and, subject to this, was prepared to entertain an application for a bulk supply. Malden Committee recommended the Council to consider the advisability of applying for a provisional order, and that Messrs. Talbot and Stevenson, consulting electrical engineers, be engaged to advise the Council and prepare estimates as to the probable capital outlay and annual expense to be incurred by Wimbledon, and, alternatively, the cost to Malden, of providing a generating station. In opposition to the Committee's proposal, it was urged that the feeling of the district was against electric lighting on the ground of expense. The motion for the adoption of the report was negatived by 6 votes to 5.

NOTES.

(*Concluded from page* 178.)

Educational.—Northampton Polytechnic Institute. —Particulars of the commencement of day courses in mechanical and electrical engineering and electrochemistry appear in our "Official Notices" to-day.

Appointment Vacant.—University of Birmingham. —Assistant Lecturer and Demonstrator in Electrical Engineering (£150).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Chas. Cuthbertson, electrician of the Longton Gas and Electricity Department, was on Friday last presented with a marble clock by the staff and employés of the department, to mark the occasion of his recent marriage.

Tramway Officials.—Mr. A. W. Banister, late manager of the Norwich Electric Tramways Co., has been appointed manager of the New British Motor Cab Co., Ltd., London.

General.—On Monday last Mr. A. L. Weekes, general manager of the British Electric Calibrated Fuse Co., Harpenden, Herts, was presented with a pedestal writing-desk by the staff and employés on the occasion of his marriage to Miss Alys Linnell, of Rugby.

On the 17th inst. Mr. W. G. Roberts, charge-man of electrical fitters at the Pembroke Dockyard, who is leaving to take up the post of Admiralty assistant overseer, was presented with a Gladstone bag, a case of pipes and a set of razors by his friends in the electrical fitting shop.

Mr. E. Raymond-Barker, who has just left in the Silvertown c.s. *Dacia* on a cable-repairing expedition, deposited with us some months ago a further series of articles on "Cable-fault Localisation Graphs in Practice." The pressure on our space has hitherto prevented us from inserting these, but we hope to commence their publication immediately on the author's return.

Obituary.—Frölich.—We regret to record the death of Dr. O. Frölich, on the 6th inst., at Berlin, aged 66 years. Dr. Frölich was one of the great pioneers of the electrical industry, being associated with Messrs. Siemens & Halske in the days when telegraphs were the mainstay of electrical work; later, he turned his attention more particularly to the development of the theory of the dynamo and to the design of measuring instruments, while he maintained his interest in pure scientific research. Latterly he was connected with the Charlottenburg Technical High School as lecturer.

NEW COMPANIES REGISTERED.

Fife Tramway, Light and Power Co., Ltd. (7,188).—This company was registered in Edinburgh on July 3rd, with a capital of £200,000 in £1 shares, to acquire all or part of the share capital of the Dunfermline and District Tramways Co. and the Fife Electric Power Co., to construct or acquire light or other railways, electric or other tramways, and electric lighting and power supply works, &c. The subscribers (with one share each) are:—W. Low, Blebo, Cupar, Fife, merchant; K. Sanderson, 23, Rutland Street, Edinburgh, W.S.; F. B. Stuart, 63, Frederick Street, Edinburgh, W.S.; W. L. Wilson, 16, Charlotte Square, Edinburgh, clerk; A. Shepherd, 16, Charlotte Square, Edinburgh, W.S.; G. Ferguson, 16, Charlotte Square, Edinburgh, clerk; G. Balfour, 22A, College Hill, Cannon Street, E.C. The number of directors is not to be less than two or more than five; the first are to be afterwards appointed; qualification, 100 shares; remuneration as fixed by the company.

British Radio-Telegraph and Telephone Co., Ltd. (104,024). —This company was registered on July 13th, with a capital of £15,000 in £1 shares, to adopt an agreement with J. G. Balsillie, and to carry on the business of manufacturers of and dealers in radio-telegraphic and telephonic instruments and installations, electric and general engineers, &c. The subscribers are:—T. V. Smith, 30, Linden Gardens, Notting Hill Gate, W., electrical engineer, 100 shares; B. C. Turner, 87, Circus Road, St. John's Wood, London, insurance manager, 100 shares; T. B. Ince, 14, Cornhill, E.C., assessor and surveyor, 50 shares; W. H. Matthews, 32, Queen Victoria Street, E.C., solicitor, 100 shares; A. Knight, 4, St. Mary Axe, E.C., merchant, 100 shares. Private company. The number of directors is not to be less than two or more than five; the first are not named; qualification, 100 shares. Registered by G. F. Hudson, Matthews & Co., 32, Queen Victoria Street, E.C.

Caversham Motor Co., Ltd. (103,995).—This company was registered on July 12th, with a capital of £1,000 in £1 shares (950 preference), to carry on the business of electrical engineers, manufacturers of and dealers in motor carriages and other mechanically-propelled vehicles, &c. The subscribers are:—J. A. P. Price, 124, Castle Street, Reading, M.D., 20 preferred shares; H. N. Dickson, M.A., D.Sc., The Lawn, Upper Redlands Road, Reading, 25 preferred; Mrs. E. Woollan, Endellion, Priory Avenue, Caversham, 50 deferred; L. E. Stephens, The White House, Elmsworth, Hants., 25 preference; A. C. Brewerton, Kiln House, Caversham, Oxon, brick and tile manufacturer, 10 preference; T. S. English, 136, Oxford Road, Reading, corn merchant, 10 preference; C. G. Chambers, 1 Friar Street, Reading, solicitor, 1 preference. Minimum cash subscription, 60 preference and all ordinary shares. Registered without articles of association. The first directors are J. A. P. Price, H. N. Dickson, M.A., D.Sc., and A. C. Brewerton. Registered by Solicitors' Law Stationery Society, Ltd., 28-9, Chancery Lane, E.C.

Chippenham Electric Supply Co., Ltd. (104,107).—This company was registered on July 19th, with a capital of £5,000 in £1 shares (2,500 5 per cent. preference), to adopt an agreement with the Chippenham Corporation, and to carry on in Chippenham and elsewhere in Wiltshire the business of suppliers of electric light, electricians, engineers, &c. The subscribers are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer, 400 shares; E. Neale, 10, High Street, Chippenham, chemist, 100 shares. Private company. The number of directors is not to be less than two or more than five. The first are J. H. Edwards and E. Neale (both permanent). The Chippenham Corporation may nominate one permanent director, who shall be a member of the Corporation and not a shareholder in the Chippenham Gas Co.; qualification, of permanent directors, £100; of ordinary directors, as fixed by the company. The directors shall issue 100 5 per cent. cumulative preference shares to the Chippenham Corporation as fully paid up, and exchange the same for £100 debenture stock or shares, when any shall be issued by the company, referred to in the agreement. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Lighting, Ltd. (104,154).—This company was registered on July 21st, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in lamps, burners, parts and apparatus for lighting and other purposes, electricians, engineers, &c. The subscribers (with one share each) are:—F. S. Mitchell, 3, Market Street, Dewsbury, accountant; R. S. Naylor, 3, Market Street, Dewsbury, accountant. Private company. Table "A" mainly applies. Registered office, 25, King Street West, Manchester.

Filaments, Ltd. (104,108).—This company was registered on July 19th, with a capital of £500 in £1 shares, to adopt an agreement with J. W. H. Reynolds, for a secret process for the manufacture of metal filaments for electric lamps, and to carry on the business of manufacturers of and dealers in metal filaments for electric lamps and apparatus used in connection therewith, &c. The subscribers (with one share each) are:—J. W. H. Reynolds, 9, Braxted Park, Streatham Common, S.W., electro-chemist; W. G. Bate, 35, Bedford Row, W.C., solicitor. Private company. The number of directors is not to be less than two or more than four; the first are J. W. H. Reynolds and W. G. Bate. Registered office, 6, Newcastle Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro-Mechanical Brake Co., Ltd. (98,276).—Mortgage or charge on certain patents for inventions relating to an electro-mechanical brake, dated June 7th, 1909, to secure not more than £1,500. Holder: G. Law, jun., Landoak House, Kidderminster. Also mortgage on certain book debts, dated June 9th, 1909, to secure £140. Holders: Metropolitan Bank of England and Wales, Ltd., West Bromwich.

Anglo-Argentine Tramways Co., Ltd. (25,363).—Trust-deed dated July 1st, 1909, to secure £1,733,380 4½ per cent. debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital, subject to certain prior charges. Trustees: The Trustees, Executors and Securities Insurance Corporation, Ltd.

Bogota Telephone Co., Ltd. (69,059).—Particulars of £25,000 second debentures created October 30th and secured by trust-deed dated December 12th, 1906, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: Certain land with buildings thereon in Bogota, Colombia, used in connection with the telephone service, concessions or grants relating to the said service, working plant, engines, machinery, poles, lines, installation, and the company's undertaking and property, including uncalled capital, subject to £15,000 first mortgage debentures. Trustee: S. H. Jenks, Barrow Hedges, Carshalton.

Electric Supply Corporation, Ltd. (52,036).—Trust-deed dated July 18th, 1904, was stamped to cover a further £20,000 in addition to £110,000 already registered. Property charged: Company's assets. Trustees: F. Tufnell, Kenley, Surrey, and W. B. M. Bird, 58, Cadogan Place, S.W.

CITY NOTES.

Direct United States Cable Co., Ltd.

The sixty-fourth ordinary general meeting of the shareholders of this company was held on Tuesday at Winchester House, Mr. E. M. Underdown, K.C., in the chair.

In proposing the adoption of the report (see Electrical Review, July 23rd, page 147), the Chairman said that the revenue for the past six months to June 30th last, after deductions on the payments, amounted in round figures to £56,445. The working and other expenses, including income-tax, but exclusive of cost of maintenance, absorbed £25,036, leaving a balance of £31,409 as net profit, making, with £4,506 brought forward, a total of £35,915. That had been appropriated as follows:—Interim dividend of 4s. per share on March 31st, absorbing £12,142, a proposed final dividend of the same amount, and a bonus of 1s. per share to June 30th, requiring £15,177, transferred to reserve fund £5,000, leaving a balance of £3,596 to be carried forward. A considerable period of trade depression was, he hoped, now passed over and cable business showed signs of revival, with the result that their revenue exhibited an improvement of £5,077 during the past half-year, as compared with the corresponding half of 1908. The working expenses in London and at the stations showed a slight variation as compared with those in the corresponding period. The reserve fund had been credited with £9,733 from interest on the investments; £1,501 from profit on the sale of securities and with the £5 000 transferred from revenue. On the other hand, it had been debited with £13,857 for cost of maintenance of cables, and the balance of the account now amounted to £510,267. The investments stood in the balance-sheet at £493,004, after allowing for the provision of £40,000 made two years ago on account of market depreciation. It was satisfactory to note that their market value at present was between £9,000 and £10,000 in excess of the reduced figure at which they stood in the accounts. Although on the present occasion they had

had some heavy repairs, the reserve fund remained fully adequate to meet their requirements, and, in fact, the situation had improved. Dealing with the results for the whole year, the receipts had amounted to £112,780, less expenses £50,393, leaving a balance of £62,387. They had paid in dividends £51,603; £10,000 had been placed to reserve, and they had an increased balance in hand of £784 as compared with June, 1908. The reserve account had been increased in balance during the year by £5,071; £10,000 had been transferred from revenue; interest on investments had yielded £18,882, profit on sale of securities (£1,595) giving a total of £31,447. From that they had to deduct £24,901, the cost of maintenance of cables, and £505, the cost of the installation of a gas plant at their station on the West Coast of Ireland. When they heard criticisms as to the cost of messages to the public, it was as well to remember that the cost per word was no real guide. So extensive was the use of codes by means of which one word was made to embrace many words and sentences, that the actual cost to the public was even below the word rate suggested by those who had no practical knowledge of distant telegraphy. Their relations with the allied companies were excellent. The Government had, he thought, met them in several points with regard to the continuance of their business and licence, and altogether he thought he might congratulate the shareholders upon the position of the undertaking.

Sir James Pender, Bart., seconded the resolution, and the report was adopted.

City and South London Railway Co.

The Right Hon. C. B. Stuart Wortley, M.P., presided at the offices, Finsbury Pavement, on Tuesday, July 27th, over the fiftieth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, July 23rd, page 147), the Chairman said they met in more encouraging circumstances, and the board were able to claim that they were right, when six months ago they said that the comparatively unfavourable results of the half-year then under review were due to temporary and abnormal causes. There were many gratifying features in the working of the last half-year. They had a net increase of £1,062 in gross receipts, and a net decrease of £989 in expenses; so that they were in a position to carry to net revenue account a balance increased by £2,051. After deducting from this the diminution of £166 in the carry-over from the December account, and the increase of £427 in debenture interest, but adding, on the other hand, the £204 saved on the item of general interest, they got an increase in the balance available for dividend of £1,662. They had £269 more to pay now than last year in dividends on preference stocks; so that there was a final resulting improvement of £1,393 in the sum available for the ordinary shareholders. By carrying forward only £457 less than they did this time last year, they were able to find the £1,850 necessary to provide the extra ¼ per cent. which the ordinary shareholder so well deserved, and which they recommended that he should receive. This result, though not brilliant, was at least satisfactory. It was satisfactory not only as coming hand in hand with the fact that the half-year showed a larger amount of gross receipts and a larger number of passengers carried than any previous half-year in the history of the railway, but also because the percentage of working expenses showed a gratifying decrease (as between the June half-years of 1908 and 1909) from 46·28 per cent. to 44·63 per cent. As showing economy in management he might say that they had kept their service going with 92,673 trains, against 94,636. Had there been 28 days in February, 1908, instead of 29, the number of trains in the 1908 half-year would have been about 600 less than the 94,636. The number of passengers carried per train had been 121·15, against 115·09. The receipts per train had been 18s. 3·64d., against 17s. 9·04d., and per train-mile 2s. 5·93d., against 2s. 5·03d. The only receipt which showed a decrease was the one which, less than all others, could be influenced by management. He referred to the receipts per passenger, which had gone down from 1·75d. to 1·72d. This merely showed that the average distance travelled had been shorter. On the other hand, all the expense ratios showed decreases:—1s. 2·11d. total expenses per train-mile, against 1s. 2·16d.; loco. expenses per train-mile, 4·52d., against 4·68d.; and traffic charges, 6·13d. per train-mile, against 6·27d. The accounts showed an increased amount paid during the half-year in local rates. They considered that in several districts they were assessed at too high values, and the general manager had instructions to endeavour by making proper representations to the assessment committees, to get valuations reconsidered in their favour. Decreases in local bookings at the "Angel" and Moorgate seemed to show that the limit of L.C.C. tramway competition on the north side had not yet been reached. But local bookings at Euston and King's Cross continued slowly to increase, and through bookings made up well for diminished local bookings—there having been a gratifying increase of this business with all three of the underground companies' tubes. A noticeable feature of the half-year was the fact that (except at King's Cross) Sunday bookings were uniformly down—the average drop being £18 per Sunday. The main burden of this loss seemed to arise at the Bank and certain stations on the south side. Competition with L.C.C. tramways and the motor-omnibuses continued to be so severe that the question had arisen whether there should not be some revision, in favour of the passengers, of certain fares and season-ticket rates. This important matter was under the consideration of the board. The competition that they suffered from the L.C.C. tramways and the diminished receipts on Sundays were, perhaps, more closely connected than might be supposed. All through the early hours of Sunday, from 8 o'clock to nearly 12 noon, when no City and South London trains were running, the L.C.C. tramways enjoyed to the full a monopoly of the business of carrying South London people to the Elephant and Castle Station and to London Bridge, as well as to all such places on the north side of the river as could be reached by the Westminster Bridge tramlines and their extensions. At the Elephant they found connecting trains all Sunday morning to all stations on the Bakerloo line and lines connected with it; and at London Bridge they found facilities for Sunday excursions by the Brighton Railway and South-Eastern and Chatham and Dover Railway to places in Kent and Sussex, and for embarking hard by on the excursion steamers to the various places on the East Coast. Most of these opportunities were past and gone by the time that the City and South London Sunday trains began to run. On all the four West End tube railways, as well as on the great railways having termini in London, trains were running on Sunday morning during most of the time that on the City and South London business was at a standstill. The Great Northern and City Tube Railway, which joined up to their station at Moorgate, now started its trains on Sundays about the same time as they did. They had arranged with the Great Northern and City to start running on Sundays at about the same time as they did, their trains beginning in future from Euston and from Clapham Common about 8.15 in the morning. The board did not think they could with justice to the shareholders continue to allow during all these hours, those who on other days were their own passengers and patrons, to be taught and encouraged to use other systems than their own. What the L.C.C. did could not be supposed to be against the conscience of the people of London, or they would not be suffered to do it. The board proposed, therefore, to defend themselves against this particular competition by modifications of their Sunday time table, which they hoped would shorten the actual hours of Sunday duty worked by individual members of their staff, and yet would preserve to the great majority of them the alternate Sunday off which they now enjoyed. The report spoke of the projected high-level subway to connect their station at the Bank with the stations of the Central London and Waterloo and City lines. Parliamentary sanction to this scheme might be regarded as practically assured. Though not eventful, the half-year's working had been neither uninteresting nor unhopeful.

Mr. C. S. Grenfell seconded the motion.

Mr. E. Levy thought the time had arrived when they ought to have a profit-sharing scheme for the employés. He suggested that 5 per cent. should be deducted from the shareholders' dividends each half-year and divided amongst the servants of the company who had been over six months in the service in proportion to the wages and salaries received.

Mr. Porter suggested that in conjunction with other tube railways, they might issue special season tickets in the middle of the day for commercial travellers, at a cost not exceeding £4 per quarter. He also thought that some of the stations which did not pay might be closed.

The Chairman, in reply, said one of the difficulties of a profit-sharing system on railways was the minuteness of the amounts to be divided. In principle, they all agreed it was a good thing. As to commercial travellers' tickets, the difficulty was that other railways did not issue season tickets. It was true that the City Road station did not pay.

The report was then adopted.

Prospectuses.—*Brieh Rubber Estate, Ltd.*—An issue of 20,000 shares of £1 each at par has been offered for subscription this week. The company will acquire the Brieh estate of 1,190 acres in Perak, F.M.S., 506 acres being planted.

Sylverlyte (1909), *Ltd.*—During the past week this company offered for subscription 50,000 shares of £1 each at par. The company has been formed to take over the business of the Sylverlyte Electric Lamp Co., Ltd., which was formed in May, 1908, with a capital of £2,750, to acquire and work an invention (No. 5,191 of 1904). The business of the syndicate has been confined to the production and sale of motor-car lamps, using a special lens, and it is proposed to extend the use of the company's "Sylverlyte" lenses.

Sungei Krian Rubber Estate Ltd.—The list closes to-day in an issue of 45,000 6 per cent. cumulative participating preference shares of £1 each. The company will acquire the Samagaga estate of 2,500 acres in Perak, F.M.S.

Stock Exchange Notices. — The Committee has appointed a special settling day as under:—

Friday, July 30th.—Bombay Electric Supply and Tramways Co., Ltd.—Scrip, fully and partly paid, for £150,000 5 per cent. second mortgage debentures.

Southern Electric Tramways Co. of Buenos Aires (Compania de Tramways Electricos del Sud).—Scrip, fully paid, for £100,000 5 per cent. first mortgage debentures, Nos. 1 to 800 of £100 and 801 to 1,800 of £20 each.

And ordered the same to be quoted in the Official List.

The Bristol Tramways and Carriage Co., Ltd.—An interim dividend has been declared at the rate of 6 per cent. per annum for the half-year ended June 30th, as last year. Dividend warrants will be posted to-day.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th, 1909, on the ordinary shares at the rate of 4 per cent. per annum, less income-tax, as last year.

National Telephone Co., Ltd.

Mr. George Franklin presided on the 22nd inst. over the meeting of this company held at Hamilton House, Victoria Embankment.

In moving the adoption of the report (see Electrical Review, July 16th, page 106), the Chairman reminded the shareholders that the figures were only accurate for five months, and the sixth month was an estimate. The income accrued for the six months ending June 30th was £1,546,837, as compared with £1,452,569 a year ago, an increase of £64,798. That increase was not quite at the usual rate of progress, but it was largely accounted for by the depression in trade, and to some extent by the necessity of the company restricting its capital expenditure, so as to coincide with the termination of its licensed period. The royalties paid to the Post Office had increased from £139,531 to £148,951, a difference of £9,419. There was very little to say in regard to that item, except the chronic complaint which was always made at those meetings that it was a charge imposed upon the telephone industry without any justification. The working expenses amounted to £893,767, as against £828,969, an increase of £64,798. Apart from the expenses of the company, due to the growth of the business, there were extra items of expenditure, such as the increase in the rates, which had gone up in the half-year £5,843, and an extra outlay on lines, including renewals of £10,148 Another item which went to swell the expenses was the maintenance of the Post Office wires, towards the cost of which they had to make some contribution, although the money should, strictly speaking, come out of capital. The net result of the half-year (after deducting royalties) was a profit balance of £504,118, as compared with £484,068, or a net increase of £20,050, of which £12,954 was absorbed by the debentures and other interests, £124,607 by the preference and deferred shares, and the directors recommended the placing of £150,000 to reserve, an increase of £10,000 over the amount placed to that item a year ago. That would leave a balance of £110,000 to be carried forward. The rentals for unexpired terms of running contracts pursued their upward course, as was to be expected, the figure standing at £1,366,283, as against £1,314,591, showing an increase of £51,692. The capital expenditure during the past six months on construction of exchange and private stations was £313,393. It was the company's policy now not to spend any money which would not be reproductive by December 31st, 1911, when their licence expired. They had made an offer to the Post Office, which had been accepted in part, to provide for the requirements of the Post Office after 1911, provided that the company were insured against any loss. The Post Office had agreed to that so far as such capital expenditure might relate to new work, which did not involve the supplanting of existing plant; but as to other classes of work, it had not been yet possible to come to any arrangement. The reserve fund now stood at £3,226,381, and that figure included the amount proposed to be added that half-year. All of that money was invested in the company's business. Questions had been asked in Parliament suggesting that the company's plant was antiquated and obsolete, and that they were starving the system, but he could say that the plant was never in a better condition, and when the undertaking was acquired by the Government it would be found that it was in accordance with the agreement made with the Post Office. As to the recent legal proceedings in which they were involved with the Postmaster-General with reference to what were known as A to B lines—that was a communication between a person and a doctor or his stockbroker, such lines not having any connection with the company's exchange—the shareholders were aware that the Government said they ought to pay a 10 per cent. royalty on them, but the Court of Appeal upheld the views of the company that they were not bound to pay such royalties. On the case being taken to the House of Lords the decision was reversed, and the company had now to pay royalties on that class of business. The effect of that would not fall upon the present shareholders, as the directors had set aside a half-year's profit to meet the charge in the event of their having to meet it. The company recognised their full obligation to the public up to the end of 1911, but they had not recognised, and did not intend to recognise, any provision for the needs of the subsequent period. With reference to a recent statement of the Postmaster-General that it would be in the public interest if the undertaking could be acquired before the end of 1911, the company were perfectly willing to hand it over before, provided they were fully compensated for the loss of their unexpired tenure.

Mr. G. Sands seconded the motion, and the report was adopted.

United River Plate Telephone Co., Ltd.

The meeting of this company was held on Tuesday, July 20th, at Winchester House, E.C., Sir Irving Courtenay presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, July 16th, page 106), said that the steady growth and development of the Argentine Republic, which had been a feature of recent years, still continued, and was reflected in every department of the business, resulting in an increase both in gross income and net profit. During the year under review they had added considerably to the number of their subscribers both in Buenos Ayres and the provinces. They had opened new exchanges in Dolores, General Paz, General Belgrano, Nueva Roma, Lobos, Balcarce and Canuelas, all of which were important centres and would pay a good return on the capital invested in them. They had also started work on the extension of their main southern line from General Belgrano to Azul, a line which was destined eventually to be carried to Bahia Blanca, and to become one of their most important trunk routes, and in response to strong and influential demands they had authorised the extension of another section of the southern line from Dolores to Mar del Plata. During the year they had continued the work of extending their subways in Buenos Ayres and reconstructing their overhead circuits for common battery working. The three new exchanges in that city, which had been constructed on the common battery system, gave great satisfaction to their engineers, and to the general public, and they were now busily engaged in altering their Avenida building, which was their principal exchange in Buenos Ayres, to receive a new common battery board which they hoped to have working within the next nine or ten months. In the beginning of the present year, Sir John Gavey visited Buenos Ayres, and he reported that the new boards already installed have resulted in a most appreciable improvement in the service since his previous visit about 18 months before. Besides their subway work in Buenos Ayres, they had also done a considerable amount of similar work in Rosario, Cordoba and Bahia Blanca. Passing to the accounts, they would see that the capital was increased by £100,000, the amount of the issue made in April, 1908. The subscriptions paid in advance had increased by about £3,000, which was a satisfactory feature, while the reserve fund and the reserve for renewal of plant remained at the same figures as before, nothing having been added to these last year. They proposed, however, this year to increase the reserve fund by £25,000. The directors felt very strongly, and had no doubt the shareholders would agree with them, that, in view of the continual expansion of the company, it was necessary to build up the reserve. Nothing was more calculated to give stability to an enterprise than a reserve in proper proportion to the capital, and as a considerable part of the reserve was invested in the business, and was, consequently, revenue producing, the shareholders were getting the benefit both ways. They had expended £119,590 on capital account. Last year they wrote £25,000 off the special replacement account, but this year it had again increased to £35,138, and as the work of conversion was still proceeding, they proposed this year to write off £32,000 from this account, which would give them a fairly clean slate. Their securities were considerably increased from last year. Stock of materials was some £600 under last year's figure. Of course, with an expanding business, it was necessary to keep a fairly large stock, but this item was most carefully watched, both with the view of keeping the figures as low as possible, and also to prevent waste or leakage. Coming to the profit and loss account, there had been an increase in receipts and expenditure in the Argentine of £36,300 and £23,000 respectively; the cumulative result being that there was an increase in net profit for the year of about £12,700, and he ventured to think they would find these results satisfactory. Of course, they owed them largely to the skill and energy put into the business by the staff, and as the staff were forming a provident fund in Argentina, towards which they would themselves subscribe for the purpose of mutual help in sickness or misfortune, the directors believed the shareholders would be glad to follow the excellent example set by other public companies, and make a donation out of the profits towards such a laudable object. The sum the directors recommended was £2,000, and after more experience had been obtained from the actual working of the fund, the question of future grants could be considered on its merits. They looked forward to the future with confidence. As the population increased, so did the demand for their services. There was still plenty of outlet before they reached the proportion of telephones to inhabitants which had been reached in Europe or the United States. To provide for the increasing wants of the business it would be necessary to make a new issue of capital in the autumn. The amount required would be £150,000, and while it was too early to enter fully into particulars, he had no doubt that the terms would be acceptable to the shareholders. The directors recommended a final dividend of 5 per cent. on the ordinary share capital, making with the interim dividend paid on December 31st last, a return of 8 per cent. for the year, free of income-tax.

The report was adopted.

Mexico Tramways Co.

The directors' second annual report, for the year ending December 31st, 1908, shows that the net revenue for the year, after paying all expenses and fixed charges, amounted to $459,648.99, which added to the balance of $151,701.18 standing to the credit of profit and loss account at the end of the previous year, brought up the balance of such account to $611,350.17. During the year four quarterly dividends each at the rate of 4 per cent. per annum were paid to the shareholders, absorbing $240,000, and leaving a credit balance on profit and loss account of $371,350.17 to be carried forward to next year. During the year the sum of $1,027,294 22 was spent on capital account, extensions, improvements and the general equipment of the tramways system. The outlay already incurred has had the result of reducing the ratio of working expenses from 56 per cent. in 1907 to 52½ per cent. in the year now under review, while the results for the first few months of the current year show a still further reduction. As the company now has very complete car shops, thoroughly equipped with modern tools for wood and metal work, all of the rolling stock required is now being constructed by the company. The quality of the work turned out by the shops is fully equal to that in the imported cars and the cost, ready for service, is considerably less than that for which they could be imported. The policy of the company, in using to the greatest possible extent, native materials and native labour in the construction of its rolling stock, has met with the very cordial approval of the authorities. To guard against loss of equipment by fire, an automatic sprinkler system of the most approved type has been installed in all the company's car barns and shops as well as in the principal offices.

At the present time (June, 1909) the tramways system consists of 171·01 miles of track, of which 131·82 miles are operated by electricity, 32·90 miles by mules and 6·29 miles by steam; 13·82 miles of electric track have been added since the report of 1907. It is anticipated that by the end of 1910 the whole system will be equipped and worked by electricity. The car equipment at the present time (June, 1909) consists of the following:—

Electric passenger cars and trailers	312
Mule passenger cars	70
Freight equipment	203
Funeral special equipment	45
Miscellaneous equipment, carts, wagons, &c. ...	45
	675

Since the date at which the accounts for this report were made up the company has acquired a controlling interest in the Mexican Light and Power Co., Ltd., by the purchase of 84,000 ordinary shares in the capital stock of that company. These shares were bought at a price of $80 per share, the purchase price being provided by the issue of the company's shares at $140, being at a premium of $40 per share. This step was taken with the object of assuring a certain and increasing supply of power for the tramways system which is of vital importance to the company, but the directors are satisfied that apart from this consideration, the acquisition will prove a remunerative investment, and with the centralisation of the management will result in considerable economy in the working of both companies. With a view of providing for the rapidly growing needs of the tramways business and in order to assist in the financing of the Mexican Light and Power Co., Ltd., who are carrying out large extensions to cope with the demand for power, the directors recently created an issue of 6 per cent. 50-year mortgage debenture bonds and sold in London £1,250,000 of such bonds. In view of the large interest of this company in the Mexican Light and Power Co., Ltd., the annual reports and accounts of that company will be sent to shareholders in this company with this and subsequent annual reports. The legal action referred to in the last report, brought against the Mexico Electric Tramways, Ltd., by a shareholder in that company, for the purpose of annulling the lease, has been settled on terms satisfactory to this company, and the lease, therefore, remains in force, and the directors are satisfied that the operation under such lease will be most satisfactory for all concerned. The following statistics relating to the operations of the company indicate the continual expansion of its business:—

	Gross earnings (Mexican currency).	Passengers carried.
1906	$4,210,768·00	54,448.225
1907	$4,924,075·00	64,623,567
1908	$5,328,574·00	70,357,661

Comparative Statement of Track Mileage.

	Electric.	Mule.	Steam.	Total.
1905	98·47	39 16	12·33	149·96
1906	108·00	39·00	12·00	159·00
1907	118·00	37·00	12 00	167·00
1908	125·41	37·88	7·88	171·17
June, 1909	131·82	32·90	6·29	171·01

Metropolitan Railway Co.

The directors report that the total receipts for the half-year ending June 30th, 1909, amount to £379,487, and the expenses to £193,243, leaving a profit of £186,244. Compared with the corresponding half-year of 1908, the receipts show an increase of £22,700, and the expenses a decrease of £6,537. The expenditure is at the rate of 56·25 per cent. of the total traffic receipts, as compared with 60·36 per cent. in the corresponding period. The net revenue account, after providing for the interest upon the debenture stocks and other fixed charges and for electrical depreciation, shows a balance of £137,075, which will permit of the payment of the dividends upon the preference stocks, and leave a balance of £32,564 available for dividend upon the ordinary stock. The directors recommend a dividend upon the ordinary stock, for the past half-year, at the rate of £1 per cent. per annum, carrying forward £3,904. The Surplus Lands Committee announce that the dividend on the surplus lands stock, for the past half-year, will be at the rate of £2 15s. per cent. per annum, as in the corresponding half-year. The development of the passenger traffic resulting from the improved train services and through bookings with the tube railways, has been well maintained; while the new express parcels service, which was brought into operation at the beginning of the year, has also been very successful, and has attracted a large amount of new business. The inauguration on July 1st of a morning and evening through train service between the City and stations on the Aylesbury and Uxbridge extensions, thereby obviating the change of trains at Baker Street, is a great convenience to the public, and cannot fail to have the effect of securing additional traffic to the railway. The Imperial International Exhibition at Wood Lane was opened on May 20th last. The traffic from this source has not, so far, been so large as that obtained from its predecessor, the Franco-British Exhibition, but it will no doubt develop considerably during the forthcoming holiday and excursion season. The Bill deposited by the North-West London Railway Co. was considered by a committee of the House of Commons in May last, when this company took an active part in opposing it, and the Committee, after eight days' hearing, decided not to allow the Bill to proceed. The electrical plant and machinery have worked very satisfactorily throughout the half-year, and the current is still produced at a low rate per unit. The installation of automatic signalling on the Inner Circle is now practically completed, and has resulted in greatly improved punctuality in the running of the trains. A new station is in course of erection at Dollis Hill, in order to serve the rapidly-growing neighbourhood between Willesden Green and Neasden. A goods receiving depôt is being constructed at Farringdon Street, which will be brought into use before the end of the current half-year.

Year.	Number of passengers.	Gross receipts for passengers, goods, minerals, and tolls.
1907	96,859,108	£640,838
1908	99,846,735	£680,357
1909 To June 30th	49,647,166	£343,566

Sao Paulo Tramway, Light and Power Co., Ltd.

The report of the directors for the year ending December 31st, 1908, which was recently submitted to the annual general meeting, states that, notwithstanding depressed business conditions, an increase in the gross and net earnings of the company took place. The gross earnings amounted to $2,287,410·56, an increase of $175,887·42, and the net earnings were $1,504,359 78, an increase of $108,486·28. A sum of $92,665·48, which has been charged to the contingent account, was expended for renewals and replacements; and to meet such expenditure, and provide for reconstruction of tracks, the directors have set aside $300,000 from the year's earnings to the above account, and $17,968 has been already charged against this appropriation. During the year the track mileage was increased by 4·75 miles; the Santa Anna Railway, which was acquired in the previous year, has been replaced by an electric line, and was opened on October 8th. The electric lighting connections show increases of incandescent lamps from 44,319 to 51,320, and of arc lamps from 1,251 to 1,458. There are now 4,209 lighting consumers, and the flat rate basis of charging is being superseded by meter charges, which it is expected will prove beneficial to the company. During the year 764 houses were wired for electric light, this being nearly 50 per cent. of new houses erected. In the power department, the connected load shows an increase of 3,553 H.P.; contracts in hand this year are expected to add a further 1,500 H.P. The total of motors now installed is 9,555 H.P. During the year shut-downs at the power house only aggregated seven minutes in all, and transmission line troubles have been overcome. The power house was extended to accommodate three additional units, and steel poles were substituted for wooden ones on the transmission line, leaving only 25 per cent. to be replaced in future. The rolling stock was increased by 25 passenger cars, and various additions made to substation and transformer plant and mains. To meet this capital expenditure the directors during the year disposed of $1,200,000 of capital stock; the premium on those shares, amounting to $161,562·77, was transferred to the reserve fund. The accounts show that the surplus earnings, together with the balance from the previous year, amounted to $1,795,790 45, from which three 2½ per cent. and one 2½ per cent. dividends were paid, absorbing $836,538 46; $300,000 was transferred to contingency account, and a balance of $659,251·99 carried forward.

Madras Electric Supply Corporation, Ltd.

The third annual meeting of the shareholders of this company was held on Friday at Salisbury House, London Wall, Mr. Arthur M. H. Walrond presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, July 23rd, page 147), said that the outlay on capital works amounted to £225,348. They had made a loss of £1,500 on the working of the temporary plant. That was not surprising, and while no profit was anticipated, they never expected to have to run that small plant for such a long time, and the loss, therefore, was larger than it would have been had they been in a position to supply current from their main station on the expected date. The profits of the tramways company had increased, and they had received a 5 per cent. dividend on that investment. The board had had a very anxious time, due not to any fear on their part as to the future prospects of the company, but solely on account of the very serious delay in the completion of the contract. As they were aware the company was formed to take over a concession, held by Messrs. Crompton & Co., their contractors. The concession was handed over to them free of charge on the condition that the contract for the work should be given to Messrs. Crompton. Unfortunately there was no penalty attached to the contract for failing to complete within a given time. The board were, however, assured that two years would be ample time, and Messrs. Crompton led them to believe that that time might be considerably accelerated, and that they might very possibly be obtaining current in September, 1907. The great delay which had taken place in completing the contract had materially affected, but only for the moment, the financial position of the company. The delay in completing the work raised a question between the company and Messrs. Crompton, which was largely a legal one, and the question was receiving the best consideration of the directors, who were resolved to adopt every means in their power for the protection of the company. They had received a telegram saying that the buildings were now practically complete, and that included the sub-stations at Mylapore, and for the tramways. The complete plant would consist, on the direct-current side for the town supply, of plant of a capacity of 2,000 KW., capable, it was estimated, of supplying current for fans and lighting, to an equivalent of 100,000 lamps connected to the mains. On the alternating-current side they had plant of 1,500 KW. capacity for the supply to the tramways and workshops in the town. The tramways had contracted to take or pay for at least one million units per annum, and although that supply must be made before long, he regretted to say that even to-day the contractors could not give them a definite date for commencing the tramway supply. Independently of the tramways they had applications equivalent to 21,500 lamps, and they had already connected up an equivalent of 14,000 8-C.P. lamps. The number of inquiries for both lighting and power purposes was very encouraging. An arrangement was practically concluded for supplying the Madras Port Trust with an estimated consumption of 40,000 units per annum. They failed to obtain the contract for street lighting, the municipality having decided at the last moment to adopt another form of. illuminant. They had applied for a licence to supply to Fort St. George, which they believed to be a large consumer, and meanwhile, with the sanction of the Indian Government, they were giving a supply to the Army Temperance Association at the fort from an overhead main. He thought he had said sufficient to indicate that there was every encouragement for the future. They would probably have to raise more capital before long, part of which would be wanted on account of delay in completing the contract, but they would undoubtedly require, from time to time, extra capital for extensions of mains to keep pace with increased requirements, and there was every reason to believe that capital for this latter purpose would be remunerative, and mean increased net profit.

Sir Ralph Moor, in seconding the motion, said he could assure the shareholders that the importance of the early completion of the work had been appreciated by the board from the very commencement; so much so, that when Messrs. Crompton indicated the possibility of their being able to obtain current by September, 1907, the board offered them a bonus if they succeeded in doing that. The delay during the past year had been most disheartening, considering the efforts the directors had made all along to get early completion of the contract.

The report was adopted.

African Trans-Continental Telegraph Co., Ltd.

The directors in their annual report for the year ended March 31st, 1908, state that the company's lines continue in good working order and condition. Interruptions to telegraphic communication during the year under review were few and of short duration, except in two cases where the interruption on one section of the line, caused by the natives having cut and removed portions of the wire, lasted for over a week. It has, however, been found necessary to renew the telegraph wire at Tete, in Portuguese East Africa, where the line crosses the Zambesi in a single span of 2,178 ft. It may be stated that the line and poles at this spot are run in duplicate, in order to guard against the interruption to traffic that would result from a breakdown if the line were single. The Northern terminus of the line is still at Udjidji, on the East Coast of Lake Tanganyika, no arrangements having yet been found possible for the provision of funds for its further construction northwards. The gaps in the British East Africa Administration's telegraph have been further reduced within the last year, and the distance to be covered before Cape Town and Cairo are joined by an unbroken line of telegraph has now been reduced to about 520 miles. The annual working expenditure of the line is not yet balanced by the revenue, and the deficiency continues, as before, to be advanced by the British South Africa Co. The deficit on the working of the line for the year covered by the accounts shows a considerable decrease compared with that of the previous year, and there will be a further decrease in the year 1908-9. It has been decided to raise the tariff rates for code and cypher messages by 50 per cent., that is to say, from 3d. a word to 4½d. a word. This has been rendered necessary by the general adoption of the five-letter combination codes, compiled to take full advantage of the new regulation with regard to the transmission as single words of any pronounceable combination of 10 letters—a regulation that increases the liability to errors in transmission and, in effect, reduces the number of code words transmitted. Mr. Rochfort Maguire and Mr. Sigmund Neumann retire from office, but offer themselves for re-election.

The sixth ordinary general meeting of the shareholders of this company was held on Monday at the offices, 2, London Wall Buildings, Mr. Rochfort Maguire in the chair.

In moving the adoption of the report, the Chairman said they would have learned that the line was being maintained in good working order, and that interruptions to traffic had been of short duration. On that point it was not necessary for him to say more than that, considering the length of the line and the unprotected nature of the country through which, for a great part, it passed, it was extremely satisfactory that the interruptions had been so few, and that the thefts of the wire, which were suggested as one of the chief difficulties of constructing the line, had also been extremely few. They would notice that the excess of working expenditure over revenue for the year dealt with in the accounts, was considerably less than that for the previous year, and there would be a further decrease for the year 1908-9. For the year 1905 the loss was £2,764, whilst for the current year it was not expected to exceed £1,500. That result was due to the economies which had been effected from time to time as the varying circumstances of the line had rendered them possible. It was to be regretted that it was due to that cause alone and not to any increase of revenue, for, as a matter of fact, between the years 1904 and 1908, the revenue had steadily diminished, and since that time it had been only stationary. To endeavour to increase in some small degree the revenue coming to them, it had been decided to raise the tariff rates for code and cypher messages by 50 per cent., and it was hoped that that would make a moderate increase in the revenue. This want of elasticity in their revenue led them to a further consideration—that the circumstances of a new country, such as the greater part of the line passed through, which was not in any real sense opened up to civilisation, and which had only a very small and gradually growing white population, did not afford a basis for rapidly developing telegraphic traffic, and it was to be feared that that consideration would apply with even greater force to the country which still remained to be traversed before the Cape to Cairo telegraph would be completed. In fact, their experience, which now extended over many years, showed them that telegraphic enterprise in a country situated as this was, did not afford a basis for profitable commercial enterprise, and that, coupled with the fact which he had more than once explained at such meetings, that the whole capital problem was completely altered since Mr. Rhodes initiated the enterprise, now 17 years ago, doubtless had weighed, and would weigh, with the Rhodes and Beit trustees in their consideration of the claims of the Cape to Cairo telegraph, as compared with other schemes of development claiming their assistance. Consequently he was not in a position to report any progress, since the last meeting, in the negotiations or hopes which they were then inclined to form of assistance to complete the remaining sections necessary to finish the line.

Mr. Bourchier F. Hawksley seconded the motion, and the report was adopted.

Victoria Falls and Transvaal Power Co., Ltd.

The ordinary general meeting of the above company was held at Salisbury House, London Wall, on Friday, under the chairmanship of Mr. H. Birchenough, C.M.G.

The Chairman, in proposing the adoption of the report (see Electrical Review, July 9th, page 69), said he had been asked to preside in the absence of Lord Winchester, who at the present time was on his way back from South Africa, where for the last few months he had been closely engaged upon their business. Great progress had been made during the year in establishing the business upon a solid and permanent basis. Since they last met, far-reaching developments had taken place. To deal with the balance-sheet on December 31st last, the issued capital of the company consisted of 1,801,050 shares, divided into 1,000,000 ordinary shares and 801,050 preference shares of £1 each. First mortgage debentures to the amount of £800,000 had been issued, and, in accordance with the wishes of the auditors, there had been added to this figure the interest and income-tax for the half-year to December 31st due, but not paid until January 1st, 1909. The amounts due to creditors in Europe and South Africa were for contract work certified, but not paid, at the date of balance-sheet, together with sundry merchants' accounts, natives' wages accounts, &c., all of which had since been paid. In this year's balance-sheet the heading "purchase of property and concessions" had been divided into "purchase of leases and undertakings" and "expenditure in connection with new stations." A total amount of £699,885 had now been expended upon new stations. As a considerable proportion of the time of the directors and staff had during this construction period been taken up with matters connected with the erection of plant, the board had felt justified in including a proportion of the management expenses in London and South Africa under this heading. The debts due to the company, amounting to £20,127, were all good, and had since been paid. Owing to the fact that they were again mainly occupied in construction work, and only supplied current from the old stations, a profit and loss account was not submitted. They would, however, see that after paying interest on the debentures allotted in part purchase of the Rand central station, and providing for general expenses and depreciation of stores, furniture and live stock, the account showed a surplus of £48,178, compared with a surplus last year of £36,686. This result was satisfactory, especially when it was remembered that their temporary contract for the bulk supply of electricity to the city of Johannesburg, expired in the middle of the year. The directors had not charged to the revenue and expenditure account anything for depreciation of the new works, as it was only towards the end of the year that the first units of the new plant were ready for commercial use. They had every reason to believe that the working of the year 1909 would show a satisfactory surplus, but it was too early to estimate with any degree of certainty what that surplus would be. They were still in the construction period, and under these circumstances they thought it wiser and more prudent not to pay any interim dividend upon the preference shares for the first six months of this year, but to ascertain their profits before they divided them. In the long run the preference shareholders would not suffer, as their dividends were cumulative. Since the meeting in October last, an immense change has taken place in the position and magnitude of the undertaking. Their business had developed from one of medium size and importance into one of the largest electrical power businesses in the world with an assured and, he might say, permanent connection. At the extraordinary meeting held in February they were told they had acquired from Mr. Harper a conditional agreement made by him with the Rand Mines, Ltd., under which, when the agreement became definite, 15 mining companies controlled by the Rand Mines and Eckstein Groups would contract to take the whole of their power requirements from a company to be formed for the purpose of supplying them with electricity and compressed air. This agreement was originally for 12 years, but they were successful in negotiating an extension of the contract from 12 to 20 years—without any right on the part of the Rand Mines of terminating it at an earlier period. The annual power requirements of these mines were estimated by the Rand Mines, Ltd., at 270,000,000 units, and Lord Winchester spoke of this contract as being the largest contract for power ever placed with one company. In addition to this agreement, negotiations had been successfully carried out for the prolongation of the contract with the Consolidated Goldfields of South Africa from 10 years to 12 years, and important contracts had been entered into with other mining groups, including the Johannesburg Consolidated Investment Co. In order to take advantage of the Harper agreement it became necessary to raise additional capital. Accordingly an agreement was negotiated and entered into with the German banks for the subscription of £900,000 5 per cent. debentures, and subsequently, in accordance with arrangements made with the banks, a prospectus was prepared and £900,000 preference shares were issued in London. A company had been formed and registered in the Transvaal, entitled the Rand Mines Power Supply Co., Ltd., to operate the Eckstein contract and to supply power in bulk to their company. It had a capital of £1,500,000, namely, a share capital of £500,000 in shares of £1 each, and it would have borrowed capital of £1,000,000. The whole of these 500,000 shares were being subscribed at par by their company, and the borrowed capital would be advanced by their company. He wanted to make it quite clear to them that, while the Rand Mines Power Supply Co. was a separate and distinct company from the Victoria Falls and Transvaal Power Co., yet it had been called into existence by the Victoria Falls and Transvaal Power Co. for a specific purpose, and its entire capital was owned and held by the Victoria Falls and Transvaal Power Co. Proceeding to deal with the question of competition, which was threatened when the meeting was held last year, the chairman said that, thanks to negotiations, cut-throat competition, with its unnecessary duplication of plant and great economic waste, had been avoided, while the interests of the consumers of electric power had been effectively and amply safeguarded. The result was that their undertaking, which, a year ago, had a revenue of £160,000, with scope for increase up to £300,000, would have a revenue of £800,000 a year as soon as the machinery necessary for supplying the huge demand they had in sight was ready for commercial use. They had now a secured business, based upon long contracts. They had the active goodwill, and, in some cases, the powerful financial co-operation of the great mining groups, who saw in cheap electrical power a material element in their own prosperity and success. As a rule, in business, the difficulty was to find customers; in their case the immediate difficulty was to cope with the demands for power as they came in. Touching next on the strenuous work of Lord Winchester and the Committee, by whom the negotiations for the Eckstein and other contracts were carried through, the chairman said they had voted these gentlemen special remuneration, and the board had fixed the remuneration of Lord Winchester as chairman and member of the executive committee at £3,000 a year.

Sir Charles Metcalfe, Bart., in seconding the motion, said he had recently visited their stations, and found everything working well and smoothly. He believed they had the finest up-to-date plant in the world. They had now something like 12,000 kw. in actual use, and would have double that amount in 12 months' time. The opposition to them appeared largely to have died away, and they were now looked upon as contributing to the general prosperity of the country.

Replying to a question by Mr. Wisden as to the generating of electricity at the Victoria Falls, Sir Charles Metcalfe said that they had found the question of the transmission of power from the Victoria Falls an enormously difficult one, owing to the attitude of the people in the Transvaal, who supplied coal to various companies, and also of the railway authorities, who feared that they would lose a large amount of revenue if coal was not used. To meet that opposition they had had to defer the question of the long transmission for the present.

The report was then adopted, and the retiring directors were re-elected.

The recent annual report of this company evoked a complaint by the *Berliner Tageblatt* on the ground that it was only published in English. When the 5 per cent. loan of £625,000 was offered in Germany, the Berlin newspaper states that it was expressly declared in the prospectus that all announcements respecting the debentures, as well as the publication of the balance sheet and profit and loss account, would be effected in the *Reichsanzeiger*, and in two other Berlin newspapers, as long as a portion of the A loan was in circulation. It is therefore all the more astonishing, it is said, that the present report appears solely in English. It should have been the duty of the company, and of the interested German firms, it is considered, to take care that the report was also published in the German language, as the German market was drawn upon for very considerable sums, and the undertaking is still in course of development, so that German debenture holders have an extraordinary interest in being sufficiently informed of the position of the enterprise.

Liverpool Overhead Railway Co.—The accounts for the past half-year show an available balance of £7,696, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the (1892) preference shares, as last year, leaving a balance of £4,696 to be carried forward.

Central London Railway Co.

The directors' report for the half-year ending June 30th, 1909, shows that, compared with the corresponding period in 1908, there has been a decrease of £19,646 in the revenue receipts and of £258 in the working expenses. The balance carried to net revenue is £64,139. After providing for interest on the debenture stock and other payments, as shown by the net revenue account, there remains a balance of £84,093. The directors recommend the declaration of dividends on the undivided ordinary stock at the rate of 3 per cent. per annum for the half-year, and on the preferred ordinary stock at the rate of 4 per cent. per annum for the half-year. Dividend on the deferred ordinary stock not being payable until the result of the working of the whole year is ascertained, the remaining balance of £44,750 is carried forward to next half-year. The number of passengers carried since the opening of the railway in 1900, including those using through tickets and the cheap return tickets, is 376,824,427. In the reports to the proprietors for the year 1908, attention was called to the satisfactory traffic derived from the Franco-British Exhibition at Shepherd's Bush. The Imperial International Exhibition was opened in May of the current year, but though it yields some additional traffic, the remarkable results of last year have not up to the present been repeated. The effect of the competition by horse and motor-omnibuses over the whole of the company's route, especially for short distances, has resulted in a material decrease in the number of passengers carried by the company's trains, and after careful inquiry and observation the directors decided in March last to adopt, in addition to the 2d. and 3d. fares, a fare of 1d. for passengers travelling not more than three stations from the station of departure. There has been a large increase in the number carried for short distances, but the experience has been too brief to permit of the expression of a decided opinion on the experiment. The decrease in the number of ordinary local passengers carried during the half-year was 1,515,633, as compared with the corresponding period, which, it must be remembered, included traffic to and from the Franco-British Exhibition. The number of workmen carried was 454,714 less, but the passengers exchanged with other companies' lines increased by 1,067,706, indicating the value of the through booking arrangements. The net decrease in the number of passengers carried was 912,641. The company's Bill for the extension of their line from the Bank to and under the Liverpool Street Station of the Great Eastern Co., with a connection to the adjacent Broad Street Station of the North London Co., has been passed by Committees of both Houses of Parliament. It now awaits the Royal Assent. The Bill also provides for exchange subways between the Holborn Station of the Great Northern, Piccadilly and Brompton Co. and the British Museum Station of the Central London Co., and between the public subway of the Central London Co.'s Bank Station and the booking hall of the City and South London Co.'s station in Lombard Street.

Crompton & Co., Ltd.

The twenty-first annual general meeting of the shareholders of this company was held on Monday, at Salisbury House, London Wall, Mr. J. Trotter presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, July 23rd, page 147), said he had no doubt that the net trading results for the past year would be considered unsatisfactory by the shareholders. The cause of that general depression in trade, he had little doubt, was to be found in the rapid growth of expenditure, not only in this country but abroad, especially expenditure of an unproductive kind. The large sums raised a few years ago by municipal authorities produced an unnatural demand for electrical appliances, with the inevitable result that many new works were established, resulting, now that the municipal expenditure had, to a great extent, ceased, in very unhealthy competition, and the reduction of prices to a level which, for the time being, left no room for reasonable profit. There were other causes at work of a far-reaching character which had had an effect upon our industries. One of them might be found in the reluctance of our Government to give support to industrial enterprise abroad, compared with the Canadian, American, the German and Russian Consuls in foreign countries, who were to all intents and purposes pioneer travellers in the interests of the industries of their respective countries. There were also abroad financial institutions of a semi-political character whose business it was to finance vast undertakings throughout the world. There was, for instance, the Victoria Falls Power Co.'s undertaking, involving an expenditure running into millions on electrical plant. There in one of the British Colonies the work was given to Germany, work which should go to a British company, but they could not possibly undertake that work for lack of that financial support, which was easily obtained by German companies from German industrial banks. Even for much smaller undertakings at home and abroad, there was a lack of financial support in London which could not properly be supplied by our present banks, and it left room for the establishment of a strong industrial bank, with able men at the head doing business on the lines of the Deutsche Bank in Germany. The result of the absence of those facilities was that electrical manufacturers and contractors were turning to company promoting on their own account—an unhealthy condition which invariably resulted sooner or later in the lock-up of capital which should be kept in a more liquid form. That was shown in their balance-sheet, but fortunately not to a very serious extent. They were obliged temporarily to hold investments in other companies, especially in the Electrical Supply Corporation—a thoroughly sound undertaking, making satisfactory progress, but, as was always the case, involving a period of a few years for the business to become thoroughly established. Such a bank as he had indicated might safely invest in undertakings of that description with advantage to itself and with advantage to manufacturing concerns such as theirs, who should be in a position to use their capital for fresh undertakings as soon as the first installation was complete. There was another cause which, without doubt, prejudicially affected their own and other undertakings, and that was the general want of confidence which had been brought about by recent legislation. Slackness of trade had resulted, and capital which, if used in this country, might bring about a speedy revival, had gone abroad or to the Colonies. During the past six months there had been new issues on the London market which had been successfully placed to the following extent:—For the Colonies, 25 millions; foreign Governments, about 19 millions; foreign railways, 17 millions; Colonial and foreign corporations, 12 millions; Colonial and Indian railways, 7 millions; or 81 millions in all. It was true that a portion of that vast sum might be spent in the purchase of goods in this country for shipment abroad, but even so the money went over seas, and it must follow that this country was not benefited to anything like the extent it would be if the greater part of the money were used in this country. If they took the last four years, including the present one, they would find that there had been an average profit of about £25,000. The previous four years, which also included a bad year like the present one, showed an average profit of £16,500; they would therefore see that the business was making a genuine advance. The secret of the bad result obtained in the present year was to be found in the diminished gross profit. The gross profit was reduced to some extent by a slight falling off in the turnover, yet the turnover had only twice been surpassed in the history of the company. The actual gross profit on the turnover was 3 per cent. less than on the turnover of the previous year. There seemed no apparent reason why prices should rise materially in the immediate future, and the only way of making a profit in these times was to use every effort to increase, as well as to improve, the business, and consequently still further reduce the cost of production. The general manager and the staff had during the year given their attention to the question of the manufacture and sale of machinery and apparatus on which there might be a larger margin of profit than could be obtained from the sale of standard manufactures, in which there was so much competition. They did not limit themselves to the manufacture of electrical apparatus only, but had looked further afield, and were turning out some non-electrical apparatus suitable to their existing machine tools and appliances. The company's designers had been exceedingly busy during the year, and several new patents had been taken out, the most important of which were a series covering the auto-converter. One of the most important fields open to the auto-converter was its application to the control of electrical vehicles—for example, omnibuses and tramcars. An omnibus had been equipped, and had already run over 1,500 miles, with results that amply justified the high opinion formed of the invention. He was happy to say that they still secured a considerable amount of Government work, and within the last few days had secured an important contract of that description, in face of international competition. During the year foreign competition had again made itself felt, particularly with alternating-current machinery. It was disappointing to find that many large manufacturing concerns in this country would as readily purchase foreign as British made machinery, although the prices were the same. One feature which had hampered business during the year had been the large amount of the company's capital locked up in retention moneys. That feature was reflected in the item of trade debtors which had gone up some £30,000, and correspondingly loans from banks had increased temporarily. Then again there was a considerable amount of capital locked up in the Electrical Supply Corporation. In the meantime it had been desirable to find temporarily a certain amount of capital, and with that object the directors offered to the shareholders an issue of short term notes. They were still open to dispose of some more of those notes, but in the event of their not being applied for, they had made such arrangements as would fully meet all their financial requirements. Turning to the balance-sheet the item of plant and tools was reduced by nearly £31,000. The stock also had been slightly reduced. Investments in other companies showed an increase of £10,000. Trade debtors were up by some £30,000, a large portion of which was due to retention money, much of which should have been realised before now, but for unforseen circumstances beyond their control. The reserve fund stood at £28,000, instead of £20,000 last year. The gross profit was reduced by £23,000, and the net profit to revenue account was only £10,000, in place of £31,000. The result of the year's trade was that they had paid their way, but were unfortunately not able to pay any dividend to the shareholders.

Col. Crompton, in seconding the resolution, said that as he was the largest shareholder, he was hit far harder than anybody else, and he could tell them that this bad year was a very great blow, but he could say that he was not cast down. He thought that the future was still bright, for they had the best of all assets, a very good staff of engineers, and experts on whom they could depend, and none of whom were leaving them. He did not consider it was necessary to say anything in apology for an honest balance-sheet produced by honest work, by thoroughly capable engineers, and he believed that they had the best engineers in the kingdom.

The report was adopted.

Liverpool District Lighting Co.—The directors announce an interim dividend at the rate of 4 per cent. per annum, less income-tax. Last year the rate was 5 per cent.

Anglo-American Telegraph Co., Ltd.—The directors' report states that the total receipts from January 1st to June 30th, 1909, including the balance of £1,565 brought forward from the last account, amounted to £211,760. The traffic receipts show an increase of £14,503 as compared with the half-year ended June 30th, 1908. The working expenses of the half-year, as shown by the revenue account, amounted to £72,345, being a decrease of £950 as compared with the corresponding period of 1908. The directors, under the powers conferred upon them by the Articles of Association, have, before declaring the net profits, set apart the sum of £10,000 to the renewal fund, leaving a balance of £129,414.

Quarterly interim dividends of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock were paid on May 1st, 1909, absorbing £52,500, and second quarterly interim dividends of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, amounting to £52,500, will be paid on July 31st, 1909, as in the previous year. The balance of £24,414 will be carried forward.

Stratford-on-Avon Electricity Co., Ltd.—The directors, in their second annual report, state that, although the profits do not at present justify the declaration of a dividend, they are well satisfied with the rapid progress that is being made. Mr. S. Paterson retires and does not seek re-election, but the board recommends the election of Mr. John MacGregor, managing director of Messrs. Johnson & Phillips, Ltd., in his place. The accounts show gross receipts amounting to £886, and a balance to net revenue of £216, which suffices to meet interest on debentures and bank charges, leaving a balance carried down of £75.

Anglo-Argentine Tramways Co., Ltd.—At an extraordinary general meeting of the proprietors, a resolution passed at the extraordinary general meeting held on July 7th, approving the new regulations of the company to the exclusion of and in substitution for all existing regulations, was agreed to unanimously. The chairman announced that the board had considered the suggestions made with regard to the issue of bearer shares, and that, in consultation with their Continental friends, facilities would be given to meet the wishes of the proprietors in that respect.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ending June 30th, 1909, at the rate of 8 per cent. per annum, payable on August 12th. Last year the rate was the same.

The National Gas Engine Co., Ltd.—The directors have resolved to pay an interim dividend at the rate of 5½ per cent. per annum, less income-tax, on preference shares, and 20 per cent. per annum, less income-tax, on ordinary shares, for the six months ended June 30th, 1909. Dividend warrants will be posted to shareholders on the 31st inst. in respect of all shares standing in their names on the 23rd inst. Last year the rates were the same.

Melbourne Tramway and Omnibus Co., Ltd.—The London secretary has received cable advice of the declaration of a bonus for the year ended June 30th last at the rate of 5 per cent., as in the previous year, payable on August 10th.

Bournemouth and Poole Electricity Co., Ltd.—The interim dividends upon the 4½ per cent. preference shares and the 6 per cent. second preference shares, less income-tax, for the half-year to June 30th, and an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax, for the same period, as in the previous year, all payable on August 15th, are announced.

Rees Roturbo Development Syndicate, Ltd.—The report states that during the six months to June 30th the rate of progress shown in the earlier reports of the syndicate has been fully maintained. The royalties for the half-year amount to £1,108, as against £608 for the corresponding period of last year. The directors have decided to pay an interim dividend at the rate of 5 per cent. per annum, which, less income-tax, will absorb £709.

Brompton and Kensington Electricity Supply Co., Ltd.—The directors have declared an interim dividend for the half-year to June 30th on the ordinary shares at the rate of 9 per cent. per annum, the same rate as last year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the three months ended June 30th last (as last year).

Vickers, Sons & Maxim, Ltd.—The directors announce the following interim dividends for the half-year ended June 30th last: 2½ per cent. (less income-tax) on the preferred 5 per cent. stock and 5 per cent. preference shares, and 1s. per share (free of income-tax) on the ordinary shares.

Continental Notes.—La Compagnie Egyptienne Thomson-Houston, of Brussels, reports a profit of £4,057 for the last financial year.

Messrs. Brown, Boveri & Co., of Baden, are declaring a dividend of 11 per cent. for the last financial year, the same as for the preceding 12 months.

Imperial Tramways Co.—It is announced that no interim dividend will be paid at this time on either class of shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	July 21	3,347	+ 18	7	11,011	— 208	..	..
Ayr	,, 24	1,343	— 5	10	3,805	— 171	8	..
Bath	,, 21	1,978	+ 283	29	21,274	+ 898	..	..
Belfast	,, 23	8,243	+ 987	16	63,311	+ 2,771	37	..
Birkenhead.. ..	,, 25	2,177	— 44	16	17,811	— 457	18·52	..
Birmingham Corp.	,, 17	15,398	+2,532	16	103,927	+ 3,182	..	..
Blackburn	,, 21	2,252	— 151	17	19,357	— 628	13·97	..
Blackpool-Fleetw'd	,, 24	2,036	— 111	3	3,665	— 128	..	..
Bolton	,, 18	4,781	+ 169	16	37,537	— 531	26	..
Bournemouth ..	,, 21	3,332	— 95	16	26,559	— 23	21·96	..
Bradford	,, 17	9,903	+ 440	15	76,712	+ 1,371	54·9	..
Brighton	,, 25	2,065	+ 34	17	15,910	+ 768	9·5	..
Bristol	,, 23	11,772	+ 810	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 16	455	— 16	28	6,096	— 144	3·65	..
Barnsley	,, 16	328	— 22	,,	4,640	— 204	..	..
Barrow	,, 16	517	— 34	,,	6,159	— 481	5·37	..
Cavehill	,, 16	306	+ 78	,,	2,311	— 174	..	..
Devonport ..	,, 16	716	— 177	,,	10,189	— 2,303	8·85	..
Gateshead ..	,, 16	2,017	— 23	,,	27,674	— 317	11·25	..
Gravesend ..	,, 16	470	+ 5	,,	5,521	— 219	6·5	..
Greenock	,, 16	1,028	+ 37	,,	14,569	+ 192	7·25	..
Hartlepool ..	,, 16	556	+ 9	,,	6,201	— 160	6·72	..
Kidderminster ..	,, 16	279	— 20	,,	2,752	— 202	..	..
Leamington ..	,, 16	419	+ 21	,,	4,581	+ 163	..	..
Merthyr	,, 16	466	+ 34	,,	5,905	+ 55	2·9	..
Metropolitan ..	,, 16	13,742	+1,518	,,	167,030	+13,444	22	..
Middleton ..	,, 16	729	— 23	,,	9,263	— 709	8·5	..
Mid. Joint Com'tee	,, 16	13,796	+1,978	,,	217,441	— 2,094	..	..
Oldham—Ashton	,, 16	1,168	— 27	,,	15,498	— 1,028	9·13	..
Peterborough ..	,, 16	352	— 26	,,	3,161	— 280	5·31	..
Potteries	,, 16	3.605	+ 43	,,	49,446	— 1,246	29	..
Rothesay	,, 16	832	+ 32	,,	4 113	— 70	2·75	..
Southport.. ..	,, 16	693	— 12	,,	7,620	— 248	8·17	..
S. Metropolitan ..	,, 16	1,744	+ 68	,,	21,245	— 313	..	..
Swansea	,, 16	2,031	+ 50	,,	25,872	+ 488	12·5	..
Tynemouth ..	,, 16	771	+ 165	,,	5,615	+ 46	3·75	..
Weston-s-Mare ..	,, 16	555	+ 26	,,	2,792	+ 165	3	..
‡Worcester ..	,, 16	634	— 5	,,	7,331	— 128	5·75	..
Wrexham ..	,, 16	200	— 10	,,	2,663	— 123	..	..
Yorks. Wool. Dist.	,, 16	1,824	+ 69	,,	24,724	— 505	17	..
Miscellaneous ..	,, 16	454	+ 26	,,	5,536	— 4	..	..
Burnley	,, 24	2,441	— 280	..	..	..	..	..
Burton-on-Trent ..	,, 25	553	— 38	17	4,461	— 134	6·62	..
†Bury..	,, 18	1,188	— 60	$15\frac{4}{7}$	18,864	— 521	22·5	..
Cardiff	,, 17	4,484	— 99	16	33,909	— 1,003	..	..
Carlisle	,, 24	374	— 47	29	4,708	— 188	..	..
Chatham and Dist.	,, 22	1,888	+ 303	29	24,644	+ 1,346	14·98	·61
Cork	,, 22	1,118	+ 73	29	12,245	— 564	..	..
Croydon	,, 16	3,016	+ 132	..	23,112	+ 68	11·25	4·75
Darlington	,, 24	374	— 38	17	3,182	— 199	..	..
Darwen	,, 16	528	— 13	15	3,929	— 159	4·36	..
Dover..	,, 17	456	— 140	16	3,168	— 346	4·75	..
†Dublin	,, 16	5,682	+ 247	..	13,002	— 86	54·25	..
Dundee	,, 21	2,351	— 96	$9\frac{4}{7}$	11,413	— 458	15	..
East Ham	,, 24	2,193	+ 487	$16\frac{1}{2}$	16,984	+ 2,305	8·43	·68
Exeter	,, 23	687	— 15	17	5,871	+ 544	5·5	..
Glasgow	,, 24	30,044	—1,402	..	130,672	— 4,425	90·5	1·5
Hastings	,, 22	2,320	+ 26	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	,, 24	4,997	— 21	16	40,998	+ 403	13	..
Ilkeston	,, 21	276	— 23	16	2,149	— 73	..	..
Ipswich	,, 24	946	+ 29	17	6,636	+ 15	10·5	..
Kilmarnock.. ..	,, 24	320	— 7	10	1,512	— 79	4·25	..
†Lan'kshire Trm. Co.	,, 22	3 035	+ 113	29	36,202	— 1,697	17·62	1·18
Lancashire United	,, 21	2,688	— 129	29	37,992	+ 110	..	..
Leeds	,, 17	14,157	—2,593	16	105,716	+ 301	96·75	·25
†Leicester	,, 17	2,161	— 129	..	..	..	..	..
†Leith	,, 10	708	+ 103	8	5,028	+ 419	6	..
Liverpool	,, 17	22,765	+ 569	$28\frac{4}{7}$	300,206	— 3,047	104	..
‡L.C.C.	,, 10	73,116	— 718	..	522,776	+18,397	121	4·25
London United ..	,, 24	14,055	—1,012		172,148	—16,269	..	..
Lowestoft	,, 24	480	— 85	43	6,585	— 785	3·5	..
†Manchester ..	,, 17	15,218	— 281	16	237,119	— 625	90·5	6
Newcastle	,, 24	7,548	..	..	65,371	+ 1,425	..	..
Newport	,, 24	1,286	— 80	17	11,202	— 341	14·5	..
Oldham	,, 25	3,738	— 403	17	33,259	— 2,230	23·75	..
Pontypridd	,, 17	756	+ 54	$15\frac{1}{2}$	6,614	+ 1,058	5·5	1·75
Portsmouth.. ..	..	..	..	..	..	..	..	..
†Preston	,, 14	748	— 29	..	..	..	..	..
Rotherham	,, 22	1,095	— 92	16	9,722	— 324	10	·66
Salford	,, 19	9,678	— 737	$15\frac{5}{7}$	73,677	— 2,192	..	..
Sheffield	,, 27	11,281	+ 6	$17\frac{3}{7}$	98,836	— 1,296	87	1·25
Southampton ..	,, 21	2,268	— 22	16	17,082	— 444	..	..
Southend-on-Sea ..	,, 21	1,581	+ 510	16	8,290	+ 1,483	..	..
†South Shields ..	,, 17	604	— 4	$15\frac{3}{7}$	8,785	+ 37	..	..
Swindon	,, 7	260	— 52	.	..	..	..	..
Tyneside	,, 21	959	+ 119	3	1,420	+ 151	..	..
Wallasey	,, 17	2,073	+ 156	$15\frac{1}{2}$	14.742	+ 510	..	·22
Walthamstow ..	,, 10	1,342	— 102	15	9,992	+ 161	9	..
West Ham	,, 15	4,828	+ 429	15	86,151	+ 2,161	15	·8
Wolverhampton ..	,, 21	1,749	+ 5	16	18,161	+ 776	12·5	..
Baker St.-Waterloo	,, 24	6.170	+ 150	8	9,535	+ 425	4·25	..
Cen. London Rly...	,, 24	10,721	—4,857	8	16,829	— 6,474	6·32	·55
Char. +, Eus. Hamp.	,, 24	7,830	+1,815	8	11,820	+ 2,000	7.75	..
City & S. Lon. Rly.	,, 25	6,051	+ 633	8	9,259	+ 637	7·8	..
Dublin-Lucan Rly.	,, 23	818	— 19	8	506	+ 6	7	..
G.N. and City Rly.	,, 24	2,604	+ 57	8	8,969	— 24	8·5	..
G.N., P'y. & Brmtn.	,, 24	10.780	+ 255	8	16,435	+ 510	9·25	..
L'pool Overh'd Rly.	,, 25	2,844	— 121	8	5,846	— 43	6·8	4·8
Llandudno-Col. Bay	,, 28	1,154	+ 25	34	7,010	+ 1,636	..	..
Mersey Railway ..	,, 24	8,858	+ 193	8	5,786	+ 295	4·5	..
Metropolitan Rly...	,, 25	88,044	+ 662	8	49,828	+ 1,010	24·5	..
Met. District Rly...	,, 24	21,082	+2,869	8	81,830	+ 8,285	24	..
Anglo-Argentine ..	,, 22	78,620	+5,209	29	1,182,806	+65,520	..	..
§Auckland	,, 16	18,418	+1,508	28	96,514	+18,296	22·8	8·1
Bombay (B.E.T.) ..	June 24	4,922	+ 816	24	68,546	+ 8,720	..	..
§Brisbane	,,	15,480	+2,120	..	..	..	..	..
§Brit. Columbia Rly.	,,	41,865	+8,826	..	..	..	..	..
Calcutta	July 24	6,759	+ 681	..	..	..	..	..
§Cape Electric T. Ld.	June	11,208	..	..	..	..	..	..
§Kalgoorlie, W.A...	,,	4,008	..	26	22,629	..	20·5	..
Madras	July 15	1,822	+ 61	28	16,886	+ 114	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	July 28	2,652	— 97	29	41,876	— 55	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE rush of new prospectuses is the sign that the holiday closure upon Stock Exchange business is about to be moved, August being a particularly dead month for fresh issues. Activity in the markets is dying quietly, and the Home Railway dividends, while they have stirred up rather more animation than is usual in this department, do not seem able to create much additional business. There is greater interest taken in the Test Match, Channel flights, Goodwood racing, and the August time-tables, than in stocks and shares.

Amongst the few really interesting markets are those in copper—the metal, and copper shares. A remarkable position exists, in which copper prices are gaily rising, while the trade statistics are distinctly adverse to the movement. According to expert accounts, there is plenty of supply and no unusual demand, yet the American division which has the market in hand continues to drive prices up in a manner which mystifies the outsider who has not experienced the ways of Wall Street when financiering is on foot.

In the Stock Exchange the price of copper appears to be generally considered indefensibly high; but, at the same time, the impression prevails that it may be put up further still if it suits the manipulators to continue their buying.

Up to the present, the movements in copper and in rubber—which last is also standing exceedingly high—have had little or no effect upon the prices of electrical stocks and shares, cable or otherwise. Telegraph Constructions are £1 up this week, and both Callender's and Henley's shares are substantially better. In the case of the last two, the Debenture issues, as well as the shares, have risen, and the advances came, curiously enough, almost simultaneously.

British Aluminium Ordinary are the turn harder, and General Electric Preference gained 5s. Other manufacturing varieties are quiet. Armament shares picked up on the Government announcement of the additional ships that are to be laid down. Rubber shares display a good deal of strength, and while it is undeniable that prices now stand at very high levels, reaction can hardly be expected so long as the product itself is in such keen demand at rising figures.

Home Railway dividends make a distinctly creditable showing up to the present, and there is reasonable ground for hoping that the coal strike may be averted. Prices in this department are accordingly firm as a whole, but the strength is oozing out of Districts after their recent rises, and the Ordinary is ¼ lower, Metropolitans having gained a similar fraction, although the Surplus Lands stock shed a point. Central Londons are quite unmoved by the dividend declaration, which turned out to be pretty much what the market anticipated. Holders of the stocks are more concerned with the prospects for improved attendance at the Exhibition, but even the Queen's patronage does not suffice to draw great crowds to Shepherd's Bush this season.

London United Tramways Debenture stock has again risen 2 points, and there is a certain amount of business being done in the Preference shares between 2¼ and 2½.

Irregularity characterises the Canadian-Mexican group. Canadian General Electric rose 3½, and the Preferred advanced to 117, but Mexico Trams are several points lower, and Rio Trams fell 1 to 89, while Sao Paulos stayed at 105½. Mexican Light and Power Common shed a point, yet the Preferred stock and the bonds are harder. British Columbia Electric Railway descriptions are nominally without change, the 6 per cent. dividend on the Preferred having been regarded as a foregone conclusion. The Anglo-Argentine Tramways issues are steady. Calcutta Trams improved ⅛. British Electric Tractions have not moved, but Potteries Ordinary at 5s. are a trifle easier.

Charing Cross and Strand Electricity Supply shares have hardened, and County of London Preference rose ⅛. For the new First Debenture stock 2 premium is bid, but this we regard as too low a price for so sound a security, which has every prospect of rising to, at all events, 4 or 5 premium when the stock settles down into the hands of permanent holders. Metropolitan Preference rose a small fraction. Urban Preference lost 2s. 6d., and the Debenture stock has been marked down to 81.

The Telegraph list, after its shaking by the Imperial journalists' demand for cheaper cable rates, is beginning to regain its equilibrium and its prices. A good number of small rises are scattered down the column, the Anglo-American group being most favoured. The improvement embraces telephone stocks and shares, but it failed to prevent a decline in Marconi's, where the Ordinary and Preference are both $\frac{1}{16}$ down.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations July 20th.	Closing Quotations July 27th.	Business done week ended July 27th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞— 3¼	2⅞— 3¼	60/-	57/6	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96	92 — 96	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143½—144½	143½—144½	113⅜	..	..	5 10 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	97⅜	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£8 4s.	58 — 60	58½ — 60½	58½	..	+ ½	5 5 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	5 %	6 %	6 %	101½—102½	102½—103½	103	102	+1	5 15 11
3,220,770	Do. do. do. Deferred	Stock	⅜ %	1⅞%	1 %	8/-	16⅞— 17	17¼— 17½	$17\frac{7}{16}$	16⅞	+ ½	1 11 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102½—104½	103 —105	..	..	+ ½	4 15 8
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8⅛— 8½	8⅜	$8\frac{11}{32}$	+ ⅛	4 14 1
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	..	..	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8⅛— 8⅞	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 8 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅛— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	3 16 8
60,710l	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅞— 13¼	12⅞— 13⅜	13⅜	13	+ ⅛	6 7 5
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —128 xd	125 —128	126½	125½	..	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½— 86½ xd	84½— 86½	86	85	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	106	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½— 11¾	11½— 12	11⅞	11½	..	5 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	103½—105½	104 —106	105½	..	+ ½	3 15 6
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	100	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	$10\frac{9}{16}$	..	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼— 13¾	13¼— 13¾	$13\frac{9}{16}$	..	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	25¾— 26¼	26 — 27	26¼	..	+ ½	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	99½	..	..	4 9 1
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51½— 53½	51½— 53½	53	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	$1\frac{1}{16}$— $1\frac{3}{16}$	1⅛ — $1\frac{3}{16}$	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞— 1	$\frac{13}{16}$— $\frac{15}{16}$	16/3	15/7½	— $\frac{1}{16}$	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	$\frac{13}{16}$— $\frac{15}{16}$	¾— ⅞	..	..	— $\frac{1}{16}$	5 13 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½—110	109 - 110½	109½	108½	+ ½	5 8 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	125½—127½	125½—127½	126¾	126	..	4 14 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅞	5⅜— 5⅞	5¾	$5\frac{23}{32}$	..	4 5 1
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	97¾	..	..	3 12 2
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	100¼	..	..	3 19 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	$1\frac{5}{16}$— $1\frac{7}{16}$	$1\frac{5}{16}$— $1\frac{7}{16}$	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	$1\frac{1}{16}$— $1\frac{3}{16}$	22/6	..	..	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 87	85½— 87½	..	..	+ ½	4 11 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98½—100½	99 —101	..	..	+ ½	4 9 1
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	130 —133	..	..	+1	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞— 7⅛	7⅛— 7⅜	7⅛	$7\frac{3}{32}$	+ ¼	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5⅛— 5½	5¼	$5\frac{5}{32}$	+ ⅛	4 10 3
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½— 14	13½— 14	$13\frac{13}{16}$	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101½—103½	102½—104½	102¾	102	+1	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½— ⅝	½— ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼— 8¾	8 — 8½	8¼	8⅛	— ¼	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½—102½	101 —103	101	..	+ ½	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations July 20th.	Closing Quotations July 27th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	$9\frac{3}{16}$— $9\frac{7}{16}$	9¼— 9½	9⅜	9¼	+ $\frac{1}{16}$	5 5 3
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90¾ - 91¾	90¾— 91¾	91⅜	90⅞	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
[illegible]	Babcock & Wilcox, 1 to 530,000..	1	20 %	10 %	20 %	20 %	4¼— 4⅝	4¼— 4⅝	86/10½	86/8	..	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	⅛— ⅝	¼— ¾	..	..	+ ⅛	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¼— 1¾	1¼— 1¾	..	..	..	[illegible] 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3½	3 — 3½	..	..	..	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	6 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	94 — 99	94 — 99	..	..	..	5 11 1
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	143 —147	147	146	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	122 —126	122 —126	..	..	..	4 15 8
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110 xd	107 —110	109	108½	..	4 10 11
233,[illegible]	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	102¾	102½	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104 xd	101 —104	103	..	..	4 6 7
183,801	British Electric Traction	10	8 %	Nil	Nil	Nil	½— ⅞	½— ⅞	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2¼— 2¾	2¼— 2¾	48/9	47/6	..	4 10 11
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	86 — 90	87	..	..	5 11 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	66 — 70	66 — 70	..	..	..	6 8 7
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	7⅝	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼— 6⅝	6¼— 6⅝	..	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
304,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	$\frac{3}{16}$— $\frac{7}{16}$	$\frac{3}{16}$— $\frac{7}{16}$	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	$\frac{9}{16}$— $\frac{11}{16}$	$\frac{9}{16}$— $\frac{11}{16}$	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅜— 4¾	4½— 4⅞	96/3	92/6	+ ⅛	4 12 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 11 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	9¾— 10¼	10 — 10¾	..	..	+ ¼	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5½	5¼— 5⅝	5¼	..	+ ⅛	4 13 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	103½—105½	104½—106½	..	..	+1	4 4 6
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅞— 2	1⅞— 2	..	..	..	6 0 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	103 —106	103 —106	..	..	..	4 4 11
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	61 — 63	61 — 63	62	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
[illegible]	City and South London Railway	Stock	1¾%	2¼%	2⅛%	1½%	31½— 32½	31½ — 32½	..	..	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	½— 1	½ — 1	..	..	..	15 0 0
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	91 — 94	91 — 94	..	..	..	5 6 5

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* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 20th.	Closing Quotations July 27th.	Business done week ended July 27th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16—1¼	1 1/16—1¼	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 3/32—1 7/32	1 3/32—1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99—102	99—102	..	..	..	4 8 8
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13—14	13—14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	⅛—⅜	⅛—⅜	⅛	⅜	..	25 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	..	1½—2½	1½—2½	..	.	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68—73	68—73	68	73	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84—87	84—87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16—11/16	7/16—11/16	10/-	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 7/16—1 11/16	1 7/16—1 11/16	..	..	..	8 7 2
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛—7½	7½—8	..	..	+ 7/16	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85—88	85—88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾—1	¾—1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼—10¾	10¼—10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102—103	102—103¼	..	.	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11¾—12½	12—12¾	12½	11 13/16	+ ¼	5 19 6
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5—5⅜	5⅛—5½	5 9/32	..	+ ⅛	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105—107	105½—107½	..	..	+ ½	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14½—15¼	14½—15¼	15 3/16	14⅞	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞—15/16	⅞—15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5—6	5—6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½—2½	1½—2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½—2½	1½—2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2—2½	2—2½	50/-	45/-	..	15 0 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	65—68	68—71	67¼	66½	+3	5 12 8
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	40¼—40¾	40½—41	41½	40½	+ ¼	1 10 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	68—70	67—69	68½	67½	—1	3 19 6
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	17½—18	17½—17¾	17⅞	17⅜	— ½	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝—¾	⅝—¾	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32—5/32	1/32—5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32—27/32	23/32—27/32	..	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96½—98½	95—97	..	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130—132	126—129	130	127¾	—3½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92½—94½	93—95	94¼	93¼	+ ½	5 5 3
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	5/16—7/16	⅛—⅜	..	..	— 1/16	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½—¾	½—¾	12/-	11/6	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86—89	86—89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	33½—35	34½—36	35	33½	+1	5 0 0
140,000l	Do. 4% Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99—101	99½—101½	..	..	.	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	103½	102½	+ ½	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87—89	87—89	88⅞	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	37—39	36—38	37¼	..	— 1	..
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝—⅞	⅝—⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¾—3¼	2¾—3¼	..	..	..	7 7 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76—80	76—80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations July 20th.	Closing Quotations July 27th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4½—4¾	4½—4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93—96	93—96	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8—8½	8—8½	8⅛	8	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8—8½	8—8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97—100	97—100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞—4⅜	4—4½	87/6	..	+ ⅛	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜—4⅞	4½—5	95/-	..	+ ⅛	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾—4¼	3⅞—4⅜	..	..	+ ⅛	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96—99	96—99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝—4⅛	3⅝—4⅛	..	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100—103	100—103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½—11	10½—11	10¾	10 21/32	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12—13	12—13	12 11/16	12 9/16	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121—124	121—124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99—102	99—102	..	..	..	4 8 8
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾—3¼	2¾—3¼	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼—3¾	3¼—3¾	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½—95½	93½—95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅛—8⅝	8⅛—8⅝	..	..	..	5 6 8
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝—11⅛	10¾—11¼	11 1/16	10 15/16	+ ⅛	5 6 8
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	103—106	103—106	105	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100—103	100—103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16—5/16	3/16—5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝—⅞	⅝—⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59—62 xd	59—62	59½	59⅛	..	7 5 2
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	85½—88½	84½—86½	86¼	84½	—1½	5 16 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½—5	4½—5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5—5½	5—5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98—101	98—101	..	..	..	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛—7⅝	7⅛—7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½—100½	97½—100½	98	..	..	4 19 6
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅞—7⅜	6⅞—7⅜	..	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97—100	97—100	..	..	..	3 19 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞—2¼	1⅞—2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛—5⅝	5⅛—5⅝	..	..	..	5 11 8
£82,555	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93—97	93—97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4¼—4⅝	4 5/16—4 11/16	93/1½	..	+ 1/16	5 6 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝—5	4⅝—5	..	..	..	4 10 0
285,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105—108	105—108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½—86½	83½—86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82—84	82—84	83¾	..	..	4 18 7
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	68—72	67—71	71½	69½	—1	4 17 3
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	103—107	104—108	106¾	105	..	5 11 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	87½—89½	88—90	89½	88½	+ ½	5 12 4
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94—97	94—97	..	..	..	4 12 9
180,491	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4¾—5¼	4⅝—5⅛	..	..	— ⅛	2 10 0
187,000	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾—5¼	4¾—5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99—101	99—101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¼—12¼ xd	11¼—12¼	..	..	..	5 14 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6—6½	6—6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	92—95 xd	94—97	..	..	..	4 4 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16—1 7/16	1 5/16—1 7/16	28/-	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32—1 3/32	31/32—1 3/32	20/9	20/-	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102—105	102—105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾—9¼	8¾—9¼	9⅛	..	..	6 13 4
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7—7½	7⅛—7⅝	..	..	+ ⅛	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84—88	84—88	86	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16—13/16	9/16—13/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2¾—3⅛	2¾—3⅛	..	..	..	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16—9/16	5/16—9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16—1 5/16	1 3/16—1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—103	100—103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½—1	½—1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¾—2½	1⅝—2⅛	..	..	— ⅛	11 15 4
275,000	Do. do. 4½% 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80—84	79—83	..	..	—1	5 8 5
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	¾—⅞	13/16—15/16	..	..	+ 1/16	5 6 8
110,000	Westminster Electric Supply, Ord.		13 %	13 %	10 %	10 %	8⅝—9⅛	8⅝—9⅛	..	..	..	6 11 2
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞—5¼ xd	4⅞—5¼	5	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

THE ELECTRO-MECHANICAL PROPULSION OF SHIPS.

By A. P. CHALKLEY, B.Sc.

(Concluded from page 154.)

A SYSTEM which is attracting widespread notice is that of Mr. Durtnall, who for many years has interested himself in the problem of electric propulsion. Fig. 5 shows his "Paragon" system, in which, as in the previous case, three-phase alternating current is used, but variations of speed are obtained in a different manner, the generator being of special design, instead of the motor, as in the Mavor arrangement. In the figure, A is the shaft of the prime mover (which may be a turbine or a gas or oil engine), and on it are the rotors of two machines, B, the generator, and H, the transformer generator; K is the low-speed motor in the stern of the ship, driving the propeller shaft J direct, the motor being of the ordinary efficient three-phase squirrel-cage type. The object of the transformer generator is to vary the periodicity of the current supplied to the motor, and hence allow economical variations of speed. To take an explicit case, suppose the generator B to be wound with four poles, the transformer-generator H with 16 poles, and the motor K with 60 poles, the speed of the prime mover being 1,000 R.P.M. The field of the exciter E is first short-circuited by the switch F, but on breaking this the voltage rises in the generator, giving a periodicity of 1,000 × 2 ÷ 60 equals 33·3 per second, and if by means of suitable switchgear the current is taken directly into the motor, the latter will have a synchronous speed of 4 × 1,000 ÷ 60 equals 66·6 R.P.M. To bring the motor up to its second speed, the exciter field is short-circuited again, and the current from H is led into the slip rings of the rotor (or primary) of the transformer generator, from the stator (or secondary) of which, the motor K now receives its power.

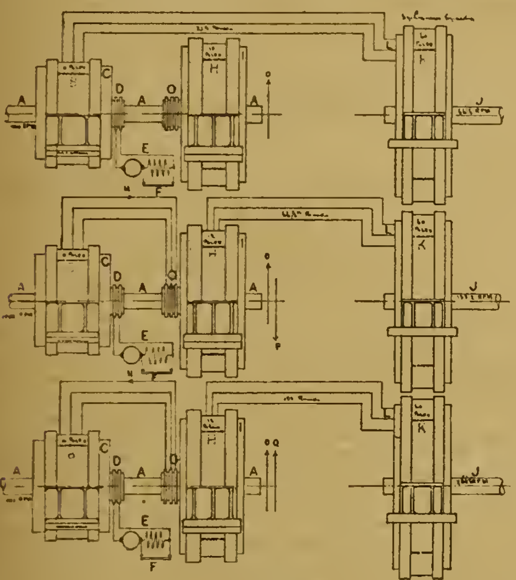


Fig. 5.

Referring to the top diagram in fig. 5, the arrow O shows the direction of rotation of the prime mover, and, of course, of the rotor of the transformer generator, and the connection to the slip rings G is such that the flux due to the current is in an opposite direction to that of rotation. We have, therefore, 4 × 1,000 equals 4,000 alternations per minute, due to B, and 12 × 1,000 equals 12,000 alternations per minute due to H, *but in an opposite direction.* The periodicity is, therefore, 12,000 — 4,000 ÷ 2 equals 4,000 per minute, or 66·6 per second, giving a synchronous speed of the motor of 133·3 R.P.M. For the third and maximum speed the voltage is once more reduced to zero by closing the switch F, two of the phases of the generator being reversed, and the voltage brought up again. The flux in H, due to the generator, is now in the same direction as the speed of rotation and the alternations of current in the secondary of the transformer generator are 12,000 plus 4,000 equals 16,000 per minute, or 133·3 periods per second, giving a synchronous motor speed of 266·6 R.P.M. It will be noticed that these changes can be brought about by the use of very simple switchgear, that each speed gives a high overall efficiency, since the losses are only equivalent to transformer losses, which are notoriously low, and that the speed of the prime mover remains unaltered throughout.

Any intermediate speed of the motor (and propeller) could be obtained by mounting the stator of the transformer generator on bearings, and braking it to give any required periodicity, but this is not to be recommended for marine work, and is, indeed, unnecessary, since three speeds will satisfy all requirements. The motor may be reversed, and the same three speeds obtained, going astern, by simply reversing two of the phases of the motor, and it is evident that practically the same efficiency could be relied upon, as in the previous case, besides which, manœuvring will be carried out with great ease and precision.

In America there is already an electrically-propelled boat in operation, being used as a fire float at Chicago, and its results are most satisfactory, though, of course, it is only a small affair of about 500 H.P. In this case the steam turbines drive both generators and rotary water pumps, which is a very economical arrangement, since power is not required by the propelling motors when water is needed from the pumps. The generators are D.C. machines, the voltage being about 250, and series wound motors are employed for driving the propellers. The general disposition of the machinery in the boat is seen in fig. 6, from which it appears that there are two turbine sets with the condenser in the middle, the boat being propelled by the two motors, which are placed well in the stern. Above the propeller motors, on a platform, are small turbine-driven exciters for the main generators. The whole of the machinery is conveniently at the command of the pilot, since everything may be operated by two controllers, on either side of the wheel.

There is at present working in Russia a boat fitted with Diesel oil engines, and driven by electric power, designed in a somewhat novel manner to overcome the loss of efficiency at low speeds. The Diesel engine is coupled to a direct-current generator, which at cruising speed delivers its power to separately-excited motors on the propeller shaft; but when full speed is required, a magnetic clutch engages automatically, and the oil engine drives the propeller shaft direct. This system is bold and interesting, particularly from the fact that oil engines are used as prime movers, but it is probably not nearly so efficient an arrangement as it would have been with a purely electrical drive, for the speed of the Diesel is almost certainly far too high to obtain maximum economy from the propellers, and, moreover, full power is not provided for the reverse, which will lessen the ease of manœuvring.

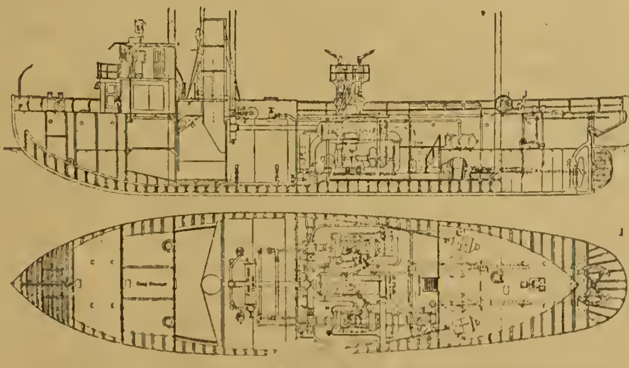


Fig. 6.

The prospects of electric propulsion would admittedly be small, unless some substantial reduction in running costs could be predicted, but fortunately a complete investigation of steam consumptions for both systems shows a very marked advantage in favour of electricity for almost every type of ship. It will be sufficient, for purposes of comparison, to take as instances two totally different boats, and see what saving could be effected in each case. Of course, it may be said that figures will prove anything, and the upholders of the electro-mechanical system are the first to admit that their calculations are not absolute; but what they do insist upon is that the disproportion in costs between the two methods is, apparently, so very great, that the figures show definitely that electro-mechanical propulsion merits a fair and exhaustive trial.

Taking the results actually obtained on the *Dreadnought*, we find that at full power nearly 30,000 H.P. is required, and the steam consumption was about 14·7 lb. per shaft H.P.-hour, including auxiliaries, the speed of the propellers being 300 R.P.M. In place of direct drive, consider an electrical system in which four turbo-alternators of 6,000 KW. output each are employed, the power being delivered to four 7,500 B.H.P. three-phase motors, having an efficiency of 95 per cent., which is quite allowable. A steam consumption of 14·5 lb. per KW.-hour for the turbines, including auxiliaries, would be guaranteed by any firm of turbine manufacturers (no superheat being used, to keep the comparison legitimate), which is equivalent to 10·9 lb. per H.P.-hour. This means that the consumption of steam per H.P.-hour at the propeller shaft is 10·9 ÷ ·94 = 11·6 lb. per shaft H.P.-hour, as against 14·7 lb., with direct drive, showing a saving of 21 per cent. in steam and coal. This is the economy produced at full speed, but it would be even more marked at cruising speed, which is the general condition for a battleship. In this case, the electrical system would be practically equally efficient, or at any rate within 7 or 8 per cent., since part of the generating plant could be shut down, and the remainder run at full power, but with the direct drive the efficiency drops at least 20 per cent., and probably more. This fact is well brought out in the figures given by Mr. Bell in his paper before the Institution of Naval Architects last year, with reference to the *Lusitania*, in which it was stated that the steam consumption at 25·4 knots was 12·77 lb. per shaft H.P.-hour, while at 15·8 knots the consumption was 21·23 lb.—an increase of nearly 40 per cent. Of course, this difference would not be so great in a battleship where special cruising turbines are employed, but it would be sufficient to show a heavy margin in favour of electricity. As regards first costs, there is, to commence with, a saving of 21 per cent. in boiler power, size of feed, air and circulating pumps, condensers, piping and many auxiliaries, while the astern turbines and the greater portion of the propeller shafting would disappear. In the *Dreadnought* there are 10 turbines, so that it is not beyond the realm of possibility to assume that the electrical plant, with four turbo-generators and four motors, would cost less than with the direct drive, allowing for the above-mentioned reductions, while the weight would be more or less proportional to the cost (or *vice versa*). Manœuvring would be carried out much more easily, since full power is available for going astern, and this is a point which cannot be too strongly emphasised in warships.

It is to be noted that if superheat were used, a saving of another 7 per cent. could safely be reckoned on, since it is well known that 100° superheat causes a reduction of 7 or 8 per cent. in the steam consumption of turbines of almost any power. It might be argued that this cannot be considered an economy for the electric drive, since it would apply equally to the direct drive, but this is not the case. Superheat has never been used for large marine turbines, probably on account of the fear of distortion of the very heavy cylinders, and consequent stripping of the blades, but this point scarcely enters into consideration with high-speed turbines, coupled to alternators, since the cylinder castings are so very much lighter.

There is, in fact, no reason against the use of 100° or 150° superheat in electrically propelled vessels, and this may be accepted as an inherent advantage of the system, and the gain in efficiency by superheat added to the increased economy, in the case of the *Dreadnought*, would then become 28 per cent. in favour of electric propulsion.

On the above showing, it will be admitted that a good case has been made out for battleships, since the figures are not mere assumptions, but are those actually obtained in practice, and it will be seen that equally good results may be anticipated with intermediate speed liners.

One of the commonest types afloat is the 14 to 18-knot boat, driven by reciprocating engines—a type which the turbine has been practically unable to touch, because of the comparatively low speed, but which is eminently adapted for electric propulsion. One of the modern Cunard liners of 15 knots has been found to require 13·5 lb. of steam per I.H.P.-hour, or, allowing the high efficiency of 85 per cent., the engines take 15·9 lb. per shaft H.P.-hour. The total shaft horse-power is 8,000, and this, in the electric system, could be obtained by two 4,000-B.H.P. squirrel-cage motors of 95 per cent. efficiency, the input being, therefore, 8,400 H.P., of 6,300 KW. For the generation of this power, two turbo-alternators (three-phase) of 3,500 KW. each, would be employed, the surplus current being used for various auxiliary purposes, and replacing the electric generating engines. The steam consumption of turbines of this power, running at 1,000 or 1,200 R.P.M., with 100° superheat, and 28 in. vacuum would not exceed 14 lb. per KW.-hour, excluding auxiliaries, or 10·5 lb. per H.P.-hour. This is equivalent to 10·5 ÷ ·95 equals 11 lb. per shaft H.P.-hour, as against 15·9 lb. with reciprocating engines, showing a saving of no less than 31 per cent.

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

The Electrodeposition of Brass.

It is a surprising fact that, although electroplating is the very oldest of the electrochemical industries, its practice is still almost entirely pervaded by the "rule-of-thumb" method, and it is only just now beginning to progress beyond a point which was already attained 50 years ago. The admirable paper, entitled "The Conditions which Determine the Composition of Electrodeposited Alloys: I. Copper-Zinc Alloys," which Mr. S. Field, of the Northampton Institute, read before the Faraday Society on June 29th, is a healthy symptom of the passing away of the old state of affairs. It is to be hoped that it will be carefully studied by the large number of persons engaged in the electroplating industries, particularly in such districts as Clerkenwell, where "rule of thumb" is rampant, and that Mr. Field and others will follow up this experimental study of one branch of electroplating by others which will cover the whole field of practice of this most interesting art. This paper on brass deposition is all the more welcome, as it is the first systematic study on the subject which has appeared, at least in English, as far as our recollection of the subject goes.

It is obvious that to deposit an alloy of constant composition, we must use a mixed solution of the metals from which each is deposited at the same E.M.F.; or, in other words, we must electrolyse compounds having approximately the same heat of formation. In the case of copper and zinc, the constituents of brass, these conditions are more or less fulfilled by the cyanide solutions of the metals, and the metallic ions, therefore, are easily discharged together. The E.M.F. of deposition of the two metals, however, is strongly influenced by such conditions as the concentration of each in solution, the amount of free cyanide in solution, the temperature, the current density employed, the amount of stirring the solution is subject to, and so forth, and it is the influence of these conditions on the composition of the brass deposited which forms the subject of Mr. Field's investigation. In practice it is of great importance to know how to change the composition of the deposit, because, generally speaking, one has to deal with cathodic objects of very irregular shapes, so that there is a varying current density at different points of the cathode, and hence brass of varying composition is continually being deposited, and the composition of the solution being correspondingly altered automatically. To rectify or make the necessary allowances for these unavoidable changes is one of the duties of the skilled electroplater.

A preliminary word on the electrolysis of cyanide solutions may be usefully stated here. The solution from which brass is deposited consists of a mixture of the double cyanides of copper ($CuCN.KCN$) and zinc ($Zn(CN)_2.2\,KCN$). The ions of solutions of these salts are $K^{\cdot}$, $Cu(CN)_2^{-}$, and $K^{\cdot}$, $Zn(CN)_4^{-}$ respectively. Consequently, the metals copper and zinc are deposited from solution by secondary chemical reactions, potassium being the primary cathodic product:—

$$\left.\begin{aligned} K^{\cdot} + CuCN.KCN &= Cu + 2\,KCN \\ 2\,K^{\cdot} + Zn(CN)_2.2\,KCN &= Zn + 4\,KCN \end{aligned}\right\} \quad \ldots \quad (1)$$

At the anodes, insoluble cyanides of copper and zinc are formed:—

$$\left.\begin{aligned} Cu(CN)_2^{-} + Cu &= 2\,CuCN \\ Zn(CN)_4^{-} + Zn &= 2\,Zn(CN)_2 \end{aligned}\right\} \quad \ldots \quad \ldots \quad (2)$$

Unless the solution is stirred, so as to bring the free potassium cyanide formed at the cathode up to the anode, these cyanides of copper and zinc will form an insulating coating on the brass anode. In practice, however, free cyanide is present in the solution, and this keeps the anodes clear, so that they dissolve freely. The free cyanide (being only slightly dissociated) does not impart conduct-ance to the solution in the same way that free acid does, say, to a copper sulphate solution.

It will be seen from equations (1) that the same current will deposit about twice as much copper as zinc, hence under ideal conditions the resultant brass will approximate to the composition 2 Cu : 1 Zn. This is a very fortunate dispensation, as brass of that quality happens to have a fairly average colour, although erring somewhat on the light side.

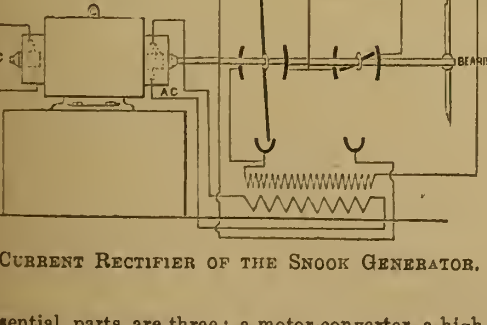
It will be impossible here to describe in any detail all the experiments Mr. Field has made on the conditions which influence the composition of the brass deposit; those specially interested in the subject must carefully study the original paper. Suffice it to say that as the solution of zinc and copper and their deposition follow very different laws, there must be a continual change of composition in the electrolyte, and hence it is of the utmost importance to know how changes in such conditions as (1) density composition of electrolyte; (2) rate of agitation; (3) current density; (4) temperature, will affect the proportions of copper and zinc in the brass deposit. The general conclusions arrived at by Mr. Field are briefly as follows:—Conditions which tend to raise the P.D. between the terminals of the cells, such as dilution of the solution, decrease of temperature, and increased current density, increase the percentage of zinc in the deposit. On the other hand, the addition of free cyanide increases the percentage of copper in the deposits, and it also increases the solution of hydrogen, unless this be minimised by rapid agitation. Copper may be freely deposited with a large proportion of zinc compound present. The one important respect in which Mr. Field's research is incomplete is that he has not yet studied the effect of very rapidly stirring the solution, that is, far beyond the agitation necessary merely to ensure free solution of anodes. The rapid renewal of electrolyte near the cathodes, due to very vigorous agitation, is certain to have a very considerable effect on the deposits, and it is to be hoped that Mr. Field will extend his experiments in this promising direction. We would also express the hope that his studies will not stop at the electrodeposition of brass, but will also include the deposition of such other useful alloys as bronze, which now also has considerable practical application.

A paper by Dr. Henry Sand on "Rapid Electro-analytical Separation of Metals" contains a description of some developments in the apparatus designed for this purpose some years ago by the author. The apparatus—which is in constant use at the National Physical Laboratory—makes it possible to deposit and separate, in most cases in from 5 to 15 minutes, the metals silver, mercury, copper, bismuth, lead, cadmium, zinc, antimony and tin.

Dr. R. Beckett Denison, in a research on "The Relative Rates of Migration of Ions in Aqueous Solution," has determined by the well-known method (devised by himself and Dr. Steele) of direct observation of moving ionic boundaries, the transport numbers of the halide salts of the metals of the alkalis and alkaline earths. It is pointed out that the study of transport numbers by the direct and indirect methods affords a means of determining the degree of hydration of the ions.

The Röntgen Society.

At the annual general meeting on June 3rd, Mr. R. S. Wright read a paper on the new Snook Röntgen apparatus. This apparatus is the invention of Mr. H. Clyde Snook, of Philadelphia, and for some time it was manufactured only by the American firm which Mr. Snook represents. During the autumn of last year arrangements were concluded for the instrument to be made in this country, but this involved laying down new and expensive machinery, and it was not until the early spring that arrangements for the manufacture in England were completed. The instrument shown was constructed in this country from beginning to end; it was the 2 kw. size, and weighed a good many hundredweight.



Current Rectifier of the Snook Generator.

The essential parts are three; a motor-converter, a high-tension transformer, and a pole-changing rectifier. The sole function of the motor-converter shown on the extreme left is to convert the original continuous current into a sinusoidal or alternating one, and this is supplied to a high-tension step-up transformer giving some 100,000 to 120,000 volts on the secondary circuit. Above this transformer is the revolving commutator or rectifier shown on the right, which is rigidly attached to the axle of the motor-converter (thereby ensuring absolute synchronism), transforming the alternating discharge into a unidirectional one. For the sake of clearness, the regulating switchboard, resistance, &c., are omitted in this diagram.

The transformer is of the closed-circuit type, and the winding is extremely intricate.

In working the apparatus, the first step is to start the motor by means of the ordinary starting switch attached to the switchboard, and then by simply closing the switch controlling the winding of the transformer, we can obtain an absolutely unidirectional discharge from the secondary, regulated to any extent by means of the adjusting rheostat. Whether the output is great or small, there is absolutely no reverse current.

If an X-ray tube is connected to the dischargers, the current in it can be varied at will from ½ milliampere up to 30, 40 or 50 milliamperes; all that is needed is to vary the resistance. There being no uncertain contact-breaker to reckon with, the current from the X-ray tube rises and falls accordingly as the switch handle is turned to the right or to the left.

The radiographs obtained with the apparatus are practically instantaneous; the actual time of exposure is certainly within one-tenth of a second. Extreme detail is obtained in the soft tissues, much greater than is seen in a radiograph taken with a longer exposure.

The large currents used undoubtedly put a heavy strain on the X ray tubes, and no doubt the weak point at present is the impossibility of finding tubes that will carry with anything like real safety a current of 50 or 60 milliamperes. Fortunately it seems to be the case that a tube exhausted while a current of a certain strength is being passed through it will stand that current in after work very much better than a tube not so exhausted, and this apparatus affords a ready means of putting such a heavy current through X-ray tubes for any length of time desired.

Physical Society of London.

At the meeting held on June 25th, amongst other papers, one was read by Mr. A. Campbell "On the Measurement of Wave Length for High-frequency Electrical Oscillations." The experiments had for their object the calibration of wavemeters for the measurement of the high frequencies (200,000 up to 1,000,000 cycles per sec.) used in wave-telegraphy. Two wavemeters were tested, both being of the type consisting of a series of self-inductance coils used singly in series with a variable air-condenser and a thermo-ammeter, the capacity being altered until the circuit showed resonance with the working circuit. The coils of one wavemeter were wound with solid wire, those of the other with stranded wire (7/36), each strand being separately insulated. The absolute value of the frequency was determined by photographing spark-trains in the primary circuit by means of a rotating mirror running at a constant and accurately measured speed. The values of the frequency deduced from the measured values of K and L with the stranded-wire wavemeter were in close agreement with the actual values deduced from the spark-photographs. With the other wavemeter the agreement was not nearly so close. The results show that the inductances of the stranded-wire coils are practically unaltered for frequencies from 0 up to 1,000,000 cycles per second.

A paper on "An Electro-Magnetic Method of Studying the Theory of and Solving Algebraical Equations of any degree," by Dr. Russell and Mr. Alty, was read by the authors. A simple apparatus which the authors had devised for students' use was described, with which all the roots could be determined with a maximum inaccuracy of 1 per cent.

Dr. C. V. Drysdale exhibited a new Féry thermo-electric calorimeter. This form of calorimeter can be used continuously, and permits the value of the gas produced in a gasworks or producer plant to be watched from time to time. The principle of the instrument is that of burning the gas to be tested at a constant rate in a special burner consuming from 5 to 10 litres per hour. This burner heats a recuperative thermopile, of which the cold junction is traversed by the air employed for the combustion, while the hot junction is heated by the products of combustion. The thermopile contains 15 junctions, which enable a P.D. of ·2 volt to be obtained. The energy produced is sufficient to obtain a trace with a recording instrument similar to that obtained with the Richard recording thermometers and barometers.

A paper by Mr. F. W. Jordan, on "An Instrument for Measuring the Strength of an Intense Horizontal Magnetic Field," was read by the author. The method consisted in measuring directly the transverse force on a conductor traversed by a current in a direction at right angles to the field.

German Installation Contractors' Union.—The seventh annual conference of the Union of Electrical Installation Firms was held recently at Aix-la-Chapelle, where representatives of kindred firms were present from Austria, Switzerland and Belgium. It was mentioned in the annual report that the scope of the union was extended during the year, and now comprised 392 firms, who are distributed over a number of branch associations. The turnover of the co-operative purchasing organisation of the union amounted to £65,000 in 1908, as compared with £40,000 in 1907, and the net profits were £6,250 and £4,450 in the two years respectively. The report also referred to the work accomplished in the direction of the simplification and unification of the rules for the erection of installations, the collection of statistics in regard to accidents, and the memorials presented to the responsible authorities for the purpose of combatting the system of monopoly in the electrical industry.

PARLIAMENTARY.

Electric Lighting Acts (Amendment) Bill.

(*Concluded from page* 134.)

Mr. Henderson said that his experience was that local authorities occasionally objected to tramways and electric lighting schemes unreasonably, and therefore he thought it would be much better if the Board of Trade was to remain the authority.

Mr. Courtenay Warner said, in his opinion, it was very essential that the local authority should have the power it was proposed to give them. As Mr. Tennant had pointed out, it was not absolute power, but it was a power that was given to all the local authorities in London, and he could not see why urban or district councils should not have the same power.

Mr. Parker said he thought they needed a clearer definition as to what a local authority was. In his view the authority to whom this power should be given was the highway authority.

Sir W. Collins agreed with the previous speaker, and instanced the difficulty that might arise in the case of a main road where the local authority might take one view and the borough council another. He would like to know whether in such a case the consent of the two authorities would be necessary?

Mr. Dickinson pointed out that under the clause, as it stood, the L.C.C. in London, in many instances, would be the local authority, but the borough council would be the road authority.

Mr. Tennant admitted that the question was a rather difficult and puzzling one. He was, however, informed by his advisers that Sec. 14 of the Act of 1899 gave county councils power to approve or disapprove of works in main roads. That answered Mr. Dickinson's point.

Sir W. Collins said his point was that in the case of a county authority taking a different view from the local authority through whose area the main road ran, would it be necessary to get the consent of both bodies, or would the consent of the local authority override the consent of the borough council?

Mr. Tennant said he was unable to give an answer to the question straight away. He should think that the county authority would have the ultimate authority in the case of a main road.

After further discussion the amendment was agreed to.

Mr. Holt moved to substitute the word "permit" for "authorise" in Sub-sec. 3. This was carried, and the clause as amended was agreed to.

Clause 5 was as follows:—"(1) Any local authority, company, or person authorised to supply electricity in any area may, with the consent of the Board of Trade, supply at any point within that area electricity for the purposes of haulage or traction on any railway, tramway, or canal situate partly within and partly without that area, and for the purposes of lighting vehicles and vessels used on any such railway, tramway, or canal; but the Board of Trade shall not in any case give any such consent until notice of the application for the consent has been given by advertisement or otherwise in such manner as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected of stating any objections he may have thereto. (2) The Board of Trade may by Provisional Order authorise any such local authority, company, or person so to supply electricity to be used for purposes incidental to the working or lighting of the railway, tramway, or canal, other than the purposes aforesaid. (3) A company, local authority, or body receiving a supply of electricity under this section shall not use the electricity in such manner as to cause, or to be likely to cause, any interference with Government observatories or laboratories, but this sub-section shall not apply to any such company, local authority, or body who, by any Act of Parliament or Order confirmed by or having the effect of an Act of Parliament containing provisions for the protection of such observatories or laboratories, are authorised to use electricity for the purposes for which a supply is authorised to be given under this section."

Mr. Holt moved a series of amendments to bring docks within the purview of the clause. He said the object of the clause was to give power to railways, tramways and canals which were situated in the areas of several electrical supply authorities to take their supply from anyone they chose, and to use it freely over the whole of their system. He wanted to secure the same freedom for the dock authorities. He thought the request was a very reasonable one.

Mr. Scott said that, on behalf of the municipalities, he objected to the amendment. The principle involved was a very serious one—it was that local authorities having provided their undertakings to supply a district with electrical energy would find that the most profitable means of utilising their power would be taken away. It was quite possible that in many districts the companies might enter into arrangements with the municipalities, but it was not right that a private concern or company should be empowered to go out of its original district of supply to get its electricity.

Mr. Tennant appealed to the Committee to allow the clause to stand as printed. He said it had been the subject of much negotiation between the Board of Trade and the various interests concerned, and they had arrived at an agreement. The amendments were lost.

Mr. Scott then moved to omit sub-section (2) of the clause.

Mr. Tennant said he regarded the section as an important part of the clause. It was designed to give the Board of Trade power by provisional order to authorise a railway or other company to obtain electrical energy for other purposes than traction. The Board of Trade had spent a considerable time in negotiating with the different interests, and an arrangement had been arrived at which was embodied in the sub-section. It would obviously be a convenience to a railway or canal company to have its supply all from one source, and he did not think they ought to require a company which was getting its supply of electricity for traction purposes from one quarter to go elsewhere in order to light its workshops. The amendment was negatived.

Mr. Scott then moved to add the following words to the sub-section:—"But no such Provisional Order shall be granted for the supply of electricity to be used within any area in which any undertakers are authorised to supply and are supplying electricity except with the consent of such undertakers."

Mr. Tennant resisted the proposal on the ground that it would give undertakers an absolute veto, whether they were prepared to supply on reasonable terms or not. That was a wrong principle, to which he could not assent. The amendment was, by leave, withdrawn, and after some further discussion the clause was agreed to.

Clause (6) was as follows:—"(1) Where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, and that either the premises are not within the area of supply of any undertakers, or that the undertakers within whose area of supply the premises are situate are not able or willing to give a supply to the premises, and cannot be compelled to do so on reasonable terms, the Board of Trade may, if the local authority within whose district the premises are situate consent, by order authorise the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit. (2) An order given by the Board of Trade under this section may, for the purpose of enabling a supply to be given thereunder, confer any such powers and impose any such duties on the undertakers as would have been conferred or imposed by the Electric Lighting Acts, and as might have been conferred or imposed by Provisional Order if the premises and the route along which lines are authorised to be laid for the purpose of giving the supply were within the area of supply of the undertakers, anything in the special Act or Order relating to the undertaking to the contrary notwithstanding. (3) If the undertakers on whom powers are conferred by an order under this section are not a local authority, the works and lines erected and laid under the powers so conferred shall, so long as the order remains in force, be deemed, for the purposes of the provisions as to purchase applicable to the undertaking, to form part of the undertaking within the district of the local authority which comprises the area of supply of the undertakers, or, if that area is comprised within the districts of more than one local authority, within such of those districts as the Board of Trade may determine."

Mr. Tennant in sub-section (1) moved to omit the words from "situate" to "terms" in order to add the following proviso:—"Provided that, if in the opinion of the Board of Trade any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given."

Mr Abel Smith said he took it that if consent was not obtained the matter could be embodied in a private Bill and thrashed out in Parliament.

Mr. Tennant replied that it was no question of a Bill at all. The hon. member had misunderstood the object of the clause. It was simply to give a supply to places just outside the area of supply to people who could not get a supply from anywhere else. The amendment was carried, and with one or two consequential amendments the clause was ordered to stand part of the Bill.

Clause (7) was as follows:—"(1) Where any generating station, mains, or other works of a company used solely for supplying electricity within the district of a local authority are situated outside the district of that local authority, the generating station, mains, and other works so used shall for the purposes of the provisions of the Electric Lighting Acts, and any provisional order conferring on local authorities power to purchase undertakings, be deemed to be situated within the district of that local authority, and, where any generating station, mains, and other works are used solely for supplying electricity within the districts of two or more local authorities, but are not situated within any of those districts, the Board of Trade may, on the application of all or any of those authorities, by provisional order apply this provision subject to such adaptations as the circumstances of the case may require. Provided that this sub-section shall not, except by agreement between the local authority and the company concerned, apply to any generating station, mains, or other works authorised by a special Act passed before the passing of this Act. (2) Any local authority having power under the Electric Lighting Acts or any provisional order to purchase so much of the undertaking of a company as is within the district of that local authority may, with the consent of and upon such terms and conditions as may be approved by the Board of Trade, and, in the case of an undertaking authorised before the commencement of this Act, with the consent of the company, transfer their rights of purchase to any other local authority having power to purchase so much of the same undertaking as is within the district of that last-mentioned local authority, and the deed of transfer may contain such consequential provisions as may be necessary for giving effect to the transfer."

Mr. Scott moved to add the following addition to the clause:—"(3) Without prejudice to the foregoing provisions of this section, where the undertaking of a company is situate within the districts of two or more local authorities, the Board of Trade may, by provisional order transfer any rights of purchase vested in the local authority of any district in which part of the undertaking is situate to the local authority of any other district in which part of such undertaking is situate, but such provisional order shall not be made except with the consent of both such local authorities." He argued that, unless some such provision was put in, it might be possible for a company to refuse to sell to a small local authority, or to impose such a heavy price as to make purchase impossible.

Mr. Tennant said the point was an important one, and one on which he could not see his way to meet his hon. friend. The companies that were formed before the passing of the Act raised their capital upon the idea that any interference with them would prejudice them and be very hard upon them. Great importance was attached by these undertakings to compensation for severance in the event of purchase. The amendment would do away with that, and it would not be putting the companies in a fair position. He hoped the hon. member would withdraw his amendment.

Mr. Scott said he must press the amendment to a division, as the point was a most important one.

Mr. Henderson, Mr. Courtenay Warner, and Mr. Falconer spoke against the amendment.

Mr. Falconer was very doubtful if it was the right thing to give powers to the ratepayers to purchase an enterprise in the area of some other local authority. After further discussion, the amendment, on a division, was negatived by 14 votes to 9; and the clause was agreed to.

Clauses (8), (9), (10), (11) and (12), as follows, were agreed to without discussion:—

(8). "The Board of Trade may, with the concurrence of the Local Government Board, by provisional order make such provisions as appear to them necessary or expedient, by the constitution of a joint committee or joint board or otherwise, for the joint exercise of all or any of the powers under the Electric Lighting Acts, or this Act, or any Provisional Order, by two or more local authorities as respects any area of supply consisting of the whole or parts of the districts of those authorities, in any case where it appears to them that the joint exercise of those powers would be expedient, and any such provisional order may contain such provisions as may appear necessary or proper for adapting any of the provisions of the Electric Lighting Acts, or this Act, or any such Provisional Order, to the case of any committee or board so constituted."

(9). "The Board of Trade may grant a provisional order notwithstanding that the notice required by Sec. 4 of the Electric Lighting Act, 1882, to be given to a local authority on or before July 1st has not been given in the case of any local authority which waives its right to receive such a notice, and no such notice need be given to the local authority of a district in which it is not intended to take power to distribute electricity."

(10). "(1) With a view to making five years the ordinary period of revision of maximum price and allowing representations as to revision to be made by consumers, sub section (2) of Sec. 32 of the schedule to the Electric Lighting (Clauses) Act, 1899, shall, for the purpose of incorporation with any Act or order passed or confirmed after the passing of this Act, be read as if the words 'five years' were substituted for the words 'seven years,' and the words 'or such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply,' were inserted after the words 'either the local authority or the undertakers.' (2) Where any Act or Provisional Order passed or confirmed before the commencement of this Act enables the Board of Trade to revise or vary any maximum prices to be charged for electricity, that Act or order shall be construed—(*a*) so as to enable the revision or variation to take place at an interval of five years after the commencement of the Act or order, or the last revision in cases where a longer interval is fixed by the Act or Order; and (*b*) so as to enable the power of revision or variation to be exercised on the representation of such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply, in cases where under the Act or Order such a power either cannot be exercised on such a representation or can be exercised only on the representation of a number of consumers greater than 20.

(11). "(1) The sections set out in the Second Schedule to this Act shall be substituted for Secs. 49, 50, 51 and 53 of the schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any Act or Order passed or confirmed after the commencement of this Act. (2) The provisions contained in the sections so set out shall, subject to such adaptations (if any) as may be necessary, be substituted for any corresponding provisions as to the use, examination, and certification of meters and their connection and disconnection with electric lines, contained in or incorporated with any special Act or Provisional Order relating to the supply of electricity passed or confirmed before the commencement of this Act.

(12). "For the purposes of Sec. 9 of the Electric Lighting Act, 1882, the accounts of any undertakers being a local authority shall be made up to March 31st in each year, and accordingly as respects those accounts, June 30th shall be substituted in that section for March 25th, and March 31st for December 31st: Provided that, if any such undertakers show to the Board of Trade that some other dates are, owing to special circumstances, more convenient in their case than March 31st and June 30th, the Board of Trade may substitute such other dates for the said March 31st and June 30th, and this section shall as respects those undertakers be construed with the substituted dates."

Clause (13) was as follows: "(1) If an auditor appointed by the Board of Trade to audit the accounts of any undertakers who are not a local authority reports to the Board that the undertakers have declined or neglected to comply with any of his recommendations or requirements, in so far as they relate to matters affecting the interests of the authority empowered to purchase the undertaking, or of the consumers, the Board may, if they think fit, after giving the undertakers an opportunity of being heard, make an order directing the undertakers to comply with such recommendations and requirements, with or without modification, as may be specified in the order, subject to an appeal to the Railway and Canal Commissioners, or any two of them, who shall finally decide the matter and confirm, annul or amend the order as they may think fit. (2) If the undertakers fail to comply with an order under this section, they shall, on conviction under the Summary Jurisdiction Acts, be liable to a fine not exceeding £10 and to a further fine not exceeding £5 for each day on which the offence is continued after conviction therefor."

Mr. Tennant proposed the following new clause in substitution of the above, and it was agreed to: "The Board of Trade shall from time to time make a return to Parliament giving such particulars as they may think proper with regard to the reports made by any auditors appointed by them to audit the accounts of any undertakers, and any action taken on such reports by the Board and by the undertakers."

Clauses (14) and (15) were agreed to without discussion:—

(14). "(1) A local authority, company or person who have obtained a licence, order or special Act for the supply of electricity shall not, by transfer or otherwise, divest themselves of any of the powers, rights or obligations conferred or imposed upon them by the Electric Lighting Acts, or by any licence, order or special Act, otherwise than under and in accordance with a provision contained in a licence, order or special Act authorising such a divestiture. (2) Sec. 11 of the Electric Lighting Act, 1882, shall be repealed from 'but no local authority' to the end of the section."

(15). "Notwithstanding anything in the Electric Lighting Acts, or in any Act of Parliament or Provisional Order, authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises: the sum to be so paid shall be determined in default of agreement by arbitration."

Clause (16) was as follows:—"(1) Where the undertakers are a local authority they may, through a contractor, but not otherwise, provide, let for hire, and fix, repair and remove, but shall not manufacture lamps, electric lines, fuses, switches, fittings, lampholders, motors, and other fittings for lighting and motive power, and for all other purposes for which electrical energy can or may be used, and may provide all materials and work necessary or proper in that behalf, and with respect thereto may demand and take such remuneration or rents and charges and make such terms and conditions as may be agreed upon: Provided that—(*a*) The undertakers shall so adjust the charges to be made by them for any such fittings, or for the fixing, repairing, or removal thereof, as to meet any expenditure by them under the powers of this section in connection therewith (including interest upon moneys borrowed for those purposes and all sums applied to sinking fund for repayment of moneys so borrowed); (*b*) Every sum charged by the undertakers to a consumer in respect of the provision of such fittings, or the fixing, repairing, or removal thereof, shall be separately stated on every demand note delivered by the undertakers to the consumer; (*c*) The total sums expended and received by the undertakers in connection with the purposes in this section mentioned in each year (including interest and sinking fund) shall be separately shown in the published accounts of the electricity undertaking of the undertakers for that year; (*d*) Nothing in this section shall, in cases where within three months after the undertakers have obtained any loan necessary for the purpose of the undertaking there is or are no firm or firms carrying on the business of electrical contractors within the area of supply, prevent the undertakers themselves from exercising the powers given by this section without the employment of a contractor; (*e*) If the undertakers fail to comply with the provisoes (*a*), (*b*) and (*c*) of this section, they shall, on conviction under the Summary Jurisdiction Acts, be liable to a fine not exceeding £10, and to a further fine not exceeding £5 for each day on which the offence is continued after conviction therefor. (2) Any such fittings as aforesaid let for hire by any undertakers (whether a local authority or not) shall not be subject to distress or to the landlord's remedy for rent, or liable to be taken in execution under process of law or proceedings in bankruptcy against the person in whose possession the same may be; provided that such fittings are marked or impressed with a sufficient mark or brand indicating the undertakers as the actual owners thereof."

Mr. James Parker moved to omit the words in Sec. 1 "through a contractor but not otherwise." The words he said were not in the original Bill, but were inserted by the House of Lords. He claimed that the local authorities and the municipalities had a right to supply electricity, and he did not see why in the case of lending fittings they should be called upon to introduce a contractor, any more than they should in the case of laying a tramway.

Mr. Tennant said it was quite true that the words "through a contractor" were inserted in another place. The clause as they introduced it was intended to embody a model or standard clause, and he was informed that 75 local authorities, including the London boroughs, had already got these powers to supply these fittings. It was proposed by the Bill to give all local authorities in future similar powers.

Mr. Courtenay Warner said he had a request from the Rural District Council's Association, who were the last people in the world likely to support municipal trading, asking him to oppose the inclusion of the words, as it would be the small districts that would suffer. It was not the large towns who were likely to go in for municipal trading that would suffer, because they could easily get a contractor, but in small towns it would be very difficult to work this through a contractor.

Mr. Holt agreed that it was ridiculous that a local authority should not be able to supply those fittings without the intervention of a contractor, but he was afraid they had rather provoked the insertion of the words by the House of Lords, owing to the attitude they too often took up of objecting to competition. The amendment was then carried; and with one or two minor amendments moved by Mr. Scott, the clause was agreed to.

Clauses 17 and 18 as follows were agreed to without discussion:—

(17) "(1) Twenty-four hours' notice in writing shall be given to the undertakers by every consumer before he quits any premises supplied with electrical energy by the undertakers, and, in default of such notice, the consumer so quitting shall be liable to pay to the undertakers the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises may require the undertakers to supply electrical energy to such premises, whichever shall first occur. (2) Notice to the effect of this section shall be endorsed upon any demand note for charges for electrical energy."

(18) "The undertakers may refuse to supply electrical energy to any person whose payments for the supply of electrical energy are for the time being in arrear (not being the subject of a *bonâ fide* dispute), whether any such payments be due to the undertakers in respect of a supply to the premises in respect of which such supply is demanded or in respect of other premises."

Clause (19) read as follows:—"Electrical energy shall be deemed to be goods, wares, or merchandise for the purposes of Sec. 59 of the Stamp Act, 1891 (which makes certain contracts chargeable with stamp duty as conveyances on sale), and also for the purposes of the exemption numbered 3 under the heading 'Agreement or any memorandum of an agreement' contained in the First Schedule to that Act."

Mr. Scott moved to add the following words at the end of the clause:—"An agreement for the supply of electrical energy in pursuance of which sums are to be paid at stated periods as the price of the energy supplied or as fixed or minimum charges in respect of such supply, and an agreement for payment of a minimum annual sum in regard to a supply of energy, shall not be deemed to be a bond, covenant, or instrument of any kind whatsoever within the meaning of the Stamp Act, 1891."

Mr. Tennant said the amendment was really an amendment of the Stamp Act, and he hoped the Committee would reject it in connection with the present Bill. On a division the amendment was negatived by 18 votes to 4, and the clause was agreed to.

Clause (20), as follows, was agreed to without discussion:—"For removing doubts, it is hereby declared that so much of any provisional order or special Act, or of the schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any such order or Act, as prohibits undertakers from associating themselves with any company or person supplying energy under any licence, provisional order, or special Act unless the undertakers are authorised by Parliament to do so, shall not be construed as prohibiting the undertakers from taking a supply of electricity in bulk from any company or person authorised to give such a supply."

Clause (21) was as follows:—"(1) With a view to the protection of the royal palaces, parks, and gardens, museums and other public buildings, and their contents (in this section referred to as 'the protected premises'), the Commissioners of Works and their engineer, or other officer duly authorised in writing under the hand of their secretary, may from time to time enter upon and inspect any generating station of any undertakers, and if on such inspection it should appear to the Commissioners that proper precautions are not being adopted for the due consumption of smoke, and for preventing as far as reasonably practicable the evolution of oxides of sulphur, and generally for the prevention of nuisance in relation to the protected premises, they may, without prejudice to any other remedy, require the undertakers forthwith to carry out such works and to do such things as are necessary in the circumstances. (2) The undertakers shall give all reasonable facilities for such inspection to the Commissioners and their engineer or other officer as aforesaid. (3) Any dispute arising between the Commissioners and the undertakers in relation to any of the provisions of this section shall be determined by arbitration."

On the motion of Mr. Henderson, it was agreed to omit the station of the Westminster Electric Supply Corporation, Ltd., at Horseferry Road, Westminster, from the provisions of the section, and the clause, as amended, was agreed to.

Clause (22) was as follows: "(1) Nothing in any provisional order, whether confirmed before or after the passing of this Act, shall in any way limit or affect the powers of any county council to re-build, alter, widen, or repair the structure of any bridge or to divert, widen, raise, drain or improve any road repairable by them upon which any work authorised by the order may be constructed, or impose upon the county council any liability which was not by law imposed upon them prior to the commencement of the order. (2) If at any time the county council require to carry out works for rebuilding, altering, widening or repairing any bridge, or for diverting, widening, raising, draining or improving any road, which might involve interference with any portion of the undertaking authorised by the order, they shall, prior to the commencement of the works, give the undertakers one month's notice of their intention to carry out the works, and if, in order to avoid interruption to the supply of electrical energy, it is, in the opinion of the county council, necessary temporarily to remove any electric lines or works belonging to the undertakers from such bridge or road, then the undertakers shall (and they are hereby authorised so to do at their own expense) temporarily carry their electric lines across such bridge or along such road overhead or at the side thereof in such a manner as will not be a danger or inconvenience to the public or unreasonably interfere with the works to be carried out by the County Council. (3) When the rebuilding, altering, widening, or repairing of such bridge, or the diverting, widening, raising, draining, or improvement of such road has been completed, the undertakers shall have the same rights and powers with regard to such bridge or such road and its approaches as they had before the works were carried out. Wherever a main road is carried over a railway by a bridge maintained by the railway company all the rights, powers, privileges, and exemptions conferred upon County Councils, and the benefit of all obligations imposed upon the undertakers by this section, shall for the purposes of rebuilding, altering, widening, or repairing such bridge be extended to the railway company, and may be exercised and enjoyed by them as fully as if the railway company were a County Council and the bridge were a bridge repairable by such Council. (4) If any dispute arises between the County Council or a railway company as the case may be and the undertakers with regard to this section, it shall be determined by arbitration."

Mr. Tennant moved a series of amendments which were agreed to, deleting the words in the clause relating to roads. He explained that the original idea was to protect the County Councils from having to pay for damage to lines over county bridges, but he did not see his way to include all roads. The clause was then agreed to.

Clause (23) as follows was adopted without discussion:—"Nothing in this Act shall enable the Board of Trade by Provisional Order to authorise the compulsory acquisition of any land which, at the date of the first publication of the notice for the Order, belongs to any gas undertakers and is used or authorised to be used by them for the purposes of their undertaking."

Clause (24) was as follows:—"In this Act, unless the context otherwise requires, the expression 'Provisional Order' means a Provisional Order under the Electric Lighting Acts; the expression 'Electric Lighting Acts' means (*a*) as respects England and Ireland, the Electric Lighting Acts, 1882 and 1888: and (*b*) as respects Scotland, the Electric Lighting Acts, 1882 and 1888, the Electric Lighting (Scotland) Act, 1890, and the Electric Lighting (Scotland) Act, 1902; the expression 'authorised' means authorised by Act of Parliament or Provisional Order; the expression 'area of supply' means any area within which any local authority, company or person is authorised to supply electricity; the expression 'undertakers' means any local authority, company, or person, authorised to supply electricity. The expression 'road' includes any street as defined by the Electric Lighting Act, 1882. The expression 'generating station' includes any station for generating, transforming, converting, or distributing electricity. The expression 'to supply electricity in bulk' means to supply electricity—(*a*) to any local authority, company, or person authorised to distribute electricity to be used for the purposes of distribution; or (*b*) to any local authority authorised by any general or special Act to undertake or contract for the lighting of streets, bridges, or public places, to be used for the purposes of lighting streets, bridges, and public places." The clause was agreed to.

Clause (25) was as follows:—(1) In the application of this Act to Scotland the Secretary for Scotland shall be substituted for the Local Government Board as respects Provisional Orders relating to Scottish local authorities, and May 15th shall be substituted for March 31st, and August 1st shall be substituted for June 30th. (2) In the application of this Act to Ireland the Local Government Board for Ireland shall be substituted for the Local Government Board as respects Provisional Orders relating to Irish local authorities."

The clause was agreed to with the addition of the following words:—"Sec. 99 of the Burgh Police (Scotland) Act, 1892, as applied by Sec. 44 of the Local Government (Scotland) Act, 1894, shall be read as if the words 'subject to the provisions of the Electric Lighting Act, 1882, or any Act or Acts amending or superseding the same,' were repealed."

The last clause (26) as follows was unanimously agreed to:—"(1) This Act may be cited as the Electric Lighting Act, 1909. (2) This Act and the Electric Lighting Acts shall be construed together as one Act, and may be cited as the Electric Lighting Acts, 1882 to 1909. (3) This Act shall come into operation on the first day of April, 1910."

Mr. Falconer proposed the following new clause, which was accepted by Mr. Tennant on behalf of the Government, and agreed to by the Committee:—"All electrical lines, fittings and other apparatus and appliances let by any undertakers on hire or belonging to the undertaker, but being in or upon premises of which the undertaker is not in possession, shall, whether they be or be not fixed or fastened to any part of any premises in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and be removable by, the undertaker, and Secs. 24 and 25 of the Electric Lighting Act, 1882, shall extend and apply to all such fittings, apparatus and appliances. Provided that such electric lines, fittings and apparatus or appliances have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon, sufficiently indicating the undertaker as the actual owner thereof. For the purposes of this section electric lines, fittings, apparatus and appliances, articles and things disposed of by the undertakers on terms of payment by instalments shall, until the whole of the instalments have been paid, be deemed to be articles and things let on hire by the undertakers. Nothing in this section shall affect the amount of the assessment for rating of any premises upon which any electric lines, fittings and apparatus are or shall be fixed."

The Bill was then ordered to be reported to the House.

Gateshead and District Tramways.

This Bill was again before the Unopposed Bills Committee of the House of Commons on Monday. The consideration of the measure had previously been adjourned, to allow of the parties consulting with the Local Government Board on various matters.

Mr. Kennedy, Parliamentary agent for the promoters, said that under Clause 23 of the Bill the company could enter into an agreement with certain specified local authorities for the purpose of the construction and working of the respective undertakings.

Mr. Moon, K.C., Speaker's counsel, objected to this provision, as he said the corporations were getting in a company's Bill powers which they could exercise without reference to their ratepayers.

Mr. Kennedy said that was so, and he had precedents for it in the clauses of the Lancashire Bill of 1903, Nottingham Bill, 1904, and Folkestone, 1906. The Nottingham Bill, however, allowed the leasing, working and maintaining of the lines, but not the construction.

After further discussion, the word "construction" was deleted.

On Clause 23, Mr. Moon said that it gave the local authorities powers to sell their undertakings without any power of resumption, besides various other matters. On his suggestion the clause was altered so that the effect of it was to enable the company to buy, but not the corporations to sell; if the corporations wanted to sell they would have to come to Parliament.

Mr. Kennedy explained that Clause 25 gave the company power to use the trackless trolley system.

In answer to the Chairman, the agent said that the system was not used in England, but there were instances of the system being used in Italy and Germany. There was no case where a tramway track had been taken up and this system substituted.

Mr. Hilton, replying to the Chairman, said that the company had no particular object in view as to where to lay the system.

The Chairman, after further discussion, said that the promoters had not made out any case for these powers, and the Committee could not see their way to grant them.

Mr. Hilton then formally proved the preamble, and the Bill was ordered to proceed as amended.

West Kent Electric Power Co.

On Monday the Select Committee of the House of Commons, presided over by Mr. A. Emmott, which considers Unopposed Bills, passed the measure promoted by the West Kent Electric Power Co., Ltd.

Mr. Cripps, Parliamentary Agent, explained the provisions of the Bill, which, he said, authorised the transfer to the promoters of the powers, and all the rights, granted to the Kent Electric Power Co. in 1902, for the supply of electricity "within the West Kent area of supply." The majority of the gentlemen associated with the project were directors of the South Metropolitan Electric Co., and it was that company that was providing the capital.

Mr. Martin, the secretary to the company, formally proved the preamble of the measure, and the Bill was ordered to proceed.

Oldham Corporation.—This Bill, after two days' consideration, was passed on the 21st inst. by the Select Committee of the House of Lords, presided over by Lord Clifford of Chudleigh. The Bill, which has already passed the House of Commons, provides for the extension of the limits of supply of electricity, and to places outside the area of the borough, the construction of tramways and waiting rooms, at an estimated cost of £17,550; and the electrical equipment of such tramways at an estimated cost of £4,600. The proposal to supply electricity outside the borough was opposed by the Lancashire Power Co., who contended that they were already in the area. The Committee, after hearing evidence and arguments from counsel, passed the preamble, and as to the electrical proposals inserted the "Kitson" clause in the Bill for the protection of the Power Co.

Holywood Tramway Bill.—This Bill, promoted by the Holywood Tramway Co., was before the Select Committee of the House of Lords, presided over by Lord Clifford of Chudleigh, on the 22nd inst. The measure provides for an extension of the period allowed for the construction of the tramways authorised under the company's Act of 1904. When the Committee met, Mr. Fitzgerald, K.C., submitted that the opponents to the Bill, the Belfast and County Down Railway Co., had no *locus standi* to be heard. After hearing arguments on either side, the Committee upheld the promoters' contention. The measure thereupon became an unopposed Bill, and was referred to the Committee on Unopposed Bills. It has since passed the third reading in the House of Lords.

Central London Railway.—This Bill has passed third reading in the House of Lords.

Pump Contracts.—We understand that Messrs. Willans & Robinson are already making headway in their manufacture of pumps to Mr Orten-Böving's designs, and they have just received an order from the Lambton Collieries for a pump to deliver 2,500 gallons per minute against a head of 315 ft. at 1,170 r.p.m. Another order, booked some time ago, is for two pumps for Messrs. Isaac Holden & Sons, of Rheims. Each of these pumps will deliver 400 gallons per minute against a head of 170 ft. at 950 r.p.m. These pumps are placed at a depth of 120 ft., and are driven by gearing and vertical shafting more than 100 ft. in length, the narrowness of the pit not allowing space for electrical motors.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FINLAND.—The following goods are free of duty:—Instruments of navigation, such as compasses, sounding apparatus, signal lamps, side-lights, &c.; pottery of stoneware and fireclay for use in metallurgy, &c.; rails, fishplates and plates, tramway rails.

The following duties are payable per 100 kg.:—

	Marks.
Lead in ingots, rolls, plates and piping of all kinds ...	60
Iron, wrought, or rolled, in bars not exceeding 29 7 cm. in width, corner and angle iron, T, H and similar iron ...	6·50
Iron and steel pipes and conduits, drawn or welded ...	2·40
Copper and other common metals, in ingots, blooms, bars, plates, tubes, pipes, filings and scrap ...	5·90
Tin in ingots, bars, plates, &c. ...	2·90
Zinc " " " " ...	2·90
India-rubber, caoutchouc and gutta-percha without the admixture of other materials ...	58 80
India-rubber, caoutchouc and gutta-percha with admixture of other materials ...	105 90
Transmission belting of leather ...	14 70
Physical, chemical, optical, &c., instruments not specially mentioned ...	105 90
Copper and brass wire ...	23·50
Iron and steel axles and tires for locomotives and railway carriages ...	11 80
Iron and steel castings for buildings, hydraulic works, &c. ...	11 80
Bronzed cast-iron parts for lamps ...	29·40
Wire of iron or steel of a diameter of less than 6 mm.:	
Not coated with other metals ...	14·10
Coated with other metals ...	17 60
Steam boilers, cisterns, &c. ...	11 80
Locomotives, portable steam engines, turbines, mills and sawmills, blast engines and parts thereof:	
Of iron and steel with integral parts of copper, &c. ...	14 70
Of copper, &c., even if iron or steel is combined therewith in a small quantity ...	58 80
Electrotechnical machines and apparatus as well as parts and accessories thereof ...	47 10
Electrical machines and motors in which iron is the chief component material, and which weigh over 100 kg. ...	14·70
Electrodes ...	12
Cables and insulated wire for electrochemical purposes	12
Accumulators and galvanic batteries ...	12
Detached parts and accessories for batteries ...	12

Finnish mark = $9\frac{6}{10}$d., or 25 marks = £1.

Kilogram = 2 204 lb.

Accidents in Coal Mines.—The general report of the Chief Inspector of Mines in relation to the working of the mines and quarries in the United Kingdom during 1908 contains particulars of the accidents attributed to the use of electricity. We have compiled the following table from the report, and have given the corresponding figures from the similar Blue Book issued for 1907:—

	1908.	1907.
Coal Mines Regulation Act.		
Separate fatal accidents underground ...	11	10
" " " on the surface ...	4	Nil
Non-fatal accidents underground ...	21	16
" " " on the surface ...	11	8
Metalliferous Mines Regulation Act.		
Non-fatal accidents underground ...	1	Nil
" " " on the surface ...	1	Nil
Quarries Act.		
Non-fatal accidents (outside quarry) ...	1	Nil

Although all accidents of the above classes are required to be intimated to the Inspector, it appears that only 15 out of the 21 of the non-fatal kind in the case of underground coal working were reported to the official. It should be mentioned that with one exception all the figures apply to the number of accidents, and they also represent the actual number of persons involved in them. The exception relates to the number of non-fatal underground accidents in coal mines in 1907, which, although returned at 16, is stated to have resulted in injuries to 22 persons.

"Efesca" Tungsten Lamps.—Sending us a preliminary list, P. 576, giving particulars of their metallic-filament lamps, Messrs. Falk, Stadelmann & Co., Ltd., of 83-87, Farringdon Road, E.C., inform us that they now have large stocks of 16-c.p. low-voltage and 32-c.p. high-voltage "Efesca" tungsten lamps, a complete range of the various other candle powers in voltages from 25 to 260, and also high-candle-power lamps in 100, 200, 300 and 400-c.p. sizes.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,205. "Improvements in direct current and alternating current balancers, boosters, and auto-transformers." A. M. Taylor. July 12th.

16,222. "Arc lights with permanent metallic electrodes." H. A. Kent. July 12th.

16,224. "Improvements in the production of compounds of oxygen and nitrogen by electrical means." P. Bunet and A. Badin. (Date applied for under Sec. 91 of the Act, August 17th, 1908, being date of application in France.) July 12th. (Complete.)

16,225. "Improvements in apparatus for the production of electric arcs intended for the formation of compounds of oxygen and nitrogen." P. Bunet and A. Badin. (Date applied for under Sec. 91 of the Act, November 30th, 1908, being date of application in France.) July 12th. (Complete.)

16,273. "Improvements in automatic electric switches." T. Ferguson. July 13th.

16,292. "Electric arc lamps." P. A. Messenie and W. E. Slaughter. July 13th. (Complete.)

16,309. "Production of lightning effects on the stage by means of high-tension currents of high frequency." F. Zhaniel, née C. Feher. (Date applied for under Sec. 91 of the Act, July 16th, 1908, being date of application in Germany.) July 13th. (Complete.)

16,328. "Improvements in or relating to the manufacture of incandescence lamp filaments." C. H. Weber. July 13th. (Complete.)

16,331. "Electric transmission for motor vehicles." W. Morrison. July 13th. (Complete.)

16,332. "Improvements in electricity meters." W. H. Johnson and A. M. Billington. July 13th.

16,341. "Improvements relating to the lighting of gas burners electrically." M. Delage and P. Woog. (Date applied for under Sec. 91 of the Act, July 13th, 1908, being date of application in France.) July 13th. (Complete.)

16,405. "Combined massaging and magneto-electric machine." F. Burke. July 14th.

16,415. "Improvements in valves or rectifiers for high alternating potential differences." E. Wilson and W. H. Wilson. July 14th.

16,457. "Improvements in or relating to apparatus for winding frames, coils and similar parts of electric machinery with insulating material, and for manufacturing structures from the same material." E. Haefely. July 14th. (Complete.)

16,475. "Multiplex accumulator." H. G. Carter. July 15th.

16,476. "Improvements in electrically-driven centrifugal fans." Alldays and Onions Pneumatic Engineering Co., Ltd., and E. L. Joselin. July 15th.

16,520. "Improvements in connection with telephone and other similar mouthpieces." W. B. Tattersall. July 15th.

16,522. "Improvements in methods of charging and discharging electric accumulators or secondary batteries." A. M. Taylor. July 15th.

16,537. "Improvements in and relating to electric motor starting switches." Siemens Bros. Dynamo Works, Ltd., and E. Schupp. July 15th. (Complete.)

16,538. "Improvements in and relating to the bearings of electricity meters." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) July 15th. (Complete.)

16,547. "Improvements in electric heaters." F. W. F. Ross. July 15th.

16,552. "Improvements in and relating to electrical generating plant." J. Stone & Co., Ltd., and C. H. Vinal. July 15th.

16,558. "Improvements relating to devices for producing electrical oscillations." W. E. Lake. ("Polyfrequenz" Elektricitäts-Ges. m.b.H., Germany.) July 15th. (Complete.)

16,559. "Improvements in or relating to the control of induction motors." M. Milch. July 15th.

16,584. "Improvements in or appertaining to electric terminals or binding screws." G. W. Micklethwait. July 16th.

16,607. "Improvements in portable magnetic compasses." L. W. P. Chetwynd, Kelvin & James White, Ltd., and F. W. Clark. (Application for Patent of Addition to No. 21,634, of 1908.) July 16th.

16,630. "Improvements in and relating to the regulation of electric installations." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, September 16th, 1908, being date of application in Germany.) July 16th. (Complete.)

16,631. "Improvements in and relating to the control of dynamo-electric machinery in electric lighting installations worked with accumulators." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, September 14th, 1908, being date of application in Germany.) July 16th. (Complete.)

16,641. "Portable telephone transmitter mouthpiece attachment." W. Aitken and British Insulated and Helsby Cables, Ltd. July 16th.

16,642. "Improvements in telephone switchboards." W. Aitken and British Insulated and Helsby Cables, Ltd. July 16th.

16,643. "Improvements in telephonic sub-station switching systems." W. Aitken and British Insulated and Helsby Cables, Ltd. July 16th. (Complete.)

16,645. "Improvements in and relating to electric distribution systems." Dalziel's Constant Voltage Patents, Ltd., and J. Dalziel. July 16th.

16,649. "Improvements in quick make and break electric switches." A. West. July 16th.

16,662. "Improvements in or relating to the manufacture of electrical condensers and similar apparatus." J. A. L. Dearlove and S. G. Brown. July 16th.

16,678. "Improvements in multiple electric switches and automatic circuit-breakers especially applicable to motor starters." P. S. Brook and J. A. Hirst. July 17th.

16,679. "Improvements in electric batteries." F. Richmond. July 17th.

16,682. "Improvements in trolley heads employed for electric traction." F. Jackson. July 17th.

16,690. "Improvements in portable electric hand lamps." H. O. Wraith. July 17th.

16,702. "Improvements in or relating to electric batteries." H. H. Simmons. July 17th.

16,728. "Improvements in and relating to means for making electrical connections." A. Vandam. July 17th.

16,732. "Improved amplifying device for use in high-tension electric spark-ignition apparatus." M. Delage and P. Woog. (Date applied for under Sec. 91 of the Act, October 12th, 1908, being date of application in France.) July 17th. (Complete.)

Bradford-on-Avon.—The R.D.C. has decided to oppose the application of the Western Electric Distributing Corporation for a prov. order for E.L., and to draw the attention of the B. of T. to the fact that the company failed to carry out a previous order, which was cancelled. The U.D.C. has adopted a similar course.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electric Batteries. F. Richmond. 9,900. May 7th. (Post-dated November 9th, 1908.)

Devices for Operating Automatic Switches Applicable for Use with Electric Transformers. L. Sunderland and G. C. Pillinger. 13,185. June 20th.

Electro-Magnetic Switch. R. F. Venner, R. C. Griesbach and P. K. Morris. 13,327. June 23rd.

Rotors of Dynamo-Electric Machines. Lancashire Dynamo and Motor Co. and R. G. McLeod. 13,504. June 25th.

Control of Electric Motors. M. Haitenheim. 13,520. June 25th.

Magnetic Brakes for Railway and Tramway Vehicles. O. H. Baldwin. 13,781. June 29th.

Electric Meters. British Thomson-Houston Co. and A. J. Martin. 13,788. June 29th.

Switches for Supplying Electric Power. G. Cooper and F. C. Sharp. 14,773. July 11th.

Electric Accumulators. Van Raden & Co. and M. Metz. 15,388. July 21st.

Transformation of Electric Currents. H. Taylor. 15,522. July 22nd.

Electric Telegraphs. E. Tyer and J. R. Dobson. 17,143. August 14th.

Means for Indicating and Recording Current Leakage in Electric Circuits or Motors. Ashington Coal Co. and T. McKie. 17,161. August 14th.

Sparking Plugs for Internal-Combustion Engines. O. H. O. B. Payne. 17,912. August 26th.

Construction of Regulating Switch. A. E. Gott. 19,757. September 21st.

Direct-Current Dynamo-Electric Machinery. A. H. Midgley and G. A. Vandervell. 21,936. October 16th.

Direct-Current Dynamo-Electric Machinery. A. H. Midgley and G. A. Vandervell. 21,938. October 16th.

Supply and Regulation of the Electric Energy Employed in the Operation of Arc Lamps Used in Searchlights and like Apparatus. British Thomson-Houston Co. and A. A. Pollock. 23,070. October 29th. (Application for Patent of Addition to No. 4,379 of 1905.)

High Potential Rectifying Switch. H. C. Snook. 23,489. November 3rd. (Date applied for under International Convention, July 20th, 1907.) (Originally included in No. 13,854 of 1908.)

Electrical Apparatus for Working Planing Machines and other Reciprocating Tools. Vickers, Sons & Maxim, Ltd., and A. D. Williamson. 23,908. November 7th.

Alternating-Current Meters. Siemens Schuckertwerke Ges. 27,343. December 16th. (Date applied for under International Convention, December 17th, 1907.)

Single-Phase Alternating-Current Meters. H. Aron Elektricitäts Zahlerfabrik Ges. 28,271. December 28th. (Date applied for under International Convention, October 9th, 1908.)

Means for Starting and Regulating Compensated Electric Repulsion Motors. Allmänna Svenska Elektriska Aktie-bolaget. 25,537. November 26th. (Date applied for under International Convention, November 27th, 1907.)

Time Switches for Gas or Water Cocks or Valves and Electric Switches. A. Raasch. 27,207. December 15th.

Apparatus for Transmitting Power at a Reduced and Variable Speed by means of Dynamo-Electric Generators and Motors. M. Johannet. 28,438. December 30th. (Date applied for under International Convention, February 3rd, 1908.)

1909.

Automatic Electric Signals for Tramways, Railways, and the like. A. I. Rogers and Brecknell, Munro & Rogers, Ltd. 319. January 6th.

Cooling of the Windings of Dynamo-electric Machines. Siemens Bros. Dynamo Works and M. Kloss. (Partly by Siemens Schuckertwerke Ges. 1,679. January 23rd.

Methods of Electrically Lighting Motor Cars. J. Polkey. 4,117. February 19th.

Electric Cut-Outs. T. E. Murray. 4,228. February 20th.

Control of Electric Motors. Allgemeine Elektricitäts Ges. 5,318. March 4th. (Date applied for under International Convention, March 4th, 1908.)

Induction Coils. A. W. Sharman. 6,962. March 23rd. (Date applied for under Rule 13, June 4th, 1908.)

Arrangements for the Cooling of Commutators of Dynamo-electric Machines. Siemens Bros. Dynamo Works and F. F. O'Hagan. (Partly Siemens Schuckertwerke Ges.) 10,067. April 28th.

Supports for Electric Lamp Filaments. Soc. Française d'Incandescence par le Gaz (Système Auer). 11,149. May 11th. (Date applied for under International Convention, July 13th, 1907. Originally included in No. 12,720/08.)

Apparatus for Controlling Electric Motors. H. E. Day. 78. January 1st.

Continuous-Current Dynamo-Electric Machines. P. Marchal. 590. January 9th. Date applied for under Rule 13, August 14th, 1908.

Electric Servo-Motors. M. Couade. 2,374. February 1st. (Date applied for under International Convention, February 25th, 1908. Application for Patent of Addition to No. 3,9[illegible]7/07.)

Vents for use with Electric Accumulators or Batteries. W. Cowderoy and Reason Manufacturing Co. 2,379. February 1st.

Electric Liquid Heater. W. F. Cutler and T. Barnett. 3,028. February 8th.

Electrical Induction Furnaces. C. Grunwald. 3,599. February 13th. (Date applied for under International Convention, May 7th, 1908.)

Carbonic Acid Engine in which the Carbonic Acid is Heated by Electricity. L. Horst. 4,576. February 24th.

Spark Plugs. G. P. B. Hoyt and E. L. Sinsabaugh. 5,893. March 11th.

Electrical Induction Furnaces. C. Grunwald. 7,396. March 27th. (Date applied for under International Convention, August 15th, 1908.)

Lightning Arrester for Overhead Lines. G. Krause. 9,987. April 27th. (Date applied for under International Convention, July 29th, 1908.)

Electrically Heated Cooking Apparatus. W. A. Lowden. 12,985. June 2nd. (Date applied for under Rule 13, June 12th, 1908.)

Central America.—A contract has been concluded between the municipality of San Miguel, Salvador, and private individuals for supplying the town with electric light.—*Board of Trade Journal.*

THE
ELECTRICAL REVIEW.

VOL. LXV. AUGUST 6, 1909. No. 1,654.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

THE BRUSSELS EXHIBITION.

As a place of entertainment, owing to the wonderfully favourable weather, the Franco-British Exhibition last year was phenomenally successful; as an industrial concern quite so much could not be said of it; and the arts and crafts which particularly interest our readers were not satisfactorily represented at all. Some important steps, however, have been taken to remove the stigma which has hitherto been attached to British representations at great international shows; and, although in some respects the Government have not gone as far as we suggested, in the series of articles which ended in March last year, in other ways they have gone further and done more than was expected of them. No advantage was taken of the presence of the Comité Français and of the host of representatives from overseas to lay the foundations of a similar body for the Empire in general; nor, as far as we know, during the Press Conference, was attention drawn to the good work being done by the new Exhibitions Branch of the Board of Trade, work which should be undertaken by all our Colonies and Dependencies. In fact, in our opinion, the new Department has been doing good more or less by stealth (as, indeed, is very much the habit of our officials), and it has not practised what it preaches—viz., the efficient use of advertisement. Of course, as it is a Government affair, there is no precedent for the carrying out of an extensive Press campaign from a big publicity bureau; but on the other hand, the whole business is a new departure, and, therefore, precedents are inapplicable.

So much for what has not been done; we turn now to the more agreeable task of recording that Mr. U. F. Wintour, the Commissioner-General, and his zealous assistants are doing more for exhibitors at Brussels from the United Kingdom than has been done before by any other body; indeed, even more than the Comité Français does for its members. Pity it is that such excellent arrangements as have been made could not have been extended throughout the Empire, and thus by co-operation and co-ordination have given the world in general a practical example of the resources of the British Empire. This may come in time, and the idea might be mooted during some function of the present Defence Conference. Surely what may be called industrial defence is as important as any other kind of protection from possible evils, and no better opportunity for bringing the matter forward is likely to occur for some years to come. The present Exhibition Branch, it is true, is in its infancy, and it must learn to walk warily and steadily and gain experience in the comparatively narrow national path it has chosen before venturing on the broad imperial highway which, in course of time, it will be able to negotiate successfully, and which will lead to the collection of the Empire's exhibits in one stately building made up of various courts, harmonious, and yet characteristic of the various nationalities and dominions.

Failing organised private enterprise, the Exhibition Branch of the Board of Trade, whose offices are in Queen Anne's Chambers, Westminster, has boldly stepped into the breach, and is now doing more than is done for the exhibitors of any other nationality. A prominent position has been secured, such that the main stream of visitors will have to pass through the British Section in order to reach those of other nations; the space allotted is as great as that of any other country, and those who take advantage of this unique opportunity will be able, with the help of the Department, to know beforehand to a penny what their venture will cost them. The only charge will be for space and that is very moderate indeed, considering what this charge will cover, viz., show-cases, general decorations, the handling of the goods between the entrances and the space allotted, and back again, catalogue entries in French and English, storage of packing cases, unskilled labour, as far as possible, free installation, and last, but not least, the passing through the Customs at the gate of the Exhibition, there being no octroi. In the case of machinery there will, of course, be extra charges, but all of them are on a similarly moderate scale; crane power will be provided gratuitously, and the laying of the foundations by Belgian contractors will be under the superintendence of the Royal Commission's engineer; inventions, industrial trade marks and designs will be protected; lastly, a suite of reading, writing and business rooms will be provided for exhibitors' agents, with a reference library and a staff of high-class interpreters. Reduced charges by land and sea will be made for all returned exhibits. These and all other particulars are willingly given at the offices, where applicants will find that their inquiries, whether personal or in writing, are treated in a prompt, businesslike and unusually courteous manner. A sum of £60,000 has up to now been allotted by Government for expenses in connection with International Exhibitions at Brussels, Rome and Turin. A reference to our previous articles will show that in this matter, so far, there is no new departure, for the average Government contribution has been £27,800 in 23 Exhibitions; as, however, the greater part of the funds were often, in the past, squandered on lovely, but insignificant looking, and enormously costly Royal Pavilions, and as there is no intention of repeating this folly, the money will go much further than it has ever done before.

The number of applications for space to show both individual and collective exhibits is so satisfactory that the success of the rather sporting venture is secured. Collective exhibits are being organised at Bradford, Nottingham, Huddersfield, Galashiels, Macclesfield, Bury and Wycombe, and there is a good prospect of this being done elsewhere; one cotton firm alone has appropriated 5,200 sq. ft. Sir Boverton Redwood is arranging a collective exhibit of the fine chemical trades, and strong individual exhibitors in the electrical, iron, steel and engineering trades, are coming in, following the example of Messrs. Armstrong, Whitworth and Co. Shipbuilding and land transport generally, especially the motor trades, will be well represented, as well as the Northampton and Walsall specialities, manufacturing grocers, and the makers of sanitary fittings, &c. There will be a "Road Conference" during the Brussels Exhibition, with which, by the way, it is to be hoped the Anglo-Japanese Exhibition next year will not clash, to their mutual disadvantage.

Jet Condensers. OUR contemporary, the *Engineer*, recently put in a plea for the jet condenser, which it is averred has been ousted by the surface condenser, a type, new for land purposes, that has become fashionable of late years, and having become the fashion, has been put in at places both fit and unfit. The fashion of the surface condenser, no doubt, grew up on a good foundation, for it arose out of the boiler scale difficulty. The soft water from a surface condenser carries no salts of lime, and condensed steam is an ideal boiler feed. But condensed steam plus oil is anything but ideal, and the use of the surface condenser has brought in its train oil separators which are by no means devoid of trouble. And probably some of our readers may be acquainted with places where, with a perfectly soft feed-water, surface condensation has been adopted at a quite unnecessary cost. With soft feed-water, a feed-water surface heater is a justifiable preface to a jet condenser, but it is obviously wasteful to employ general surface condensation. Of what value, for example, would surface condensation be with feed water of the quality of the public water supply of Manchester, Leeds, Glasgow, and some other of the northern towns? And after all, is not a jet condenser a surface condenser—for the steam condenses upon the surface of the water injected? Since a water jet falls in drops if it is more or less broken up, the condensing surface is the superficial area of the drop. Water being a poor conductor of heat, it follows that where a drop of water is large, it will consist of a cold central core surrounded by a hot thin shell. There is probably no definite information that will tell us how thick this hot envelope will be in the case of water falling, say, 8 ft., in company with exhaust steam. It is, however, certain, if the kinetic theory of steam be accepted as a working hypothesis, that the steam, with its velocity of molecules of 1,800 ft. per second, must encounter some water in a condenser of, say, 3 ft. diameter, since a molecule of steam would travel 420 diameters of the condenser, while a drop of water was falling 8 ft.

Our contemporary points out that the larger air pump will not be more costly than the small air pump plus the circulating pump of the surface condenser. There is no comparison between the cost of a jet and a surface condenser, and, if some air does get in with the jet, are there no leakage troubles with the tube ends of a surface apparatus?

To return to the question of division of the jet, if it be assumed that a drop of water of $\frac{1}{16}$ in. diameter will be heated throughout by, say, 50° F. in its fall through the steam, then a drop of $\frac{1}{8}$ in. diameter will only acquire an average temperature of approximately half of this, for its area being fourfold, it will absorb four times the heat to add to an eightfold mass, and the water will flow away at 75° F. only. In order, therefore, that jet condensing may be fairly efficient, the water supply should be well comminuted, and it would appear rational to admit steam near the base of the condenser to meet water falling from spray nozzles in the head.

Fault is found with the admission of the jet so that it is directed against the side of the condenser. No very serious objection need be raised to this. It was quite a common practice in Lancashire to carry in the jet near the top of a vertical condenser and let it splash itself simply against the opposite side; and with hot-well temperatures of 100° F. very high vacua were often obtained, which seems to show that our drop theory above put forward may be a needless sort of refinement. Also, the old practice brought in the steam at the head of the condenser, athwart the entering jet of water, it is true, but with no provision for spraying except the eddying set up in traversing the pipe and the injection valve. Indeed, while at one time the injection pipe had an internal perforated length extended inside the condenser, as may be seen in old illustrations, these were eventually omitted, being found of no value.

It may well be argued that surface condensers are often a costly fad that involve as much expense in oil treatment as would put down a feed softening plant. There are some feed waters that cannot readily be softened; if they contain much lime sulphate there will be a concentration of soda sulphate in time in the boilers. But a plain carbonate water can be softened, and an initially soft water will usually be improved for boiler purposes if filtered through limestone chips so as to kill its peat acids and help to form an eggshell scale on the boilers.

It would appear to-day that some of the men responsible for power-station design do not give sufficient thought to the condensers. Many of them, trained up during the surface-condenser period, seem to regard the jet condenser as a cheap and inferior appliance; others, perhaps, think it is obsolete because of some inherent fault. As a fact, the surface condenser was originated for marine purposes, to get over the inherent disability of sea water—to wit, its salt; it was regarded, in fact, as a necessary nuisance, and it is only justified to-day where there is sufficient of the same evil that brought it into being—namely, some impurity in the water that cannot be got rid of.

Is there an Implied Warranty on the Sale of a Patent?

At a time when an Act of Parliament renders the working of patents more or less compulsory in England, there is much to induce the patentee either to sell his monopoly out and out, or else license its user by other persons. He may not be in a position, financial or otherwise, to do the work himself; a little ready cash on an assignment, or the grant of a licence may be much more acceptable than the flotation of a company or the erection of a factory. But what are the obligations of a man who grants a licence or assigns his patent? Does he warrant the validity of his invention? Does he warrant that it infringes the patent of no other person? Finally, does he impliedly undertake to do nothing in respect of the invention which will jeopardise its validity? The question whether an assignment involves a warranty of the validity of the patent was decided in Smith *v.* Neale, 1857, 26 L.J.C.P. 143. There, to a declaration alleging a contract for the assignment by the plaintiff of the letters patent in trust for an institution, and upon the terms contained in the proposal of the defendant, the defendant pleaded that there had been no assignment, on the ground that the patent was invalid. It was held that either the contract involved no warranty by the plaintiff and that the invention was new, or that the manufacture was within the statute of James, and therefore that the plea put in issue no more than the mere grant of the letters patent which the plaintiff contracted to assign.

It would seem also that on the sale of an article which is provisionally protected, the purchaser cannot complain if the various allegations made by the patentee as to the great merits of his invention are not realised. Thus in Smith *v.* Buckingham, which was heard in 1870, by an agreement, after reciting that the plaintiff had lately invented an improved composition or material to be employed in water-proofing or rendering woven fabrics impervious to moisture, for which he had duly obtained provisional protection, and had obtained a certificate of protection, it was agreed between him and the defendant, for the considerations therein mentioned, and in consideration of a further sum of £350, to be paid on the completion of the necessary specification and grant of the letters patent, to transfer and make over to the defendant all his interest in the invention or improvement thereof, and all benefit to be derived from the provisional protection, or from any letters patent to be thereafter granted for the invention. In an action on this agreement to recover the £350, the defendant pleaded that the plaintiff had not invented an improved composition or material to be employed in water-proofing or rendering woven fabrics impervious to moisture: Held, that the plea was bad, as there was no implied warranty that the patented article was good for what was claimed for it.

On the assignment of a patent without a warranty, the assignee may not, in an action upon the contract of assignment, set up the invalidity of the patent as a defence. An express covenant for the validity of the patent will of course remove the estoppel, and the assignee may rely on this in answer to an action for the purchase money (Nadel *v.* Martin, 1903, 20 P.O.R. 735).

In Smith *v.* Scott, 1859, 6 C.B.N.S. 771, it was decided that where a licence to use certain patent machines is granted by indenture, in which it is recited that the grantor has invented the machines, and has obtained letters patent for the sole use of the invention, and inrolled the specification, parties (and privies) are estopped from pleading either that the invention is not a new invention, or that the grantor was not the first inventor, or that no specification was enrolled.

These statements of the law may serve to draw the attention of those who are acquiring patents, to the desirability of securing some kind of written warranty from the patentee. If the invention is really valuable and good subject matter for a patent, the patentee will not be shy about putting the matter into writing. Now that the patent officials take some steps to inquire into the validity of the inventions which are made the subject of sealed patents, there is less difficulty than formerly in deciding whether there is good subject matter.

A Point in the Law of Trade Marks.

The manufacturer whose commodity has become identified in some degree with a particular place is naturally desirous of connecting the article with the place by means of a name which can be registered as a trade mark, but the law does not allow this. By the Trade Marks Act, 1905, a registered trade mark may be either "a word or words having no direct reference to the character or quality of the goods, and not being according to its ordinary significance a geographical name or a surname," or "any other distinctive mark." The word distinctive mark, however, means "adapted to distinguish the goods of the proprietor of the trade mark from those of other persons." In the case in question, the proprietors of a medicinal preparation sought registration of "California Syrup of Figs." The evidence showed that it had been introduced into England some 12 or 13 years ago, and that the preparation had been continuously sold here under that name. The name was on the bottles, and did, in fact, distinguish the manufacture of the applicant's from other preparations of a similar manufacture in this country. It was held upon these facts that the trade mark sought to be registered was not one which was adapted to distinguish the goods of the applicant's from those of other persons within the meaning of Sec. 9, and, therefore, that the application must be refused.

A Novel Oven.

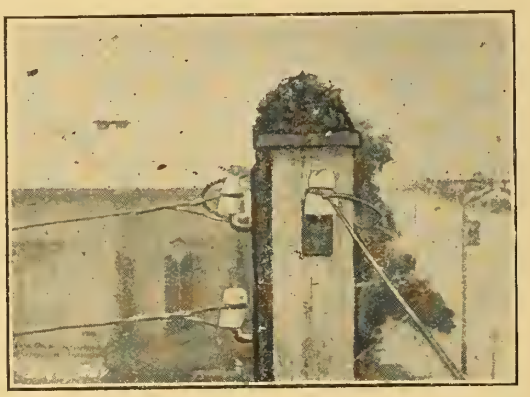
An interesting application of electricity to the needs of the textile business—one of the many such developments of the past year or two—is the electrical conditioning oven, designed by Messrs. Ellis and Allsopp, of the Bradford Municipal Electricity Department, for use in connection with the local woollen industry, and described in a later page.

Those who are acquainted with Bradford's municipal enterprise will be aware of the important part played in the local textile industry by that Corporation's conditioning house—or, to use a more homely title, testing station; and there is little doubt that any improvement in the apparatus for use in this direction will be generally appreciated by the textile community, not to mention the many others whose business it is to popularise the use of electricity for all and sundry purposes.

THE UNDERTAKING OF THE ADELAIDE ELECTRIC SUPPLY CO., SOUTH AUSTRALIA.

By J. H. DAVIES.

In 1899 the Electric Lighting and Traction Co., already carrying on business in Victoria, in which State it owned electric supply undertakings at Melbourne and Geelong, acquired a small undertaking, situated at Port Adelaide, South Australia, and a private Electric Supply Act, authorising electric supply within the city of Adelaide, its suburbs and elsewhere, from the South Australian Electric Light and Motive Power Co., Ltd. The undertaking at Port Adelaide (which is situated on the coast about 9 miles distant from the city of Adelaide) was a very small one, and as the load has since been transferred to the main supply system in Adelaide, there is no need to refer to it at length; the Adelaide undertaking was built up by the Electric Lighting and Traction Co., and within the last two years by its successor—the Adelaide Electric Supply Co., Ltd.—which has acquired the whole of the former company's interests in South Australia.



Cremated Ants' Nest on Distribution Pole, Adelaide.

Besides the private Act taken over from the original holders, only a small uncompleted portion of the buildings for a central station, which had been commenced, was taken over as well. These were on a centrally-situated site in Grenfell Street East—that is, within the city area proper.

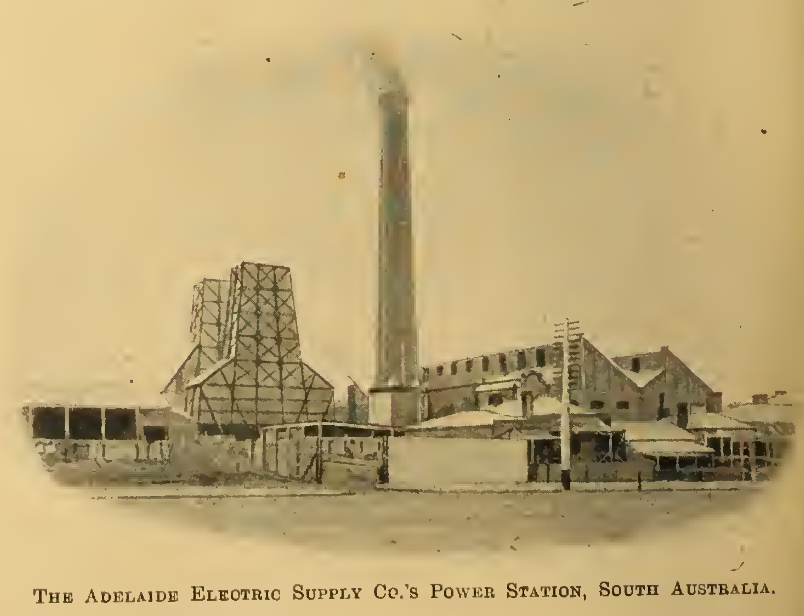
In consequence of the lay out of the city, special consideration had to be given to the question of distribution. Adelaide, with a population of 150,000 inhabitants, like most Australian cities, covers with its suburbs an enormous area, and in this particular case the area is again inordinately increased by the city portion proper being surrounded by a belt of park land, half a mile wide, thus throwing the suburbs still further out from the business centre, near which the supply station is situated. It was ultimately decided, therefore, to distribute within the city, on the three-wire, continuous-current system at a pressure of 400 volts between the outers, and to the suburban portions by means of alternating, single-phase current. For the first three or four years, however, the company's energies were taken up in meeting the demands for a supply in the continuous-current area, and as this area would for many years be the principal one as regards magnitude of requirements, it was decided to lay out the power house as a continuous-current station only, leaving the alternating-current arrangements to a later date. A small pioneer plant was, therefore, put down to test the demand, and the requirements have increased at such a rapid rate, that the present installation consists of two 200-kw. Willans-Peebles steam generators, one 850-kw. Brush-Parsons turbo-generator, and two Belliss-Brush 750-kw. steam generators. The Brush turbine set is fitted with only one generator of 850 kw., the machine being provided with polar windings and interpoles.

Two 100-kw. steam balancers and one 30-kw. motor balancer are also installed.

South Australia being generally a very dry and somewhat waterless country, the condensing arrangements required very careful consideration.

The plan adopted allows of all the Willans-Peebles generating sets exhausting into a common exhaust pipe, connected to two barometric condensers of the siphon type, which do not require the use of an air pump. The turbo-generator exhausts into a barometric condenser of the counter flow type, in which the air is drawn off from the top by means of a motor-driven Mirrlees-Watson dry air pump. The two 750-kw. Belliss sets exhaust into one common condenser of the surface type, below floor level. The circulating water is cooled by means of natural draught cooling towers, and as the temperature in Adelaide during the summer often rises to 110° and over, it will be seen that not only is a large capacity in cooling towers necessary, but that the quantities of circulating water to be dealt with are also large. The barometric condensers discharge into a pit 20 ft. below the general floor level of the station, and the combined hotwell and circulating water is raised by means of totally immersed centrifugal pumps (operated by vertical spindle motors situated at floor level) to the top of the cooling towers; and as the sumps of the cooling towers are at a higher level than the engine room floor level, the use of a pump for returning the cooled water to the tops of the barometric condensers is unnecessary, as the condensers draw their own water.

The boiler house is laid out on the principle of reserving the centre portion for the economisers and by-pass portion of the flue, whilst a set of boilers is placed at each side. The boilers originally installed consist of four of the Babcock and Wilcox type, hand fired, but in consequence of the extremely rapid increase in load, it has been found necessary to lay out the remaining space on the other side of the economisers for as large boilers as could be conveniently got in, and therefore two Babcock boilers of 3,580 sq. ft. heating surface each have been installed, and two further boilers are contemplated for erection during the coming year. These larger boilers are fitted with automatic chain-grate stokers, and an ash tunnel communicating with an elevator and bin, runs underneath them. Coal bunkers, delivering the coal through side chutes into the boiler house, are built up parallel with the boiler house wall, and fuel is elevated into them and ash removed by a continuous, motor-driven, push plate conveyor.

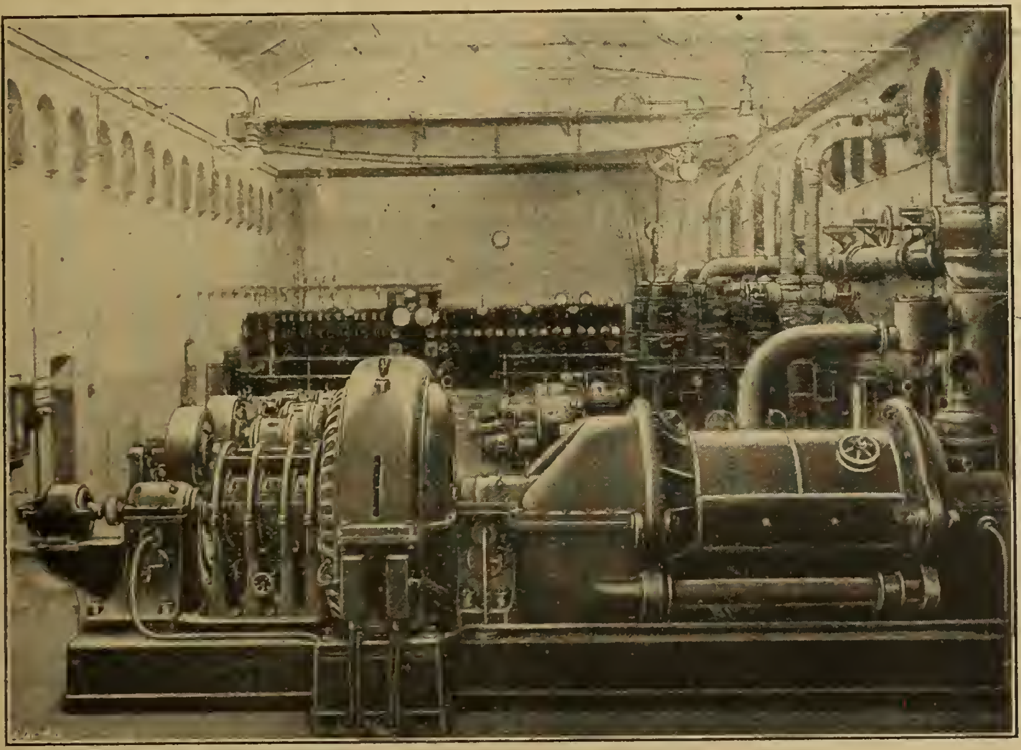


The Adelaide Electric Supply Co.'s Power Station, South Australia.

The feed water is measured by means of one of Leinert's weighing meters of a maximum capacity of 9,000 gallons per hour. This meter operates on the principle of carefully poised buckets which tilt and automatically discharge their contents through siphons when a certain weight of water has been poured into the bucket. Two buckets, side by side, are fitted, and an automatic throw-over arrangement is provided, which deflects the stream of water from one bucket to the other as they alternately fill and discharge.

The continuous-current switchboard takes up the full width of the engine room with a H.T. alternating board at right angles to it, but in consequence of the rapidly increasing load, it is already evident that more space will be required for the switching arrangements, and this will probably be provided within the next year.

As regards the alternating-current portion of the undertaking, this work has already been commenced, and is being pioneered during its early stages by the use of motor-generators, operated from the existing continuous-current plant. The motor-generators installed consist of one set of 50 KW., two sets of 100 KW. each, and a third set of 200 KW. is in process of erection.



Interior of the Adelaide Electric Supply Co.'s Generating Station.

As stated above, the business and city area proper is supplied by means of a three-wire continuous-current system of mains with 400 volts across the outers. These are laid throughout the greater part of the city underground, on the solid system, lead sheathed, paper-insulated cable being usually employed. In the outskirts of the city area hard-drawn copper, overhead mains, supported on jarrah or ironbark poles, are used.

In the suburban areas, distribution is effected by means of the single-phase alternating-current system, in which H.T. concentric feeders at 2,000 volts are run underground, on the solid system, to a number of transformer sub-stations placed beneath the pavements. Secondary distribution on the three-wire system with 400 volts between the "outers" is carried out entirely above ground by means of bare, hard drawn, copper cables, supported on poles. The proper material for poles has been the subject of much consideration, for Adelaide is much infested by the white ant. Ant-proof qualities are popularly attributed to jarrah, but the company is continually coming across cases in which the white ant does damage. It will eat away the jarrah troughing of the mains laid on the solid system, down as far as the pitch; in fact, in another Australian city it has even been accused of consuming the pitch and a portion of the lead, thus bringing about a "short." Poles, apparently sound, are upon examination found to be supported only by the skin of paint on the outside, and short circuits have taken place at the tops of 30 ft. poles, supporting special terminal devices, in consequence of the ants having bored up through the centre of the pole and built their nests under the metal cap covering the terminals, until the whole colony was suddenly cremated. The company's experience is that ironbark, obtained from New South Wales, is considerably better in its ant resisting qualities than even the well known jarrah.

It was decided some two years ago to shut down the separate station at Port Adelaide and to change the supply over from continuous current to alternating current and connect it with the main power house in Adelaide proper, by means of a transmission line, nine miles long; this transmission line is underground at both ends, where it passes through busy streets, but for the greater part of the distance it runs overhead along a country road. The overhead portion, consisting of bare hard-drawn copper, is supported on ironbark poles by means of special extra high tension insulators, glazed a dark colour so as to afford less temptation to owners of catapults and rifles, and is so arranged that the "outer" is split into two cables of half the sectional area of the "inner" and placed below the latter, the "inner" taking the topmost position on the pole. At intervals along each span, short lengths of wire connect the two halves of the "outer," forming a kind of cradle into which the live "inner" could fall in case of breakage, thus short-circuiting the line and blowing the fuses at the supply end. At the supply station the pressure is stepped up from the 2,000 volts pressure for the suburbs immediately surrounding Adelaide, to 4,000 volts, and this is distributed at the Port Adelaide end on the three-wire overhead system with 400 volts between the "outers," thus corresponding exactly with the supply given on other portions of the system. Another similar line about 8 miles long is shortly to be constructed to supply the small coastal residential town of Glenelg.

The following statistics are interesting:—

The population of Adelaide and suburbs, together with Port Adelaide and Glenelg, is about 150,000.

The area of the districts actually covered by the private Act is of very great extent, namely, about 67 sq. miles.

The connections total the equivalent of about 129,334 30-watt lamps, and about 1,832 H.P. in motors are included.

The output during the past 12 months was 1,575,019 units, and it is very rapidly increasing from year to year; 39·6 miles of H. and L.T. cable have been laid underground, and the electric supply is available along 82 miles of street.

The company has just lately arranged with the Tramways Trust for the supply of about 1½ million units per annum until such time as the trust shall have completed its own power house; for this the pressure will be boosted by a specially constructed and compounded motor-generator of 200 kw. capacity, in series with the main current. The Adelaide tramways system is at the present time being changed over from horse to electric traction, and is a very large undertaking, some 70 miles of track being under conversion. This is being carried out by a Municipal Tramways Trust, whose chief engineer is Mr. W. G. Goodman.

The head office of the Adelaide Electric Supply Co. is at Finsbury Pavement House, London, but there is a local advisory board in South Australia.

The writer is indebted to the company's manager, Mr. F. W. Clements (who, by the way, is also engineer and manager of the Melbourne Electric Supply Co., Ltd.) and its engineer, Mr. Wheadon, for the kindly assistance which enabled him to prepare this article.

THE MAN OF RESOURCE.

By C. A. SMITH, B.Sc., A.M.I.E.E.

The Public, the Inventor and the Apprentice.

The Electrical Review told us, in a striking leading article,* that "it is, indeed, wholly erroneous to imagine that the majority of our adult population are in search of knowledge of any kind. The person who attempts to teach them by pen or by word of mouth is guilty of presumptuous sin." But that statement is only partially correct. You cannot balance it with the proven fact that the self-education and "get on or get out" books have phenomenal sales. You cannot neglect the strength of the public appetite for "Science Bits" and the paragraphs about radium and "The Electric Gun." The public are willing to *search* (in a desultory manner, it is true) for knowledge of a kind, but it must be served up to tickle the public's palate.

What the British public seem hopelessly to lack is the power of *concentration.*

The same evil is apparent in the evening student at technical schools. It is staying power that is wanted. Only too frequently during the race the student gets "winded" and drops out. Contrast the attendance at evening classes at the beginning and the end of the session. In some cases the authorities at the school are to blame. They are quite content for a student who has been at work all day to take up four or five evenings a week at the technical school. Frequently no home work is done in one subject; interest flags; the result is inevitable. The student gets his tuition practically free, and he does not value it much above the coin which gains him entrance to the class.

The technical schools and colleges are in danger of attempting to teach too many subjects. It is not at all unusual for an evening student to be taking, during a winter session, instruction of the Board of Education "stage two" order, in steam, applied mechanics and machine drawing. Frequently a fourth subject, such as mathematics or electricity and magnetism, is taken; and if the first two and the last subject mentioned above are to be understood, then laboratory instruction is essential. There are, of course, students of great ability who can carry the load, but we must lay out our programme for the average student, and unless a lecturer is well aware of the great ability of the student, he should strongly advise him to *concentrate* upon not more than two subjects. Unfortunately, the Board of Education grants are given on the attendances; there is, therefore, every encouragement given to the authorities to overload the student and to sow seed for spasmodic efforts. A glance at a time-table before me as I write reminds me of the story of the Quaker lady and Southey. After the poet had, with no little satisfaction, explained how he studied Spanish at breakfast, Portuguese when shaving, wrote poetry from 3 to 5—how, in a word, every minute was occupied in reading, writing, eating, exercise or sleeping—she replied, "and friend, when dost thee *think?*"

The three greatest factors in this life are will, imagination and concentration. An acorn cannot grow unless it has a fit soil, and the student will never really learn until he has been taught to think for himself. The average products of the evening classes of this decade are apt to resemble human gramophones. For a time they possess an encyclopædic knowledge of certain facts connected with science—and then they gradually forget most of it. It seems a pity to set such store on memory, when it is hard common-sense that is so often required.

John Milton, two and a half centuries ago, told us that "though a man have all the tongues that Babel cleft the world into, yet if he has not studied the solid things in them, as well as the words and lexicons, he were nothing so much to be esteemed a learned man, as any yeoman or tradesman competently wise in his mother dialect only." It is the complete education which is needed.

In London there is a great tendency for a student to acquire nomadic habits. Many wander in and out of technical colleges, like stray ions. There is no disguising the fact that there is a tendency to overrate the importance of numbers at a college. There is also, unfortunately, considerable overlapping. No one objects when the boy leaves the Board School, and passes on to a more advanced centre of learning; but what should we think if, at every Board School, they offered to coach for the London final B.A. and B.Sc.? Yet many technical schools are making efforts to send men in for the "final." Why should they not *concentrate* on trade school work? Co-operation is needed. The polytechnics and the colleges should concentrate upon the type of instruction most suitable to the *majority* of their students. The lecturer suffers from this tendency to cover such a large range of subjects. Most lecturers involuntarily suffer from the same complaint as Southey; their time table gives them but little chance to *think.* Too often a steam hammer is used to crack a nut. Men capable of doing original research teach very elementary subjects, as well as those which are considered advanced. The teacher cannot concentrate. Perhaps the State, or the business man who we hope will endow technical colleges, does not fully appreciate the value of research. The Electrical Review for May 15th, 1908, says that it is the public who do not appreciate these things. But are we sure that the public cannot be led to take a deeper interest in such matters?

There is no publication in this country which fills the same niche as does *The Scientific American* across the Atlantic. But the circulation of semi-technical and workshop journals among the mechanics is an encouraging sign. It is clearly much better for the artisan to be interested in details connected with his work than in *Scrappy Bits.*

There seems, however, no paper suitable to the man who knows not science but who wants to read about things scientific. It would need a great deal of energy to found such a publication, and success is not certain. But it is curious that no attempt has been made in such a direction.

Practical Research.

Prof. Churton Collins, an authority on literature, says that science is attracting the greatest intellects into its ranks. Every side of our life, from the cradle to the grave, is touched by the works of the inventor. The public are aware of this fact. Is it then hopeless to attempt to influence public opinion concerning the value to this country of invention and research?

There is a very popular idea that research work at college must necessarily mean that the member of the staff who conducts it should be divorced from his students. It must have been with this thought in his mind that Mr. James Swinburne, when addressing the students of the Institution of Electrical Engineers, said: "There is no more baneful influence on the technical advancement of this country than the Royal Society ideal in science." But is it necessary that research should embrace only subjects that are caviare to the million, and that may not become of any practical value till long after the professor's death? May not research include things that we should like to know now, and that would assist in the commercial struggle with other nations? Surely this kind of work is just what would be excellent teaching for the student. He would be getting a good inkling of the actual conditions of the work he would have to do later. And there are numerous practical problems coming well within the region of research that would be very instructive indeed in working out, and that would be of immense value to the nation when solved.

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* May 15th, 1908, "The Attitude of the Public towards Science."

The New Man.

The Elementary Education Act of 1872 has brought into existence a new type of mind. There has been so much talk about the "new woman," that we are apt to overlook the coming of the "new man." The old apprenticeship system is gone; the boy in the works frequently does not get the opportunity to learn a trade thoroughly. Sometimes he drifts into a small repair shop, and gets to the stage of the "Let's-'ave-a-look-at-it" mechanic. Attention has been drawn in these columns to the excellent trade schools of Mr. Stanley at Norwood. It might be possible for some of the technical schools to formulate day classes for lads on the same general plan. It is our duty to do something to improve the youthful "new man." We must try to make him take an interest in things scientific. He possesses quite a different type of mind to that of his predecessor of 30 years ago, who stolidly pushed the plough and drove the cart horse. When given the opportunity he usually takes kindly to things mechanical. Probably, just at present his great ambition is to become a chauffeur. There is a penny motoring paper with a weekly circulation of 50,000 copies. Observe what a number of these are purchased by quite poor lads.

Public Opinion.

Perhaps it is true that the public are at fault. For some hundreds of nights the public attended one of the London theatres in great numbers, to see what to them was a comedy. To the deep thinker, laugh though he might at the epigram, there must have been a feeling of tragedy. It is the Barrie play, "The Admirable Crichton," that is referred to. The hero is a born mechanic. Under normal conditions he is represented in the first act as a butler in Mayfair. Suddenly, owing to the wreck of a yacht, the butler, the earl, the earl's nephew and three society girls all "return to nature." The butler is the man of resource. He saves the party from starvation, and becomes king of the island. But when the party are rescued by a warship, then they return to society as built up by public opinion.

There is only one moral to be drawn from the play. It is that the public class the engineer as the man of resource in a poor category. Politicians and lawyers are in the habit of stimulating the public interest in their doings, and quite naturally the public regards them as a class of man with a very superior intellect. And this leads us to wonder whether it is worth while trying to interest the public in things scientific as well as things political. Is it, or is it not, waste of time and energy for a man of commanding genius to lecture to the public upon a scientific subject? These thoughts flashed through my mind four years ago as I listened in the Birmingham Town Hall to Sir Oliver Lodge propounding, in his wonderfully lucid fashion, to 3,000 working men, the details of our knowledge concerning radium. In the afternoon he had given the same lecture to a fashionable audience, and in both cases his listeners awaited eagerly every word. Was he doing a great work, or should he have been communing with himself in his own laboratory? Surely he was helping the ideal of a Civic University when giving those lectures. When Prof. Silvanus Thompson gave his Kelvin lecture, one felt that a great opportunity had been missed. Surely the public should have gone in their thousands. Such an oration was of as much national importance as a great eulogy of some politician. One cannot despise the power of the daily newspapers. If public opinion is to be changed, it can only be done by the weapons of the politician. The first Kelvin lecture was worthy of more than one column in the newspapers. But we must have imagination sufficient to convince the proprietors of these great organs that the public will read and gradually become interested in such matters.

It is not altogether impossible to influence public opinion. When they can be convinced of the need, taxpayers will cheerfully agree to the spending of millions upon education. The work of the British Association and the British Science Guild deserves every encouragement. The new Universities are much more in touch with the million than many of us suppose. They are also receiving the co-operation of the local works managers. They would, of course, welcome increased assistance.

There are, therefore, two directions in which public opinion must be influenced. The public must be made to grasp the need for dealing with the youth who at present goes to swell the army of the unskilled. There must be something in the place of the old apprenticeship system; and the State must be more generous with rewards for men capable of invention. A century ago our countrymen allowed James Watt to pass away without any thought of honouring him until he was dead. We have not that lasting shame with regard to Lord Kelvin. But we are content to see the national honours showered almost exclusively upon the politicians and the courtiers. If we made efforts to convince the public that men, upon whose work great industries have been built, are worthy of their country's gratitude, then public opinion would be strong enough to insist that they should have their due.

REPAYMENT OF CAPITAL: MUNICIPAL ELECTRICITY WORKS IN LONDON.

By "INTERESTED."

At the present time the indebtedness of these municipal electricity supply stations is increasing too fast, and, unless a distinct alteration is made in the present system of taking up loans and of repayments, the near future will land some of them in a sore dilemma. The sinking fund is still growing up at a good pace, and it is now high time the debt ceased growing and commenced declining. Perhaps I should apologise for again referring to this subject, but I am not going to do so, because I consider the question one demanding ventilation.

Let me revert to the commencement or birth of these departments, and review the conditions governing the capital borrowed from the sanctioning authority—the London County Council. In the early stages the periods fixed for repayments were as follows:—Freehold land, 60 years; buildings, culverts, and bare copper mains, 50 years; meters, 10 years; and 20 years for all other purposes. At the start of a works the usual custom was to take the items collectively and make one general loan for the whole. The usual term for such a loan was 42 years. When a general loan of this description was taken up, the lending authority required the borough council to pass a resolution to the effect that all renewals and replacements should be made, during the currency of the loan, either out of revenue or from a sinking fund created for that purpose. At a later date—November, 1906, to be exact—the Council revised the periods for repayments and decided upon the following maxima: Freehold land, 60 years; buildings, 50 years; mains, 30 years; plant, 20 years; house connections (excluding meters), 12 years; and meters, 10 years. Another revision within the next few years would not come as a surprise. Outside London, the usual average maximum fixed by the L.G.B. is 25 years.

Now, in the beginning, the long-period loans proved a blessing in disguise, and materially assisted the undertakings by keeping the amount of redemption low. Had the present-day maxima then been in force, the stations would have experienced considerably more trouble in making both ends meet. In their infancy the stations benefited by this privilege, I might say, of small annual repayments, but at the present date, when most of them are nearing maturity, what is the effect of that privilege? Remember that the borough councils have resolved to pay for all renewals and replacements out of revenue. The answer is clear. Sufficient profit must be made each year to cover the small amount redeemed; pay a yet tall sum for interest on the large amount of capital outstanding; and put by sufficient for probable replacements and renewals in the near future. What at first appeared a blessing proves at this juncture to be somewhat of a handicap, and looks like hampering the undertakings in the future, because the interest charges will remain heavy for many years to come. I certainly think that the sum set aside for replacements and renewals is not sufficient for the purpose.

The annual return prepared by the statistical officer of the L.C.C. (P. S. King & Son, price 1s.) gives a wealth of detail and much food for thought in this connection, and the following figures, abstracted from the last report issued (1907-8), are well worth consideration :—Total amount borrowed, £5,907,163 ; total repayments, £508,757 ; total outstanding, £5,398,406 ; proportion repayment bears to amount borrowed, 8 6 per cent. Since the commencement of the undertakings, the contributions made in aid of local rates are £36,695, and the sum taken from the rates in aid of the undertakings is £121,459. Already devoted to replacements or written off capital expenditure, £107,617 ; balance at Cr. of renewals or reserve, &c., funds, £126,702, and at net revenue account, £54,252.

These figures speak for themselves. When a station has been in existence for something like 10 or 12 years, the above-mentioned proportion should be higher than an average of about 8½ per cent. Financially some stations are in more favourable positions than others, and are, comparatively speaking, safe, but that cannot be said of the majority. A large sum has already been expended in renewals and replacements, or written off the capital. Thus, within 12 years from the commencement, replacements have become necessary, and some of the original installation has been scrapped or sold. Another few years will necessitate expenditure of a much higher figure for the following reason :—No station would be originally designed in such a manner as to require renewals or replacements within, say, five to six years from the start; therefore, it is evident that the above-mentioned sum has been spent in the last five or six years, and ordinary reason says that that sum will develop into a larger one in the immediate future. True, nearly £181,000 is in hand for this purpose, but that cannot be confidently expected to grow to any appreciable extent when constantly increasing sums are required for redemption and interest.

This question of repayment of capital should be approached from a public point of view, quite apart from any personal or party feeling. I do not care a straw for the ravings of some people over municipal trading, taking that on the whole. Facts are recorded, and figures can be obtained with but little trouble, so, if they choose to be optimistic in this particular respect—municipal electricity works—they are at fault. Many of those interested—more or less—in this matter argue that a point will shortly be reached when borrowing will cease, and from that time onwards the debt will annually be reduced until finally extinguished. That is the hypothesis. When will that point be reached? Can any fact be found in the published accounts pointing to the probability mentioned? The figures given in the L.C.C. return fail to give any clue, and the annual accounts published from time to time in those journals devoted to the electrical industry also fail to elucidate matters in this respect.

We have, without doubt, a mortgage debt increasing at a time when it should be falling off, notwithstanding the heavy repayments being made, and, incidentally, the sum drawn annually from the rates in aid of some concerns. Quite apart from the money taken from the rates, there are a few instances where certain sums have been paid in aid of the local rates. I consider that a step in the wrong direction. A far better and safer course would have been to place the surplus in a renewals, depreciation or reserve fund. The undertakings are not at present in a financial position strong enough to submit to such a drain, and, sooner or later, will feel the drought. In these hard times a little relief is very welcome, and councils must be excused for occasionally taking the surplus from the electricity department to assist the local populace, but that practice must on no account become general.

To a certain extent the recently inaugurated custom in some districts of taking up loans repayable over short periods, *i.e.*, less than the maximum period allowed by the L.C.C., is a step in the right direction, and might be extended with advantage. Also, some form of consolidation scheme whereby various loans are grouped together, so as to shorten the period of repayment for some of the original ones, might be adopted. Were councils to persist in taking up their loans on a short repayment scale, and to put all surplus on one side for the purpose of replacing plant, &c., which becomes obsolete or inefficient owing to the installation of larger units or modern improvements, and for renewals, then the matter would be well taken in hand, and the sinking fund might really sink. The burden would become a heavy one after a few short-period loans were obtained, but the load will have to be tackled soon in order to safeguard the future.

Speaking generally, the ratepayer seldom takes much interest in the local electricity supply works. Occasionally a few remarks on his rate notice may serve to fan into a glow some few sparks of thought, but thinking of just how and when he can meet the demand soon damps them again. By some means he should be induced to watch the figures, and weigh up the pros and cons for himself. Then, perhaps, the future position of the electricity department would receive a greater share of attention from those elected to manage the undertakings. Perhaps, after all is said, the auditor will, by dropping a gentle hint in his report, be the means of awakening the management, and show them what a serious outlook the future has, and that immediate attention is required on their part.

A SLIPWAY HAULAGE GEAR FOR FRANCE.

An electrically-operated winch was recently built by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, for an important French firm of contractors. It is designed to haul a load of 30 tons at the rate of 5 ft. per minute by means of chain cables, and is, therefore, capable of dealing with medium sized vessels. Its overall dimensions are only 10 ft. 3 in. × 11 ft. 6 in. × 6 ft. 3 in. high. The economy in space and material is effected by introducing chain cable lifters as used in windlasses, in place of the usual drum for use with steel ropes. The effective diameter of the cable lifter is 2 ft., and the cable as drawn over the lifter is dropped into a tank, as in the case of anchor cables on board ship.

A drum to accommodate a rope, which would be nearly 2 in. in diameter, would have to be 6 or 8 ft. in diameter in order to avoid bending the rope too sharply, and as a wire rope of such a size could not lie in more than one layer on the drum without speedy damage, the drum would be fairly wide for any suitable length of slipway. Moreover, the large diameter of the drum would involve considerable extra speed reduction to avoid installing a very low-speed motor, and this would again bring up the cost of the plant.

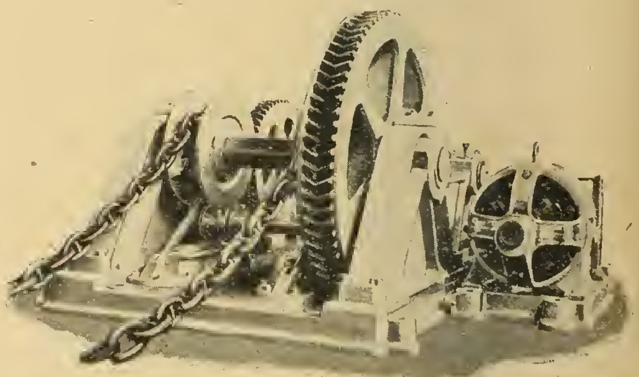


Fig. 1.—View of Motor and Chain Wheels.

The chain wheels are of cast-steel, fitted with snugs carefully pitched to give easy running of the chains. They are keyed to a massive shaft, operated by a double helical spur wheel of cast-steel. The pinion rides loose on its shaft, and is engaged with it by means of a strong steel clutch when it is required to haul by means of the chain lifters. The shaft carrying this pinion is driven by worm gear, totally enclosed in a cast-iron box filled with oil, and fitted with a roller bearing to take the thrust of the worm. The worm wheel is of special construction, consisting of a gun-metal machine-cut rim bolted to a cast-iron centre, the idea being to avoid the development of any slackness of the wheel on the key in the course of operation, while securing the advantage of the gun-metal teeth. The worm is of steel, cut from the solid, on a shaft coupled directly to the motor spindle.

It is frequently convenient, in order to give a start to the vessel which has been docked for repair, for manipulating the cradle, or other purposes, to have a warping gear which can be operated independently of the main haulage. This is provided in this instance by attaching a warping drum to the clutch pinion shaft, 26 in. in diameter, and having a warping speed of 45 ft. per minute.

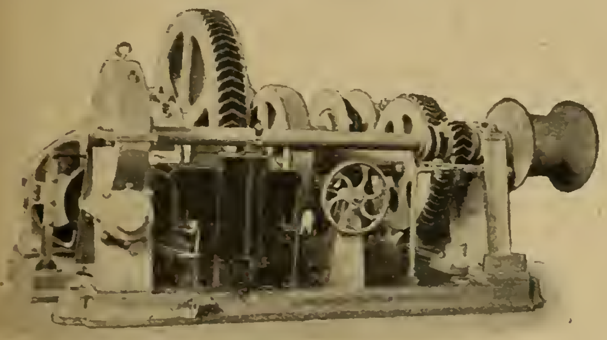


Fig. 2.—View of Controlling Gear.

In order that the carriage may be held still while the warping drum is used, the chain lifters are disconnected from the motor by means of the clutch, and a powerful band brake is provided, having hardwood blocks, operating on the intermediate shaft and controlled by a screw and hand wheel. There is also on the motor spindle a post brake operated by a foot lever, capable of holding the greatest load that the motor can pull by means of the warping drum.

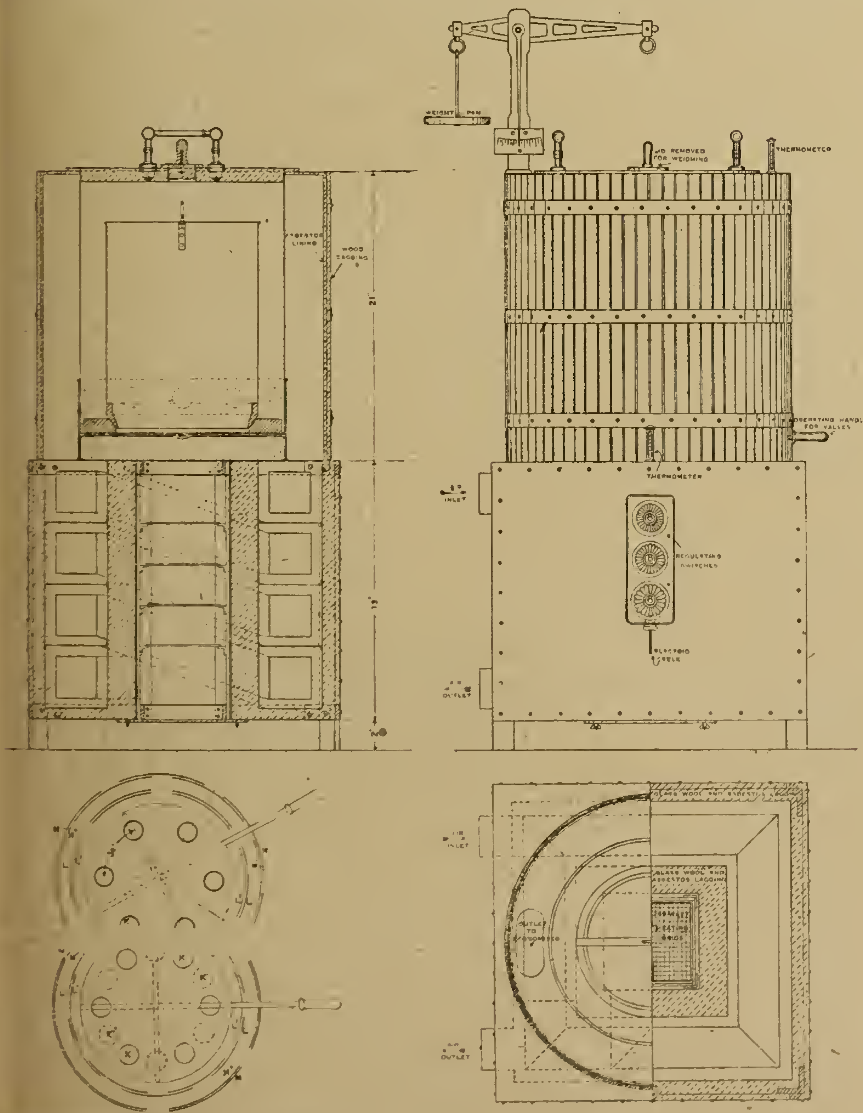
The electrical part of the equipment consists of a four-pole series-wound Clarke, Chapman motor, having a totally enclosed slot-wound drum armature. The motor runs at 750 R.P.M. on a 550-volt circuit, gives 27 H.P., and is designed to have a temperature rise of not more than 100° F. on a run of one hour at full load. It is operated by means of a controller capable of speed regulation by means of cast-iron grid resistances. The controller, foot levers for brakes and clutch lever are all grouped at the end of the winch, so as to be under the control of one operator. Our illustrations show the general appearance of this interesting gear; fig. 1 is a view of the motor drive and cable lifter, while fig. 2 shows the control side of the gear, including the drum controller for the motor, band brake hand wheel, foot levers, and clutch for the chain lifters.

AN ELECTRICAL CONDITIONING OVEN.

The object of this apparatus is to ascertain the percentage of moisture in any fabric which might be considered hygroscopic, as the presence of moisture not only affects the weight, but also the strength of the material. For instance, with regard to the sale of wool, either in the raw state or otherwise, it is obviously necessary for the purchaser to satisfy himself that he is paying for wool, and not for wool and water; then again, when a merchant desires to buy cloth, he not only considers the appearance and weight of it, but is careful to test the strength of it. This is done by straining various samples of equal length and width between two jaws, the one fixed and the other moving along a screw, to which is attached an indicator which records the breaking strain in pounds.

It is obviously unfair to the better class of cloth manufacturers for the merchant to ignore such a test as this, and it is just as unfair that such a test should be carried out unless the cloth has first been conditioned, as there are many cloths which have a lower breaking point when wet than dry.

The conditioning oven ensures that the fibre or cloth is free from moisture, or at any rate, that the percentage of moisture remaining is such as to be a negligible quantity when considering weight or strength.



Alternative Positions of Air Valves.

Electrical Conditioning Oven, Exterior and Sectional Views.

The object of all conditioning ovens is the same, but their construction differs slightly owing to the heating medium, which up to the present has been confined to gas or steam. The steam oven is used only where a supply of steam is available for power or heating purposes, but where steam is not available gas is used. The efficiency of the gas-heated oven is naturally low, as the air passing through the wool must not be in contact with the flame or fumes; it is usually passed over a series of large copper plates on its way to the conditioning tank; this means, then, that by far the greater percentage of heat passes away to the atmosphere.

In most modern gas-heated ovens the hot air is driven through the wool by means of a fan or blower at a pressure such as will ensure that all moisture is taken away with it. Obviously, if electric heating was applied in the same way, the expense would prohibit its use; but, owing to the fact that the air comes in direct contact with the heating element in the new design, the efficiency is very considerably increased.

Referring to the plan, the rectangular-shaped box in the centre contains a number of woven-wire resistance mats arranged horizontally one over another. Surrounding this, and insulated from it by slag wool, is a chamber (also insulated on its outer surface) which is really a spiral surrounding the heater. In this spiral, which is square, is a 3 in. by 3 in. tube, which is also a spiral. These tubes form the economiser of the apparatus. Air is blown through the smaller tube by a fan, entering at the top, into the bottom of the heater, then up through the wire mats into the space at the top. From this point, by means of a series of ports, the air may either be directed through the wool, which is contained in the conditioning tin, or by-passed into the annular space surrounding the oven, and thence down into the larger tube of the economiser. The latter method is adopted when the weighing operation takes place, as it would obviously be impossible to weigh the material with a pressure of air under the tin; furthermore, it is not advisable to switch the current off, as even while weighing takes place it is necessary to maintain the air temperature in the oven as near the normal as possible, as otherwise the fabric would absorb moisture from the atmosphere, and so give a misleading result.

The material rests in the tin on gauze or perforated zinc of small mesh, and the usual quantity used for conditioning is ½ lb. This sample is taken from the inside of a bale indiscriminately, and the percentage of moisture in the sample represents the percentage of moisture in that particular bale. Directly above the tin there is a sensitive scale, and it is customary to keep the scale balanced throughout the test by adding weights on the wool side to make up for the loss of weight due to evaporation.

The whole apparatus is designed in a manner which ensures the highest possible efficiency, and that the result aimed at has been attained is easily proved by noting the temperature of the air at the outlet. The temperature of the oven is maintained at 220° F. throughout the test, and yet the outlet temperature is but a few degrees above that of the inlet, and the difference can only be noted by taking a reading on a thermometer. This proves the value of the economiser, which, it will be noted, is similar in principle to a feed-water heater. A motor consuming about 60 watts is quite large enough for driving the necessary amount of air through the oven; the heaters consume only one unit per hour, so that the cost for energy is but small, and is, in fact, less than that of gas in the most recent type of gas-heated ovens.

As most modern textile mills are fitted with electrical plant, there should be no difficulty in adopting this type of oven generally, but even if no supply is available, it is a simple matter to run a small dynamo off the line shafting, to which also the fan could be coupled. In such a case the dynamo would merely replace the motor; the extra cost, therefore, of such an arrangement would be small.

One great advantage that this oven has over the gas-heated oven is that it is ready for use in five minutes, whereas it takes from 30 to 45 minutes to thoroughly warm up the other, owing to the fact that a large mass of copper or other metal has to be heated up before the air-blast can be applied. It has many other advantages, the chief of which are:—

It is compact.

It may be moved from place to place, and used without trouble, so long as there is a supply of current available, and a plug and flexible.

The temperature regulation is perfect, and may be controlled either by regulating the amount of air or by switching the current on or off.

It may be used on alternating or direct current at any medium pressure.

The apparatus described has been developed by Messrs. Ellis and Allsopp, of the Bradford Corporation electricity department, and it is bound to interest central-station engineers, especially those in the woollen and worsted districts.

ELECTRIC CHAFING DISHES.

By FREDERICK M. WEST.

Chafing-dish cookery is of quite early origin, and is principally used in the preparation of those dainty omelets and sauces so beloved of the French. It is in America, however, that it has become most popular, and, probably driven by the acuteness of the servant problem to do much of her own cooking, the American housekeeper has taken fuller advantage of the comfort and pleasure derived from this and similar appliances. It must not be imagined that chafing-dish cookery is a fad; it is extremely practical, so much so that the well-known cooking expert, Mr. Herman Senn, has issued a book on "Chafing-dish and Casserole Cookery," which contains upwards of 80 recipes for the chafing dish alone. The following items convey an idea of its possibilities:—Kedgeree of fish, fried scallops, soles à la Parisienne, lobster patties, réchauffé of cold meat, fish toast, chicken croquets, kidneys à la minute, mutton cutlets à la minute, tripe with cream sauce, Welsh rarebits, &c.

Chafing Dish in Use.

The chafing dish consists of a heater, a water pan, a blazer, and numerous accessories such as egg poachers, forks, &c., all of which would find a place in the most modest of kitchens. The part that the cooking is done in is the blazer, which is used in the same way as the upper part of a double boiler or porringer for scalding milk, the essence of he thing being the cooking over hot water. Most chafing dishes at present in use are heated by alcohol, but little difficulty should be found in showing the advantages of electricity over spirits. The cost for energy is low, many of the operations taking only 15 or 20 minutes; a long one, for instance, soles à la Parisienne, taking under half an hour, would cost about ½d. with electricity at 1d. per unit.

A useful service is in the preparation of supper dishes; these can be partially cooked, and then completed upon the return of, say, a theatre party, and a warm supper, perfectly cooked, enjoyed without troubling the servants. Its value in a sick room for heating milk, &c., is obvious; also the water pan can be used separately as a saucepan.

The price is about 40s., and they are usually rated at 200 watts for the low heat and 600 watts at full heat. They form useful presents, and would well repay pushing, as their use would do much to advertise the convenience, practicability and low cost of electric cooking.

AN ELECTRICALLY-OPERATED TURBINE FIRE-PUMP.

[BY OUR BERLIN CORRESPONDENT.]

The voluntary fire brigade of Wiadhofen-on-Ybbs, Austria, has recently adopted a novel type of electrically-operated fire engine, designed as a four-stage high-pressure turbine pump.

This pump is able to throw upwards of 400 litres of water per minute through two lines of hose to 40 metres distance, and comprises a cast-iron housing, bucket-wheels, a nickel-steel shaft, and two ring-lubricated bearings. The shaft is perfectly balanced in regard to axial thrusts, and is coupled by an elastic clutch to a 10-H.P 150-volt three-phase motor with slip-ring armature.

The pump, motor and accessories are mounted on a four-wheel car fitted with excellent springs. This car contains in its forepart seating accommodation for four men, and in the rear standing accommodation for three, care being taken to reduce the dimensions and weight of the car while providing room for as many passengers as possible, and rendering operation as easy as it can be made.

Immediately beside the motor is located the motor starter, a three-pole lever switch with fuses, and between the pump and motor the amperemeter, carried by an iron fork. Below the electromotor there is fixed to the underframe of the car a cable drum fitted with three slip-rings and three pairs of carbon brushes. This cable drum is operated through a simple hand-crank fixed to an extension of the shaft. The motor is protected against moisture by a half-round sheet metal case.

The pump motor is connected to the electrical mains by means of plug contacts, or by hook couplings consisting of metal hooks roughened on the inside so as to remove the oxidised skin of bare conductors and to obtain a satisfactory contact. From these couplings, which are fixed to three-part bamboo rods of about 6 metres total length, a flexible cable of 60 sq. mm. section and about 10 metres long, terminating in a well-insulated three-core rubber-insulated cable of 3 × 60 mm., with galvanised-iron wire sheathing, leads to the engine. Hook contacts are used only in connection with overhead conductors, and are readily fixed at any point of the line without any disturbance in the service. Plug-contacts are mainly used in connection with underground circuits, the necessary contact boxes being installed close to the water hydrants.

Being able to carry a length of cable of several hundred metres, the pump can be operated, within certain limits, at any place desired.

Two ordinary candle lanterns are used to light the pump on its way to the site of the fire; two 32-C.P. electrical incandescent lamps in each of the lanterns, as well as an incandescent lamp fixed above the amperemeter, are connected to the circuit during the operation of the pump.

A special electrical detachment of the fire brigade has been organised for handling the pump and carrying out any work required during fires for the prevention of accidents and breakdowns in service.

On the occasion of public tests recently made, a jet 60 metres in height was thrown, 1½ minutes after arrival.

Electrical Fire Pump.

The main advantages of this fire engine, which has been designed by Herr J. Reiner, manager of the Waidhofen municipal electricity works, are as follows :—

Increased rapidity in getting into working order; reduction in first cost, weight and space requirements; increased simplicity and safety in operation (due to the absence of any complicated driving gear or valves); reduction in the wear and tear, and cost of operation, the current being in most cases derived free of charge from the city mains.

For smaller outputs, the same type of fire engine could be mounted on a two-wheel barrow handled by one man, and would constitute an excellent fire extinguisher for factories, store-rooms, farms, theatres, &c.

AN AERIAL ROPEWAY INSTALLATION.

We illustrate herewith a novel and expeditious method of automatically disposing of waste ashes from steam boilers, as installed by Messrs. Richard White & Sons, engineers, of Widnes, for the Sheffield Corporation at their Neepsend generating station.

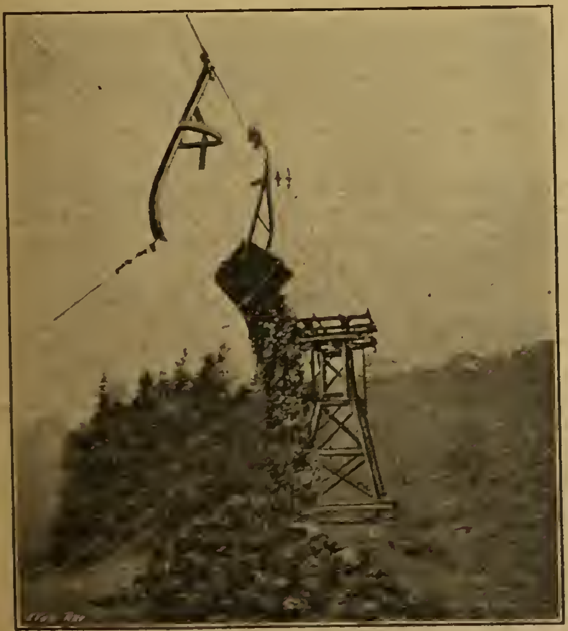


Fig. 1.—Automatic Ash Tipper.

Some time ago, Mr. S. E. Fedden, the city electrical engineer, with a view to adopting the best means of distributing the ashes from the boilers, and utilising these ashes for the purpose of filling up some waste ground, advertised in all the leading technical papers for estimates for the work, each firm competing to submit their own scheme for the duty required. Messrs. White's proposals and drawings were selected after careful consideration of a large number of propositions submitted by the leading conveying firms, not only of this country, but also from America and the Continent, so that the matter assumed a kind of international competition, and it is gratifying to think that British enterprise and invention were found equal to the occasion.

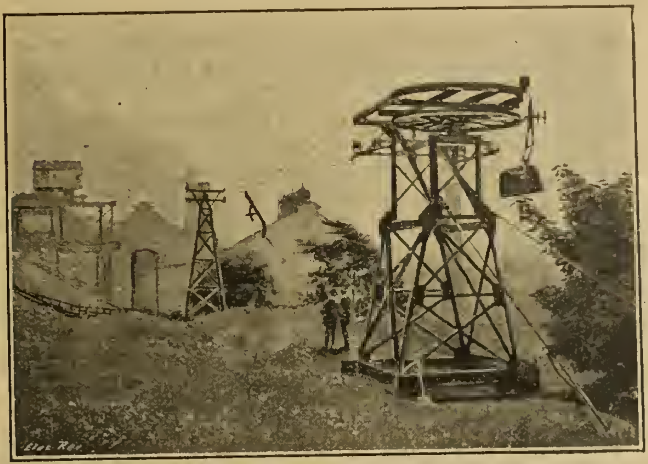


Fig. 2.—Return Terminal for Ropeway.

It will be seen that the plan adopted is an aerial wire ropeway on Messrs. White's patent principle, with automatic tipping of the ashes wherever required, as clearly shown in fig. 1, whilst the empty carriers proceed onward without stopping or being handled in any way, and are automatically conveyed around the return terminal, as shown in fig. 2, so that the carriers are never touched by hand after leaving the loading rail, until they arrive back again at the loading terminal, where they are automatically disengaged from the hauling rope, and then stand ready for loading again, as shown in fig. 3.

In order not to interfere in any way with ground traffic, it was found necessary, in the first place, to elevate the loading rail of the installation to a height of 17 ft. above the ground level. The ashes are collected in the basement underneath the boilers in ordinary tipping wagons, each wagon holding ¾ cb. yd. of material, and running on a light tramway of 2 ft. gauge. The wagons are then run to an electric hoist just outside the boiler house, by which they are raised to a height of 40 ft. above the basement level. Here the contents of the wagons are tipped into a hopper of 54 cb. ft. capacity, the arrangement being clearly shown in the accompanying view.

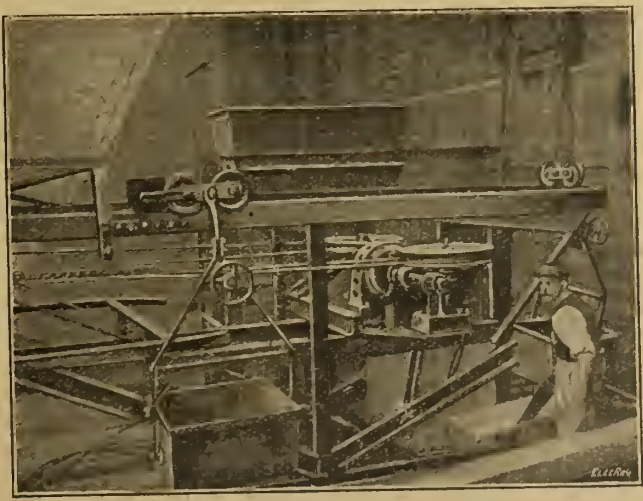


Fig. 3.—Loading Terminal at Boiler House.

From this hopper the ashes fall through a shoot, controlled by a hand lever, into the boxes of the ropeway carriers standing on the loading rail.

The carrier is then engaged with the hauling rope by means of the patent gripper provided, which conveys the load along the ropeway as shown in fig. 4, until it reaches the automatic tipper, as already described.

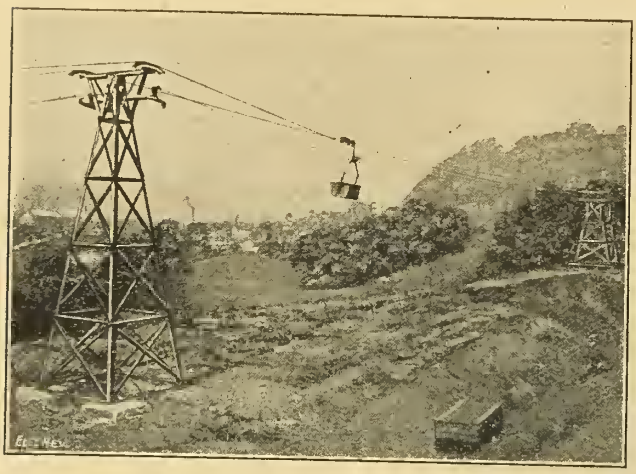


FIG. 4.—ROPEWAY, SHOWING INTERMEDIATE SUPPORT.

The hauling rope, which, of course, is endless, and is constantly running when the ropeway is at work, is driven by means of an ordinary fleeting wheel, which is connected with worm gearing, driven by an electric motor.

The loading terminal is of special design, with a loading rail curved to an exact circle, so that the terminal itself can be readily turned round to face any part of the tipping ground without interfering with its position with respect to the loading hopper, a central pivot maintaining its correct alignment.

The automatic return terminal is mounted on eight steel wheels running on a pair of rails, as shown in fig. 2, so that as the ground around it is filled up in course of time by the tipping, the terminal itself can be moved along. In this way it will be seen that the whole installation can be moved round fanwise for a total length of 190 ft., so that in time the whole of the low ground to the left of the ropeway will be automatically filled up. The whole of the hauling rope sheaves are mounted on roller bearings, and only occasionally require lubricating, whilst an automatic lubricator on one of the carriers provides for keeping the carrying ropes properly lubricated.

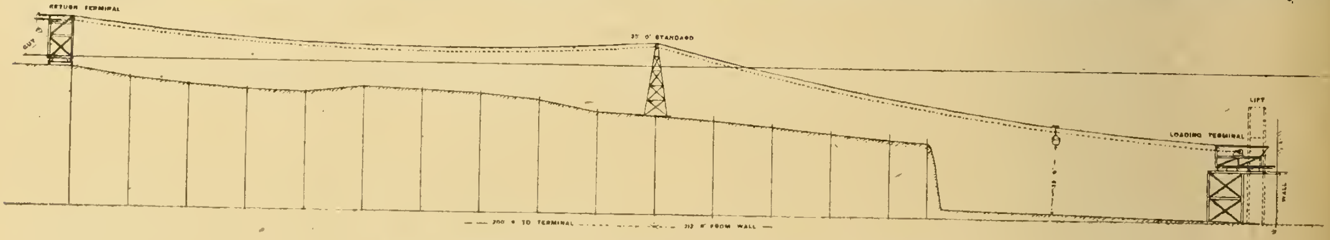


FIG. 5.—ELEVATION OF AERIAL ROPE-WAY INSTALLATION.

The carrying ropes are of lock coil construction, giving easy and smooth running to the carrying sheaves, whilst the standard (see fig. 2) is provided with White's improved form of rope saddle, giving a long bearing for the carrying rope with easy running of the carrying wheels.

The whole installation, including the loading and dispatch of the carriers, is worked by one man, so that it will be seen that the actual cost of disposing of these ashes is exceedingly small.

Westminster Electric Supply Corporation, Ltd.—The directors have declared an interim dividend for the half-year to June 30th at the rate of 10 per cent. per annum, less income-tax, as last year.

LEGAL.

DEVONPORT CORPORATION v. THE DEVONPORT AND DISTRICT TRAMWAYS CO.

AT Devonport on Wednesday and Thursday last week, the 155 summonses issued by the Corporation against the Devonport and District Tramways Co., with regard to the discontinuance of the service on the lines leased by the Corporation to the company, came before the Borough Magistrates. Seventy-one summonses were for failing to run at least four cars each way in the morning and in the evening, at the hours thought by the Corporation most convenient for artisans, mechanics, &c., on the lines leased to the company in pursuance of a certain agreement, from January 18th to April 10th, 1909. Eighty-four summonses were for failing to comply with a lease, &c., by not providing on the leased lines such cars as were reasonably required by the Corporation in the public interests from January 17th to April 10th, 1909.

Mr. R. J. Fittall (town clerk) appeared for the Corporation, and Mr. Eustace Hills for the company.

MR. FITTALL proposed an arrangement for abbreviating the proceedings, but Mr. Hills said that important questions of principle were involved, and he could not make any admission such as Mr. Fittall asked.

MR. FITTALL asked for judgment upon the whole of the summonses. He proceeded to detail the circumstances which led to the discontinuance of the service on the leased lines since January 16th last, particulars of which have already been published in these columns (June 25th). He said the company contended that through financial disability they had been unable to comply with the notice given by the Corporation. It was an important matter that the ratepayers of the borough, who had £62,000 invested in the leased lines, should not have those lines lying idle in the streets. During the six months since the cars ceased running upon the leased lines, the company's takings had decreased £2,445, or £94 a week, compared with the corresponding period of last year. If the company were not willing to run a service on these lines, and the Bench agreed with the contention he put before them, and also agreed that the requirements of the Corporation were reasonable and in the public interest, he would ask them to impose the maximum penalty of £5 a day, because of the great public inconvenience caused. This was the only effective remedy that the Corporation had against the company.

Evidence for the Corporation was given by Mr. Rupert Royle (assistant town clerk), Ald. Tozer (chairman of the Tramways Committee) and Mr. C. R. Everson (manager, Plymouth Corporation Tramways, who considered that the service required by the Corporation was reasonable in the interests of the riding public).

MR. HILLS addressed the Bench for the defence. The only thing they were concerned with, he said, was whether the Corporation were entitled to the penalties they were seeking. If the Bench found that the requirements could only be complied with at very serious financial loss to the company, so as to be to a trading company practically impossible, he would ask them to say that whatever might have been the condition of things months or years ago, at the time that requirement was made, it was not reasonable in the interests of the public. The notice given on January 4th was, in effect, bad, and the company were entitled to have the summonses dismissed on the ground that it was not a requirement by the Corporation at all. There was no resolution of the Corporation until January 14th. The notice being bad, and being the foundation of the proceedings, the company on that account were entitled to a decision in their favour. It was clear that whatever might have been the condition of things in 1904, 1905, or 1906, on January 17th, 1909, taking all the facts into consideration, it was not a reasonable requirement in the interest of the public to ask the company to provide a 60 minute service between three places which had had no effective service—some no service at all—since November, 1905. As regards those three services, it was certainly not reasonable, and if not reasonable in regard to those services, it was a requirement upon which criminal proceedings could not be based, because the document must be reasonable as a whole, or it failed. Until they took over these extensions in 1903 the company carried on a profitable undertaking. It had been said that the lease was voluntarily entered into, but it was under threat of competition that the company took over the extensions and agreed to pay the rent.

MR. WALTER BOND (chairman of the company) said that as the result of the first year's (1902) working of their own lines, apart from the extensions, they were able to declare a dividend of 4 per cent., and put by sums for renewals. In 1902 the gross revenue was £6,990, and in 1904 (the first complete year with extensions) £8,636, an increase of £1,646. Against that increase there was the Corporation rent of £3,900, so that the extensions failed to pay their way by £2,254. Speaking generally, the deficiency on the extension had increased since 1904. The share capital of the company was £132,000, and the British Electric Traction Co. held the major part.

Mr. Durnford, engineer and manager to the company, gave details of the service, and said that the company were distinctly better off through the service on the extensions being discontinued. The total saving through being without the extension had been about £115 per week since January 17th. The service prescribed by the Corporation was neither reasonable nor possible. The loss on the line between St. Budeaux and Saltash passage was just under 1s. per mile.

Mr. P. N. Gray, secretary of the company, having given evidence,

Mr. Fittall addressed the Court on points of law.

The 71 summonses relating to workmen's cars were next dealt with, and the Chairman announced that the Bench would communicate their decision at a later date.

Blackwell & Co. *v.* The Mayor and Corporation of Derby.

In the Court of Appeal, before Lords Justices Moulton and Buckley last week, this case was heard on the appeal of the plaintiffs from an order of Mr. Justice Bucknill in Chambers staying the action under Sec. 4 of the Arbitration Act.

Mr. Atkin, K.C., for the appellants, said that the question was whether the Judge in his discretion was right in staying the action on the ground that the contract between the parties contained an arbitration clause, under which disputes arising under the contract were to be referred to the arbitration of the borough engineer of the Corporation. The plaintiffs were electrical engineers, and the contract was for the construction of an electric tramway in Derby. The borough engineer had certified for certain penalties in respect of alleged delay in the completion of the contract, and the plaintiffs' case was that the delay arose from the arbitrary conduct of the borough engineer himself in, as alleged, directing the work to be done in a certain manner and materials to be obtained from specific firms, and in refusing to permit the plaintiffs to store material required for the work in certain places. The action was brought by the plaintiffs to recover the balance alleged to be due under the contract. Counsel submitted that Mr. Justice Bucknill was wrong in staying the action, inasmuch as the dispute was not one which ought fairly to be referred to the arbitration of the borough engineer, who, in order to arrive at a conclusion, would have to sit in judgment upon himself.

Mr. Danckwerts, K.C., for the defendants, supported the order of the Judge, submitting that the dispute in question was such as must have been in the contemplation of the parties when it was agreed that the borough engineer should act as sole arbitrator. The authorities showed that an arbitrator appointed under a contract was only displaced and the jurisdiction of the Courts called in aid, when it was shown that the arbitrator was likely to be biased or that he had been guilty of misconduct, such, for instance, as receiving bribes. In the present case the *bona-fides* of the borough engineer could not be attacked, the only suggestion being that as he had certified for penalties, as he was entitled to do under the contract, he was not a fit person to arbitrate on the dispute. If it were sufficient, in order to oust an arbitrator, to say that he would be sitting in judgment upon himself, then contracting parties might just as well treat arbitration clauses as so much waste paper.

Lord Justice Moulton said that the Courts in exercising their discretion must look at the facts of each particular case.

Mr. Danckwerts contended that Courts ought to act on fixed principles, and that having laid down certain principles they ought to be true to them, and people in entering into such a bargain did so with knowledge of those principles and in the belief that they would be supported by the Courts.

Lord Justice Buckley asked whether Mr. Danckwerts thought that a person who was accused of being unreasonable was the best judge as to whether he had in fact been unreasonable.

Mr. Danckwerts replied that when the parties made the contract they must have known that in a dispute relating to penalties the conduct of the engineer must necessarily be largely in question. Invariably in cases where there was an allegation of delay the contractor turned round and said that delay was due to the acts of the employers. He submitted that, in such cases, the jurisdiction of the engineer, as arbitrator, ought not to be ousted.

Lord Justice Moulton, giving judgment, said that there was no doubt with regard to the law to be applied in this case. In older days, an agreement to refer disputes to domestic tribunals was not enforceable, but the Legislature had since recognised that such an agreement was part of the contract, and that it would not be fair if it did not, to a certain extent, enforce arbitration clauses. But it wisely took this course—it gave a right to a person against whom an action was brought to come to the Court and ask for the action to be stayed under the Arbitration Clause in the contract sued upon. The person so coming to the Court had to prove that he had always been ready and willing to go to arbitration, and then the Court had power, under the Common Law Procedure Act, to stay the action if it saw no good reason why the matter should not be disposed of in the way the parties had contracted. But each case had to be raised on its own facts. In his Lordship's opinion, where the nature of the dispute arising from facts which were subsequent to the contract was such that the Court thought that the arbitrator was not likely to be able to deal impartially with the dispute, it was open to the Court and it was their duty to refuse to enforce the arbitration clause. It was suggested that this ruling would make arbitration clauses useless, but the Courts were quite able to judge what was the subject of the dispute, and they would not be misled by unfounded allegations. In the present case he was satisfied that the dispute was substantially whether the borough engineer from the first acted unreasonably towards the contractors from the point of view of the contract. Corporations were, in his Lordship's opinion, too fond of putting officers of their own in the position of engineers under a contract, and they forgot that as the officer had to perform other duties for the Corporation, there might arise conflicting interests between those duties and his duties under the contract which might give rise to unfair treatment of the contractor by reason of the zeal with which the officer performed those other duties. In the present case he was of opinion that the Court would not be acting in the spirit of the law if they were to shut the doors of the Courts to the action and force it to be referred to arbitration. He was satisfied that there was a substantial dispute arising out of events which occurred subsequent to the making of the contract, and he did not think they ought to force it to be tried by the engineer whose conduct was practically the sole point in dispute.

Lord Justice Buckley concurred. He said that he did not in any way reflect upon the engineer, but in the circumstances he did not think he was the proper person to determine the dispute.

The appeal was accordingly allowed, with costs, and the order staying the action set aside.

Phythian *v.* Liverpool Corporation, &c.

At the Liverpool Assizes on July 28th, the action of Phythian *v.* the Liverpool Corporation and Woolton Motor-'Bus Co., Ltd., came on for hearing, being a claim by Mrs. Phythian, of Wallasey, to recover damages for personal injuries sustained as a result of a collision between a motor-'bus belonging to the company, and an electric tramcar belonging to the corporation. Counsel appeared on both sides, and the main point was whether the Corporation or the company were to blame for the collision. The case for the plaintiff, as put forward by Mr. Greer, was that on March 31st, Mrs. Phythian entered a motor omnibus at the usual stopping place opposite the Coffee House Hotel, Wavertree, and that just before it started, the tramcar collided with the rear of the motor-'bus. As a result of the impact, the plaintiff was rendered unconscious and remained in that condition for three or four days, and suffered from shock and headache. She had to call in two medical men, and go to North Wales, and she was not able to take that part in her husband's business of fruiterer that she formerly did. The case for the Corporation was that the accident was brought about through the omnibus drawing suddenly and without warning on to the tramlines in front of the tramcar. Mr. Tobin submitted on behalf of the company that the accident was the fault of the tramcar driver in not pulling up quickly enough in view of the danger of a collision. At the resumed hearing on July 29th, the plaintiff's right to compensation was admitted by the two defendants, and the foreman subsequently announced that the jury had found a verdict for £141 12s. against the Liverpool Corporation.

The Judge: You do not find any verdict against the company?

The Foreman: No.

Clarke *v.* the Mayor, &c., of West Ham.

In the Court of Appeal, on Friday last, the Master of the Rolls and Lords Justices Farwell and Kennedy delivered judgment in this case on the defendants' application for judgment or new trial in the action which was tried before Mr. Justice Coleridge and a common jury. The circumstances and the trial were fully reported in our issues of March 5th and April 30th last. At the trial the jury awarded the plaintiff £500 damages, and Mr. Justice Coleridge held that the plaintiff was entitled in the circumstances of the case to the damages awarded to him, and entered judgment for the plaintiff for £500 and costs. The defendants appealed upon the grounds that the judge should have entered judgment for them, having regard to the sum paid into Court and that the judge had misdirected the jury by telling them that it was open to them to assess a greater amount of damages than £25, and in directing them that the defendants had broken Regulation 12 made by the Board of Trade.

The arguments on the appeal concluded on July 16th, when judgment was reserved.

The Master of the Rolls, in delivering judgment, recited the circumstances and said that the first and main point to be considered was whether there was an obligation upon the defendants to carry a member of the public, not being an objectionable person, who desired to enter a car in which there was a vacant place: or whether the defendants were under no such obligation, but at liberty to refuse to take any one except upon such conditions as they thought fit to impose. In his opinion there was such an obligation upon the defendants; the plaintiff had a right, on paying or offering to pay his fare, to travel in the tramcar. The undertakers were empowered to do that which would otherwise have been a nuisance to lay rails along the highway; it was in the nature of a franchise granted by Parliament. Parliament had allowed the levying of tolls, which again seemed to him to negative the idea that the defendants could pick and choose their passengers. Moreover, the by-laws, which had statutory effect, strongly supported this view. It followed that the right conferred upon the plaintiff was a right to be carried on payment of the published fare—namely, one halfpenny, and that there was no justification for qualifying the plaintiff's right by the addition of a term limiting liability for negligence to £25. It might be, though he hesitated without further argument so to hold, that if the defendants had chosen to publish two lists of fares in their carriages, one of which contained their maximum rates and the other of which contained reduced rates, and an option were given to a passenger to pay either the full rate without any limitation of liability or the reduced rate with a limitation of liability, a passenger electing to pay the smaller fare would be bound by the terms on which, and on which alone, the reduced rate was accepted. In that case there might be consideration for the limitation of liability, but in the present case it seemed to him that no option was given to the plaintiff. The plaintiff had paid the only fare which the defendants could demand, and the defendants were no more entitled to limit their liability to £25 than they would be to negative all liability for negligence. In his opinion it was not useful to refer to provisions contained in the Railway Acts or to cases decided under those Acts. He based his judgment on the simple proposition that the plaintiff, who had a right to be conveyed in a tramcar on payment of the published fare, enjoyed that right with everything incidental to it, including a right to such damages as a jury might assess by reason of the defendants' negligence. He thought that the appeal failed, and must be dismissed with costs. The Lords Justices also delivered judgment dismissing the appeal.

A stay of execution was granted pending an appeal to the House of Lords, on the terms that the plaintiff was to have his costs in the Court below and in the Court of Appeal taxed and paid him in any event, and that the defendants should pay him £1 a week till the hearing of the appeal.

Morrison *v.* The British Aluminium Co., Ltd.

In the Chancery Division on Friday (July 30th), Mr. Simmons for the plaintiff, in the action of Morrison *v.* The British Aluminium Co., Ltd., informed Mr. Justice Warrington that the motion in the case for the appointment of joint receivers would, subject to his Lordship's sanction, and with the consent of counsel for the company, stand over till the second motion day of next sittings.

His Lordship allowed the motion to stand over accordingly.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Reyrolle Flame-Proof Drum-Type Starters.

In view of the recent correspondence in our pages on the subject of mining switchgear, the accompanying illustration of a new type of flame-proof motor starter, recently put on the market by Messrs. A. Reyrolle & Co., of Hebburn-on-Tyne, will be of interest.

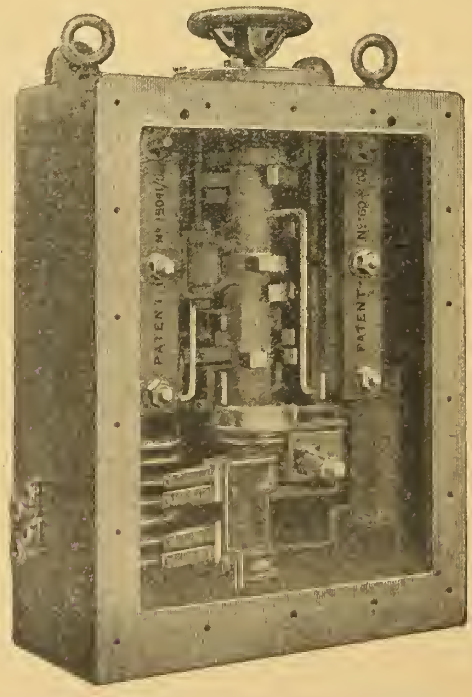


Fig. 1.—Reyrolle Flame-Proof Starter.

Internally the starter is similar to the firm's well-known drum type, but the case and cover have been designed with special reference to the conditions obtaining in mining work.

The main casting is of stout cast-iron, and is provided with a broad flange, on which a heavy steel cover is fitted. The push-button release is operated by means of a special form of plunger which makes a flame-proof joint with the cover, and the cables are taken through stuffing-boxes at the side, the design of these depending upon the type of cable employed.

Messrs. Reyrolle & Co. have satisfied themselves, after an extended series of experiments, that even should a mixture having the maximum explosive force be ignited inside the starter case, there is not the slightest risk of rupture, and further, on account of the long path through which the flame would have to travel, there is no possibility of a flash getting to the outside.

If necessary, these starters can be fitted with overload and no-voltage releases, which are guaranteed absolutely vibration-proof; anyone who has had experience in working coal-cutters will recognise that this is a highly important feature, the vibration on this type of machinery being excessive.

Street Lighting with Tungsten Lamps.

We mentioned recently that Mr. Haydn T. Harrison, of 11, Victoria Street, S.W., had issued a small booklet on street lighting apparatus, and in view of the rapidly increasing importance of the tungsten lamp in this connection, we have thought it of interest to reproduce one or two illustrations of recent practice.

Fig. 2 shows how, at Harrogate, an arc lamp has been replaced by four high-candle-power tungsten lamps, supported by a graceful branching fitting. Possibly the fitting is rather more ornamental than would seem necessary, but this is a matter which it is essential to consider with due regard to the character of the immediate surroundings of the lamp standard. Fig. 3, by way of contrast, shows an extremely simple fitting for one to four lamps, fitted with Mr. Harrison's D.P. switch-fuse and sealing chamber, as used at Bedford. A very similar fitting is used at Croydon. In some cases (*e.g.*, Canterbury) the globe is dispensed with entirely, the spigot cap only being provided, to afford the lamp protection from rain. At Marylebone two tungsten lamps have been fitted in each of the existing gas lanterns that have been converted, a convenient fitting for this purpose being available. Mr. Harrison's ingenious D.P. switch-fuse, recently described in this column, is readily fitted to street lamps, as shown in fig. 2, and the Venner time-switch, which switches on and off for 14 days without rewinding, is a useful adjunct. In an appendix to the booklet Mr. Harrison gives useful data regarding street lighting, including the cost of renewals with Osram lamps, for which he is able to undertake supply and maintenance contracts.

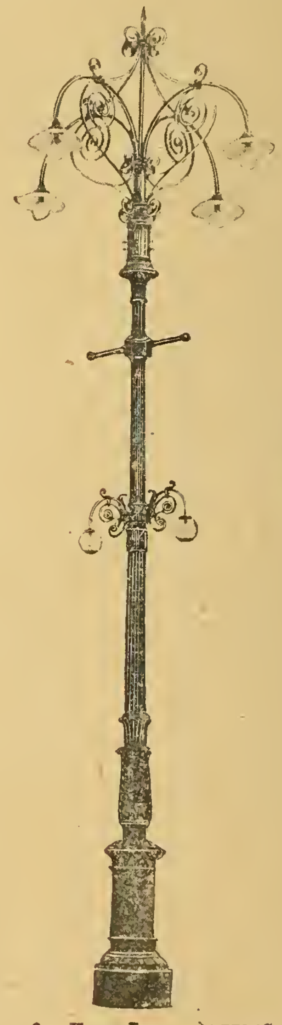


Fig. 2.—Four-Light Fitting (Harrogate).

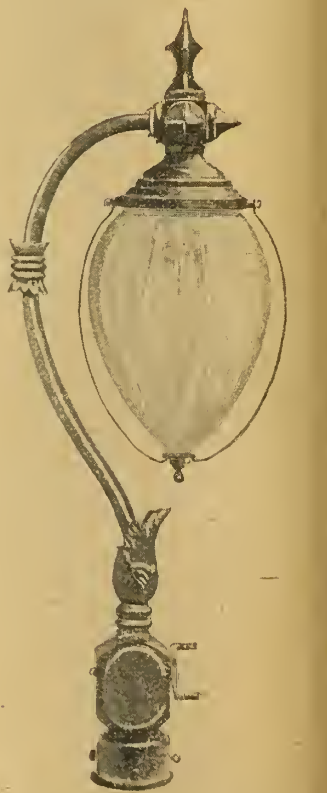


Fig. 3.—Two-Light Fitting (Bedford).

"Electra" Insulated Hand-Lamp.

The Electric & General Stores Co., Commercial Chambers, 104, Albion Street, Leeds, are introducing a portable hand-lamp specially constructed to conform with the Home Office regulations, for use in works, collieries, mills, &c. The body of this hand-lamp is made throughout of a substantial insulating material, which, it is stated, will not break, even if dropped upon iron or stone. The metal parts of the lampholder are so placed that an accidental contact with live parts is impossible. The well-glass screws into the body of the hand-lamp, and being fitted with a rubber ring, makes a watertight joint with it, while a strong galvanised wire guard is fitted over the well-glass, and is also thoroughly insulated.

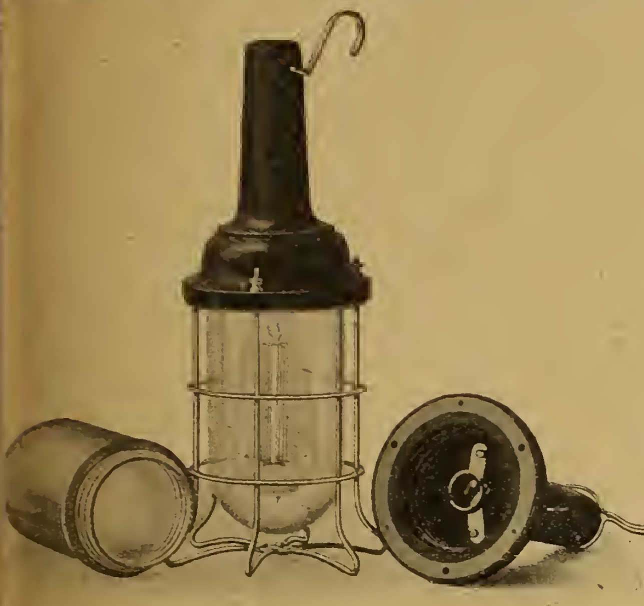


Fig. 4.—"Electra" Portable Hand-Lamp and Parts.

Silver-lined Shades and Reflectors.

The Silver-lined Shade & Reflector Co., of 4, Milk Street, Cheapside, E.C., is introducing a series of reflectors of novel type, which give admirable results. The reflectors are silvered on rough cloth, which is attached to card or zinc; they are therefore unbreakable, and will not tarnish. They give a soft white light, and having a rough surface, they do not throw bright lines on one's desk. They can be used on any existing fittings. We have used a sample one for some time, and have been much pleased with the pleasant effect and the improved illumination on our work.

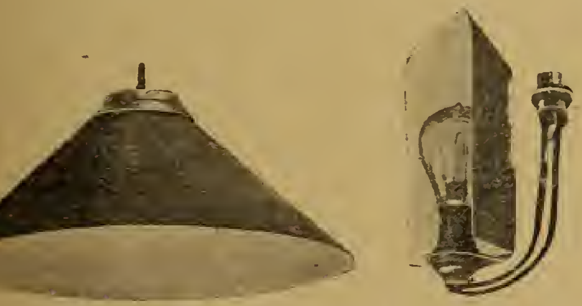


Fig. 5.—Silver-lined Shades.

BUSINESS NOTES.

Book Notices.—*The Mechanical Design and Construction of Commutators.* By R. Livingstone. London: *Electrician* Printing and Publishing Co. Price 6s. net.—In this little work Mr. Livingstone has applied scientific principles to the mechanical design of commutators, and has produced a book which cannot fail to be both interesting and useful to those engaged in the practical design of dynamo machinery. The author does not concern himself with electrical matters, such as the theory of commutation, contact resistance or determination of electrical losses, but confines himself to the calculation of the mechanical stresses due to centrifugal force, initial tension, and expansion caused by heating, both for commutators of the V-ring and the shrink-ring type. Two practical chapters are given on the building-up of commutators, and various types are described, with criticisms upon their design. A table is given of proposed dimensions of commutators, from 6 in. to 90 in., which may be used as a basis for designers to start from.

A Text-Book of Electrical Engineering. By Dr. A. Thomälen. Translated by G. W. O. Howe. London: E. Arnold. Price 15s. net.—This work is principally intended as a text-book for second and third year students at the Central Technical College, and deals with principles rather than details of practical construction of electrical machinery. The greater part of the book is devoted to generators, motors and transformers. The first two chapters deal with the general laws of electric currents, and with electrolysis, primary cells and accumulators. Subsequent chapters deal with electromagnetic laws and the generation of current, after which the underlying theories of direct and alternating-current generators, motors and transformers are treated in a manner which is exceptionally full and clear. This is essentially a student's book, and can be confidently recommended to those who wish to gain a clear insight into the science of the construction of electrical machinery.

"Leçons sur les Alliages Métalliques." By J. Cavalier. Paris: Vuibert & Nony. 1909.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIII, part 3. May and June, 1909. Milan: The Association. Price L.5.

"Science Abstracts." Sections A and B. Vol. 12, part 7. No. 139. London: E. & F. N. Spon, Ltd. 1909. Price 1s. 6d. each section.

"The Engineering of Ordnance." The Gustave Canet Lecture, delivered by Lieut. A. Trevor Dawson before the Junior Institution of Engineers. London: The Institution.

Chilian Industrial Improvement.—According to an American Consular report, there are strong indications of a general industrial development in Chile far in advance of anything heretofore known in South America. The work of construction on the first steel plant south of Mexico is progressing rapidly at Corral, and it is expected to be ready for operation early in 1910. This plant is to cost $2,000,000 United States gold, and will have a daily capacity of 200 tons. It is backed by French capital, and the machinery, it is said, will be principally of French manufacture. A fine quality of iron ore is found in large quantities within 5 miles of the plant, whence it is to be transported to the works by an overhead cable. A few months ago a large cement plant was opened at Calera, with a capacity about equal to the consumption of the country, and there is a strong movement in favour of Government car works, where all the rolling stock can be manufactured for the State railways. It is expected that the opening of the steel plant early next year will encourage the development of many other industries that are dependent upon the iron and steel industries for raw material. In all of this the Chilian Government is taking an active interest, and wherever possible is lending a helping hand. These industrial developments will open a market for much industrial machinery, and the British manufacturer should keep in close touch with Chilian development for the next few years. Importations of machinery and fuel during 1908 were the only items of importance that showed an increase; the total imports showed a decrease. Machinery enters free of duty.

Catalogues and Lists.—Messrs. W. A. Stevens, Ltd., Victoria Works, Maidstone.—New catalogue of the "Hallford-Stevens" petrol-electric and electric omnibuses and commercial vehicles. One of the petrol-electric omnibuses has been run in London service by Messrs. Thos. Tilling, Ltd., covering 50,000 miles in the past 18 months. The patent electrical equipments are manufactured by Messrs. Stevens, who are sole selling agents in the United Kingdom for Messrs. J. & E. Hall, Ltd., the makers of the vehicles. The catalogue gives specifications and drawings of the omnibuses, &c., and details of the gear, with half-tone views of complete vehicles of various types, and of the "Hallford" engine. Reprint also of an article on the Stevens system of charging the batteries of omnibuses from the mains with efficiency.

Mr. George Ellison, Birmingham.—August calendar card, with portrait of a charming young woman named Harriet, and a view of an A.C. motor-starter.

Mr. E. E. Coy, 77, St. John's Road, Bootle.—Circular describing the "Whipall" electric air pump for inflating tires in motor garages up to 150 lb. pressure per sq. in.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.—Leaflet showing the "Sun" interlocked ironclad D.P. fuse and pressed brass sweating sockets, with particulars and prices.

Visit to Works.—Yesterday the works of Messrs. Mavor and Coulson, Ltd., Glasgow, were open to the members of the joint summer meeting of the Institution of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders, and several interesting novelties were placed on exhibition, including the following: Three-speed 5-H.P. spinner motor in operation, showing the proposed method of speed control for electric ship propulsion; an A.C. motor wound with four and six poles, for use with two separate generators of different periodicities, both generators and both motor windings being used together on the motor at full load and normal speed. For one speed above the normal and one speed below the normal, one generator only is used. This is an alternative method of ship propulsion. Where more than two generators are available, the number of windings on the motor is increased accordingly, and more speeds are available; 10-H.P. single-speed spinner motor, illustrating the use of A.C. motors for starting up against load without the use of resistance or electric control; a Pick-Quick coal-cutter, arranged for working on a steep inclination, as used in collieries in Scotland, in Belgium and in Austria, for dealing with seams not otherwise workable by machine-power; an entirely enclosed dust and explosion-proof motor cooled by air, positively circulated and acting through radiators on the air enclosed in the motor, which is also positively circulated. There was also a stator core in course of construction for a 500-H.P. alternator of normal type, and a number of large motors of the squirrel-cage type for industrial purposes, partly for use on power-supply mains.

New Wiring System.—We recently inspected a new wiring system devised by Mr. Sarsfield W. Martyn, of 11, Pratt Street, Camden Town, which appears to possess many admirable features, and is interesting in view of the importance of the subject of cheap wiring for small houses, which is now so prominently to the fore. Mr. Martyn, whose patent cable connector, watertight fuse, and motor-car terminals have already been described in our columns, contrives by means of a simple universal box to satisfy a remarkably wide range of requirements with the mimimum number of parts and accessories. His system is not yet on the market, but is practically complete. He would be glad to meet with some other enthusiast who would share with him the burden of development of this branch of his business; he already possesses works, offices and the necessary facilities for the commercial management of the undertaking.

Australian Insulators.—A new Melbourne company has been formed for the purpose of manufacturing telegraph and telephone insulators from Victorian clay. A suitable deposit of clay has been found at Ringwood from which insulators can be made.

Liquidations.—Uxbridge and District Electric Supply Company, Ltd.—The creditors and shareholders of this company met on Thursday last week at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C., when accounts were submitted showing unsecured debts £6,622, loans on debenture bonds £52,579, and preferential claims £89. The assets are valued at £75,038, thus showing a surplus of £15,748 over the liabilities, but the account with the shareholders discloses a deficiency of £10,526. Mr. H. E. Burgess, Official Receiver, reported that the company was promoted in 1900 as the Uxbridge and District Development Syndicate, Ltd, with a nominal capital of £1,000, with the object of providing an electric supply for the parish of Hillingdon. It was found, however, that the expense of obtaining a provisional order would have to be incurred, and the scheme was altered so as to extend the supply to several parishes, including Uxbridge. A provisional order was obtained, and the company was able to start work; a certain amount of capital was subscribed by the public, and the nominal amount was increased, first to £20,000, and eventually to £75,000. The name of the company was then changed to its present title, and its objects were stated to be to carry on at Uxbridge and in the counties of Middlesex, Buckingham and Hereford, the business of an electric supply company in all its branches. A company, known as the General Electric Co. (1900), Ltd, undertook to finance the concern on certain conditions, and had financed it to a certain extent, but later on in the history of the company the directors thought it desirable to transfer the debentures held by the General Electric Co. to the Metropolitan Electric Supply Co., Ltd., who took them up, and at the present time there was £43,000 of debentures held by the latter company. By an agreement dated May 8th, 1905, in consideration of the company withdrawing its opposition to a Bill then being promoted by the Metropolitan Co., the latter undertook to acquire the interest of the General Electric Co. and that of Callender's Cable and Construction Co., Ltd. The sales of electrical energy amounted in 1902 to £721, and had increased to £5,644 in 1908, and after providing for working expenses there was a net profit of £2,903, which went in payment of interest on the debentures. The failure of the company was attributed to want of working capital required to carry out the extension and make it a paying concern. There was a good future still before them, and negotiations were pending with a view to the continuance of the company's business. The liquidation was left in the hands of the Official Receiver.

Geneva Tramways Co. (1906), Ltd.—Creditors are required to communicate with the liquidators, Messrs. A. G. Brand and J. Seear, at 286, Salisbury House, E.C., on or before September 1st next.

Eastern Electrical Syndicate, Ltd.—A meeting will be held at 1, Broad Street Place, E.C., on September 14th, to receive an account of the winding-up from the liquidator, Mr. W. H. Stentiford.

South America.—A syndicate has acquired the rights in the "Z" (Zircone-Wolfram) metal-filament electric lamps for Brazil, Uruguay and the Argentine Republic.

Notices re Patents.—The proprietor of a patent for separating conductors from non-conductors wishes to make arrangements for its working in this country. Notice is given of application for leave to amend a patent for an improved reflector.

The owners of patents relating to vacuum lighting and to an improved system of electric lighting wish to lease their rights.

Particulars are given in our advertisement pages to-day.

Private Meeting.—Mountain & Gibson, Ltd., Elton Fold Works, Bury.—The creditors interested in this matter were called together at Manchester, when it was reported by Mr. H. A. Bowden, chartered accountant, that no accurate statement of affairs had been prepared. Taking the balance-sheet of June, 1908, as a basis, the position approximately was that the liabilities amounted to £33,100. The liabilities were as follows:—Unsecured trade creditors, £11,200; unsecured loan creditors, £12,100; and partly secured creditors, £9,800. There were debentures to the extent of £30,000, and after making provision for these, and for preference claims totalling £200, the assets were estimated to produce £29,320. A deficiency was thus disclosed, as regarded the unsecured creditors, of £3,780. The assets consisted of patterns, machinery, buildings, &c., £29,920, and stock, book debts, &c., £29,600. The company was registered in June, 1905, to take over a business previously carried on by a manufacturing company. The nominal capital of the company was £60,000, divided into shares of £10 each. A very large amount of experimental work had to be carried out, and it was found that a large capital was required. At the end of 1907 it was contemplated that new works should be erected. Last year it was decided to remove to Gloucester. Subsequently, it was resolved that a new company should be floated with a larger capital. In May of the present year a prospectus was issued, but the company did not go to allotment. A meeting of the shareholders of the company had already been held, when a resolution was passed for the voluntary liquidation of the company. Mr. H. A. Bowden was then appointed to act as the liquidator in the proceedings. It was pointed out that the meeting was called to comply with the requirements of the Companies' Act, and it was open to the meeting to confirm the appointment of the present liquidator, or to make application to the Court. The matter was discussed at very considerable length, and eventually it was decided that Mr. A. Whittaker, chartered accountant, should be appointed to act as co-liquidator with Mr. Bowden in the voluntary liquidation of the company. A Committee of Inspection was also appointed, consisting of the representatives of the principal creditors.

Brussels Exhibition.—The National Electrical Manufacturers' Association (Inc.) has issued a circular letter to electrical manufacturers regarding the Brussels Exhibition, drawing their attention to the fact that the Board of Trade are giving special facilities to British exhibitors, which briefly consist in fixing the platforms for the stands, show-cases, &c., unpacking and packing the goods, and various other minor matters for the assistance of exhibitors. It is estimated that they will pay £50 out of every £150 expended on British exhibits—in other words, one-third of the expenses. Beyond the assistance which the Board of Trade can give, there are many details (says the circular) in which the Association can be of assistance to those who anticipate exhibiting; among others the following:—

1. It is very desirable that an exhibitor should have some information regarding the positions available for his exhibit beyond that which can be obtained from a plan, and this can only be furnished by someone who has seen the buildings, &c. It is, therefore, suggested that joint action should be taken on the part of the members of the Association who are proposing to exhibit, by arranging for someone to report to them on this point.

2. In the case of firms who would be prepared to make a joint exhibit with others, the Association can arrange for such members to co-operate and obtain an arrangement of space, show-cases, &c., suitable for the exhibit.

3. As regards either the sending out of a representative to report or arranging for joint exhibits, the Association would not make any profit, and would propose to share the actual cost among the exhibitors. It is thought that it will probably be wise for the exhibitors to appoint a representative to go over to Brussels and to act in conjunction with someone who can be appointed locally.

The secretary, Mr. F. B. O. Hawes, invites communications on the matter at the earliest possible moment, so that he can make whatever arrangements are necessary. The exhibition commences in April next, and will remain open for a period of at least six months.

New Zealand Tariffs.—The Customs authorities have recently given a decision to the effect that "electric batteries for use in surgical instruments" are to be classified under No. 190 of the Tariff, the duty being at the rate of 20 per cent. on British goods and 30 per cent. *ad valorem* on those of foreign manufacture.

Platinum Exports from Colombia.—An American Consular report states that the exports of platinum from the Republic were in 1905, 2,475 lb.; in 1906, 565·8 lb.; and in 1907, 20·5 lb.; while the value rose enormously, being $83,088 in 1905, $122,219 in 1906, and $2,856 in 1907.

Trade Announcements.—Messrs. Simplex Conduits, Ltd., inform us that they have been appointed by the British Prometheus Co., Ltd., their sole selling agents in London, the South and West of England and South Wales, and have re-stocked their various show-rooms with a representative selection of apparatus. The management of this department will be in the hands of Mr. Beves, who has been associated since its inception with the British Prometheus Co.; he will be assisted by Mr. Bennett.

Messrs. Davidson & Blackadder, of 50, Wellington Street, Glasgow, have been appointed agents for the St. Helens Cable and Rubber Co., Ltd., of Warrington, for the whole of Scotland. Mr. J. W. Logan will continue to represent the St. Helens Co. in the Scottish district as a member of Messrs. Davidson & Blackadder's staff.

The partnership hitherto existing between himself and Mr. Schultz and others having terminated by effluxion of time on July 31st, Mr. Charles Comins informs us that he will continue to practise as a chartered accountant at 50, Cannon Street, E.C., on his own account, under the style of Charles Comins & Co.

Messrs. Veritys, Ltd., inform us that their Bristol address is now 59, Victoria Street.

The Bradford Electrical Engineering Co., Ltd., has removed from Royal Arcade to Manningham Lane, Bradford.

The Adnil Electric Co., Ltd., of Adnil Building, Artillery Lane, E.C., has been established under the management of Messrs. R. A. Marples and S. G. Leach, as the wholesale distributing agency of all types of electrical machinery and apparatus of the well-known "Bergmann" manufacture.

Annual Holidays.—The Lancashire Dynamo and Motor Co., Ltd., Trafford Park.—Works and offices will be closed from August 16th to the 21st inclusive. A small staff will be in attendance to deal with urgent correspondence.

British-Made Gas Engines.—We are very pleased to learn from The Key Engineering Co., Ltd., that they have made arrangements with Messrs. Galloways, Ltd., to manufacture the Ehrhardt & Sehmer gas engines. It will be remembered that in 1907 the company organised a tour on the Continent for the purpose of visiting a number of large gas-engine installations in Germany and France, when Messrs. Ehrhardt & Sehmer's engines were shown driving dynamos, alternators, and blowers, up to a maximum of 2,200 h.p. in one unit; the members of the party were much impressed with the excellent design and substantial construction of these engines, while their performance left no room for criticism. Similar engines have been installed in this country, notably by the Skinningrove Iron Co. (repeat orders), and at an English chemical works (repeat order) where an Ehrhardt and Sehmer 1,200-h.p. engine has been running on producer gas for the last two years. The Key Co. received several propositions from British manufacturers, and gave the preference to Messrs. Galloways, on account of their experience in building large rolling-mill engines, blowing engines, &c.—Messrs. Ehrhardt & Sehmer's speciality. The chairman and some of the directors of Messrs. Galloways, with Mr. Leonard Andrews and Mr. R. B. Slacke, of the Key Co., recently made a tour of inspection on the Continent, and visited several installations, as well as Messrs. Ehrhardt and Sehmer's works, with the result that they were fully satisfied that the large gas engine had arrived at maturity; and after their general manager, Mr. Pilling, had also made a visit of inspection and reported favourably, they decided to enter into the arrangement that we have mentioned. The step will involve a considerable outlay upon tools and equipment, but we have no doubt that Messrs. Galloways will reap a substantial reward, for the reputation of the engine is already established, and even in this country, iron and steel makers are at last awakening to the material economies that may be effected by the generation of power from blast-furnace gas. Moreover, the adoption of gas power in electrical generating stations is quite within the sphere of practical economics, and no one dare say that it is far from realisation. In future the Key Engineering Co. will act as agents both for Messrs. Galloways, Ltd., and for Messrs. Ehrhardt & Sehmer, and we congratulate them upon the successful outcome of their energetic campaign.

Cessio Proceedings.—Robert Richardson, electrical engineer, of Leven (Fife), who was examined in connection with his petition for cessio at Cupar, said he had no assets and his liabilities amounted to £901. His brother was prepared to pay a dividend of 5s. in the £ to his creditors. Debtor, who is in the employment of the Wemyss District Tramway Co., said he got into difficulties when he was in business in Glasgow, and he had to borrow money. Unfortunately he went to moneylenders and tried to clear himself; instead of doing so, however, he got deeper into the mire. The money he received from the moneylenders amounted to about £181; he believed he had paid back £250. The offer of 5s. in the £ was accepted, and cessio was granted. Mr. F. J. Smith, Leven, was appointed trustee.

Reduction of Capital.—Notice is given in the *London Gazette* that a petition has been presented to the High Court of Justice for confirming a resolution of Messrs. Frederick Smith and Co., Wire Manufacturers, Limited and Reduced, reducing their capital from £200,000 to £115,000.

Sale.—Messrs. Percy Huddleston & Co. will offer on Thursday and Friday next the stock and plant of a firm of engineers and electricians at Hammersmith. See our advertisement pages to-day.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electricity Committee has had before it the decision of Mr. W. H. Patchell, London, who was appointed to consider the working arrangements between the Suburban Tramways Co. and the Corporation. Mr. Patchell has suggested a fixed charge of £4 10s. per kw., with an additional ½d. per unit. He has also decided that the Suburban Tramways Co. should pay the Corporation the sum of £900 per annum. By this decision there is a reduction of ¼d. per unit on the old rate, and if the Suburban Co. uses the same number of units in the future as it has done in the past, there will be a saving to the company of about £200 per annum. A five-years' agreement is proposed.

Barking.—The U.D.C. has applied to the L.G.B. for a loan of £2,500 for E.L. purposes, viz.:—Excess expenditure, £745; new plant, £750; transformers, £250; mains extensions, £250; house services, £200; public lighting, £200; meters, £105.

Brazil.—Reporting on the trade of the district of Santos, Mr. Consul Sandell says it may be affirmed that the State of Sao Paula has been the cradle of the utilisation of hydraulic power in Brazil for generating electricity. That at present turned to account, however, is but insignificant in comparison with the immense undeveloped resources which the State possesses in the numerous large waterfalls to a large extent unexplored. The principal hydro-electric installations constructed in the State are that of the Sao Paulo Tramway, Light and Power Co., at Paruahyba, with a capacity of 8,000 h.p., and those of various other companies, viz., at Jundiahy, generating 1,000 kw.; Sorocaba, 1,000 kw.; Rio Claro, 580 kw.; Mococa, 500 kw.; and Piracicaba, 450 kw. The important hydro-electric station in course of construction by the Santos Dock Co. at the Italinga Falls, which should be completed in a year's time, will generate and transmit some 3,000 kw., which will be used in the working of the cranes on the quay at Santos and the supply of light and power to that city.

Bridlington.—The T.C. has applied to the L.G.B. for a loan of £133 for E.L. purposes.

Brighton.—The long-standing controversy between the Tramways and Lighting Committees of the Corporation was temporarily settled at the last meeting of the T.C., held on the 29th ult., when it was decided to reduce the price of traction current during the current financial year from 1·5d. to 1·35d. per unit. The Lighting Committee a short time ago agreed to reduce the price to 1·4d. per unit, but this did not satisfy the Tramways Committee, who asked for it to be reduced to 1·35d. Both Committees took separate reports to the Council, and it was fully anticipated that there would be an interesting discussion, but a compromise was effected before the proceedings came on, so that the price is now, at any rate for 12 months, settled at 1·35d. per unit. Alderman Carden, the ex-chairman of the Lighting Committee, frankly acknowledged that the tramways have been overcharged for several years past, but that the Lighting Committee, owing to the finance not being in a very healthy state, was unable to make any reduction.

Burnley.—The Electricity Committee has decided to alter its practice as regards the payment of the cost of laying service lines; in future all persons requiring a supply of electricity are to be charged the cost of laying cable in excess of 60 ft., and the cost of laying cable on private ground.

Canada.—The Ottawa Electric Co. is pulling down part of its No. 2 power house. When the wheels, timber flumes and penstocks are removed the company will start the remodelling of the station, with a view to adding at least 50 per cent. to the capacity for power development. At some time in the future, when other schemes in contemplation are carried out, this reconstructed power station will be the chief distributing depôt of the company. The project which the electric company is carrying out was rendered possible by the dam built just above the Chaudiere Falls last year by the big milling companies, which added immensely to the volume of water available for power development. The work of constructing the transmission lines for the hydro-electric power scheme is progressing very favourably; the line is being built both ways—towards Dundas and towards the Niagara Falls.

Montreal.—The Dominion Light, Heat and Power Co. is putting down a plant which will consist of three 250-h.p. twin cylinder Hornsby-Stockport gas engine units and two 125-h.p. units, coupled to three-phase 60-cycle alternators. Under the contract this plant will be in operation by December next; it is being supplied by the Colonial Engineering Co., which has already made some 14 very successful installations in Canada.

Continental Note.—Holland.—A project is on foot to construct a central generating station for the purpose of supplying with electric light and power the east district of North Brabant as far as Bois-le-Duc and the centre of Limbourg, including Luremonde, Venloo and Weert.—*Board of Trade Journal.*

Dukinfield.—At the meeting of the Town Council on Monday, Alderman W. Wood stated that the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board had produced electric current at a cheaper rate than any other undertaking in the kingdom, and he explained that the policy of the Board in charging 1d. to the tramways and less than ½d. per unit to private firms had resulted in a reduction of the loss of £5,000 in 1907 to £500 last year.

Epsom.—The inquiry into the application of the U.D.C. to borrow £1,500 for the purpose of electric lighting was resumed last week, when the Inspector (Mr. Hooper) explained that what he wanted to know was what steps had been taken to improve the condition of affairs which existed in December last. The clerk to the Council, and the accountant, stated that they were unable to give the net loss for the year ending March 31st, 1909. Mr. Foster, the former engineer, was sent for, but replied that he was unable to attend owing to an important engagement. The Inspector pointed out that there had been a loss of £7,122 on the undertaking, and they had been going on from year to year with a steady loss of £900 per annum. In the course of further discussion, the Inspector said that it appeared that the undertaking had been too ambitious altogether at first, and that the Council had been carrying on a system of lighting and did not even know what it cost. There had been a loss on both the public and private lighting, and the position in regard to the former was that the price charged had never been worked out. Evidence having been given, the inquiry was concluded, but the Inspector said that, in his opinion, the Council should have arranged for Mr. Foster to be present.

Finchley.—Some interesting correspondence has taken place between the Assistant Secretary, L.G.B., and the Council, relative to the loan of £2,200 for arc lighting. The L.G.B.'s letter hinged on an inquiry held by its Inspector, Mr. Hooper, with reference to sanction to the loan for arc lighting in Bollards Lane, Regent's Park Road, and Great North Road. The Board suggested that the Council should carefully consider the cost of gas lighting, and asked for reports of comparative costs of electric and gas lighting. The Council's reply was a lengthy one, detailing matters in connection with the lighting, and concluded with the following pertinent paragraph:—"They (the Council) respectfully subm that the point which the Board is called upon to decide is whether a loan should be granted for the necessary sum to enable arc lighting to be installed, and not as to whether gas or electricity should be used."

Gloucester.—The T.C. has decided to apply for a prov. order for E.L. in the area of the R.D.C.

Horsham.—At last week's meeting of the U.D.C. it was reported that the electric lighting accounts up till the end of March last, show a balance in hand of £10 after paying instalment of loans, working expenses, &c. Last year there was a deficit of £147. This is the first year an actual profit has been shown. The income for the year was £4,228, and the expenditure £2,187, leaving a gross profit of £2,041. Interest and instalments of loans came to £2,031.

Hull.—The Corporation last week discussed the negotiations with the Hessle Council with respect to the prov. order for electric light. It was pointed out that the Hessle Road was being rapidly built up towards Hessle, and that the D.C. had been urging the extension of the tramways also into Hessle, so that it seemed likely that before long Hessle would be taken into Hull. The Committee decided to make an offer to the D.C. of £200 for taking over the prov. order.

Ilford.—For the year ending March 31st the income of the electricity undertaking was £28,721, leaving a gross balance of £10,678, or £1,000 more than in the previous year. After deducting payment of interest and instalments of loan, there was a surplus of £1 1s. 11d., as against a loss of £375 last year. The reserve fund stood at £6,398, which was no increase on the previous year nor, indeed, on 1907. Three million units were sold during the 12 months, and there are now over 3,000 consumers on the books. Mr. Philpot, chairman of Electricity Committee, stated at the last meeting of the Council that the policy in the past years was to supply consumers at the lowest possible rate, but he did not think they had reached the minimum price yet. When they, however, got their price down to the minimum, the surplus would be devoted to the relief of the rates. In reply to questions, Mr. Philpot said he had hoped they might have been able to make a further reduction in the cost of power, but he did not think the prospects of doing so immediately were particularly rosy.

Kingston-on-Thames.—The T.C. has decided to install an electrically-driven 10-in. centrifugal pump at the sewage works.

Limerick.—On Monday, last week, a brief strike occurred at the electric lighting works, the men apparently going out in sympathy with the local gas workers, who struck owing to dissatisfaction at the employment of a particular man.

Little Lever.—The Lancashire Electric Power Co. has written to the Little Lever District Council asking for permission to supply electricity to several local premises by means of overhead wires. The matter is held over.

Longton.—The T.C. has decided to extend the mains to the Florence and Dresden districts at an estimated cost of £1,550, and a loan of £1,250 for this purpose has been applied for.

London.—The annual report of the City engineer, Mr. Frank Sumner, which has just been issued, says the lighting of most of the main thoroughfares by arc lamps was continued throughout the year. The number of the original type "open" electric lamps in lighting at the end of the year, at a cost of £26 each, was 398, being a decrease of two, accounted for by the substitution of the new and cheaper flame arc on the new rest in Aldersgate Street, and the abandonment of one lamp on the Blackfriars Bridge Approach, by the Royal Hotel, the latter being no longer required. In addition to this number, there were 34 "Oliver" flame arcs (mostly experimental), and 18 "Reason" enclosed arcs (experimental) in lighting during the year. These lamps were lighted on 23 days during the year when fog or unusual darkness occurred, at a total additional cost of £147. The number of defective electric lamps reported during the year was 71. The returns of these defects are made daily by the Police, and the City of London Electric Lighting Co. were fined for each failure, the amount deducted from their account during the year being £16. The number of arc lamps in lighting on December 31st was as follows:—398 original type "open" lamps, price per annum, £26, City of London Electric Lighting Co.; 23 "Oliver" flame arcs (partly experimental), £17 10s., City of London Electric Lighting Co.; 18 "Reason" enclosed arcs (experimental), Farringdon Street, price per annum, £12 10s., City of London Electric Lighting Co.; 11 "Oliver" flame arcs (experimental), Cannon Street, price per annum, £17 10s., Charing Cross Co. The four flame arcs at Blackfriars Bridge Approach and the four at the Mansion House area, put up by the City of London Co. for its own experiment, are charged at £26 each per annum during the year. With regard to overhead wires, Mr. Sumner says that since 1899, when the Corporation took in hand the work of supervision, a total of 25 miles of derelict wires have been removed. During the past 12 months five of such wires had been removed of a total length of 276 yards, together with their insulators and attachments. In addition, where identification was possible, a large number of disused wires and attachments were taken down by the companies and owners; the total length removed in this way during the 12 months being 4 miles 358 yards, the result of 184 notifications. All owners of overhead wires are required to identify same by having a perforated zinc label of approved pattern attached to each fixing. The numbers or identification marks are registered and the system has proved a great advantage. One of the results of inspection on the roofs is that large numbers of wires have been found to have been erected in the City without any notice at all having been given, and it is only due to careful supervision that new lines are detected. During the year the number of private owners of lines was 137 and the number of companies increased to 23. Both have considerably added to their number of spans during the last 12 months, and these now total 733,828 crossing public thoroughfares, as compared with 733,200 last year and 260,000 in 1899. There has been a net increase of $755\frac{3}{4}$ miles of National Telephone Co.'s wires, while other companies and other owners have added about 22 miles to their lines. The tendency of the National Telephone Co. is to take down their "open" wires and small cables and substitute for them heavy cables; the larger and more recent contain as many as 400 wires, the number of wires thus increasing in a greater ratio than the spans. The number of defects notified in 1908 was 5,602, as against 2,795 in the preceding year, and 1,854 in 1906. Owing to the acids formed in the smoky City atmosphere, the corrosion of exposed metal proceeds far more rapidly than is generally supposed, and the galvanising applied as a protection to pole stays and cables suspending wires does not last long. The City of London Electric Lighting Co., Ltd., gave notices during the year for laying 232 services, and the construction of 20 new boxes in connection with the supply of electrical energy to premises, and the Charing Cross Co. gave 98 notices for laying services and 51 to repair boxes.

London.—ST. PANCRAS.—The gross income of the electricity undertaking for the year ended March 31st last was £75,358, a decrease of £2 243 as compared with the previous year, and an increase of £1,187 in comparison with two years ago. The net profit was £6,925, as compared with £9,454 in 1908 and £6,495 in 1907. It is pointed out, however, that the latter year bore the cost of a legal action which amounted to £3,585. There is to the credit of the reserve fund £38,773. The Electricity Committee recommended that £4,000 of this year's surplus be allocated to the relief of the lighting fund, and that the remainder be placed to the credit of the reserve fund. The Finance Committee, however, considered that no definite sum should be allocated to the relief of the lighting rate, and that the matter should be held over until the Council's requirements for the ensuing half-year are known.

ISLINGTON.—A Special Committee has decided that the charge for public arc lighting should be reduced by £3,000 per annum, which would, upon the basis of last year's consumption, be equivalent to 2·10d. per unit, and which would bring the total charge to £12,734 per annum. After a discussion the B.C. resolved to fix the figure at £12,100 per annum.

Luton.—The T.C. has authorised mains extensions in Hibbert Street, Langley Road and Union Street at a cost of £264. A number of straw hat manufacturers in this district intend using electricity for power purposes.

Mexico.—A concession has been granted to Mr. M. Parry Gosset to utilise the waters of the River Elota, in the States of Sinaloa and Durango, for the generation of electrical energy. The contract is for a term of 20 years, and the works involved must be completed in seven years.

Middlesbrough. — The T.C. has received from the L.G.B sanction to a loan of £18,922 for mains, house services and public lighting.

Peterborough.—The accounts of the Corporation electricity undertaking for the past year show a surplus of £3,917: and after provision has been made for interest and sinking fund, a surplus of £89 remains.

Smallthorne.—The U.D.C. has asked Hanley T.C. if it can supply energy for public and private lighting. The Hanley Committee points out that it is not at present in a position to say upon what terms a supply can be given, and the matter has been deferred pending the receipt of further information from the British Aluminium Co., Ltd., who propose to establish works in the district.

Sunderland.—The Electricity Committee of the T.C. has recommended that the charge for electricity for the tramways be reduced from $1\frac{1}{16}$d. per unit to $1\frac{1}{2}$d. This will reduce the bill for power by £1,380 per annum.

Surrey.—At the meeting of the Metropolitan Asylums Board, last week, it was reported that the South Metropolitan Co. had agreed to the installation of auto-transformers and metallic lamps in the Children's Infirmary at Carshalton and the Downs School at Sutton, under an agreement which will extend to December 31st, 1918, and in which the company undertakes not to raise the price of current for lighting purposes above $2\frac{1}{2}$d. per unit. It further agrees that the supply of current for the charging of electric vehicles shall be $1\frac{1}{2}$d. per unit, instead of $2\frac{1}{2}$d.

Todmorden.—The T.C. has resolved to duplicate the large gas engine and generator at the electricity works, and the manager is to obtain the necessary tenders for the work. An application for a supply of energy to the Joint Stock Mill was favourably considered.

Trowbridge.—The Western Electric Distributing Co. has informed the U.D.C. that it intends applying for a prov. order for E.L. A previous order granted to the Council has been cancelled.

Tunbridge Wells.—The Borough Education Committee has requested the borough electrical engineer to furnish to the town clerk a report he has prepared on the subject of school lighting, which deals with the advantages of the electric light over other illuminants. A copy of the report is to be sent to each member.

Tyldesley.—The U.D.C. has decided to accept £480 as consideration money on the completion of the transfer of the electric lighting order to the Lancashire Electric Power Co.

Walton-on-Thames.—The U.D.C. has asked the Urban Electric Supply Co. to submit a tender for public lighting.

Worthing.—The resident engineer having reported that the nine Beck flame arc lamps obtained in April last for trial have been found to be very satisfactory, the Electricity Committee has decided to recommend the removal of the existing arc lamps in favour of the Beck flame lamps when and as expedient.

TRAMWAY and RAILWAY NOTES.

Brazil.—The firm of Griffiths & Co., of London, is stated to have sent in a proposal to the Minister of Public Works for the electrification of the suburban lines of the Central of Brazil Railway to the station of Deodoro and for the construction of the new central station in the city. The period asked for the completion of the work is 15 months, whilst the company suggests that payment should be made by means of a special issue of gold polices bearing 5 per cent. per annum, amortisable in 20 years. Presumably there will be a call for tenders for the execution of the work and this proposal will be presented together with others of a similar nature. Since the above was written, the President of the Republic has sent a message to Congress dealing with this matter. It is stated that the whole work will cost $5,000,000, and that there will be a reduction of at least $1,000,000 per annum in running expenses as a result of the electrification, in view of which fares and goods tariffs will be reduced. At present the Government does not intend to proceed with the question of building a new central station. The electrification will at first be undertaken as far as D. Clara, whilst a third line will be laid as far as that station. Subways and bridges are to take the place of level crossings. The time taken to D. Clara will be 30 minutes when the electrification is completed, and no stops will exceed 22 seconds.—*Brazilian Review.*

Bury.—The through-running of cars between Rochdale and Bury commenced on the 1st inst., there being a 20-minute service. Arrangements have been made as to the working agreement, the expenses being estimated on last year's accounts, and subject to readjustment at the end of the financial year. Forty-five minutes is allowed for the through journey. The usual intermediate service between Rochdale, Sudden and Heywood will be continued, the cars running *via* Manchester Road.

Cheshire.—The proposed scheme for the construction of an electrical railway in the Wirral Peninsula, announced in the ELECTRICAL REVIEW some months ago, when the plans of Messrs. Pearce and Lloyd, of Liverpool, architects of the Development Co., were submitted, is to be enlarged, we are informed, by the connecting of Port Sunlight with Thornton Hough and Heswall by means of an electric railway, while a system of tramways will intersect West Cheshire. The tramways, it is intended, will feed the railways, and the electric power produced will be turned to account in several new works that are to be opened in view of the scheme.

Continental Notes.—AUSTRIA.—It is announced that detailed schemes are being prepared for the conversion to electric traction of a number of those particular sections of the Austrian State Railways, which appear to be the most suitable from a technical and economic point of view in consequence of the heavy gradients, the existence of tunnels, the vicinity of available water-powers and the density of traffic. The sections include those between Innsbruck and Lindau, Feldkirch, Buchs and Bregenz St. Margarethen, St. Veit a.d. Glan-Assling-Trieste, and a number of others. The total length is 607 miles, and this comprises about one-fourth of all the lines in districts where water-power is likely to be utilised for electrical generation.

SPAIN.—The British Consul-General at Barcelona reports that very little has been done during the past year towards the extension of tramway lines in the city and suburbs, the three companies—two Belgian and one German—owning the entire system paying their attention to the improvement of the permanent way and of the rolling stock. Many new and commodious cars have been put on the lines, all of them made abroad, shipped in parts to the port, and put together in the local tramway workshop. There have been several concessions applied for regarding small extensions of the German lines, and one of considerable importance was granted to a Spanish company for a line from Barcelona, crossing the neighbouring hills to the north of the city, and continuing through the valley beyond as far as the towns of Rubi and Sabadell, a total distance of some 15 miles; but up to the present the promoters have not been able to secure sufficient capital. A Belgian syndicate, which some years ago bought up the British company controlling what may be termed the metropolitan lines, has now amalgamated with the company which works the suburban lines to Sarria and Sans, the combined capital being about £1,000,000. It will be recollected that during the recent rising in the city the tramways were held up by the revolutionists, many of the cars being utilised to build barricades in the streets.

Edinburgh.—An inquiry under the Private Legislature Procedure (Scotland) Bill into the Colinton Tramways Order has been held in Edinburgh. Powers are sought to link up the cable routes of the city with Colinton by an electric tramway; these were opposed by the City and Midlothian C.C., but the preamble was found proved.

East Ham.—Sanction has been received from the Board of Trade to borrow £1,836 for tramway purposes. A portion of the work covered by this sanction is the relaying of the track in High Street North. The engineer and manager reported to the Tramways Committee that he had considered means to do away with the hammering at the joints on the tramway rails, which is now making itself apparent on the tramway system, owing to wear and tear. He found that good results had been obtained elsewhere from the use of manganese steel plates over the joints, which was the patent of the Patent Railway and General Engineering Co., of Nottingham. The company would fix these plates at a cost of 35s. for each joint, inclusive of unskilled labour, excavating and making good afterwards. The Committee has decided to give the plates a trial, and, 100 joints, at 35s. per joint, are to be treated in the manner mentioned.

Liverpool-Southport Railway.—The Lancashire and Yorkshire Railway Co. has been carrying out experiments on the electric line between Liverpool and Southport, and has now devised a new car for this service by which it hopes to reduce to the minimum the possible firing of coaches by short circuits. A train fitted with the new apparatus has been designed, and a trial trip was made last week between Liverpool and Southport, when the members of the Institution of Mechanical Engineers taking part in the summer conference made the journey as guests of the Lancashire & Yorkshire Railway Co. It is claimed by the company's engineers that the new system will mean the "deadening" of the line between the train and the source of supply of electric current. At the time of the fire on this line some months ago, it was contended by passengers and others that there was too much timber about the coaches, and taking this into consideration, the new design has provided that the driver's cab shall be of metal, and all the gear for the control of the motors is placed inside this compartment. Fire extinguishers are placed at the entrance to the first-class and at the end of the third-class coaches.

London.—The Oval station of the City and South London Tube was the scene of a slight lift accident on Monday evening. Through the breaking of a water pipe, the lift (a hydraulic one) suddenly dropped a short distance to the bottom, some of the passengers being cut by broken glass and others getting a wetting from the escaping water.

The last Saturday in July saw the opening to traffic of the Norbury extension of the Streatham route and the Hackney-Bloomsbury section of the L.C.C. tramways.

G.N. & CITY RAILWAY.—An interesting article appears in the *Financial News* of Wednesday, which touches on the presumably close connection between the Gt. Northern and City tube line and the Gt. Northern Railway—which company, it is hinted, may have made good the deficiency in the Tube Co.'s earnings, mentioned in the report this week. The G.N. Co. has already considerable financial interest in the tube line, and owns the 64 chains of tube connecting Drayton Park and Finsbury Park. Moreover, the G.N. Co. is known to desire better access to the City than it at present obtains at Moorgate Street or elsewhere, it also has credit to obtain the funds necessary to extend the tube line as originally proposed to Lothbury. The Gt. Northern Co.'s sidings connect with the Drayton Park tube station, and a few weeks ago one of the company's locomotives drew a five-coach tube train—which had been suitably modified—from the latter station to High Barnet and back, with a view to testing its behaviour on the track, &c. Further, the G.N. Co.'s surveyors have been engaged in survey work which suggests the intention of constructing a short direct line between the siding and tube line. Our contemporary concludes: "These events seem to entitle us to look before long for important developments in relation to the Gt. Northern and City Railway."

Peterborough. — Sir A. Kennedy, the arbitrator appointed by the B. of T. to settle the price to be paid by the Peterborough Electric Traction Co. to the T.C. for electrical energy, has made his award. Sir A. Kennedy has fixed the price for five years from September 1st, 1907, at 2d. per unit for the first 120,000 units in each year, and 1½d. per unit for all energy beyond that quantity in each year. The arbitrator directs that the cost of the arbitration shall be paid by the Town Council, except the costs of three Peterborough witnesses called by the company.

Salford.—The annual report of the Salford Corporation Tramways shows that there was a decrease in the gross receipts amounting to £1,553 14s. The average receipts per car-mile were much less than the figure for the preceding 12 months. The reduction in receipts per car-mile amounted to ·60d., and represented a loss in earnings of approximately £14,463 13s. 5d. compared with the previous year. The net profits this year were only £17,263 17s. against £28,206 7s. 4d. The number of passengers carried was 45,975,584, an increase of 203,973; miles run 5,785,469, increase 299,319; average receipts per car-mile 9·84d. against 10·44d. The total length of tramways worked by the Corporation up to March 31st last was 75 miles; total electrical energy used for haulage, lighting of cars, &c., 9,258,774 units, an average consumption of 1·62 units per car-mile run. Salford has now 200 cars. Of the 40,271,518 tickets sold during the 12 months, 28,233,040 were of the value of a penny. Scholars' tickets sold were 97,547 of the value of a penny each. In addition 2,988,918 workmen's tickets were issued.

Tramway Competition.—At both the meetings of the Great Eastern and of the South-Eastern and Chatham Railways held last week, reference was made by the respective chairmen to the effects of tramway competition. In the case of the former line, it was announced that the decrease for 1909 below 1908 was only £409, as compared with a decrease of £4,390 in 1908 below 1907 (these figures presumably refer to London suburban traffic). Reductions in fares and increased facilities were being given to induce residential traffic from points beyond the zone of the tramways. The South-Eastern chairman said that to compete with the tramways would mean a very large capital outlay, and all the evidence showed that a proper and fair return on the outlay could not be obtained. The tramways depreciated the surrounding property and drove people further out, and for this outside traffic the managing committee were catering.

As a contrast to the above may be cited the reference in the Brighton meeting to the completion of the South London electrified route, which, by all accounts, should be running in a few days.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—In 1907 the system of aerial, subterranean, river and submarine telegraph lines increased by 278 km., of which 277 were aerial, to 6,991 km.; while the length of wires increased by 580 km., to 38,226 km. The number of offices was increased by 80, to 2,418, which were worked by 4,162 employés of all grades—an increase of 298 over the previous year; other employés numbered 5,390. Inland traffic numbered 3,641,229 messages, an increase of 19,097; international traffic consisted of 3,345,090 telegrams, an increase of 12,720; while transit telegrams numbered 537,614, an increase of 13,534, making the total number of messages handled 7,523,933, or an increase on the previous year of 45,351. International telegrams produced a revenue of 2,704,096 fr. Service telegrams numbered 12,615,700, an increase of 888,435. Inland traffic produced 2,090,431 fr., and, together with 308,318 fr. obtained from transit telegrams, the total revenue amounted to 5,684,310 fr., which also includes revenue from other sources. Expenses amounted to 8,758,805 fr. The capital account amounted to 64,566,947 fr.

The mileage of telephone wire increased by 18,767 km. to 173,244 km., and the exchanges from 182 to 196, while the subscribers numbered 28,946, an increase of 2,875 over 1906. International conversations produced 633,850 fr., and the revenue totalled 8,457,318 fr., or an increase of 715,302 fr. The combined revenues of the telegraph and telephone services exceeded combined expenses by 5,382,824 fr.—*Journal Télégraphique.*

New Cables.—The *Elektrotechnische Zeitschrift* states that the laying of the Emden-Teneriffe cable will soon be commenced, and that the Spanish Government is about to lay cables between Barcelona and Genes, and Carthagena and Oran.

Telegraphic Interruptions:—

Tangier-Cadiz	May 19, 1909
Assab-Perim	July 8, 1909

Wireless Telegraphy.—The wireless station at Trois Amis, San Fernando, Trinidad, has been completed, and it is said that trial messages have passed between it and the colony of British Guiana.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

New South Wales.—Telephone material for the P.M.G. See "Official Notices" July 23rd.

Ballinasloe.—September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Belgium.—The municipal authorities of Ramet-Yvoz (Province of Liége) are inviting tenders until the 9th inst., for the concession for the public and private electric lighting of the town.

Cleckheaton.—The U.D.C. wants tenders for the purchase of two battery regulating switches. See "Official Notices" July 30th.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" to-day.

France.—Paris.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

August 11th.—The Direction de la Manufacture d'Armes at Châtellerault (Vienne) requires tenders for cables, copper wire, and dynamo construction material (11 lots).

Germany.—Cologne.—August 25th. The Stadtisches Maschinenbauamt, Cologne, is inviting tenders until August 25th for the supply of four electrically-operated cranes.

Italy.—August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as from home makers for the supply of 100,000 metres of telegraph cable.

August 18th.—The Italian State Railway authorities in Rome are inviting tenders for the supply of six electrically-operated drop hammers.

Keighley.—August 7th. Two 1,000-kw. turbo-alternators with condensers, and two water-tube boilers for the electricity department. See "Official Notices" July 16th.

Leyton.—Tenders, to be considered early in September, are to be invited for 100 public lighting lanterns with clock switches, to complete the conversion of gas lamps in the district, also for wiring the extension of the public offices, now being erected.

London.—G.P.O.—August 9th. Creosoting telegraph poles for the P.M.G. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Battersea.—August 21st. The Council wants tenders for motors and controllers, d.c. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" to-day.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" to-day.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-kw. Diesel set and a 50-kw. steam dynamo. See "Official Notices" to-day.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Salford.—August 9th. The Corporation wants tenders for the purchase of a steam dynamo of 120 kw. See "Official Notices" July 30th.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

August 27th.—Tenders are invited by the Direccion General de Obras Publicas, at Madrid, for the taking-over of a concession for the building and working of a system of electric tramways in Barcelona. A deposit of 40,596 pesetas must accompany the tender.

Todmorden.—August 14th. The Corporation wants tenders for a 150-kw. steam dynamo, switchboard, condensers and piping, and pump. See "Official Notices" to-day.

Turkey.—The Ministry of Marine, in Constantinople, invites tenders for the supply of electrical apparatus for the Imperial fleet. Inquiries should be addressed to the Conseil de la Marine, Constantinople.—*B. of T. Journal.*

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Belgium.—Six concerns submitted tenders for the establishment of a central electric lighting station in the little town of Hollogne-aux-Pierres (Province of Liége), the lowest being that of the Société Electricité et Mecaniqué, of Charleroi.

Bradford.—The Board of Guardians has accepted the tender of the Easton Lift Co., Ltd., for the supply of brakes on two electric lifts, for the sum of £32 12s.

Canada.—The Colonial Engineering Co., Ltd., Montreal, has closed a contract with the Dominion Light, Heat and Power Co. for a 1,000-h.p. Hornsby-Stockport gas-engine equipment, to be installed in the City of Montreal for the purpose of public and private electric supply.

China.—According to *Commercial Intelligence*, the Eastern Trading Co., Ltd., has been selected out of 26 tenderers to erect modern electric lighting plant for the city of Nanking. Plant is to be supplied by Messrs. Bahcock & Wilcox and Messrs. Belliss and Morcom.

Eastbourne.—The T.C. has accepted the tender of Messrs. Lassen & Hjort, at £155, for water-softening plant. The engineer's estimate was £200.

Eccles.—The T.C. has accepted the tender of Messrs. Waring & Gillow, Ltd., of Manchester, for installing the electric light in the Corporation Road houses, at £48 15s.

France.—The French Post and Telegraph authorities have just given out contracts as follows:—La Compagnie Générale d'Electricité, of Paris, 60 tons of bronze wire, 1$\frac{1}{10}$ mm. diameter, at 2,820 francs per ton; 100 tons high conductivity copper wire, 2½ mm. diameter, at 2,090 francs per ton; and 100 tons ditto, at 2,092½ francs per ton. M. Grammont, of Pont du Cherny (Isère), 60 tons of bronze wire, at 2,800 francs per ton; 60 tons of copper wire, 2 mm. diameter, at 2,097½ francs per ton; and 100 tons ditto, 2½ mm. diameter, at 2,065 francs per ton. La Société des Tréfileries du Havre, 100 tons of bronze wire, at 2,825 francs per ton, and 600 tons of copper wire, at 2,090 francs per ton. La Compagnie Française des Métaux, of Paris, 200 tons of copper wire, at 2,080 francs per ton. La Société d'Electro-Métallurgique de Dives, 100 tons of copper wire, 3 mm. diameter, at 2,060 francs per ton; and 50 tons of annealed copper wire, at 2,090 francs per ton. La Société des Mines et Fonderies de Pontgibaud, 100 tons of copper wire, 3 mm. diameter, at 2,055 francs per ton. La Société des Forges de Franche-Comte, of Besançon, 100 tons ditto, at 2,050 francs per ton; and La Compagnie Française du Bi-Métal, of Paris, 100 tons of copper wire, 4 mm. diameter, at 2,040 francs per ton.

Glasgow.—The Tramway Committee on Works has recommended the acceptance of the following tenders:—Special track work, the Lorain Steel Co.; teak flitches, Brownlee & Co., Ltd.; scrubber blocks for rail grinder, Chas. Churchill & Co., Ltd.; speed indicators for rotary, Union Electric Co., Ltd.; copper rail bonds, the Lahmeyer Electrical Co., Ltd.; telephone cable, British Insulated & Helsby Cable Co.

Grimsby.—The T.C. has accepted the tender of Messrs. John Wilson & Co. for additional pipe-work in connection with the superheaters, at £21 10s.

Hanley.—The T.C. has accepted the offer of the Chloride Electrical Co. to maintain a secondary battery in full efficiency for ten years, at £5 per annum.

Ilford.—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for four tramway cars, at £561 each.

Japan.—In connection with the electric railway which is now being built between Osaka and Kyoto, the contract for the power station steam generating plant (according to the *Indian Textile Journal*) has been secured by Messrs. Babcock & Wilcox, Ltd. The boilers, which are six in number, are specially constructed to the specifications of the Kei-han Deski Tetsndo Kabushiki Kwaisha.

Leyton.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the electric light installation at Sybourn Street Schools, at £172 6s. 8d.

London.—St. Pancras.—The B.C. has received the following tenders for the annual supply of arc lamp carbons:—

William Geipel & Co.		£362	3	4
Sloan Electrical Co., Ltd,	(accepted)	382	1	8
H. G. Mayer & Co.		420	0	0
Crompton & Co., Ltd.		424	8	4
G. Branlik		452	5	0
Andrew & Snter		467	0	0
General Electric Co., Ltd.		498	0	0
Sirins-Werke (M. Seeck)		513	6	8
Ship Carbons, Ltd.		516	5	0
Siemens Bros. Dynamo Works, Ltd.		672	5	0
Piggott Electrical Co. (Smith Bros.)		758	0	0

Longton.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for engines and dynamos.

Luton.—The T.C. has accepted the tender of Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, for a 500-kw. steam engine and dynamo, at £2,370; and that of the Brush Electrical Engineering Co., Ltd., for condensing plant, at £780 10s.

Maidstone.—The T.C. received the following tenders for feeder cable:—

Union Electric Co.		£317	11	0
Western Electric Co.	(accepted)	397	0	0
Callender's Cable and Construction Co.		408	18	2
Henley's, Ltd.		412	0	0
Johnson & Phillips, Ltd.		412	0	0
B.I. & H. Cables, Ltd.		412	10	6
W. T. Glover & Co., Ltd.		414	17	0
Electrical Co.		424	10	9

Salford.—The Council has accepted the tender of Messrs. Harland, Bowden & Co., at £765, for re-wiring at the Royal Technical Institute.

South Africa.—Cape Town.—The Corporation has accepted the tender of Messrs. Pooley & Austen, of London, for the supply of 110 street-lamp fittings, at 16s. each f.o.b. The c.i.f. amount of this tender is £98 13s. 3d., while the delivery and other charges are estimated not to exceed £10, making a total of about £109.

West Bromwich.—The T.C. has accepted the tender of the Aron Electricity Meter Co, Ltd., for the repair of Aron meters for a year.

West Ham.—The Corporation received 12 tenders for the supply of six new tramcars, and accepted the following:—United Electric Car Co., Ltd., car bodies, £1,932; Brush Electrical Engineering Co., Ltd., electrical equipment, £1,161. An order has been placed with Mr. E. Peckham and the Anti-Magnolia Co., at £150, for the purchase of two trucks for the tramway undertaking and the purchase of the material for five others, these to be constructed at the car-sheds on payment of a royalty of £10 per truck to Mr. Peckham. The estimated cost of the seven trucks is £550.

NOTES.

Electrical Fatality.—On Saturday afternoon Edward M'Bride, aged 10 years, who resided with his parents at 10, Field Street, Birkenhead, met with his death on the Mersey Railway. He was playing with his companions when he strayed on to the line, and, coming into contact with the live rail, received a shock, which resulted in practically instant death.

Mining Explosion.—Some interesting revelations as to the manner in which electric apparatus is misused in some coal mines were made at a public inquiry held in Hamilton the other day. The inquiry was into the circumstances of an explosion which took place at Ferniegair colliery on June 27th last, when one man was killed, and two others so injured that they succumbed to their injuries three days later, in the Royal Infirmary, Glasgow. At the time of the explosion the deceased workmen were getting in readiness for the week's work an electrically-driven coal-cutting machine, and the inquiry chiefly centred upon what had caused the explosion. Mr. Nelson, of the Home Office, in giving evidence regarding a visit he had paid to the pit on July 1st, stated that he had previously learned that one of the deceased had been engaged in lengthening an electric cable, and that his visit bore out that idea. The workman had apparently disconnected a length and was in the act of joining two ends together when the explosion occurred. A spark would undoubtedly be caused at such a moment. For a pit in which safety lamps were used the design of the gate end box was very bad, no precaution being taken to have it enclosed and made perfectly gas tight. The plug connection was not suitable, and in his opinion the conditions at the colliery on the day of the explosion simply invited an explosion when gas made its appearance. The jury, in returning their verdict, expressed the opinion that a spark from the electric plant had ignited the gas and caused the explosion. They were also of opinion that whether or not the workmen were to blame in manipulating a "live" cable in the presence of gas, the employers were in fault in respect (1) that the examination by the acting fireman on the morning of the explosion had been perfunctory and insufficient to discover gas; (2) that the electric plant was not suitable for a fiery mine; and (3) that there was an absence of due inspection from time to time of the electric apparatus installed in the pit in question.

Swimming Gala.—The third Annual Swimming Gala of the County of London Electric Southern Athletic Club will take place (under A.S.A. laws) on Wednesday, September 15th, at the Wandsworth Baths. An interesting programme has been arranged, comprising club events, polo match, championship of the borough of Wandsworth, life-saving display (by ladies), and, as last year, an invitation team race, in which teams of four swimmers from electric supply companies and municipal electricity works are invited to compete. The invitation race was won last year by Richmond Electric, London Electric being second. In all seven teams competed. Teams wishing to enter should communicate with the hon. sec., Mr. H. Brown, Generating Station, The Causeway, Wandsworth, S.W., who will be pleased to forward any information desired.

Power Supply in the Transvaal.—A Johannesburg correspondent of the *Kolnische Zeitung*, in the course of an article dealing with the mines and electricity works in the Transvaal, sets forth the purely German point of view of the position, as compared with the standpoints assumed by the chairmen of the Victoria Falls and Transvaal Power Co., and at the same time gives some additional information. After stating that the establishment of a generating station at the Falls would at the outside serve local purposes later on, owing to the heavy loss in transmission, and that, moreover, coal in the Transvaal is so abundant and cheap that such long-distance transmission need not be considered, the correspondent refers to the beginning of activity of the Victoria Co., by the acquisition of the Rand Central Electric Works, at Brakpan, which was a company working with German capital, and the undertaking of the General Electric Power Co., which was created by the South African Goldfields Co. At the same time an agreement was entered into with the Vereeniging Estates Co., which owns large deposits of coal at the Vaal River, whereby the latter granted to the Victoria Co. the right to erect a new power station on its property in return for the transfer of a number of shares, and the assumption of the obligation to purchase a certain quantity of coal at definite prices. The Victoria Co. then seemed to be assured of a monopoly until a new factor arose by the sudden appearance of a Mr. Harper, who offered more favourable terms to the principal mining companies on the Rand, and secured certain contracts for the supply of power. Mr. Harper first turned to the Allgemeine Elektrizitäts Gesellschaft for the financing of his contracts, which was already largely interested in the Victoria Co., and with the assistance of the former company, he formed the Rand Mines Power Supply Co., which took over the Harper contracts. There were thus two companies which, however, in the meantime have united in the sense that both have the same technical management and administration, and only possess separate boards of directors. After referring to the existing power stations and the works in progress, it is mentioned that the A.E.G. is the general contractor for the whole of the latter, and that the participation of German capital amounts to about 62 per cent. of the total capital. Prof. Klingenberg, of Charlottenburg, is the consulting adviser of both companies. The Rand Mines Power Supply Co. proposes to erect on the Rosherville dam, which is 6·2 miles distant from Johannesburg in an easterly direction, a central station which, in addition to a power transmission at 50,000 volts, will be supplemented by an air compressing station and a network of tubes to all the mines, in order to meet the requirements provided for under the Harper contracts. These installations will also be furnished by the A.E.G. The turbines to be provided are to be of 10,000 H.P., and the Rateau centrifugal air compressors are to be partly driven by steam and partly by electric motors. The Siemens-Schuckert Works Co. is also interested in these installations, whilst the A.E.G. will deliver all the motors, transformers and cables; the Lanchhammer Co. will supply the steel work, and the British Babcock & Wilcox Co. the boilers. The distribution from the Rand Mines Co.'s station will be by means of underground cables at 20,000 volts, and the contracts mainly concern the Rand mines and the Eckstein group, whilst the Victoria Co.'s contracts are with the Goldfields group, Barnato Bros., the General Mining Co., S. Neumann, and some of the Goerz mines. The charges to the end of 1910 amount to ·75d. per KW.-hour, ·5617d. to 1912, and ·525d. per KW.-hour subsequently, and the mining companies estimate that by the use of electric power they will be able to effect an economy of from 8d. to 1s. per ton of ore produced.

Electricity in Mines.—In his report on the southern mining district for 1908, the inspector (Mr. J. S. Martin), dealing with the use of electricity in mines, remarks that rapid strides are being made in the adoption of electricity in mines throughout the district of Cornwall, Gloucestershire (Bristol and the Forest of Dean), Kent, Monmouthshire and Somerset. It is used for pumping, haulage, and the working of coal cutters. According to the *Iron and Coal Trades Review*, in which the report is abstracted, he does not recommend the working of electric coal-cutting machinery at the working face in the fiery mines of Monmouthshire, but favours the use of air compressors underground as far in-bye in the in-take airway as it may be safe to work electrically, to supply compressed air to the coal-cutters at the face.

Electro-Metallurgy.—It is announced that the Gotthardwerke, Gesellschaft für Elektro-chemische Industrie, of Bodio, in the Canton of Tessin, which was formed in January, 1908, with the co-operation of German and Swiss firms for the purpose of producing high percentage ferro-silicon, will have its plant in full operation in November. The company utilises for the greater part the water-power works of the Biaschina of a capacity of 30,000 H.P., which were erected by the Aktiengesellschaft Motor, of Baden, one of the founders of the undertaking. A syndicate is said to exist in Paris for the sale of ferro-silicon, but the Swiss company is not a constituent of it, and its output will be disposed of by the firm of L Weil and Rheinhardt, of Mannheim, which also participated in the formation of the company.

The German Electrical Industry.—A slight improvement is reported to have recently taken place in the condition of trade in Germany. If this is actually the case, it represents a change from the situation recorded some months ago, when orders were eagerly sought for, and even the large firms entered into keen competition for such small contracts as domestic installations, &c. This was the result of the unfavourable course of the trade in general, combined with the fact that manufacturing firms had largely extended their productive capacity in expectation of Government orders in connection with high-speed electric railways, or in the hope of the rapid realisation of city railway schemes. But the orders for railway conversion failed to make their appearance, in consequence of fiscal considerations, the weak financial situation and the cautious attitude of the States on the one hand, and owing to the rivalry of the town authorities interested in the projects for city railways on the other. In the circircumstances the establishment of electrical financial banks has not accomplished its purpose, as neither Government nor municipal schemes have become ripe for financing, and the preparation of projects for country central stations offered a basis that was too inconsiderable, or was designedly postponed in order to await the progress of the extensive co-operative central station movement. Thus, the two electrical banks, whose scope will in future be hampered by the coupon tax and the tax on securities, have not yet been able to carry out a single transaction. These circumstances have rendered it necessary for the large works to secure orders with the object of keeping their thousands of workmen employed, but this has only been accomplished at a sacrifice in prices, and although these firms have reserve funds and auxiliary branches, the effect of the competition to obtain work will be specially reflected in the balance-sheets of the smaller firms. The condition of prices reached such a low level as could only be compared with 1901, which was the worst year of depression in the electrical industry. But during the past few weeks an improvement has been recorded, particularly in an increase in the orders placed by the mining and iron and steel trades, which are proceeding to install new plant. If the demand continues and expands, it is expected that prices will also become firmer, although progress will only take place slowly.

An 11,200-H.P. Turbo-Alternator.—A large steam turbine set of this output has recently been built by Messrs. Brown, Boveri & Co., for Buenos Ayres. The machine runs at 750-R.P.M., and consists of a Parsons type turbine with two three-phase generators for 7,500 KW. (8,350 K.V.A.), at 12,000—13,000 volts and 25 cycles, and for 8,825 K.V.A. at 12,500 volts and 50 cycles respectively, and a direct-coupled 110-KW. 220-volt exciter. The set can be overloaded to 14,200 H.P. for two hours. A surface condenser is used, and the steam is superheated to 300° C. The steam pressure is 176 lb. per sq. in. With cooling water at 15° C., the steam consumption is guaranteed at 14 lb. per KW.-hour, at a load of 7,500 KW. The condenser has a cooling surface of 13,800 sq. ft., and, with a sufficient supply of cooling water at 15° C., it can deal with 110,000 lb. of steam per hour, and produce a 95 per cent. vacuum. Even with cooling water at 25° C. it can give a 91 per cent. vacuum. The weight of the complete set, including the condenser, is 475 tons.

The turbine is divided into two cylinders with bearings between. This arrangement enables an especially large number of sets of blades to be used, arranged on the Parsons principle, thus ensuring a high efficiency, and, further, the high-temperature steam is confined to the comparatively small high-pressure compartment, and serious temperature deformation is avoided. Steam is admitted by two pipes to the regulating double-seated inlet valve at the top. This is operated by the compressed oil used for the lubricating system, instead of by steam, as has been usual in Parsons turbines. Consequently, any failure in the lubricating arrangements automatically cuts off the steam supply.

The spring governor, which controls a relay attached to the inlet valve, is mounted on the same vertical spindle which operates the oil pumps, and is driven by worm gear. The same spindle also carries the emergency governor, which comes into operation if the speed exceeds the normal by 15 per cent., and closes the main inlet valve. A second oil pump driven from the same worm gear works in parallel with the first, and both drive the oil under a pressure of 22 lb. per sq. in., through a cooler, to the bearings. The turbine spindles consist of steel cylinders, into which the journals with cast-steel spiders are forced and held by a bayonet joint. In order to ensure quick and uniform heating of these journals, heating chambers are provided, connected with the high-pressure steam. The two parts of the turbine spindle are connected by a flexible claw-coupling.

Both the stationary armature and the cylindrical rotating magnet are liberally provided with ventilating gaps. The cool air is driven through the machine from both ends by means of fans carried on the turbine spindle. The magnet core is formed of steel plates with radial slots, in which the flat copper winding is held by metal wedges in such a way that the centrifugal force acts on the flat sides, and no shifting can, therefore, take place. The ends of the magnet winding are held in by specially strong non-magnetic metal caps. Each generator can stand an overload of 25 per cent. for half an hour. The weight of one generator (7,500 KW.) without bearings or base plate is 73 4 tons—the armature being 48 1 tons, and the magnets 25·3 tons.

The Buenos Ayres central station, for which this set is intended, will eventually contain 10 Parsons turbo-sets of 11,200 H.P. each. Five of these are already on order, the above-described machine being one of them, and the remaining four being each fitted with a single three-phase generator of 7,500 KW. normal, or 9,000 KW. maximum output.

Bills Advanced.—On Wednesday last week, in the House of Lords, the London County Council (Tramways and Improvements) Bill was read a third time and passed.

On Friday, in the House of Commons, the Lords' amendments to the Central London Railway Bill were agreed to.

On Monday, in the House of Commons, the Lords' amendments to the Holywood Tramways and London County Council (Tramways and Improvements) Bills were agreed to, and the Barry Railway, Gateshead and District Tramways, and the West Kent Electric Power Bills were read a third time.

Educational.—King's College, London University. The new session commences on October 6th; particulars are given in our "Official Notices" to-day.

Appointment Vacant.—Llandilo.—Charge engineer for the U.D.C. See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Engineers.—MR. CHAS. T. LINNEY, manager and resident engineer of the Kent Electric Power Co., was recently the recipient of a silver salver and silver cigarette case, as a token of esteem and goodwill from the directors, staff and employés of the company, on the occasion of his leaving the company's service.

MR. ALBERT GAY, electrical engineer of Islington, has been appointed President of the Associated Municipal Electrical Engineers (Greater London) for the year 1909-10.

General.—In connection with the amalgamation of the Moss Bay Hematite Iron and Steel Co., Ltd., of Workington, the Workington Iron Co., Ltd., the Harrington Iron and Coal Co., Ltd., and Messrs. Cammell, Laird & Co.'s West Cumberland interests, MR. N. G. BARRACLOUGH has been appointed chief electrical engineer to the syndicate. For the past 4½ years Mr. Barraclough has been engaged as electrical engineer to the Moss Bay Iron and Steel Co., prior to which he was on the electrical staff of the National Boiler and General Insurance Co., Ltd., Manchester.

MR. GERALD HOOGHWINKEL, M.I.E.E., M.I.Min. and Metallurgy, will shortly leave England for Mexico on professional business, and intends to study the openings for British enterprise in that country with reference to contracts for public works. He would also be willing to take charge of special interests which might be entrusted to him.

MR. BEN. BAILEY has resigned his position with the "Z" Electric Lamp Co. to join Messrs. J. & H. Grevener, of Eldon Street House, E.C., as engineer and manager of their arc lamp department.

NEW COMPANIES REGISTERED.

Sylverlyte (1909), Ltd. (104,237).—This company was registered on July 24th, with capital £200,000 in £1 shares, to acquire any inventions relating to electric and other lamps, or any lenses, reflectors or other component parts or accessories for use in connection therewith, in particular to acquire patents No. 5,191 of 1904, and 10,696 in 1908, granted for the United Kingdom in respect of inventions relating to improvements in lenses and the benefit of foreign and colonial patents, granted or applied for in connection therewith, also to acquire the business and assets (except cash in band) of the Sylverlyte Electric Lamp Co., Ltd., and to carry on the business of manufacturers of and dealers in lamps, reflectors, lenses and other articles, lense makers, electricians, opticians, glass blowers, engineers, manufacturers of and dealers in brackets, globes, films, shades, glasses, burners, meters, galvanometers, motors, batteries, wires, voltmeters, carbons, switches, insulators, &c. The subscribers are :—A. E. Berthoud, 9, Moorgate Street, E.C., merchant, 250 shares; J. S. Burns, Field Inn Lane, Pinner, managing director, 250 shares; T. E. Dickinson, 2, Copthall Buildings, E.C., Member of Stock Exchange, 250 shares; H. Harker, 102, Upper Thames Street, E.C., merchant, 250 shares; S. F. Rumball, Copthall House, Copthall Avenue, E.C., Member of Stock Exchange, 250 shares; F. P. Baxer, 13, Sise Lane, Queen Victoria Street, E.C., accountant, 1 share; A. H. Skan, 4, Copthall Chambers, E.C., solicitor, 1 share. Minimum cash subscription 50,000 shares; the number of directors is not to be less than three or more than nine; the first are A. E. Berthoud, J. S. Burns, T. E. Dickinson, H. Harker, and S. F. Rumball; qualification, 250 shares; remuneration, £50 each per annum (chairman £100) and 10 per cent. of the distributed profits, divisible. Registered office, 13, Sise Lane, Queen Victoria Street, E.C.

Alba Lamp Syndicate, Ltd. (104,342).—This company was registered on July 29th, with a capital of £3,000 in 2,925 preferred ordinary shares of £1 each and 3,000 deferred ordinary shares of 6d. each, to acquire the benefit of and develop and turn to account a certain existing invention relating to a central reflector electric lamp. The subscribers (with one share each) are:—S. Fawns, 150, Finsbury Pavement House, E.C., consulting engineer; A. E. McCracken, 40, Ferreshaw Road, Chelsea, S.W., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are S. Fawns (chairman), and A. E. McCracken; qualification, £2 10s. deferred ordinary shares; remuneration of chairman, £75 per annum; of ordinary directors, £50 each per annum. Registered office, 149-150, Finsbury Pavement House, E.C.

Barbados Electric Supply Corporation, Ltd. (104,367).—This company was registered on July 30th, with a capital of £60,000 in £1 shares (40,000 7 per cent. preferred and participating), to adopt agreements with the Anglo-American Debenture Corporation, Ltd., and to carry on the business of electricians, mechanical engineers, suppliers of electric, water and other power, manufacturers of, and dealers in, apparatus used in connection with the generation, supply, utilisation and distribution of electricity, &c. The subscribers (with one share each) are:—A. J. Brough, Torrington House, 182, Albion Road, Stoke Newington, N., accountant; L. Willoughby, Merstham, Surrey, registrar; M. H. Hearn, Hillview, Lanercost Road, Tulse Hill, S.W., clerk; R. Saward, The Hut, Woldingham, Surrey, clerk; W. J. Simpson, 35, King's Road, Willesden Green, N.W., clerk; F. Hopton, 46, Westbourne Road, Forest Hill, S.E., clerk; A. H. Coneybeare, 13, Alverstone Avenue, Wimbledon Park, S.W., clerk. Minimum cash subscription, 10 per cent. of the share capital offered. The number of directors is not to be less than two or more than seven; the first are Col. W. F. Leese, 23, Powis Square, W., and G. H. J. Hooghwinkel, 41, Chepstow Villas, Bayswater, W. So long as the Anglo-American Debenture Corporation, Ltd., hold 5,000 fully-paid ordinary shares they may nominate two directors; remuneration, £100 each per annum (chairman, £150). Registered office, 24, Martin's Lane, E.C.

Alfred Wiseman, Ltd. (104,365).—This company was registered on July 30th, with a capital of £15,000 in £1 shares, to take over the business of an iron and general metal founder, engineer, electric and tramway equipment and weighing apparatus specialist, manufacturer, &c., carried on by A. Wiseman at Venus Works, and Globe Works, Glover Street, Birmingham, as "Alfred Wisemen," the "Electric Tramway Equipment Co.," "S. C. Parkes and Co.," and "F. & J. Allen." The subscribers (with one share each) are:—A. Wiseman, 89, Glover Street, Birmingham, engineer; J. W. Harris, The Laburnums, Bilston, engineer. Private company. The number of directors is not to be more than five; the first are A. Wiseman and J. W. Harris (both permanent); qualification (except governing director), £100; remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

"Electrical Engineer," Ltd. (104,347).—This company was registered on July 29th, with a capital of £1,500 in 1,425 preferred ordinary shares of £1 each and 1,500 deferred shares of 1s. each, to acquire the rights and property in connection with the newspaper or periodical known as the *Electrical Engineer*, to adopt an agreement with C. S. Sarle, and to carry on the business of newspaper and magazine proprietors and general printers and publishers, advertising agents, &c. The subscribers (with one ordinary share each) are:—C. S. Sarle, 38, The Avenue, Brondesbury Park, N.W., journalist; G. Cadogan-Rothery, 5, Fetter-lane, E.C., journalist. Private company. The number of directors is not to be more than five; the first are H. A. Gwyne, G. Cadogan-Rothery and C. S. Sarle; remuneration as fixed by the company. Registered office, 149, Fleet Street, E.C.

Traction Supplies Co., Ltd. (104,338).—This company was registered on July 28th with a capital of £5,000 in £1 shares, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in fittings and accessories used in connection with electric traction, lighting or heating, &c., and to adopt an agreement with W. C. Thompson, W. M. Scott and A. White. The subscribers (with one share each) are:—W. C. Thompson, Grange House, Stockton Road, Sunderland, draper; W. M. Scott, 3, The Oaks, Sunderland, draper; A. White, 4, Eden Vale, Sunderland, electrical engineer. Private company. The number of directors is not to be less than three or more than seven; the first are W. C. Thompson, W. M. Scott and A. White; qualification, £50. Registered office, Gill Bridge Avenue, Sunderland.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd. (49,784).—Trust deed dated May 17th, 1909, supplemental to deed of October 31st, 1908, and modifying same for purpose of converting £60,000 debentures thereby secured into debenture stock, charged on the company's freehold and other property, present and future, including uncalled capital. Holders: Trustees, Executors and Securities Insurance Corporation, Ltd.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on July 12th of £100 debentures, part of a series of which particulars have already been filed.

County of London Electric Supply Co., Ltd. (34,320).—Particulars of £500,000 first debenture stock, created by resolutions of various dates from January 23rd, 1899, to June 28th, 1909, and secured by trust deeds dated January 23rd, 1899, and July 5th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100,000. Property charged: The company's undertaking and property, present and future. Trustees: Electric and General Investment Co., Ltd.

Hart Accumulator Co., Ltd. (60,059).—Mortgage dated July 15th, 1909, to secure £4,500 and 4 per cent. interest, charged on lands and premises at Stratford. Holders; G. A. Smith, H. A. Smith and F. Smith.

CITY NOTES.

Dublin United Tramways Co.

THE ordinary half-yearly meeting of the company was held in Dublin, on July 27th, Mr. W. M. Murphy presiding.

The CHAIRMAN, in moving the adoption of the report, said it would be seen that the receipts from passenger traffic were £347 less than in the corresponding half-year of 1908, which was more than accounted for by the extra day in leap year. A service of express cars had been instituted on the Dalkey line, which was much appreciated by residents of Blackrock and districts beyond, and it was intended to apply for powers to increase the speed on the line. "Other receipts" had increased by £750 and were made up principally of £630 parcel traffic, of which £441 was collected from passengers carrying parcels with them—a source of revenue which yielded about £1,000 a year to the company. On the expenditure side, working and general expenses were £3,420 less than in the corresponding half-year of 1908. The cost of generating and distributing energy had been reduced from ·402d. to ·366d. per unit; the decrease in maintenance costs, he attributed to the general use of steel tired wheels.

MR. C. LEHANE drew attention to the increasing taxation; between taxation, wayleaves, and income-tax, the company paid, he said, roughly £35,000 a year, while on ordinary dividends it paid its shareholders about £36,000 a year, or practically the same amount. A resolution was passed authorising the payment of a 6 per cent. dividend on the ordinary shares; £7,501 is carried forward, being £1,006 more than was carried forward in 1908.

Scottish Boiler Insurance and Engine Inspection Co., Ltd.—An interim dividend of 2s. per share, free of income-tax, on the ordinary shares for the past half-year is announced.

City of London Electric Lighting Co., Ltd.—A dividend on account of the year 1909 on the ordinary shares of 5s. per share, less income-tax, has been declared, being the same as declared last year.

Metropolitan Electric Supply Co., Ltd.—The directors have declared an interim dividend of 5 per cent., less income-tax, on the ordinary shares for the past half-year, the same as last year.

Straits Settlements (Bertam) Rubber Co.—Dividend of 4½ per cent.; £1,036 carried forward.

Anglo-American Telegraph Co., Ltd.

The half-yearly meeting of the proprietors of the Anglo-American Telegraph Co., Ltd., was held on Friday, July 30th, at Winchester House, E.C., under the chairmanship of Mr. F. A. Bevan.

In moving the adoption of the report (see Electrical Review, July 30th, page 189), the Chairman said he had to congratulate the shareholders upon the increase in their receipts during the past half-year, as compared with the corresponding period of 1908. The receipts had increased by £14,500, and the receipts of the ss. *Minia* had increased by about £3,000, making a total increase of £17,500. The expenses, on the other hand, had decreased by £950. As, however, they brought forward a smaller balance, the net result was that the increase available for distribution was £17,451 12s. 8d. If they looked at the report and accounts up to the end of June, 1908, they would find that in that statement a diminution of £17,500 was shown, so that, in the past year, they had made up what they had lost in the previous year. The increase was due to general business, and especially to receipts from stock business messages, which business was the invention of their general business manager, and had proved a very fruitful source of income. There seemed to be generally an improved condition of things with the trade between this country and the United States, and therefore they might hope, so far as they could see, that they would have good results during the next half-year at least. The renewal fund had also increased during the year by £21,380, although they had had to debit that fund with £13,000 special repairs, with £5,700 general repairs, and with £15,250 on account of the repairs to the 1874 cable. They heard at the last half-yearly meeting that their cable was broken, and owing to the wintry weather it was impossible for them to undertake any operation at the time for repairing the fault. They had been most unfortunate with the weather ever since, and it was still bad, and he regretted to say that up to the present they had not been able to complete the repair of the cable. They hoped, however, in a short time to get on to rather shallower ground where the cable had a good bottom instead of a bad bottom where up to now they had been operating. They would have to debit the renewal fund with some more money during the current year on account of that cable, and they could not say what the total cost would be until the repair to the cable had been completed. So far as they could see, the breakages to the cable on the western side of Ireland were mainly due to the reckless conduct of fishing trawlers who carried on their operations where the cables were known to be laid, and up to the present they had used some 400 miles of cable in repairing cables on the north-west side of Ireland. Only within the last few days they had received a letter from the secretary of Lloyd's, stating that a trawler had picked up 75 fathoms of telegraphic cable whilst fishing 35 miles from the coast, and this proved to be one of their old cables, either the 1865 or the 1866 cable. As they knew, a Committee, representing the Board of Trade, the Admiralty and the Fishery Boards, inquired into the question of breakages of cables by trawlers, and at that inquiry the cable companies proposed that the trawlers should be prohibited in the shallow waters of the Irish coast where cables were known to be laid. The Committee, however, would not agree to this, but as an alternative, recommended that the trawlers should be examined by Government officials. The fact that they had heard of this picking-up of the cable showed that the provisions made were not sufficient. They had informed the Post Office of this fact, and they hoped it would lead to more stringent regulations being adopted in regard to trawlers. With reference to their renewal fund, it would be remembered that some time ago he stated, when they set aside £90,000 against depreciation of their securities, that he did not consider it likely there would be any appreciation for some time to come. The appreciation up to the present had amounted to about £13,000. With regard to the suggestion for reducing rates, the companies in the Atlantic were not disposed to make any reduction at present, as far as Press rates were concerned, for there was no room for it. Suggestions had been made for reducing the rates for social messages, and there might be something put before them by the Post Office in that direction. All he could say was that they might be quite certain that whatever the result of the agitation, the directors would consider the interests of the shareholders, as well as the interests of the public. They wished to give the public the best possible service at the lowest possible cost, but at the same time they had to consider the interests of the shareholders, and they did not see at present that there was room for much reduction.

Sir Gerald Fitzgerald seconded the motion, and the report was adopted.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, as last year, free of income-tax, for the half-year ending June 30th last, both payable September 1st.

Mumbles Railway and Pier Co.—The report for the half-year ended June states that after payment of dividends due to the Swansea and Mumbles Railways under the agreement of 1898, there is an available balance of £1,986. The directors recommend a dividend at the rate of 6½ per cent., leaving £89 to carry forward.

Kepitigalla Rubber Estates.—There is a balance of £10,950 after providing £2,500 towards preliminary expenses. No dividend is recommended until the question of additional capital is settled

South American Light and Power Co., Ltd.—The report for the year ended March 31st last, to be presented to the meeting to be held on the 10th inst., states that the net profit for the year, after writing off a further sum of £550 against the cost of the dynamo, is £5,274, which, added to £147, the amount brought forward, makes the total sum available £5,422. The directors recommend the payment of a dividend of 4 per cent. and also the payment of interest at the rate of 4 per cent. per annum on the £15,961, further capital expenditure incurred during the year by the railway company, which interest amounts to £274. There will remain a balance of £627 to be carried forward. The above-mentioned capital expenditure will be satisfied by a cash payment of £461 and the allotment of 15,500 shares fully paid to the Bahia Blanca and North-Western Railway Co., Ltd., making the total amount of share capital issued £128,500. The 50 per cent. of the gross receipts payable to this company under its agreement with the Bahia Blanca and North-Western Railway Co. for the past year amounted to £12,991, against £8,889 in the previous year, showing an increase of 46 per cent. The directors consider that the increase in the business during the past year has again been very satisfactory. In accordance with the terms of the working agreement between this company and the Bahia Blanca and North-Western Railway, the latter having subscribed for £30,000 of the capital of the company were entitled to appoint a second director to the board, and therefore on September 23rd, 1908, they appointed Mr. Frederick Oldershaw Smithers in the place of Mr. Charles Murray Wilkins, resigned.

Singapore Electric Tramways, Ltd.—The report for 1908 shows an excess of revenue over expenditure of £24,294, against which has been charged debenture interest, depreciation and royalty, amounting to £28,335, showing a loss for the year of £4,040. The severe depression in trade in Singapore showed no abatement during 1908, and as a consequence the tramway revenue shows a decrease of $20,176 as compared with 1907. The demand for energy for lighting and power purposes shows a satisfactory increase—the receipts from this source in 1908 being 94 per cent. higher than in 1907. The new bridge over the Singapore River is still not completed, and it will be some months before plate-laying can commence on it, and so enable the company to link up section 6 and section 3 of the tramways. Work in connection with the new wet dock and the deviation of Keppel Road necessitated thereby is proceeding satisfactorily, and it is expected that the construction of the tramway on the new road will commence before the end of the year.

Stock Exchange Notice.—Applications have been made to the Stock Exchange Committee to appoint a special settling day in and to grant a quotation to the following securities, and to allow them to be quoted in the Official List:—

Chiswick Electricity Corporation, Ltd.—£80,000 4½ per cent. first mortgage debenture stock.

Anglo-Argentine Tramways Co., Ltd.—640,000 5 per cent. cumulative first preference shares of £5 each, fully paid, Nos. 1 to 640,000; 500,000 5 per cent. cumulative second preference shares of £5 each, fully paid, Nos. 800,001 to 1,300,000; and £1,733,380 4½ per cent. debenture stock, in lieu of the first, second and third preference shares now quoted.

National Boiler and General Insurance Co., Ltd.—The directors propose a dividend on 15,000 shares, at the rate of 6s. per share, free of income-tax, for the half-year ended June 30th, 1909, requiring £4,500; bonus of 2s. per share, £1,500; to add to current risk and reserve fund, £9,000; to write off furniture, fittings and instruments account, £500; balance to carry forward, £6,865; total, £22,364.

Chilian Electric Tramways and Lighting Co., Ltd.—The report for 1908, presented to the meeting yesterday, shows a credit balance of £8,832, which, with £1,712 brought forward, makes a net balance of £10,545. From this sum £8,000 has been transferred to renewals reserve account, leaving £2,545 to be carried forward. The Chilian currency has suffered still further depreciation in 1908, the rate of exchange being on an average about $9\frac{11}{16}$d. per peso (at one time falling as low as $7\frac{3}{4}$d.), and adversely affected the profits earned. The company has carried 68,342,366 tramway passengers, earning $5,696,868, as against 61,451,234 passengers, earning $5,011,363 in 1907. The receipts for light and power during 1908 amounted to $3,681,118, as against $2,658,254 in 1907, showing a satisfactory development in this department. It is hoped shortly to be able to meet all demands that may be made upon the company's power and lighting plant, with the advent of hydraulic power—the installation of which is nearing completion.

Stratford-on-Avon Electric Light Co.—The second ordinary meeting was held on Wednesday, last week, Mr. G. M. Bird presiding. In moving the adoption of the report, the chairman referred to the satisfactory progress being made; the works had only been in operation 20 months, so they could scarcely expect to be able to distribute anything in that time. During the year they had instituted a system of rented wiring, which had proved a good thing for the company; for the six months to July, 1909, as against the corresponding six months, they had added some 30 consumers, and sold 11,571 additional units, which meant £178 added revenue. After some discussion, the report was adopted, and Mr. G. M. Bird was re-elected a director; Mr. J. McGregor was also elected, in place of Mr. Paterson.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—The directors announce that the question of the payment of a dividend on the preference shares is deferred until the accounts for the whole year are in their hands.

Lancashire Power Construction Co., Ltd.

The directors report that in accordance with the resolutions passed at an extraordinary general meeting of shareholders held on November 11th, 1908, and confirmed on November 26th, 1908, an issue of £150,000 5 per cent. first mortgage debenture stock was made in November last, and was fully subscribed. Of this sum £61,500 was required to discharge the commitments of the company, leaving a balance of £88,500 available for developing the business of the Parliamentary company of which this company is the sole proprietor. It was only in the autumn of last year that the present board (comprising three members of the old board) was constituted and took up the active management of the company's affairs, the *personnel* of the board of this and the Parliamentary company being now identical. The period, therefore, covered by this report has been one of re-organisation, the first results of which will only become apparent during the course of the current year's work. With regard to the Parliamentary company: The plant at the generating station, and in the sub-stations, has been maintained in good condition, and, together with the mains, is proving itself reliable in operation. Some difficulty has, however, been experienced under certain conditions in maintaining an adequate draught for the boilers, and an induced draught installation has been ordered and is now in course of erection, which will doubtless entirely overcome this trouble. Various extensions of the mains have been made in order to supply new power users, the most important being an overhead line of over three miles in length to Turton. This and all other extensions to the mains have been carried out by the company's own staff. The board are able to report that the restrictions impossd in the earlier days of the company on overhead high-tension lines have now been largely removed, and the company has succeeded in negotiating wayleaves on reasonable terms for nearly all the important extensions which have recently been desirable, the cost of carrying out such extensions being greatly reduced thereby. As regards the prospects of the company, there is a very marked improvement. The Board of Trade have given their assent to the transfer of a large number of electric lighting orders from various local authorities to the Parliamentary company, thereby indicating that their confidence in the stability of that company has been re-established. Several contracts of considerable magnitude have recently been received for the supply of electrical energy, and although the full benefit of these contracts will not be felt until the year 1910, they will substantially add to the current year's revenue. At the close of the period covered by the accounts, 5,960 H.P. had been connected with the company's mains out of a total capacity of 12 000 H.P. Since then a considerable number of additional orders have been secured, and at June 30th, 1909, approximately, 6,590 H.P. was connected with the mains, besides a further 1,160 H.P. arranged for, but not yet connected. One of the chief objects of the directors in their capacity as the board of the Parliamentary company has been to arrive at an agreement with the Radcliffe Council whereby the company should supply large power users whose power requirements are too extensive for the Council to deal with from their own generating station, and protracted negotiations, having this object in view, have taken place with the Council. No agreement has, however, yet been reached. The directors are, nevertheless, hopeful that having regard to the undoubted advantage which such an arrangement would confer upon the district, a satisfactory agreement may yet be come to. Messrs. Callender and Carolan are the retiring directors, and offer themselves for re-election.

Mr. H. F. Parshall (chairman) presided over the annual meeting of the Lancashire Electric Power Co. and of its affiliated company, the Lancashire Power Construction Co., Ltd., at Salisbury House, E.C., on July 29th.

In moving the adoption of the report, the Chairman said the reorganisation of the company was not completed till the end of 1908, so that the new directorate had only been in existence for a period of six months. Matters were very much at a standstill until the financial position of the company was put on a proper basis, but, since the reorganisation, steady progress had been made, and more satisfactory contracts had been entered into now that it has been realised that the company was in a strong financial position. He was pleased to say that the B. of T. had sanctioned the transfer from the local authorities to the company of a considerable number of lighting orders. These lighting orders were a valuable asset to the Lancashire Co., in that the districts were in general along the trunk mains of the company, and, in consequence, a supply of electricity could be given with comparatively small capital outlay. One of the most satisfactory developments was in connection with the supply of electric power to collieries. It was thought that the business of the Lancashire Co. would be largely confined to cotton mills, but, as a matter of fact, a number of collieries were finding it to their advantage to take a supply of electricity from the power company, and it was anticipated that the business of the company would show considerable development in this direction in the future. During the last six months the output had increased something like 30 per cent., while the total costs of production were actually less than those of the corresponding period of last year, the revenue increase being £1,500. This was especially satisfactory considering the great depression in trade in the Lancashire district during the last 12 or 15 months, and the satisfactory increase was to be accounted for by the fact that the advantages of the company's supply were getting to be better understood by the Lancashire manufacturers. Many of the customers of the company, after a thorough trial, had decided to complete the electrical equipment of their works. There appeared to be a growing feeling of confidence in the districts generally. Various improvements were being carried out in the power station, and economies effected in the cost of generation, and new connections, were of a satisfactory nature. The policy of the board had been, first, to reduce the loss on working, and, secondly, only to expend money when there was a certainty of such an expenditure bringing additional revenue. During the year a L.G.B. inquiry was held at Radcliffe, the local authority in whose district the power station was situated. The attitude taken up by the L.G.B. was to discourage the development of the Radcliffe Urban District undertaking for the purposes of power generation, and a recommendation was made to the effect that the position of their company should be taken into consideration by the Radcliffe authorities. Radcliffe was practically the only local authority with which the Lancashire company was not on the best of terms. Having regard to the advantages of a power scheme in such a district, the position taken up by the Radcliffe Council was impossible to understand. The directors had many times met the Radcliffe authorities with a view to arriving at a better understanding, but their efforts had so far met with no encouragement. For this reason, it had appeared to the directors advisable to apply to the B. of T. for an order to supply electricity in the Radcliffe district. There were most important customers in this district who were willing to deal with this company, and it was hoped that this phase of the business might take a satisfactory turn, especially considering the attitude of the Board of Trade in respect to such matters, as evidenced by the Bill they were supporting. The board and the management had worked together in complete harmony and with a single object in view, namely, to leave no stone unturned to secure the success of the undertaking.

Sir R. A. Hampson, in seconding the motion, congratulated the shareholders upon the distinct change for the better which had taken place since the reorganisation of the concern last autumn. It was a change for the better as regarded their credit with the Board of Trade, their relations with the local authorities, and in connection with the applications for new business which were going on month by month. Of course, the results would not be shown until they were in a position to present the next annual report, as the new organisation did not take complete effect until a very late period in 1908. The board had every confidence that with the increased connection which were now being made, month by month, and the improved position of the company generally which had resulted from their being in a position to discharge all liabilities and leave them nearly £90,000 for the purpose of extending the business, their efforts in a reasonably short time would be crowned with success. At all events, they would be in a position next year to present a report and accounts which they believed would give satisfaction to all concerned.

The report was adopted without discussion and the retiring directors re-elected.

Rio de Janeiro Tramway, Light and Power Co., Ltd.

The report for 1908, to be presented at the annual meeting to be held to-day, states (according to the *Financial Times*) that the hydro-electric plant at Rio das Lages is practically finished. The large dam was finished and the reservoir completely filled before the end of the year, since which time the water has been flowing over the dam, as the flow in the river has been sufficient to supply all the power required without drawing upon the reserve in the reservoir. The transmission lines have been completed, and an independent telephone line constructed during the year, connecting the power house at Rio das Lages with the terminal station at Rio de Janeiro. The terminal station building has been finished, and the electrical equipment has all been installed and is now in regular use, and there remains to be done only the adjustment of this apparatus and the completion of the wiring about the station. Three 800-KW. motor-generators have been installed for the tramway service, and the sub-foundations and other preliminary work have been completed in this building for the additional machinery which will be required for the operation of the entire tramway system. The sub-foundations have also been completed for the gas engine units which will be installed in this building as a reserve for the public street lighting. There has been a great disturbance to the service of the tramways due to the reconstruction and electrification. This reconstruction has interfered seriously with traffic, it being impossible to maintain a satisfactory service at all times during such a period. In consequence of these various causes, a very considerable percentage of the gross income of the tramways has been lost, and the total gross income for the past year shows very little increase over the previous year. While the new electric lines were opened late in the year and it has been impossible to utilise the electric cars to their full advantage on account of the reconstruction, and consequently to reduce operating expenses to any material extent, yet the ratio of the net income to gross income of the tramways has been increased from 38 61 per cent. in 1907 to 42·19 per cent. in 1908. Close attention has been paid by the company to the development of its power business. Until January 1st, 1908, the various companies which are controlled by this company, were operated as separate concerns, but from this date the operation of these companies was taken over by this company under operating contracts and leases, so that the earnings of the various companies appear for the first time in the financial statements of this company. During the past year the company has sold $956,600 first mortgage bonds, this being the remainder of the total issue. There were also sold during the year 35,000,000 fr. of the French issue of the second mortgage bonds and £900,000 of the sterling bonds of this same issue were sold by public issue in London. Since the date of the public issue a further amount of £50,000 of this issue has been sold by private sale, making a total amount of £950,000 outstanding of these sterling bonds on December 31st. The net revenue from operation after deduction of operating expenses, maintenance, taxes and other fixed charges in Rio Janeiro, was $2,730,434, from which must be deducted the fixed charges and interest on loans at head office, leaving a net surplus after the payment of all expenses and fixed charges for the year of $870,236. An opportunity being presented of acquiring about 75 per cent. of the shares of the Jardim Botanico Tramways Co., thus assuring a controlling interest of the company, the board considered it wise to purchase these shares, as that company has a large and lucrative business in one of the best residential sections of the city, and can be operated to good advantage in connection with the other tramway systems under the control of this company, as well as assuring to this company an important contract for the power required for the operation of the system. While the purchase of these shares was made since the beginning of this year, and consequently, strictly speaking, should not be included in this report, yet (in view of the great importance of this acquisition to the company) the board felt that the shareholders should now be informed.

Metropolitan Railway Co.

The ordinary half-yearly meeting of the shareholders of the above company was held on the 28th ult. at the Great Eastern Hotel, Sir Charles McLaren, M.P., in the chair.

The Chairman, in moving the adoption of the report, said that the accounts showed a substantial increase in receipts and a very satisfactory saving in expenses. The locomotive and generating expenses were less by about £11,000, but as they had received about £7,000 less for working trains for other companies, the net saving was £4,000. There had been an increase of £12,600 in the receipts from passenger traffic, although the Exhibition traffic to Wood Lane had not been so good. There had been increases during the half-year from the traffic on practically all sections of the line, and he thought there could be no doubt that the public were beginning to realise, in a way they had not done before, the advantages of the electric underground train services generally, and of the facilities offered for interchange at various points. Including season ticket-holders, they had carried during the half-year 49,647,166 passengers, as against 48,243,951, or an increase of 1,403,215, and their receipt per passenger was slightly higher, being 1·48d., as against 1·46d. in the corresponding period. The parcels traffic showed a satisfactory increase of about £1,400. They had charged out of the half-year's revenue £5,000 to the electrical renewal and depreciation fund. That fund now stood at the very substantial figure of £53,162. They thought it wise to have a strong fund of this character not wholly for the purposes of actual depreciation, as the electrical plant was maintained so far as possible in a condition of thorough working efficiency out of the ordinary revenue, but mainly for the purpose of enabling them to take advantage of improvements in electrical machinery which might from time to time be brought out with a view to cheapening the cost of producing energy. They were at the present time engaged upon the work of increasing the horse-power capacity of their generators at Neasden, and it was satisfactory to know that when one of these machines was taken to pieces for the purposes of alteration a few weeks ago, after having been in constant service for two years, it was found by the contractors to be in as good a condition as when it was first put up, and to show practically no sign whatever of wear and tear. This was, of course, very gratifying to them, but at the same time they felt, for the reasons he had stated, they were wise to continue to build up a strong renewal fund, having regard to the fact that electrical science was still in its infancy. In a matter of this kind the board felt that they were best consulting the interests of the shareholders generally by looking beyond the immediate present and making a safe provision against possible contingencies which might seriously affect the company's revenue in future years. The balance available for dividend was £137,075, as against £122,514 in the corresponding period, when they took nothing out in respect of depreciation and renewals. They proposed, after paying the full 3½ per cent. on the several preference stocks, to pay 1 per cent. on the ordinary stock, and to carry forward £3,904 to the next half-year's accounts. The dividend was still a small one, but the fact that it was double what they were able to pay 12 months ago was, he thought, very clear evidence of a satisfactory turn in the affairs of the company. On July 1st they made an important alteration in the train services, and commenced to run about a dozen trains through from their extension line to the City in the busy hours of the morning and a similar number of through trains back to the districts served by the extension line in the evening. Some of these through trains were run to and from Aylesbury, others to and from Uxbridge, and others to and from Harrow only. The saving of the change at Baker Street, morning and evening, was a very great convenience to passengers, and they hoped, as time went on, to increase the number of these through trains. They had found very great advantages to accrue from the system of automatic signalling which they had installed on the Inner Circle, and they had in contemplation an extension of this system of signalling on the northern line as far as Neasden, as the train service there was now so heavy as to necessitate a quicker method of signalling than the existing manual system. They would be glad so see from the reports in the papers a short time ago that the Bill promoted by the North-West London Railway Co. was rejected by the Committee of the House of Commons. If the Bill had been passed and the line made as proposed, it would have been to all intents and purposes an extension of the Baker Street and Waterloo Railway from Edgware Road to Kilburn in direct competition with their line. They opposed the Bill very strenuously, and it was with no small amount of satisfaction that they learnt that the Committee would not sanction its proceeding.

Sir W. Birt seconded the resolution.

Replying to a Shareholder, the Chairman said it was quite true that the £5,000 placed to the electrical renewal and depreciation fund was an arbitrary figure, but looking at their reserve fund, and considering the fact that the British Westinghouse Co. were putting down fresh turbines for them at their own expense, they considered that they would not have been justified in charging a larger sum to depreciation out of the year's accounts.

The report was adopted.

Zircon-Tungsten Lamp Patents.

The report for 1908-9 of the Compagnie Internationale des Lampes Electriques Zircon-Wolfram, of Brussels, which was the pioneer in the introduction of the Zircon-Wolfram lamp in various parts of the world, contains interesting information relating to the progress made in the past year, together with the announcement that after efforts extending over three years, the inventors of the Z lamp at Berlin have been granted both patents by the German patent office, notwithstanding the severe attacks made by the most powerful competing companies. As the negotiations for the working by a Vienna lamp factory of the patents for Austria-Hungary did not yield the results which were expected, the report states that the company in association with the Italian Edison Co., has formed a separate company under the title of the Société des Lampes Electrique Z pour l'Autriche-Hongrie, whose recently erected factory at Rovereto, in the southern Tyrol, was now in full operation. An independent company was also formed last autumn for the working of the Z patents in Sweden, Norway, Denmark, and Finland, the manufacture of the lamps having been placed in the hands of the Glödlampfabrik, of Stockholm, which commenced production in March of this year. Of the various subsidiaries, the Spanish and Italian companies yielded excellent results for a first working year. The other factories which did not enjoy from their erection the same technical and commercial facilities, had not yet reached the dividend-paying stage, whilst the Russian company had been compelled to increase its share capital owing to the development of the business. The Z Electric Lamp Manufacturing Co., of London, whose daily production already amounted to several thousands of lamps, had also entered the era of profits. In the case of the Société des Projectionnements aux Lampes à Filaments Métallique, in which the Brussels company holds all the "capital shares," had declared a dividend of 30 per cent. on the amount paid up on this class of shares, and 8s. per share on the dividend shares. The patents for the Z lamp for Argentina, Brazil, and Uruguay had been sold to a syndicate formed by the Italian, Spanish, and Austrian companies, and the syndicate expected through the agencies obtained in these countries, to easily dispose of the surplus production of the Mediterranean factories during the dead season in Europe, which is the favourable season in South America. Negotiations in respect of Portugal had been concluded since the end of April, and Greece would be a favourable customer for the Austrian company in the autumn. The directors were still awaiting the grant of the Japanese patent, and in the meantime the option given to a leading London firm continued in operation. An interest amounting to 40 per cent. had been acquired in the Z lamp patents for the United States, where the use of electric lamps was greater than in the whole of Europe, and reached 100,000,000 lamps per annum. At present negotiations were proceeding with the representatives of a Franco-American financial company, and their conclusion depended upon the issue of the American patents, one of which had already been granted, and the other was momentarily expected. As to the competition of other metallic-filament lamps, the report contained a reassuring remark that although the high prices at first charged could not be maintained, a large increase in sales had followed the reduction in prices. On the other hand, the more the production advanced, the more the cost of manufacture diminished, so that the financial results of the companies whose shares were held in portfolio, pursued a rising curve. The accounts show net profits of £4,800 on a share capital of £48,000, and a dividend at the rate of 8 per cent. for 1908 09 has been declared.

The Chatham and District Light Railways Co.—The seventeenth ordinary general meeting (Electrical Review, July 23rd, page 147) of the shareholders of the above company was held on Thursday of last week at the offices, 83, Cannon Street, Mr. A. R. Monks presiding. The chairman formally proposed the adoption of the report, which was seconded by Mr. H. C. Levis, and agreed to.

Midland Railway Carriage and Wagon Co., Ltd.—The directors propose a dividend on the ordinary shares at the rate of 7½ per cent., free of income-tax; a bonus of 10s. per share on the ordinary shares; dividend on the preference shares, 6 per cent., free of income-tax; balance carried forward, £3,382. £2,000 is set apart for depreciation of plant.

Oxford Electric Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the half-year ended June 30th has been declared. Last year the rate was the same.

Continental Electrical Enterprise Co.

The Continentale Gesellschaft fur Elektrische Unternehmungen of Nuremberg, which is partly an investment company and partly owns and works electric railways or tramways and supply stations, states in its report for 1908 that although the effects of the economic depression were perceptible in the working of the undertakings, the latter experienced a further satisfactory development. The Augsburg tramways were transferred to the local authority last September, and the negotiations for the sale of the undertakings at Grevenbroich and Sigmaringen had been completed. As gross profits the accounts show the sum of £125,870, as compared with £130,120 in 1907, and the net surplus amounts to £70,940, as against £70,630 in the preceding year. It is proposed to pay a dividend at the rate of 4 per cent. on the preference share capital of £1,556,000 out of the total share capital of £1,600,000, being the same as in 1907. The interest payments on the bond capital, totalling £433,500, as contrasted with £446,000 in 1907, were provided for before arriving at the amount of the net surplus. The working results of various undertakings are set forth as follows:—

	Percentage Dividends.		
	1906.	1907.	1908.
Bergische Kleinbahnen	3	3	3
Augsburg Tramways	6	7	—
Zwickau Electricity and Tramways	6	6	6
New Berlin Tramways, North-East	—	4½	4⅓
Krakau Tramways	4½	4½	4½
Vienna Local Tramways	4	4	4
Rhenish Schuckert Co.	6	7	7
Elektra Co.	3½	3½	4
Société Industrielle d'Energie Electrique	3	3	3
Société Continentale de Traction et d'Eclairage ..	3	3	3
Chemin de Fer sur Route de Paris à Arpajon	4½	4½	4½
Società Sicula Imprese Elettriche	4⅓	4	4½
Società Toscana per Imprese Elettriche	8	9	10
Società Torinese di Tramways	6⅕	6⅕	6⅕
Compania Madrilene de Traccion	—	1	—
Compania Madrilena de Electricidad	—	6	6
Sociedad Electro-Quimica de Flix	—	6	7
Tramways de Constantinople	6	5	5

The receipts of the Barmen-Elberfeld-Vohwinkel suspended electric railway, which is owned by the company, amounted to £66,250 in 1908, as compared with £66,450 in 1907, and the expenses were £38,650 and £38,450 in the two years respectively. Among the assets are to be found the company's own undertakings, entered at £1,093,000, syndicate investments at £609,000, and securities at £900,000, together with debtors totalling £143,500, mostly composed of credits granted to subsidiary companies.

Mexican Light and Power Co., Ltd.

The annual report for the year ended December 31st, 1908, states that, during the past year, the actual and prospective demands for power, in the centres of consumption supplied by the company, increased beyond the most sanguine expectations, and that to meet these demands, it has been decided to double the capacity of the present hydro-electric plant at Necaxa during the next three years, and to bring into the Necaxa Basin, by a series of diverting and storage dams, canals and tunnels, the waters of the Lower Tenango, Nexapa and Catepuxtla Rivers, which are included in the water rights granted to the company by the Federal Government of Mexico, but which rights it was not, until recently, believed that the company would have need to exercise for many years to come. The advent of cheap electric power to Mexico City and its suburbs, and to El Oro and vicinity, has so reduced the operating costs of all industrial enterprises located in these places, that existing industries have extended their operations and many new undertakings have been and are about to be established. In some cases during the past year it has been deemed advisable to supply electrical energy to customers of the company by the operation of the company's steam plants during the dry season at a considerable loss, pending the completion of the hydraulic works of the company. During the present year, if the company had decided to restrict its operations to the supply of power which its present customers are entitled to receive, its net earnings would have been equivalent, after paying all fixed charges, sinking fund and preference stock dividends, to over 8 per cent. upon its ordinary shares.

On January 1st the electrical installations connected to the company's distributing lines in the City and Federal District of Mexico and in El Oro and vicinity represented, approximately, 79,000 H.P., distributed as follows:—

Public lighting.—1 810 arcs	1,470 H P.
Private lighting.—No. of 16-C.P. equivalents—338,500 ..	27,250 H.P.
Power.—Motor units, Federal District	22,783 H.P.
Electric heaters	1,085 H.P.
Tramways	8,710 H.P.
El Oro Mines and vicinity	17,775 H.P.
Total connected	79,073 H.P.

There was an increase of 11,720 H.P. in the connected load during the year 1908; and a similar increase is anticipated during the year 1909, making a total connected load of 90,000 H.P. by January 1st, 1910. The maximum power generated during the past year was 45,000 H.P., or nearly 60 per cent. of the total connected load. The present maximum hydro-electric generating capacity of the company's plant, including the San Ildefonso stations, is 50,000 H.P.; but the directors are carrying forward improvements to and extensions of the present works which, it is expected, will increase the present capacity to 66,000 H.P. by July next; and by which, when required, at least three generating units of 16,000 H.P. each may be added, if necessary, one each year thereafter, up to a total capacity of 124,000 H.P.

During the past year the Laguna Dam and the provisional dam at Los Reyes were completed, and are now available for the storage of water. The dam at Necaxa, which will be the largest of its kind ever constructed, necessitating the use of 1,534,000 cb. metres of material, is now over one-half completed. It should be finished during the present year. The height of this dam, when completed, will be 58 metres (190 ft.) above its foundations. The quantity of water actually stored for use on January 1st, 1908, was 4,000,000 cb. metres; while on January 1st, 1909, it was 25,000,000 cb. metres. Nevertheless, owing to its being deemed hazardous and impracticable to use the Necaxa Dam for any considerable storage of water during the past year, over 40,000,000 cb. metres of water were necessarily wasted. Considering that each cubic metre of water stored represents a value of about 3¾ cents, Mexican currency, when compared with the cost of producing electrical energy by steam in Mexico city, the importance to the company of the large storage works now in progress is readily realised. Two new dams are now in course of construction on the Lower Tenango and Nexapa Rivers. The waters of the Catepuxtla River are being diverted by a tunnel, 336 metres in length, into the Nexapa reservoir, where they will join the waters of the Nexapa River, and thence flow into the new Tenango reservoir, and through the new Tenango tunnel, 1,300 metres in length, into the Necaxa reservoir, which is located in the basin of the Necaxa river, at an elevation of 443 metres above the site of the present power house. By means of this diversion the present power house may be extended to more than twice its present capacity.

Financial.—The gross earnings for the year 1908 were $2,938,474 gold, as compared with $2,880,000 gold in the previous year, and similarly the operating and maintenance expenses were $1,080,570 gold, as compared with $1,075,000 gold. In Mexican currency the actual gross earnings during 1908 were:—Public lighting, $463,265; private lighting, $2,869,586; Mexico and Federal District Power, $1,316,907; El Oro, $783,576; and tramway, $443,613; making a total of $5,876,947. The general accounts for the year show that the amount brought forward from December 31st, 1907, less appropriations and expenses, together with the earnings during 1908, gave a sum of $3,656,495.64 (gold); this sufficed to meet operating and maintenance expenses, bond interest and sinking fund, dividends to December 31st, 1908, on preference shares, dividends of 3½ per cent. on ordinary shares, leaving a balance of $910,823.43 carried forward to the credit of the profit and loss account.

At a special general meeting of shareholders, held on December 31st last, a resolution respecting the proposed lease of the company's undertaking to the Mexico Tramways Co. was held to be *ultra vires*. More recently the Tramways Co. officially intimated that its offers were withdrawn, and negotiations were now at an end.

Great Northern and City Railway Co.—The report for the half-year ended June 30th last states that the total revenue for the six months just ended amounted to £40,801 and the cost of working to £21,040, being at the rate of 51·56 per cent. The net revenue amounts to £19,761, which is insufficient to meet the company's fixed charges for the half-year. The sum of £3,209, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months under review, including season-ticket holders, was 6,041,755, as against 6,875,602 for the corresponding period last year. The decrease in the number of passengers carried is due to the competition of the L.C.C. electric tramcars.

Blackpool and Fleetwood Tramroad Co.—The report for the half-year ended June 30th last, states that the balance of profit, after providing for debenture interest, is £4,685, and the directors recommend a dividend at the rate of 4 per cent. per annum, writing off £750 to depreciation reserve, and £500 to general reserve account, leaving a balance of £435 to be carried forward. The number of passengers carried during the half-year was 963,460. The receipts from all sources amounted to £11,910.—*Financial Times*.

Charing Cross, West-End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum on the ordinary shares of the West-End undertaking.

Charing Cross, Euston and Hampstead Railway Co.—The directors have declared a dividend at the rate of ¾ per cent. per annum. Last year, after providing for interest and rents, a balance of £832 remained.

Baker Street and Waterloo Railway Co.—A dividend at the rate of 1½ per cent. per annum on the ordinary stock, which will be made up to 3 per cent. per annum, except in the case of those shares held by the Underground Electric Railways, has been declared. Last year ¾ per cent. per annum was paid out of net revenue, and the dividend was made up to 3 per cent. for the same shares.

Hadfield's Steel Foundry, Ltd.—The directors have declared an interim dividend of 1s. per share on the ordinary shares.

G.N., Piccadilly and Brompton Railway Co.—The directors have declared a dividend at the rate of 1 per cent. per annum. Last year the distribution was at the rate of ¾ per cent. per annum.

MARKET QUOTATIONS.

Wednesday, August 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£25 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	¼d. inc.
c „ Tube (brazed)	„	8⅛d.	⅛d. dec.
c „ „ (solid drawn)	„	7⅛d.	⅛d. dec.
c „ Wire, basis	„	6¾d.	⅛d inc.
c Copper Tubes (brazed)	„	8¾d.	⅛d. inc.
c „ „ (solid drawn	„	8¾d.	⅛d. inc.
g „ Bars (best selected)	per ton	£71	£1 inc.
g „ Sheet	„	£71	£1 inc.
g „ Rod	„	£71	£1 inc.
e „ (Electrolytic) Bars	„	£60 5	..
e „ „ Sheets	„	£77	..
e „ „ Rod	„	£65	..
e „ „ H.C. Wire	per lb.	7⅞d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	8/5	7d. inc.
i Iron Pig (Cleveland warrants)	per ton	49/7	1/3 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£12 15 to £12 17 6	5/- dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	95/-	variable.
e Silicium Bronze Wire	per lb.	9¼d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£131 10 to £132 10	£1 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Dublin and Lucan Electric Railway Co.—The directors' report, to be submitted to the shareholders at the half-yearly meeting of the company, on August 19th, says:—After providing for debenture interest there is an available balance of £1,153, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, which will absorb £475; that £250 be allocated to Messrs. Dick, Kerr & Co., further on account of the sum still due to them on account of electrical equipment, thus reducing that debt to £350; and that the balance of £428 be carried forward to next half-year.

Continental Notes.—The Great Northern Telegraph Co., of Copenhagen, reports a net profit of £407,702 for the last financial year, as compared with £434,600 in the preceding 12 months. A dividend of 45 fr. per share is being declared.

La Société Force-Eclairage par Electricité, of Brussels, is declaring a dividend of 2½ per cent for the last financial year.

STOCKS AND SHARES.

Tuesday Afternoon.

After the accumulation of the holiday's orders had been cleared off in the markets, business settled down into a placid quietude that is likely to be the normal condition through the present month. Rubber shares are the most active in the whole of the Stock Exchange, and while the prudent prophesy ever more and more loudly that there will be a severe slump, the buoyancy of rubber itself, of course, supports the market most effectually.

The pacification of the coal trade dispute naturally brought about a swift rally in Home Railway prices, and the various bull points once more came to the front. The unfortunate market has made so many false starts—recovery only to be succeeded by relapse—that it is no wonder people rather fight shy of putting much faith in a fresh rise. However, prices are decidedly better again, and that is something. The electrical issues hardened a little in tone, but price movements are insignificant. City and South London regained part of the deducted dividend of 17s. 6d. per cent.; Metropolitan Ordinary stocks rose to 40½. Districts are quietly steady.

Telegraph descriptions retain their rises, without having made any further noticeable improvement. The market has been in a decidedly holiday frame of mind, with business at a very low ebb. Anglo-American Telegraphs continue strong, but the alterations in the general list—what few there are—consist chiefly of the falls incidental to *ex* dividend markings. Telephones are similarly quiet National Telephone Deferred and Preferred are each *ex* 3 per cent., and the Preference shares are also *ex* dividend, the deductions being reflected in quotations. The 3½ per cent. Debenture stock is ½ up. American Telephone and Telegraph capital stock marks a rise of 2, upon the extraordinary strength displayed by the American Railroad market.

Copper, and copper shares, both of which are largely swayed by American influences, suffered a check to their rise, and prices are moving more irregularly, though still without producing any effect upon shares in the manufacturing or kindred companies. Henley's have gained a further ⅛. Crompton Debenture shed 1. Willans and Robinson Preference are ⅛ lower. The armament shares are firm. Interest in trading shares, however, clings most closely to the rubber market, where the demand for the product has resulted in a regular boom for all rubber shares. Mincing Lane feeds the Stock Exchange activity; while the gamble appeals but little to the general public, the latter are well catered for by shoals of new companies, good, bad and indifferent. It is to be noticed that in only a comparatively few cases are premiums quoted on these newcomers, after allotment has taken place.

Mexican Canadians are easier on the whole, although Electrical Development of Ontario bonds rose 4½ to 90. Mexican Light and Power and Mexico Trams are weak. Rio Trams fell 1½, and Sao Paulo declined to 147½. Canadian General Common is 123, and the Preferred 117. British Columbia Electric Railway Deferred rose a point, and a private correspondent, lately home from Vancouver, paints the prosperity of the British Columbia Company in glowing terms.

Anglo-Argentine Trams are a good market, the Second Preference gaining $\frac{1}{16}$, and the Third Preference being firm at $4\frac{7}{16}$. The Company's 4 per cent. Debenture stock at about 91¼ pays nearly 4½ per cent. on the money, allowing for accrued dividend, and the security appears to be ample. Auckland 5 per cent. Debenture is a point higher. There has been a little business in Winnipeg Electric Railway 4½ per cent. Debenture stock on the basis of 102½. London United Tramways Preference change hands at about 45s., and British Electric Traction Preference shares and the Second Debenture stock are lower, the latter falling 2 per cent. Movements amongst electricity supply descriptions are too slight to call for comment.

Calcutta Electric Supply Corporation.—An extraordinary general meeting of this company was held on Friday of last week at the offices, Salisbury House, London Wall, Mr. E. Boulnois presiding. The chairman remarked that the matter for which they were called together was purely a formal one. The company, under a recent Act, had to insert in their Articles of Association a limit as to how much commission should be paid to underwriters and others. The directors proposed a limit of 10 per cent., not because they would be compelled to give that amount, but in view of any contingencies that might arise, he thought it was desirable that some figure should be put in. He accordingly moved: "That Article 82 of the company's Articles of Association be amended by the addition of the words 'but such commission shall not exceed 10 per cent.' immediately after the words 'placing its shares' in the said article." Sir Guilford C. Molesworth seconded the resolution, and it was carried.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.*	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Business done week ended Aug. 3rd, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾— 3¼	2¾— 3¼	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96	92 — 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	6 %	6 %	8 %	143½—144½	146½—147½	..	..	+3	5 8 6
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	6½%	8⅞%	8½%	£3 4s.	58½— 60½	58 — 60	..	..	..	5 5 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102½—103½	101 —102	103	101	−1½	5 17 8
3,220,770	Do. do. do. Deferred	Stock	½%	1⅜%	1 %	8/-	17¼— 17½	17¼— 17½	17 7/16	17¼	..	1 11 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	6 %	6 %	..	8⅛— 8½	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	89½	..	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8⅛— 8⅝	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 3 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	8 16 8
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	12⅞— 13⅜	12⅞— 13⅛	13⅛	12 13/16	− ¼	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —128	125 —128	126	125	..	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	6½%	3½%	84½— 86½	84½— 86½	86¼	85⅜	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	104¾	104½	..	6 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½— 12	11½— 12	11 13/16	11⅝	..	5 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	104 —106	104 —104 xd	104¼	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 6,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	6 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	10½	..	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼— 13¾	13¼— 13¾	13¾	..	..	4 7 3
160,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	..	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	16 %	13 %	13 %	51½— 53½	51½— 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	11/16 — 13/16	11/16— 13/16	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16— 15/16	13/16— 15/16	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 13 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 - 110½	106 —107½	106½	106	−3	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	125½—127½	122½—124½	126¼	123	−3	4 16 5
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10 — 10¾	..	..	− ¼	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10¼— 11	10 — 10¾	..	..	− ¼	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝— 5⅞	5½— 5¾	5½	..	− ⅛	4 6 11
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	6½%	3½%	6½%	97 — 99	98 — 100	..	..	+1	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 — 101	..	..	..	3 19 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	6 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85½ — 87½	85½ — 87½	..	..	..	4 11 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99 — 101	..	..	..	3 19 3
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	100⅜	..	..	4 9 1
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —132	130½	..	− ½	4 10 11
120,000	United River Plate Telephone	5	6 %	8 %	8 %	..	7⅛— 7⅜	6⅞— 7⅛	7⅛	6 15/16	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛— 5½	5⅛— 5½	..	..	..	4 10 8
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 10 11
160,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½— 14	13½— 14	..	..	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½—104½	102½—104½	102¾	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½— ⅝	½— ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 — 8½	8 — 8½	8	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.*	1905.	1906.	1907.	1908.	Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	6 %	6 %	9 %	10 %	9¼— 9½	9 5/16— 9 7/16	9 7/16	9 11/32	+ 1/16	5 5 3
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90¾— 91¾	90¾— 91¾	91½	90	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	102 —104	..	..	+1	4 16 2
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	4¼— 4⅜	4¼— 4⅜	85/7½	85/-	..	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼— ¾	¼— ¾	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¼— 1¾	1¼— 1¾	..	..	..	46 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3½	3 — 6½	..	..	..	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	94 — 99	93 — 96	..	..	−2	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	144 —148	147¾	146½	+1	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	122 —126	119 —123 xd	123	122¼	..	4 17 7
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	106¾	..	..	4 10 11
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
[illegible]	British Electric Traction	10	8 %	Nil	Nil	Nil	½— ⅞	½— ⅞	..	..	..	Nil
161,457	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2¼— 2¾	2 — 2½	..	..	— ¼	6 0 0
1,173,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	86 — 90	88	..	..	5 11 1
628,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	66 — 70	64 — 68	..	..	−2	6 12 4
100,000	British Insulated and Helsby Cables	5	6 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼— 6⅝	6⅛— 6½	..	..	— ⅛	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 - 106	103 —106	..	..	..	4 4 11
304,9[illegible]	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	5/-	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
60,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
60,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref. ..	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	6 %	4½%	4½— 4⅞	4½— 4⅞	96/3	..	..	4 12 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	97/6	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10 — 10¾	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼— 5⅜	5¼— 5⅜	..	..	..	4 13 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½—106½	104½—106½	..	..	..	4 4 6
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	5/9	..	..	Nil
460,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅞— 2	1⅞— 2	38/9	..	..	6 0 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	103 —106	104 —107	..	..	+1	3 14 9
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	6 %	3¼%	61 — 63	60 — 62	62¾	60½	−1	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	83	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
[illegible]	City and South London Railway	Stock	1⅞%	2½%	2⅜%	1½%	81½ — 82½	81 — 82	..	..	— ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 0 0
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	91 — 94	90 — 93	..	..	−1	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Business done week ended Aug. 3rd, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16— 1¼	1 1/16— 1¼	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/32— 1 7/32	1 3/32— 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	100 —103	..	..	+1	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13— 14	12¾— 13¼	..	..	— ¼	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	⅛— ⅜	⅛— ⅜	..	..	..	25 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	..	1½— 2½	1½— 2½	..	..	..	5 0 0
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 7/16— 1 11/16	1 5/16— 1 9/16	..	..	— ⅛	4 9 7
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7½— 8	7½— 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12¾	12⅛— 12⅞	12½	..	+ ⅛	5 18 6
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14½— 15¼	14½— 15¼	15¼	14 13/16	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞— 15/16	⅞— 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2 — 2½	2 — 2½	50/-	..	..	15 0 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	68 — 71	68 — 71	70¾	67	..	5 12 8
5,762,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	40½— 41	40¼— 40¾	40¾	39¾	..	1 10 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	67 —69	65 — 67	67½	65¼	—2	4 2 1
6,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¼— 17¾	17¼— 17¾	17⅞	17¾	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝— ¾	⅝— ¾	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32— 27/32	23/32— 27/32	16/-	15/6	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	9½	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	126 —129	123 —126	128	120	—3	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93 — 95	93 — 95	94	93	..	5 5 3
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34 — 35½	31	..	— ½	2 10 9
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	.	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	..	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	89	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	36 — 38	36 — 38	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝— ⅞	⅝— ⅞	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¾— 3¼	2⅝— 3⅛	..	..	— ⅛	1 18 1
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4¼— 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	8 — 8½	8⅛	..	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½— 5	4½— 5	..	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅜	3⅞— 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	8 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 4⅛	3⅝— 4⅛	80/-	..	..	5 9 1
175,000*l*	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½— 11	10⅜— 10⅞ xd	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	11¾— 12¾ xd	..	..	..	4 12 4
400,000*l*	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	100⅝	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾— 3¼	2¾— 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼— 3¾	3⅛— 3⅝	..	..	— ⅛	6 17 11
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅛— 8⅝	7¾— 8¼ xd	8 1/16	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10¾— 11¼	10½— 11	..	..	— ¼	5 9 1
400,000*l*	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	103 —106	103 —106	105	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	58 — 61	60	..	—1	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84½— 86½	84½— 86½	86	85½	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½— 5	4⅝— 5⅛	..	..	+ ⅛	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	97 —100	..	..	—1	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	7⅛— 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½—100½	97½—100½	..	..	..	4 19 6
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅞— 7⅜	6¼— 7⅜	..	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	95 — 98	..	..	—2	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅞— 2¼	1⅞— 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛— 5⅝	5⅛— 5⅝	..	..	..	5 11 8
282,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 5/16— 4 11/16	4⅜— 4¾	88/9	..	+ 1/16	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
235,000*l*	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	.	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	82 — 84	83⅞	83½	..	5 1 5
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	67 — 71	65 — 69	67½	67¼	—2	4 17 8
$4,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	104 —108	..	..	..	5 17 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	88 — 90	85½— 87½	89½	88½	— 2½	5 12 4
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	91 — 97	94 — 97	..	..	..	4 12 9
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	2 10 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4⅝— 5⅛	..	..	— ⅛	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¼— 12¼	11¼— 12¼	..	..	..	5 14 3
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	95 — 98	..	..	+1	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32— 1 3/32	31/32— 1 3/32	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾— 9¼	8½— 9	9 1/16	..	— ¼	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7⅛— 7⅝	7 — 7½	..	..	..	4 11 10
150,000*l*	Do. do. 6½ % Deb. Stock Red.	100	8 %	8½%	8½%	8½%	84 — 88	84 — 88	..	..	..	6 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16— 13/16	9/16— 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	6 %	4 %	5 %	2¾— 3⅛	2¾— 3⅛	..	..	..	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100—104	..	..	+ ½	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½— 1	½— 1	..	..	..	25 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝— 2⅛	1⅝— 2⅛	..	..	..	11 15 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 83	76 — 80	..	..	—3	5 12 6
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	13/16— 15/16	13/16— 15/16	..	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.		16 %	12 %	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛	..	..	..	6 11 2
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞— 5¼	4⅞— 5¼	..	..	..	4 3 9

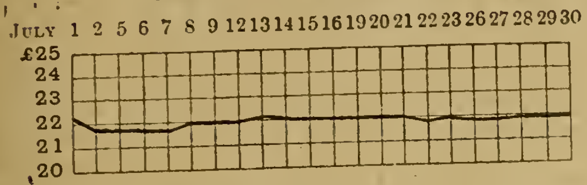
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

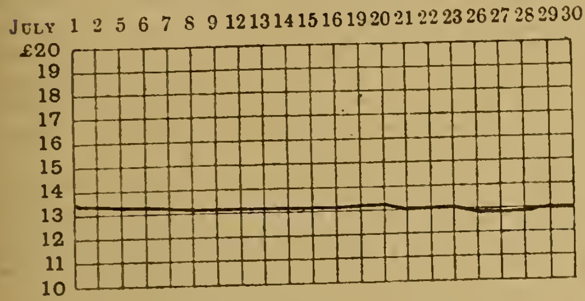
METAL MARKET.

Fluctuations in July.

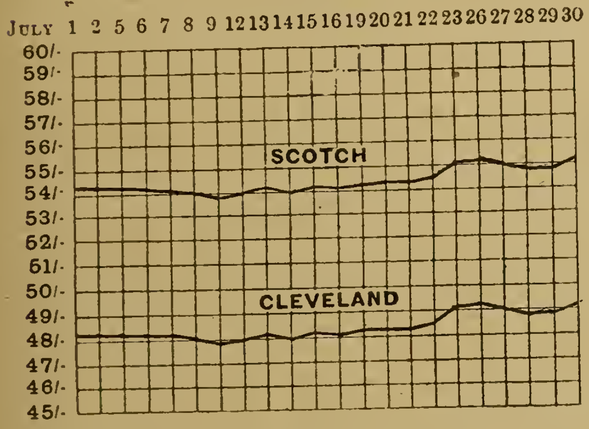
SPELTER (G.O.B.'s.).



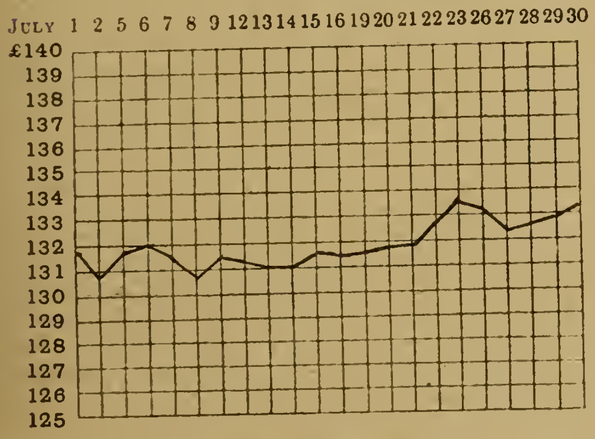
LEAD (ENGLISH).



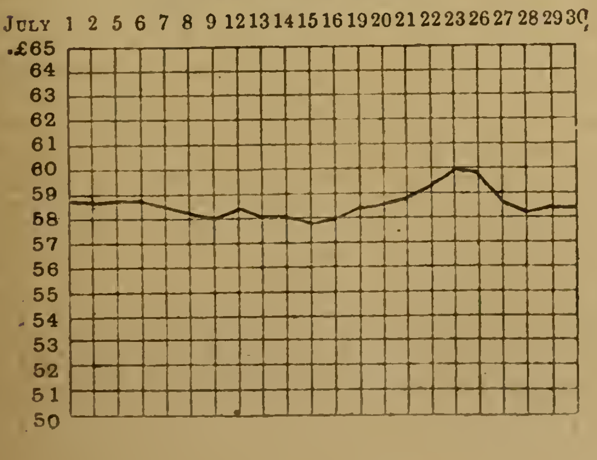
IRON.



TIN.



COPPER (G.M.B.'s.).



DETROIT RIVER TUNNEL ELECTRIC LOCOMOTIVE.

The first of six direct-current locomotives for the tunnel under the Detroit River has been finished, and the acceptance test completed. The locomotives are designed for hauling both freight and passenger trains through the tunnel, and also for switching service at the terminal. The tunnel will connect the Western Detroit yards of the Michigan Central Railroad and the new Windsor yards, Windsor, Ont., the electrified zone embracing the tunnel with its approaches, terminals, tracks and sidings extending over approximately 33,000 ft. The specifications demand a maximum service consisting in hauling a 1,800-ton trailing train up a 2 per cent. grade at a speed not less than 10 miles per hour, with two locomotives operating as multiple units; and the capacity must be such as to enable them to repeat the trips with this weight of train continuously with a lay-over of 15 minutes at each end, and without undue heating of the motors. The total weight of the locomotive is 199,000 lb.

The motor equipment consists of four 300-H.P. commutating-pole motors. The gearing between motor and axle has a 4·37 reduction, and the driving wheels are 48 in. in diameter. With this reduction each motor will develop a tractive effort of 9,000 lb. at the rail head, which gives a total tractive effort for the four motors of 36,000 lb. at 12 miles per hour. The motors have an overload capacity sufficient to slip the driving wheels, and the locomotive can develop at the slipping point of the wheels an instantaneous tractive effort of 50,000 lb. to 60,000 lb. The maximum speed of the locomotive running light upon a level track is about 35 miles per hour.

There are two gears and pinions per motor, one at either end of the armature shaft. This construction was adopted on account of the unusually heavy torque and excessive overloads that the motors will be called upon to carry. In large sizes of motor equipments, with a gear and pinion at only one end of the shaft, it has been asserted that a large proportion of the wear and breakage of pinions is due to the tilting of the motors under heavy loads, which concentrates the pressure at one end of the tooth. The form of construction adopted in the Detroit locomotives will eliminate any such danger.

The motors are designed for forced ventilation. Air is delivered into the motor frames at the end farthest from the commutator, passes between the field coils and around the armature, and finally escapes through suitable discharge openings over the commutator. The blower used for this purpose has a capacity of 2,000 cb. ft. of air per minute at 2¼ in. of water pressure, and is driven by a direct-current series motor. This blower delivers air to the passage between two centre-sills, from which the ventilating ducts are tapped off to the motors at appropriate points.

The control system used is the Sprague-General Electric multiple-unit type, with two master controllers in the main cab and the contactors in the auxiliary cab. Multiple-unit connections are fitted, so that three locomotives may be operated in unison if necessary. The problem of starting and accelerating a train of from 1,000 tons to 1,500 tons weight, which may consist of 40 or 50 cars, is a rather difficult one. Such a train is not a rigid mass, but a long elastic body, and any inequality in the starting torque results in waves of jerking and buffing strains which may reach abnormal values in some parts of the train. Consequently the control for these locomotives was designed especially to produce a uniform increase of speed and torque during the period of acceleration. The control combinations are so arranged that the motors may be operated four in series, two in series and two in parallel, or four in parallel. There are nine resistance steps in series, eight in series-parallel and seven in the parallel position. In a test run with a train of 1,578 tons weight, consisting of one locomotive and 26 freight cars, the acceleration from a standstill to 10 miles per hour was accomplished with marked smoothness. The maximum increase of draw-bar pull was about 6,500 lb. on the first few steps, after which the maximum throughout the remainder of the acceleration was from 2,000 lb. to 3,000 lb. To an observer standing in the caboose (*anglice*, guard's van) of such a train, the rear end of the train is started so gradually that the beginning of the motion is almost imperceptible; the contrast with the results obtained with a steam locomotive is thus very striking. The locomotive is equipped with third-rail shoes to take current from an inverted third-rail. It is also fitted with an overhead trolley, which can be raised or lowered by a foot-operated valve in front of the motorman. The electrical part of the equipment was supplied by the General Electric Co., the locomotive having otherwise been built at the Schenectady works of the American Locomotive Co.—*Electrical World*, N.Y.

Lignite as Station Fuel.—The use of lignite as fuel in generating stations is increasing in Germany, where stations continue to be erected in the vicinity of lignite deposits, or the electricity companies purchase the mines or lease the production. Combinations of lignite mines with power stations already exist in the Weissenfels district, at Helmstedt and Schwandorf in the Upper Palatinate, and the Electricity Supply Co. of Berlin has now arranged with the Hercules Brown Coal Co., of Zittau-Hirschfeld, for the supply of lignite for the overland central station to be erected in Oberlausitz.

REVIEWS.

Vectors and Vector Diagrams applied to the Alternating-Current Circuit. By W. Cramp, M.I.E.E., and C. F. Smith, M.I.E.E. London: Longmans, Green & Co. 1909. Price 7s. 6d. net.

The authors give a methodical description of vectors and vector diagrams. They assume that the reader has a sound knowledge of electrical phenomena and of the nature of everyday electrical apparatus, but the demands made on his mathematical knowledge are of the slightest. We take it, therefore, that the book is intended to be useful to students and to the large class of electrical engineers—and the reviewer includes himself in this class—who find it difficult to understand the principles involved in many of the vector diagrams so lavishly used by writers of technical papers. The diagrams are often in close accord with experimental results, but the methods by which they are deduced from first principles are sometimes open to question. It was with a view, therefore, of having some of these points cleared up that we studied this work. On the whole we were disappointed. The authors follow the methods of Steinmetz pretty closely, but some of the proofs given are far from convincing. They deserve praise, however, for making their meaning always clear. And possibly it is not advisable to discourage the beginner too much by pointing out the shakiness of the foundations. The arrangement of the matter and the drawing of the diagrams are also good.

A list of symbols, abbreviations and conventions is first given, and hence the necessity of much tedious iteration is avoided. The symbol $\sim$ for frequency we do not much like, as it gives many of the subsequent equations an Oriental appearance, and it disguises very effectively even old friends. Following the fashion of many electrical engineers, they take the clockwise direction as the positive direction of rotation for vectors. Why vectors should differ from other things we have never been able to make out. In teaching elementary mathematics it is the universal custom to take the counter-clockwise direction as positive. Why should students have all their previous conventions upset when they come to an electrical college? Is the study of electricity such a solemn matter that the uninitiated have either to rid themselves of all previous prejudices, or to stand on their heads, before they begin to study it?

The wonderful operating factor j rotates a vector through 90° in the *counter-clockwise* direction. To be strictly logical, we think that the authors should have denoted $-\sqrt{-1}$ by j.

We think that the student reading the introductory note would get the impression that Prof. Steinmetz was the first to apply the method of the complex variable to the study of electrical problems. As a matter of fact, Heaviside and Rayleigh had published many important results obtained by this method previous to 1886, and for 20 years before that many of the very difficult electrical problems set in the college and university examination papers at Cambridge were supposed to be solved by the students by this method. In our opinion the main credit of applying the method in all its generality to physical problems belongs to Gauss and Stokes. The elementary theory required by electricians was explained by Argand (1806). A translation of this book was published by Van Nostrand in New York in 1881.

We think it necessary to restate all this, as many electricians believe that Steinmetz invented the theory of the complex variable. We are not aware of "more academic systems suggested by various mathematicians," or that there are "complications incidental" to their use.

The ordinary reader would have some difficulty in understanding the introductory note about "equivalent sine waves." The authors state that the method can be used to solve "almost all problems connected with alternating-current circuits." It is rather unkind to the reader, however, to leave him in ignorance of when the method fails. This lack of knowledge must weaken his confidence in applying the method, even in those cases in which it can be rigorously justified.

The chapters on vector representation, vector algebra and the multiplication of vectors, will give the student a good idea of the theoretical outfit of many electrical engineers, and will enable him to understand many published papers.

The second definition of self-induction given on p. 82, and the reference to Maxwell, are misleading. Clerk Maxwell's inferred definition is rigorous, and is the one that we have always used, not without success, to calculate the self-inductance of a coil. He defines it as that length which multiplied by half the square of the current in the coil gives the electromagnetic energy, due to that current, stored up in the field. We cannot understand what the authors mean when they say, on p. 83, that Maxwell's coefficient is a complex quantity. We are therefore at a loss to understand the greater convenience of the coefficient used by electrical engineers, which is stated to be a real quantity. The reviewer has used the electrical engineer's coefficient, but he has always had his doubts as to its reality. He has, however, no doubts about the reality of Maxwell's coefficients of self and mutual induction. He has spent several months calculating them and verifying them experimentally. He has also verified experimentally Maxwell's transformer formulæ (correcting an obvious misprint) which appear on page 475 of the *Phil. Trans.* for 1865. He tests the engineering formulæ, therefore, by the simple method of supposing the permeability of the iron of the transformer to be constant. If they simplify in this case to Maxwell's formulæ then they are deserving of closer study; but if not, then so much the worse for the engineers' formulæ.

In further chapters the theory of transformers, induction motors and commutator motors is given, and a good chapter on locus diagrams concludes the volume.—A. R.

Alloys (non-ferrous). By A. Humboldt Sexton, F.I.C., F.C.S., &c. Manchester: The Scientific Publishing Co. Price 7s. 6d. net.

It is stated in the preface that the author's object has been "to indicate the direction in which research is going on, and to give the maker and user of alloys such information as may be of practical utility, and will enable him clearly to understand the current literature of the subject, and to see in what direction he must look for further developments that may be of use to him." It must be understood that this is no book of recipes for the manufacture of alloys; rather it is a book which presents, within one cover, sufficient matter to awaken the interest of the student, who has already received a sound general training in chemistry and the allied sciences, and, on the other hand, may serve to indicate to the maker and user of alloys what assistance in his business he can expect from the scientific control of his processes. All the same, the book contains much information of directly technical value, as, for example, in the account of the influence of small amounts of impurities, or of deliberately added metals, on the tensile strength and extensibility of the brasses, in Chapter VII.

Having discussed, in the introductory chapter, the nature of alloys, and reached the conclusion that, whilst a few, such as those of bismuth and tin, are true chemical compounds, in the great majority of cases we have to deal with a solid solution of two or more metals in each other, Prof. Sexton proceeds to the consideration of the methods of investigation which have been applied to most of the important series of alloys.

Chapters II and III deal with the physical properties of the alloys as related to those of their constituents, and with the phenomena of solidification, the latter containing interesting discussions of the conditions under which an homogeneous alloy may be obtained, of the phenomena of the evolution of gases from cast metals, and of the methods by which the consequent difficulties may be surmounted.

In Chapter IV, Prof. Sexton describes the preparation, by polishing and etching, of samples of metal for microscopical examination, and, with the aid of excellent reproductions of microphotographs, explains the information, which may be thus obtained, as to the structure of alloys. The properties of an alloy can be understood only in the light of a knowledge of its structure, and it is possible only by micrographical examination to observe a change in the structure, and therefore to understand a change in the properties, which may have resulted from some slight modification in the method of preparation or in the subsequent treatment of an alloy.

Chapter V, which deals with the changes which may take place in the structure of alloys in the solid condition, is interesting from a practical point of view, as showing how necessary is correct heating if good results are to be obtained in annealing. The strength of an alloy is determined to a great extent by the coarseness or fineness of its crystalline structure, and this depends on the temperature to which the alloy is heated, on the duration of the heating, and on the rate of subsequent cooling. The importance of these conditions is often not realised, which makes it possible for the author to write "there is probably no operation in which failures are more frequent." And yet annealing is considered a simple operation! The microphotographs in this chapter, of brass after heating to various temperatures between 500° and 1,000°, are very instructive.

After a chapter dealing with the properties of the metals in common use in the preparation of alloys, we come to a series of chapters, VII-XIV, devoted to an account of the results which have been obtained by applying to the different groups of alloys the methods of investigation already described. These chapters are well illustrated with curves and reproductions of microphotographs. Here are to be found striking examples of the relation between the physical properties of an alloy and, on the one hand, its chemical composition, and on the other, the treatment which it has undergone. In this connection special attention may be drawn to the table and curves for aluminium bronzes on pages 158-162.

The maker of alloys may, perhaps, find the last chapter the most directly useful, if not the most suggestive. Here, in some 40 pages, Prof. Sexton gives us a succinct account of the methods employed in the preparation of alloys. This chapter, like the rest of the book, is well up to date, and includes descriptions and illustrations of the furnaces in technical use at the present time.

The book is well worth the attention of all interested in the manufacture and use of alloys.

The Construction of Underground Telegraph and Telephone Lines. Post Office Telegraphs (Engineering Department). London: Wymans. Edinburgh: Oliver & Boyd. Dublin: Ponsonby. Price 1s. 6d. net.

The book which we have now before us is an official instruction issued by the Post Office authorities purely for the guidance of their own officers. It is, therefore, not by any means a publication in the nature of a text-book on the subject; it is far more, inasmuch as it comprises, in very concise form, a mass of information based upon practical experience derived by the Department's staff, spread over a number of years, during which this special class of engineering work has developed into what one might almost refer to as something approaching an exact science—using the term rather loosely. Indeed, one feels, after a rapid and cursory glance through the pages of the instruction, that that which consisted mainly of the application of a little rule of thumb knowledge in the laying down of a few pipes and hauling through them a few gutta-percha-covered wires has now, with the lapse of time and with the rapid growth of underground telephone systems in towns and cities, grown up, matured, and become an important branch of the profession of what is termed civil engineering. In fact, it seems that the laying down of telegraph and telephone mains is somewhat akin, although on a smaller scale, to the construction of a railway line.

We observe in the opening chapters very detailed instructions, of general utility, which deal with, *inter alia*, survey and choice of routes, descriptions of several classes of pipes and ducts, with information as to their manufacture, instructions as to jointing, avoidance of obstacles, damage to property, and strength of materials. There is also some information showing the system adopted by the Department for recording the position of underground mains. (This last, in view of recent discussions, will no doubt interest many municipal lighting and tramway engineers.) Following this comes information as to the construction of many types of manholes, jointing chambers, test pillars, &c., with chapters on the bonding of pipe lines for the preservation of their electrical continuity and tests for the efficiency of the same; all of which information should prove distinctly useful to any engineers who have to do with matters beneath the surface of the road.

The following section of the book deals with special matters relating to cables, with descriptions of methods and devices for jointing adopted for multiple wire cables. After this some pages are devoted to testing and testing apparatus, faults, repairs, and maintenance, in connection with which references are made to precautionary measures to prevent accidents from explosions or the presence of foul air, which, as experience has doubtless shown, are more or less to be anticipated. The next pages deal with descriptions of special appliances and tools, with instructions for their use; these include a description of a portable petrol-driven air compressor and a novel gas leak indicator. The final pages contain appendices in the way of schedules of materials, tools and plant, cables, speech transmission equivalents for various gauges of conductor, and grouping of multiple ducts.

The book is liberally illustrated by reproductions of photographs, drawings, and diagrams. In fact, every detail referred to in the text appears to have its corresponding illustration.

The whole has probably been subjected to a careful checking, counter-checking, sub-editing, and editing to an unknown degree, so that there is but little left for the reviewer upon which to base any of the usual criticisms. He has, therefore, to content himself with merely indicating as briefly as may be its scope and contents, recommending its perusal to all engineers at home or abroad, who have, or may have, anything to do with such or similar works. The Engineer-in-Chief's department is to be congratulated upon the addition of another number to the existing series of valuable instructions, whilst the Post Office authorities are to be much commended for allowing the same to be placed at a reasonable price within the reach of the general public.—R. M. H.

Some Electrochemical Centres. By J. N. Pring. Economic Series, No. 10. Garside Reports on Industry and Commerce, No. 7. Manchester: Manchester University Press, 1908. Price 1s. 6d. net.

The Garside Scholarships were established in 1902 by Mr. J. H. Garside, of Manchester. The conditions of tenure are that each scholar shall enter the University of Manchester for one session, the remainder of the time covered by the scholarship being occupied in an examination of commerce and industry in certain Continental countries and America. The results of these investigations are given in a series of reports, of which the present one is of interest chiefly to students of applied electricity. Although this small volume throws no new light on the progress of the electrochemical industry, a special value attaches to it, in so far as the information acquired is based mainly on personal knowledge. Accuracy, therefore, as the word "report" implies, is one of the outstanding features of the book. As the author states in his preface, the majority of electrochemical works are still more or less in an experimental state, and the details of the processes are usually held in strict secrecy, so that admittance to the works is very difficult, and often quite impossible to obtain by outsiders. This statement might have been made much stronger, even with a process which has passed beyond the experimental stage, and become public property. Further than this, these industries have sprung up in widely scattered centres, which makes a comprehensive survey of the subject a matter of much difficulty. Bearing these facts in mind, the author has been remarkably successful, and has presented a really valuable report, the price of which cannot be considered excessive. After a short introduction, the author discusses the cost of power production, which, in many industries, when coupled with the cost of distribution, is the first factor of importance. The charges in various electrical centres are given along with other useful information. The chief electrochemical centre of the world—Niagara—is dealt with at some length in Chapter II. This includes the cost of power and details of the production of various electrochemical products, such as carborundum, graphite, &c. In Chapter IV the water-power of Canada is dealt with at some length. In some specially favoured centres this has been developed or schemes are under consideration, but it will surprise most people to learn of the enormous amount of wasted energy in this portion of the British Empire. It is from this favoured corner of the world that future industrial development is to be looked for. Copper refining and electric steel production also receive a fair share of attention. Ozone and water purification is dealt with in Chapter VI, the three successful processes now in use being described. Bullion refining, the manufacture of carbon bisulphide and the fixation of atmospheric nitrogen are all considered. The electrochemical industries of the Alps, France and Belgium, and, finally, the power centres and electrochemical works of Great Britain, are given space in this report. From end to end, the book is extremely well written, and is entirely free from the so-called printers' errors. The descriptions of the various plants are clear and concise, on the whole, but might have been given in greater detail in a few cases, as in that of the ozone plant. This is a small point, but an important one, as the number of readers fully acquainted with all electrochemical developments is rather small. Beyond this, no serious criticism is offered, and the most sincere congratulations are tendered to the author for this extremely useful and comprehensive report.

Electric Furnaces. By Wilhelm Borchers, translated by H. G. Solomon. London: Longmans, Green & Co. Price 7s. 6d. net.

The present volume is translated from the second edition of "Die Elektrischen Ofen," by Dr. Borchers. An attempt has been made, however, to cope with the recent rapid progress in electric furnace work by including an appendix, wherein two new furnaces are described. The method of treatment and classification adopted is the only rational one possible, *i.e.*, from the point of view of the heating system employed. In this manner the text naturally falls into sections, each occupying a chapter. The first chapter is introductory, and might well have been omitted. This occupies four pages, without giving any information more advanced than that in an elementary text-book of electricity. After this preliminary canter the author passes on to the serious business of the book. Chapter II deals with direct resistance furnaces. The matter is developed historically, commencing with the early experiments of Davy and Pepys. The pioneer work of Cowles is described in some detail, and the development of modern resistance furnaces is brought up to date to about the end of 1905, or the beginning of 1906. In his endeavour to include everything, the author has become extremely uninteresting to read. Furnace after furnace is described, with innumerable diagrams. Many of these are unnecessary in a text-book of this class, and this is especially the case with the figures. Here two, or even three, views of one plant are given, very often in the case of a furnace which is not in commercial use. Another point is very apparent, not only in this chapter, but all through the book, viz., the very large number of modified furnaces to which the author attaches his name. There is a want of clearness in many places which is extremely annoying to the reader. Another vexatious point, which might have been changed by the translator, is that of the alteration of the basis of estimated yields. Thus, on page 59, in connection with trials on a Kjellin furnace the yield of output is first given in kilogrammes and tons per 225 E.H.P., and in the next lines for an improved furnace the output is in pounds and kilogrammes per H.P. This is a minor blemish, but it does not add to the interest of the book. Chapter III embraces indirect resistance furnaces which, of course, include Acheson's carborundum and graphite furnaces. Kryptol furnaces fall into this class, and no fewer than five types to which the name of Borchers is attached. Diagrams are again very numerous, and not too accurate. For example, the plan and elevation on page 81 do not fit each other. In Chapter IV direct arc heating is dealt with in a very exhaustive manner. Four pages of text are justly devoted to the Siemens arc furnace, which, in spite of its failure from a commercial point of view, defines the period of successful furnace work. Many difficulties were recognised and overcome in this venture, and failure was due, chiefly, to the fact that the inventor was a few years in advance of his time. Chapters V and VI deal with the arc type of furnace, and bring the subject practically up to date. Naturally, the Stassano furnace is described in detail, but it is noticeable that the latest form of rotating plant is not touched upon. In the next chapter general considerations of furnace structure receive attention. The matter in hand is thoroughly and exhaustively handled. The author evidently means this to be one of the features of his book, and in this section the numerous diagrams are by no means superfluous. Many novel forms of electrodes are described. Various electrode holders—both in use and suggested—receive the attention they deserve. Cooling devices are discussed, and many other small but essential details are treated in a very able manner. Chapter IX is short, and merely pushes the well-known claims of superiority of the electric type over the older furnaces. In the last chapter furnace outputs are dealt with for a few well-known cases.

This book is a distinct advance on anything previously published. In many respects it is too ambitious, and it is quite impossible to be thoroughly exhaustive in 224 pages. Consequently, many useful data are omitted, and a few novel types of furnaces are not even mentioned, but, on the other hand, much attention is given to plants which could not possibly come into commercial use. One feature in particular deserves attention, and this is the freedom from errors usually set down to the printer's negligence. In fact, the whole book has been prepared very carefully by both translator and publisher. Without hesitation, the book can be recommended to all interested in the evolution of applied electricity. If not perfect, it is at least far in advance of anything else in its class.

The Cultivation and Preparation of Para Rubber. By W. H. Johnson, F.L.S. London: Crosby Lockwood and Son. 1909. Price 7s. 6d. net.

This is the second edition of Mr. Johnson's book, and it is stated to be rewritten and greatly enlarged. In the preface the author says that "it includes all the latest authentic information and covers a far larger range of subjects likely to be of interest or utility to those in any way connected with the rubber industry." This is a large programme for so small a work. It would, perhaps, have been better if the author had confined himself to dealing with matters which are of interest to the planter, investor and botanist, as it is to these that this work will appeal, for the pages dealing with the technical processes to which crude rubber is subjected after it reaches the factory, and with the chemistry and physics, are somewhat superficial, not to say scrappy, and can scarcely be of much practical value either to the manufacturer or to the user of rubber articles. In this respect it is only fair to say that Mr. Johnson's work possesses the fault of a very large proportion of books dealing with technical subjects, in that they say either too much or too little.

We cannot agree with Mr. Johnson's statement that "it (india-rubber) was not, however, employed extensively in commerce until after 1874, when the method of vulcanising rubber, by heating and treating it with sulphur, was discovered." Hot vulcanising was discovered by Goodyear in 1839, and subsequently, independently, by Hancock about 1842. Cold curing was discovered by Parkes in 1846. As a matter of fact, the table on page 2 shows that, in 1870, the importation of rubber into the United Kingdom was roughly 25 per cent. of the quantity imported at the present day.

Chapter II, which is on "The World's Production and Consumption of Rubber" is of considerable interest, although the figures referring to the future development of the plantation industry must be regarded as being of a somewhat speculative nature. Chapters III and IV are on the "Para Rubber Trade at Home and Abroad," and "Propagation" respectively, and Chapter V deals with "Planting and Cultivating." Chapter VI deals with "Soils and Manures"; Mr. Johnston correctly states "that the investigation of various soils in which Para rubber trees have been successfully cultivated tends to show that it is not fastidious in regard to its requirements in this respect," and it is well that this is so, for it is doubtful whether, in most cases, artificial manures could be economically employed, although one rather gathers from Mr. Johnson that this is a somewhat ordinary operation.

Chapter VII contains a carefully written description of the various fungus and insect pests by which the trees may be attacked. It should be of practical use to the planter. Chapter VIII, on "Latex," and Chapter IX, on "Collecting the Latex," are of interest, although the former, in view of much recent published work, might have been somewhat fuller.

Chapter X, on "Rubber Manufacture," as we have indicated, leaves a good deal to be desired, and certainly that part which deals with chemistry, with physical properties and with manufacture proper, might well have been omitted. The part of this chapter dealing with the preparation of rubber from the latex would have been of more value if it had been written in a more critical spirit. Nevertheless, it contains a number of interesting illustrations of machinery of the latest type for preparing the crude rubber, and the plans of factories designed for this purpose are very fair representations of this class of work. Chapter XI is on the "Antisepticisation of Rubber," and Chapter XII contains much of general interest with regard to the "drying and packing of rubber for export." Chapter XIII is on the "Yield of Para Rubber from Cultivated Trees," and contains a number of highly-interesting tables in which statistics of production in this regard are recorded.

To the investor, there is much in Chapter XIV (on the "Establishment and Maintenance of a Para-Rubber Plantation") that is well worth reading, but it is, perhaps, desirable to point out that most of the figures are based on estimates dating back a number of years, and some of them are decidedly, in our opinion, too low, while others have, in the light of a more mature knowledge, been amply confirmed. There can be no doubt that the industry of rubber planting is one of the most valuable commercial assets of the British Empire.

DETERMINING THE AMOUNT OF INJECTION WATER REQUIRED TO CONDENSE EXHAUST STEAM.

By A. W. EMPSON.

Various formulæ have been given for finding the amount of cooling water required by a jet condenser per lb. of steam, but the results obtained are all, more or less, approximate, as the amount of water in the exhaust steam varies considerably, and this is only one source of inaccuracy.

In cases where it is possible to meter the injection water, and the discharge from the air pumps, there is no difficulty, but such conditions do not often exist, and recourse is then had to empirical formulæ.

Some time ago the writer devised a chemical method of ascertaining the ratio between injection water and steam, which he believes to be original, and which he has found to be susceptible of great accuracy.

The principle of this method consists of measuring some constituent of the injection water which is stable under the influence of such heat as would be applied to it in the process of condensation. The amount of the same substance in the air-pump discharge water is then measured, and will, of course, be less in proportion to the extent to which the injection water has been diluted by the condensed steam.

In several cases where this method was tried, the injection water was found to contain a certain amount of chlorine, combined with sodium as common salt, and this, being very stable, was selected as the most suitable substance upon which to base the tests.

The element chlorine is very easily estimated by means of a solution of silver nitrate. When silver nitrate is added to a solution of a chloride, the chlorine combines with the silver to form silver chloride, the reaction being, in the case of common salt :—

$$\text{Na Cl.} + \text{Ag NO}_3 = \text{Ag Cl.} + \text{Na NO}_3$$

Sodium chloride + silver nitrate = silver chloride + sodium nitrate.

The silver chloride appears as a milky precipitate, which will not dissolve on the addition of nitric acid, and this forms a sure test for the presence of chlorine.

In order to show the exact point at which the formation of silver chloride ceases on the addition of silver nitrate, a solution of potassium chromate is used as indicator.

Potassium chromate (K_2CrO_4) combines with silver nitrate and forms a precipitate of silver chromate, the colour of which is red, but so long as any chlorine is present uncombined with the silver nitrate, the silver nitrate will continue to combine with it in preference to the potassium chromate ; the appearance of the red colour signifies that all the chlorine has combined with the silver.

The following apparatus is required for the test, the approximate cost being given in brackets :—

One white glazed porcelain basin about 8 in. in diameter and 2 in. deep (2s.).

One Mohr's burette with stopcock to hold 10 or 20 cubic centimetres graduated in tenths of a c.c. (10 c.c. 1s. 10d., 20 c.c. 2s. 2d.).

One wood burette stand with single clamp (1s. 9d.).

One thin glass stirring rod about $\frac{1}{8}$ in. diameter and 6 in. long (2d.) ; one 250-c.c. flask graduated at one mark on neck (9d.).

The solutions required do not, as in volumetric analysis, need to be of any exact strength, as the actual amount of chlorine need not be ascertained, all that is wanted being the ratio between the amount of chlorine in the injection water and that in the discharge from the air pump.

To make the silver solution, dissolve 4·5 grams of pure recrystallised silver nitrate (2s. per oz.) in 1,000 cb. centimetres of distilled water.

For the indicating solution dissolve 5 grams of pure potassium chromate (2d. per oz.) in 100 c.c. of water, and then add a few drops of silver nitrate solution until a slight red precipitate is formed, after which decant off the clear solution into a clean bottle and reject the precipitate.

Both these solutions should be kept in stoppered bottles in a dark place, and under such conditions will remain good for months.

In order to make a test, samples should be taken simultaneously from the injection water supply, and the air-pump discharge, and the latter should be allowed to cool down until both are at about the same temperature.

All the apparatus should be perfectly clean, and should be washed with distilled water before use.

The burette should then be rinsed out with a few c.c. of the silver solution, and filled up above the zero mark, the excess being run off through the tap until the bottom of the meniscus (*i.e.*, the curved surface of the liquid caused by capillary attraction) is level with the zero mark. All readings of both burette and measuring flask should be made from the bottom of the meniscus.

250 c.c. of one of the samples should be measured in the flask, and poured into the porcelain basin, taking care to rinse the flask *first* with some of the water to be tested, and after pouring out the measured quantity, to rinse with distilled, the latter being then added to the contents of the basin.

The reason for this is obvious, as it eliminates the error due to water clinging to the surface of the flask.

Six drops of potassium chromate solution are then added, and silver nitrate solution is run in from the burette, a few drops at a time, with constant stirring, until the colour of the water changes to a permanent faint red. Note the number of c.c. of silver solution used, and then follow the same procedure with the other sample until the same tint is obtained as in the previous test.

The results are worked out as follows :—

Supposing the injection water requires 6·3 c.c. of silver solution, and the hot-well water 6·0 c.c., the ratio is then 63 : 60, and it will be seen that 100 lb. of injection water contains as much chlorine as 105 lb. of hot-well water (60 : 63 = 100 : 105), therefore every 100 lb. of injection water has been diluted by 5 lb. of condensed steam, and this gives 20 lb. of injection water required to condense 1 lb. of steam.

Should any difficulty be experienced in judging the colour, two similar porcelain basins may be employed, and one sample, having been tested, should be placed near the second sample; the tint of the latter can then be more accurately matched to that of the first.

The same amount of water and potassium chromate should be used in each case.

Should the water be faintly acid, it should be brought to neutrality by the addition of sodium carbonate (free from chlorine), but this is very rarely necessary. Oil in the water in the form of emulsion has not been found to interfere with the test, even when present to the extent of 12 grains per gallon.

Failing chlorine in the water, the permanent hardness may be determined by any of the well-known methods, and from this a ratio can be obtained which can be worked out as above.

The foregoing instructions may, at first sight, appear somewhat formidable, but the process is really very simple and easily performed, and the writer hopes it may be of service to many engineers who have not facilities for measuring by means of calibrated orifices or weirs.

PROCEEDINGS OF INSTITUTIONS.

The Electrical Operation of Textile Factories.

By Herbert W. Wilson.

(*Abstract of paper read at the Summer Meeting of the* Institution of Mechanical Engineers *at Liverpool.*)

The claims put forward by those in favour of electrical driving may in tabular form be stated as follows:—

1. The mill and engine house can be placed each in its most convenient position without regard to their relative situations.
2. The internal arrangements of the mill as regards shafting, gearing, belt and rope drives, &c., are much simplified and the cost reduced. The flexibility as to extensions is, of course, obvious.
3. The grouping of the machines is much less arbitrary than in an ordinary mill, as the motors and light shafting required can be placed where most convenient.
4. The reduction of the chance of a breakdown which would stop the whole mill.
5. The ease with which sections of the machinery can be either stopped or run overtime (where conditions permit) without waste of power.
6. The reduction in the maintenance and depreciation charges.
7. The reduction in the capital cost per loom or per spindle of the whole factory when once a given size is exceeded. This is partly due to reduction in the weight and cost of the buildings.
8. The possibility of obtaining records of the work done in the different sections of the factory, otherwise impossible, and the keeping of a constant check upon them.
9. The greater steadiness of drive which can be obtained with a consequent permissible higher average speed and increased output.

The last claim is by far the most important one. It has been proved to all reasonable satisfaction in many cases, that electrically-driven spindles in a mill can be run at a higher average speed, on the same counts, than mechanically-driven ones, with a corresponding higher production, and this can only be accounted for by the fact that the electrically-driven spindles run more steadily.

In an electrically-driven factory, properly laid out, the speed of every machine should correspond directly with the speed of the prime mover, and, given satisfactory regulation on the engine, every producing machine can be speeded up to its safe maximum and kept there. With even the best rope transmission it has been found in a number of cases in Lancashire mills that the speed of the machines closest to the driving point is steadier and higher than that of the machines furthest away. In other words, the one machine will give a larger output than the other. This has been tested by several persons in different factories quite independently, and the general order of the results has been the same. In one fairly well-known case in Lancashire, with two mills under the same management and of about the same size and working under the same general conditions, the results obtained from the electrically-driven factory have been distinctly superior to those from the mechanically-driven one. To such a marked extent was the improvement in quality of yarn noticeable, that the output of the electrically-driven mill fetched a distinctly better price than that from the other factory, the increase being stated at about 2½ per cent.

It is exceedingly difficult to get absolutely reliable statistics concerning the improvement in output and quality obtained by mills in this country, which have adopted electrical driving, but it may be taken as a conservative estimate that the increase in production is on the average at least 5 per cent.

Considering Lancashire practice, the cotton spinners and weavers state their costs at so much per pound of yarn or cloth produced. In the case of a spinning mill on most classes of counts, it may be taken that the margin over the price of raw cotton, out of which the manufacturer has to pay all his costs and make his profit, is something like 3d. to 3¾d. per lb.

Assuming a price of 4d. per lb., therefore, the selling price of the yarn would be, say, 7½d. A considerable portion of this 3½d. is made up of the piecework price per pound paid to the operatives.

Assuming, however, that the fixed charges amount to 12 per cent. of the total costs, which is a fairly average figure, an increase in output of 5 per cent. would mean a reduction in cost per pound on the whole output of 0·6 per cent. In a modern spinning mill the total power costs do not amount to more than 2½ per cent. to 3 per cent. of the total expenses, and an increase of 10 per cent. in the cost of power would only mean an addition of 0·25 per cent. to the cost per pound of production. It will be seen, therefore, that even allowing for a considerable increase in the cost of power, which personally the author does not admit, there is a margin of 0·35 per cent. extra profit on the whole turnover, which means a considerable amount in a year.

As regards capital cost, taking a new spinning factory as a basis, and assuming that if electrically operated, the structure would be brightened and modified to suit the altered conditions, then below 80,000 mill spindles the mechanical transmission system is the cheaper, between 80,000 and 100,000 the costs are about equal, and above 100,000 the electrical system is the cheaper. The efficiency of the electrical transmission system would be about 82 per cent. to 83 per cent., or about the same as a well laid-out modern mechanical transmission system.

In the case of an old factory requiring re-equipment, it frequently happens that owing to the inconvenient arrangement of the existing buildings the electric drive offers distinct advantages as regards both initial capital outlay and efficiency. Cases have come before the author where the conversion has resulted in a reduction of 20 per cent. of the power consumption.

The intermediate case of a fairly modern factory with a good mechanical transmission system requiring extensions above the capacity of the engine, is a very interesting and promising one. Under such circumstances as these the use of the exhaust steam turbine has many advantages, and, as will be shown, this almost of necessity involves, either wholly or partially, the electrical driving of the factory.

To take a concrete case now under consideration. A spinning mill mechanically driven but electrically lighted, has a main engine of the compound vertical type developing 1,000 I.H.P. with a steam consumption of about 13 lb. per I.H.P.-hour. The lighting dynamos are driven by the main engine, and in the winter when fully loaded require a trifle over 100 H.P.

It is required to make some extensions in the factory involving an additional load of about 200 H.P. It was first suggested that a generating set of 150 KW. (225 I.H.P.) should be installed, but as plenty of condensing water is available, it has been found possible to alter slightly the valve-setting of the main engine, and obtain about 850 I.H.P. from it non-condensing and 500 I.H.P. from an exhaust steam turbine utilising the steam from the engine. In this manner it would be possible to obtain some 1,350 I.H.P. for a steam consumption of about 10·5 lb. per I.H.P.-hour. The saving in fuel over the other arrangement suggested is approximately 30 per cent., and this with the comparatively high price of coal in the district under consideration makes the total saving a large one.

This brief statement of a comparatively common case shows how in existing factories the introduction of the electric drive may reduce working costs, apart altogether from every other advantage.

The result of the author's observations is that a Lancashire factory of, say, 1,500 I.H.P. capacity, can produce energy at, say, 0·2d. per I.H.P.-hour, or 0·3d. per KW.-hour, allowing for interest and depreciation. This is on a basis of being able to purchase good slack with a calorific value of 11,000 B.TH.U. at 8s. per ton delivered.

It has been found generally practicable to induce fairly large factories to purchase power at about 0·4d. per unit net, metered on the low-tension side of the mill switchboard.

The main differences of opinion among engineers designing the lay-out of electrically-equipped mills arise over the questions of group or individual driving. The more nearly the ideal of a motor to every machine can be approached the better the actual results, but the higher the capital outlay and generally the running cost. The author is in favour of the individual driving of ring spinning-frames, and the group driving of all other machines, keeping the groups fairly small. It is absolutely essential that the arrangement of the motors shall have very careful consideration.

A point needing attention is the heating effect of the motors. It is now the best practice to build them with hollow frames, and to bring cooling air from some external source round the frames, thus preventing the discharge of heat to the room.

It is by no means a safe rule to assume that the horse-power is so much per 100 spindles of the mill, as this may lead to considerable error. The most careful consideration of the power taken by each section of the installation is necessary.

Some figures from mills actually working near Manchester may be of interest. In Table I is given a list of machines installed in a small mule-spinning mill, with a statement of the horse-power required by the various machines, calculated on the usual basis.

In Table II is given a more accurate statement of the power required per machine, or the average number of spindles per horse-power, the speed of running of the machine, and the nature of the load provided by the machine, including also an estimate of the time the machine is standing idle for doffing, shown as a percentage of the total running time.

In Tables III and IV are given the sizes of motors actually installed in two mills in Lancashire where group-driving is employed, and it may be said that in nearly all cases these motors are direct coupled to high-speed line shafts. It must be remembered that in all these cases the *average* number of spindles per horse-power is stated, and this may vary considerably with the speed of the spindle and class of counts spun.

In the case of ring frames the number of spindles per horse-power may vary between 140 at 6,000 R.P.M., and 80 at 9,000 R.P.M., so that great care has to be exercised in considering the question of the size of motors required.

TABLE I.

1 Bale breaker and lattice mixing arrangement	3 H.P.
3 Horizontal exhaust openers	18 H.P.
10 Single scutchers	35 H.P.
84 Carding engines...	84 H.P.
11 Draw frames	20 H.P.
9 Slubbers, total spindles 882	17 H.P.
16 Intermediates, total spindles 2,212	36 H.P.
40 Rovers, total spindles 6,880	100 H.P.
28 Mules, 1⅛-in. gauge, total spindles 36,063 ...	314 H.P.
40 Mules, 1⅛-in. " " "	242 H.P.
Total	869 H.P.

TABLE II.

Machines.	H.P. approx.	R.P.M.	Load and loss of time.
Hopper bale-breaker	3	300	Steady if feed is regular
Hopper feeder ...	1½	600 850-1,000	"
Exhaust opener ...	6-8	950-1,400	"
Single scutcher ...	3½-5½	950-1,400	Steady
Carding engine ...	1	140-190	"
Drawing frame ...	0·15 per delivery	180-300	8-27·5 % loss; load steady during run
Slubbing frame ...	45 sps. per H.P.	200-4 0	39-22 % "
Intermediate frame	55 sps. per H.P.	360-490	18-8 % "
Roving frame ...	65 sps. per H.P.	360-480	17-5 % "
Ring frame... ...	70 sps. per H.P.	600-1,000	5-10 % "
Mules	100 sps. per H.P.	—	4-7½ % loss; load very variable
Doubling frame ...	40-70 sps. per H.P.	600-1,000	5-10 % loss; steady during run
Winding	300 sps.	140-180	Steady
Beaming	6 per H.P.	40	"
Sizing machine ...	1½-3	210-300	"

TABLE III.

Machines.	Size of motors.
Bale breakers, exhaust openers, lattice mixers, scutchers ...	45 H.P., 575 R.P.M., directly connected to line shaft.
20 carding engines, 3 draw frames, 3 slubbers and 6 intermediate	55 H.P., 575 R.P.M., driving counter-shaft with ropes.
3 pairs of mules and 14 rovers ...	100 H.P., 580 R.P.M.
6 pairs of mules	130 H.P., 530 R.P.M.
4 pairs of mules and several ring frames	100 H.P., 580 R.P.M.
120 looms	50 H.P., 580 R.P.M.
153 looms	65 H.P., 580 R.P.M.

TABLE IV.

Machines.	Driven by
2 waste pickers ... ... 1 roving waste-opener ... ... 2 hopper bale-breakers with lattice mixers	1 motor, 12 H.P.
4 hopper feeders... ... .. 4 horizontal openers with double scutchers ... ... 12 single scutchers	2 motors, 40 H.P. each.
84 cards, 45-in. cylinder.. ... 3 drawing frames, each 6 heads of 7 deliveries each	2 motors, 65 and 50 H.P.
8 slubbing frames, 100 spindles 19 intermediates, each 146 spindles ... ... 45 rovers, each 184 spindles ...	2 motors, 90 and 75 H.P.
63 ring frames, 2½-in. gauge 6-in. lift. Total spindles, 34,864 32 mules, 1⅛-in. gauge. Total spindles, 41,216	Several motors aggregating 850 H.P.; in 200-H.P. and 150-H.P. units.
3 winders, 2,000 spindles ... ... 10 beaming engines	15 H.P. Approximate total = 1,250 H.P.

Owing to want of time, the discussion on the papers "Advance of Marine Engineering" (briefly abstracted in "Notes" in our last issue) and "Electrical Operation of Textile Factories" was confined to a comparatively short period, and, in the majority of cases, the observations were submitted in writing.

Mr. W. Sisson, of Gloucester, referred to a paper read by Mr. Durtnall on electric power for main marine propulsion, and said that the application of main electric drive for working screw propellers was very promising.

In the discussion of Mr Wilson's paper, Mr. Mark Sutton, of Rio de Janeiro, Brazil, spoke of the electric installation of his two mills. He was in favour of group driving, and he had had excellent results from the motors, which had been running for about seven months.

Mr. A. Saxon, of Manchester, thought Mr. Wilson ought to have selected a better case for comparison than the two Lancashire mills he had mentioned, one having been built in 1855 and the other, electrically driven, about 1905. Under such conditions, it was hardly to be wondered at that the electrically driven mill had an increase of 2½ per cent. in price of output.

Mr. Cortey Leigh said it was true that in the Bannerman Mills a comparison was made between the two drives, but it was made with up-to-date steam engines, and, after the points had been closely considered, Mr. C. Macara decided in favour of the electric drive, which was more efficient and cheaper.

Mr. Wilson, replying to the points raised, said the old building referred to by Mr. Saxon was re-equipped with the mechanical transmission system 12 or 13 years ago. As to the Bannerman Mills, Mr. Macara had concluded that the installation of the electric drive meant at least a 5 per cent. increase in production, and he had satisfied himself that that increase was being obtained.

Some Tests and Uses of Condensers.

By W. M. Mordey, President I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *in London, May 20th,* 1909.)

There was a period when the capacity of the cables in distribution systems in many cases provided a good deal of compensation for self-induction. But now the growth of the motor load is making a difference, and in many cases there is a real need for the improvement of the power-factor in supply systems, for various reasons, such as keeping down the loss in the mains and increasing the useful output of generators and reducing their cost. The loss in the mains is inversely proportional to the square of the power-factor, thus:—

Power-factor ...	1	0·9	0·8	0·7	0.6	0.5
Loss	1	1·24	1·56	2·04	2·78	4 0

As to the effect on cost and output, Mr. Miles Walker recently cited one case where the rating of some turbo-alternators was raised 50 per cent. owing to their being used at nearly unity power-factor.

For the improvement of power-factor the use of over-excited synchronous motors, originally described by the author in 1893, is practically the only method that has so far obtained engineering recognition. Mr. Fedden, of Sheffield, has installed a specially designed motor made by the British Thomson-Houston Co. It has a capacity of 600 K.V.A., and consists of a two-phase motor for 2,000 volts 50 cycles with a direct-current exciter and an induction motor for starting up, all on one shaft. It is used at intervals during the day to keep up the power-factor of the system and to reduce the excitation of the main turbine generators, which are in a station two miles away. At the present time the average day load is about 4,000 K.V.A., at an average power-factor of 0·7, equal to an actual load of 2,800 KW. The rectifier raises the power-factor to an average of 0·83, reducing the apparent load from 4,000 to 3,380 K.V.A., thus releasing 620 KW. of capacity in generators, and in cables between the two stations. These figures correspond to a load on the motor of nearly 1,000 K.V.A.

Of the many kinds of condensers only two types are here considered—the Mansbridge and Moscicki types.

The former have the great advantage that if they are pierced they are self-healing, but they appear, however, only to have been made for low pressures.

The Moscicki condensers are said to be largely used for wireless telegraphy, and they are being used in some cases abroad for power-factor improvement on extra-high-tension transmission lines. They seem to be very suitable for this purpose, as by the use of a suitable thickness of glass they can be made to withstand a very high voltage.

I have had some tests made of both types by Mr. Wild, of the Westminster Testing Laboratory. It is believed that the results may be relied upon for the low-tension paper condensers within 5 per cent. each way, and for the high-tension glass condensers within 7½ per cent. each way at the highest voltages and 15 per cent. at the lowest.

The results of the tests are shown in figs. 1 and 2 (p. 238).

The capacity and power-factor were found to be nearly constant at all frequencies. The variation of power-factor with voltage was less than the instrumental errors within the limits of the tests. It will be seen that the loss of energy was small.

It would seem that no difficulty should be met with in using a number of Mansbridge condensers in series for high-tension work, as the conditions in each section as to voltage, loss and power-factor, will be the same when used in such a series as when used singly. The British Insulated and Helsby Cables, Ltd., who made the condenser tested, have, in answer to the author's question, suggested 500 volts per section for a condenser so made up for 10,000 volts, and state that it would occupy about 2 cb. ft. per microfarad, and they think the price would be about £27 per microfarad. They, however, have had no experience of condensers so made up or used.

The Moscicki condenser tested consists of eight tubes, having a total capacity of 0·03 microfarad. It is intended for A.C. working at

10,000 volts. Each tube is 2 in. in diameter and 2 ft. 9 in. long, or with connections, 3 ft. 2 in.

Some tests were made of a set of six Leyden jars of $\frac{1}{2}$-gallon size, having a total capacity of 0·015 microfarad, lent by Mr. Campbell Swinton.

At 5,000 and 7,500 volts the loss in watts per microfarad in the Moscicki condenser and in the Leyden jars is the same, but at 10,000 volts there is a marked difference. There is some brush discharge in the Leyden jars from 5,000 volts upwards. The losses in the Moscicki condenser continue to increase approximately as the square of the voltage. The curves showing variation of power factor with frequency must be accepted with some reserve; they show, however, that the Moscicki glass condenser works with a loss of about 1 per cent. of the kilovolt-amperes dealt with.

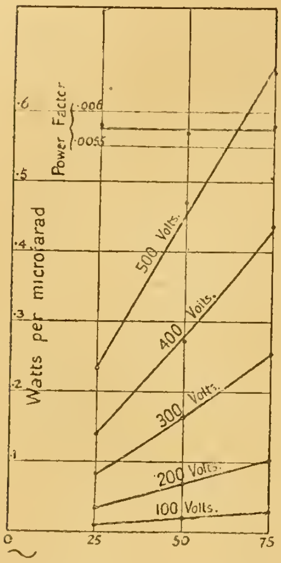


Fig. 1.—Tests of Low-voltage Paper Condenser.

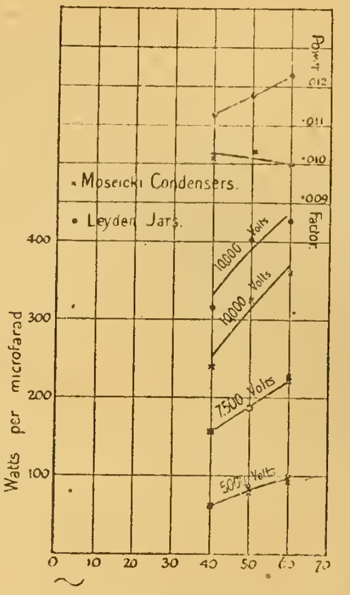


Fig. 2.—Tests of High-Voltage Glass Condensers.

The C^2R loss accounts only for an insignificant proportion of the total losses with alternate current.

From the results shown, a 10,000-volt Mansbridge condenser would lose about 190 watts per microfarad at 50 periods, and the Moscicki 10,000-volt condenser about 320 watts per microfarad; respectively about 0·6 per cent. and 1 per cent. of the kilovolt-amperes dealt with. These losses are of the same order as the magnetising losses in transformers of good design. With such small losses as these, no difficulty should be experienced in preventing objectionable heating.

Comparing condensers with over-excited synchronous motors, we will assume a synchronous motor or a condenser installed for the compensation of a circuit requiring 1,000 kw. at 10,000 volts, 50 periods, with a power factor of 0·8. To give unity power factor, this would need a motor of 750 k.v.a., or a condenser having a capacity of 24 microfarads.

The cost of the motor erected with foundations, switchgear and accessories will not be less than £1,100, and at a mean of 30 kw. for 12 hours a day, the total annual consumption will be 131,400 units.

The cost of a condenser of 24 microfarads for the above conditions would be about £720 with switchgear and accessories, and the loss not more than 7·5 kw. at full load. The condenser could be in sections, some of which would be switched out as the load fell, but we will assume that it is all kept in circuit for 12 hours a day. The total annual consumption would be 32,850 units.

Charging only the cost of the coal, say 0·25d. per unit, we get the following comparison:—

	Synchronous motor.	Condenser.
Capital cost	£1,100	£720
Annual cost of energy wasted ...	137	34·2

These figures speak for themselves. They would be still more striking if the comparison included necessary spare apparatus. Moreover, a large condenser could be sub-divided without disadvantage, but in the case of synchronous motors such sub-division would involve considerable increase of cost and loss.

No attempt has been made to compare the cost of condensers with the added cost necessary to make ordinary motors or rotary converters available for power factor correction in addition to their ordinary work, but the low capital and working cost of the condensers points to a comparison, even on this basis, being possibly favourable to the latter.

In conclusion, it may be of interest to give the result of some experiments on the use of condensers for preventing or stopping the formation of arcs under certain conditions. In investigating the action in a surface contact tramway system recently, the author found that trouble was experienced due to the formation of persistent arcs at the underground contacts. When the road was wet and dirty a small leakage current passed from the live contact stud under the car over the surface of the road to the rails. When the car had passed and the underground contact-piece had separated its proper distance from the live conductor, this leakage current was sufficient to maintain an arc across the air-space of the contact-maker, thus keeping the stud alive so long as the arc persisted. It was found that with a terminal voltage of about 560 volts the voltage between the stud and the rail was usually about 400 to 440 volts, and the voltage across the arc about 120 to 160 volts. Sometimes arcs would persist for a few seconds with not more than 0·6 ampere, and they would often persist when the leakage current was over 1 ampere—this latter condition, it will be seen, corresponds to a resistance of the leakage path from the stud to the rail of a maximum of 440 ohms.

The prevention of these arcs by increase of gap, or by other structural alterations was not found to be practicable, and it therefore remained to try to find some means for preventing their formation, or for immediately putting them out if they were formed. For this purpose experiments were made with a condenser, which was found to be quite effective.

Two conditions may be given:—

(A) A suitable condenser placed across the gap prevents any arc being formed, however small the gap—for example, it was not possible to maintain an arc across a gap of even $\frac{1}{64}$ in.

(B) If the arc is formed and it is then shunted by a suitable condenser it will at once go out.

The minimum safe capacity for these two cases was found to be as follows:—

Amperes.	Condition (A). Microfarads.	Condition (B). Microfarads.
1·5	1	2
2·0	2	4
2·5	3	6
3·0	4	8

It was found quite practicable to extinguish the arcs by shunting them by a condenser carried on the car, one terminal being connected to the collector or skate, the other to a small wire brush hanging down under the rear platform of the car, and making successive contacts with the studs.

It was also found that the arcs could be put out by placing the condenser in shunt across the leakage path instead of across the arc itself, or with two condensers in series across the resistance and the arc, with a middle connection to the junction between them.

It was not necessary that the condenser should be in a discharged condition, the arc being put out, whether the condenser when applied was discharged or charged to the full voltage of the circuit, in which latter case the effect would be produced in whichever direction of polarity the condenser was applied.

The arcs could also be put out by a resistance shunt, but there are objections to that, and in any case it need not be examined here.

Mr. Mansbridge, in opening the discussion, said the Helsby Co. were making l.t. condensers by the thousand, but very few h.t. ones, and as it did not pay to put down special plant for the latter, the l.t. units were usually built up for h.t. purposes. There were obvious advantages in not having high pressures across the terminals of a condenser, and he preferred multiple units. The C^2R losses were partly due to the resistance of the electrodes, as at present the Mansbridge condenser was used almost entirely for telegraph and telephone purposes, and the quantity of tin was kept small; if used continuously for heavy currents, it would be necessary to use more tin or more electrodes. He thought that a decrease in thickness of wax in the condenser would probably lead to a decrease of dielectric loss.

Mr. W. B. Esson commented on the unreliability of condensers up to the present, due, he supposed, to their having been made entirely by instrument makers; the Moscicki condenser, however, was an engineering device, and he had seen one behaving satisfactorily under a prolonged test at 6,000 volts. The compensating motor had been used with success in the Kolar Goldfields transmissions, where trouble was caused through lagging currents.

Mr. J. E. Taylor suggested that the Duddell thermo-ammeter was preferable to the wattmeter for measuring condenser losses.

Mr. Mordey, in replying, said that the total losses in the condenser were at present so small that he thought there was not much chance of improvement.

Institution of Electrical Engineers.

At the special general meeting of members, associate members and associates, held on July 29th, the President, Mr. W. M. Mordey, made the following statement:—

We have now reached a very important stage in connection with our new building on the Victoria Embankment.

On June 30th, last year, at a special general meeting, authority was given for the purchase of the property for a sum of £50,000. This purchase was duly completed on June 1st this year, the purchase money being provided as follows:—

From the accumulated funds of the Institution	£24,000
From a mortgage on the building	26,000
	£50,000

Ever since the meeting of June 30th last year, the Council have been engaged on the consideration of various schemes for adapting the building to the purposes of the Institution, and they have finally decided that it will be in the best interests of the Institution to enlarge and improve the entrance hall, and to rebuild the theatre completely. Plans prepared by our architect, Mr. Percy Adams, have been considered, and finally, specifications have been issued and tenders obtained for the work. The result is that an expenditure estimated at £18,000 is necessary to cover these alterations in the building, and the equipment and furnishing of the large library on the first floor, and of the parts of the building to be occupied by the Institution, including also the cost of a lift and various other matters necessary to adapt the whole of the other parts of the building to the requirements of our tenants, the Colleges of Physicians and Surgeons.

The new theatre will be a very handsome one, appreciably larger than that of the Institution of Civil Engineers, in which we have for so long had the great privilege of holding our meetings. The modified entrance hall will provide a very attractive and convenient means of access to the theatre, library, offices and public rooms.

The funds of the Institution would be sufficient for the purpose of the required expenditure if we sold the Tothill Street site at the price we gave for it, viz., £17,500—a price which, we are advised, is a low one. It is believed that, when the time is more favourable, we shall be able to dispose of the site at a profit. Meantime, we have arranged for a mortgage on the Tothill Street property of £11,500, and have securities available amounting to £4,000, making a total of £15,500. As already explained, the estimated expenditure is about £18,000, and adding for contingencies and margin £2,000, we require a total of £20,000. We are, therefore, short to the extent of about £4,500.

The sale of the Tothill Street site at cost price would, after paying off the mortgage, yield £6,000. To meet this expenditure of £4,500, and to justify the Council in putting before the members a recommendation to proceed with the proposed alterations, the past and present members of the Council have guaranteed the difference between the assets and the requirements, on the understanding that if they are called upon to make any payments under this guarantee they are to be repaid out of the funds of the Institution when available, either as a result of the sale of the Tothill Street property, or from contributions to the building fund, or otherwise.

Two resolutions are before you: the first is necessary to meet the wishes of the Economic Life Assurance Society, from whom we have borrowed a sum of £26,000 on the security of the new building; the second is a resolution approving the proposed expenditure.

The resolutions, of which we gave the substance in our issue of July 23rd, were then passed unanimously.

Death through Lightning, and Workmen's Insurance.—The question whether a workman killed by a stroke of lightning, while at work, can be regarded as having met his death owing to an accident during the course of his employment, has engaged the attention of the Court of Arbitration for Swabia and Neuburg. It appears that on July 13th, 1908, while engaged in plastering the passage inside a new dwelling a workman was killed by a flash of lightning, which struck the fireplace and passed through the house. The father of the workman applied to the Bavarian Builders' Friendly Society for payment of the funeral benefit, but this was refused on the ground that the requisite connection between the death and the work was lacking. The union based its refusal on the consideration that it is necessary to prove not only that the accident occurred at the place of work, but also that it was produced by the work, that is, that it was occasioned by a danger standing in close relation to the work. Against this decision the father appealed to the Court of Arbitration, which ordered the friendly society to pay to the applicant funeral benefit to the amount of £4 13s., and the incidental costs. The Court held that in any circumstances, bodily injury caused to an insured person by lightning while following employment must be recognised as an accident at work, irrespective of whether the lightning stroke occurs in the open or in a protected room, or whether the conditions determining the direction of the path of the lightning can or can no longer be recognised.

Professional Etiquette.—An Australian correspondent sends us "A Few Notes on Electricity," the product of a *soi-disant* "consulting engineer," who has commenced business there. These notes are apparently intended to inform the public, and incidentally to attract custom :—

"Now, I wish you to thoroughly understand that you can apply electricity to any purpose or person of the most delicate character or nature, without the slightest danger. You can use it to melt a piece of iron in a pair of seconds. Therefore you can form an idea of the wonderful and powerful substance we are handling. . . . .

"I wish to convey to the mind of the public that if an electrical installation is effected in any building or factory of any character, even a powder plant or magazine, in a proper manner, it can be handled by a child without the slightest fear of any damage or danger. Therefore, I think it my duty to express my opinion to the public, and notify them that when they wish to use electricity, on account of its cleanliness, comparatively low cost, and small amount of energy required to have it installed in a first-class way on the premises, and it will be impossible to have any trouble or accident with electric motive power, which is the principal element of life.

"Therefore the public should employ a *consulting electrical engineer*. . . . ."

These extracts speak for themselves.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE.—A statement of the duties leviable in France on electrical and other similar materials was published in the Electrical Review of February 19th and 26th last. At the same time a statement of proposed new duties was also given. These duties have not yet been put into force, so that the rates at present leviable are those given in the column "Present rates" in the statement referred to.

FRANCE—ALGERIA.—The duties are the same as those levied on goods imported into France.

FRANCE—CORSICA.—The duties payable on goods imported into Corsica from countries other than France, and dutiable by weight, are the same as those levied on goods imported from such countries into France, reduced one-half for the portion exceeding 6 fr. per 100 kg.

FRENCH CONGO.—(1) Gaboon.—In the district not included in the Conventional Basin of the Congo the same duties (with a few exceptions) are levied as in France.

(2) Conventional Basin of the Congo.—A duty of 10 per cent. *ad valorem* is levied on all imported goods with the exception of spirits (dutiable at special rates) and the following, which are free of duty:—Steam engines, machinery for industry or agriculture and tools for industry, locomotives, carriages and railway material of various kinds during the construction of the railway for which they are intended (afterwards 3 per cent. *ad valorem*), scientific instruments.

FRENCH GUIANA.—The duties levied on goods imported from countries other than France into French Guiana are the same as those levied in France (with a few exceptions); but, in addition to these duties, certain consumption and octroi duties are also levied on French and foreign goods alike.

The following consumption duties are payable on the goods named :

	Fr. per 100 kg.
Resins and resinous substances	1
Cement	·24
Cast-iron, rough	·60
Steel in bars, rails	3·20
„ „ other	3
Steel in sheets	3·20
Copper, pure, in pigs	4·80
„ alloyed	5·60
Lead, in pigs	4·60
Tin, in pigs	7
Zinc, in pigs	2·40
Mercury	20
Other metals	4 % ad val.
Acids, salts and other chemicals	4 % ad val.
Earthenware pipes	4 % ad val.
Glassware	4 % ad val.
Paper	4 % ad val.
Machines not intended for agriculture or industry	4 % ad val.
Cutlery and all metal goods	4 % ad val.
Material for telegraph and telephone lines	free
Goods not specially mentioned	4 % ad val.

The following octroi duties are payable on the goods named :—

	Fr. per 100 kg.
Resins and resinous substances	1·25
Lubricating oils	5
Cement	·30
Cast-iron	·75
Iron rails	4
Other iron in bars	3
Steel rails	4
Other steel in bars	4
Steel sheets and plates	4
Copper, pure, in pigs	6
„ alloyed, „	7
Lead, in pigs	5·65
Tin „	8·75
Zinc „	3
Metals not named	5 % ad val.
Acids, salts and other chemical products	5 % ad val.
Glassware	5 % ad val.
Metal ware	5 % ad val.
Machinery for industry and agriculture	free
Materials for telegraph and telephone lines	free

FRENCH INDIES.—No duties are levied on electrical and similar goods imported into the French Establishments in India.

FRENCH INDO-CHINA.—The duties on goods imported into French Indo-China from countries other than France are, with some exceptions, the same as those levied in France. The following are some of the exceptions:—

Building stones, cut or not	free
Mineral oils	4 fr. per 100 kg.
Complete machines, mounted or not, for gold-mining (not including the motor)	8 „ „

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,811. "Improvements in and relating to alternating current electric induction motors." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 19th.

16,812. "Improvements in fans for cooling dynamo-electric machines and for other purposes," Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 19th.

16,823. "Improvements in conduits and adaptors for electrical conductors and the like, and in the method of protecting the latter." H. Moss. July 19th.

16,855. "Improvements in or connected with the production of electric light between the electrodes of arc lamps." Ges. Fur Elektrotechnische Industrie m.b.H. and J. Gyuris. July 19th. (Complete.)

16,904. "Improvements in electric arc lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 20th. Complete.)

16,912. "Improved hygienic guard for the talking funnels of telephone apparatus." E. Sand. July 20th. (Complete.)

16,924. "Improvements in electric arc lamps." F. Proctor. July 20th.

16,928. "Arrangement of connections for automatic sub-station switchboards with several exchange double leads in which the selection of the subscriber is effected from the exchange by means of alternating currents of different frequencies." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, August 20th, 1908, being date of application in Germany.) July 20th. (Complete.)

16,931. "Improvements in electroplating baths." B. J. B. Mills. (A. Van Winkle.) July 20th. (Complete.)

16,943. "Electric controlling and distributing mechanism for sparking devices." G. D. Rogers. (Date applied for under Sec. 91 of the Act, August 7th, 1908, being date of application in United States.) July 20th. (Complete.)

16,950. "Improvements in or connected with electric wiring and switching systems." B. P. Scattergood and T. G. Bray. July 20th.

16,985. "Improvements in insulating former wound coils or the like." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, July 21st, 1908, being date of application in Germany.) July 21st. (Complete.)

16,990. "Improvements in and relating to electric mechanism for writing and colour changing signs." R. F. Venner. July 21st.

17,023. "Method of obtaining from or impressing upon electric dynamos or motors electrical pressures of various magnitudes." W. J. Bransom. July 21st.

17,031. "Improvements in and relating to protective devices for electrical transmission and distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. July 21st.

17,043. "Improvements in or relating to small transformers." A. J. Boult. (Deutsche Elektro-Sparklicht G.m.b.H., Germany.) July 21st. (Complete.)

17,101. "Improved insulating device for electric lampholders." H. Hirst and H. J. Coates. July 22nd.

17,104. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 22nd. (Complete.)

17 106. "Improvements in or relating to crossings and junctions for electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. July 22nd.

17,107. "Improvements in intercommunication telephone instruments." J. A. Romer. July 22nd.

17,114. "Improvements in or relating to electrically operated switches suitable for use in connection with train lighting and for other purposes." M. W. W. Mackie. July 22nd.

17,137. "Improvements in sound intensifiers for telephone mouthpieces and the like." H. Foss. July 22nd. (Complete.)

17,138. "Improvements in electric meters indicating maximum consumption." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. (Date applied for under Sec. 91 of the Act, August 3rd, 1908, being date of application in France.) July 22nd. (Complete.)

17,189. "Improvements in and relating to dynamo-electric generators for generating systems." A. H. Midgley and C. A. Vandervell. July 23rd.

17,190. "Improved electrical switching devices." H. Lavy. July 23rd.

17,199. "Improvements in and relating to the regulation of dynamo-electric machines." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, July 23rd, 1908, being date of application in Germany.) July 23rd. (Complete.)

17,208. "Improvements in electric and other advertising and the like purposes." W. K.-L. Dickson. July 23rd.

17,215. "Improvements in beams, particularly applicable for use as masts of wireless telegraphy stations." S. Eisenstein. July 23rd. (Complete.)

17,217. "Improvements in apparatus for the production of electric impulse charges for the purpose of wireless telegraphy." S. Eisenstein. (Application for Patent of Addition to No. 10,019/1908.) July 23rd. (Complete.)

17,230. "Improvements in electric incandescent lamp fittings and the like." Wardle Engineering Co., Ltd., and W. Wardle, jun. July 24th.

17,254. "Improvements in windings for the armatures of dynamo-electric machines and the like." A. Greenwood and F. T. Chapman. July 24th.

17,274. "Improvements relating to electric switches." H. R. Schultz. July 24th.

Embezzlement by a Tramway Manager. — At Glasgow Sheriff's Court, Arthur Delves, late manager of the Airdrie and Coatbridge Tramways Co., pleaded guilty to a charge of embezzlement. The indictment was to the effect that between January 4th, 1908, and June 19th, 1909, he embezzled £204 14s. 10d. The accused had been manager of the tramways for several years at a salary of £250 per annum; he had had serious illness in his family, and became pressed for money. His wife was in very bad health, and there were four children. The Sheriff-substitute described the case as a very painful one, and passed sentence of three months' imprisonment.

Electricity in Servia. — The *Bulletin Commercial* (Brussels) of July 17th contains a long article on the electrical industry in Servia. The report draws attention to the good openings in that country for electric lighting and kindred appliances, and to the necessity not only for supplying articles of good quality at reasonable cost, but also for developing the market on the spot by means of personal visits. The establishment in Servia of a depôt where electrical material could be seen by persons interested would, according to this report, be the most efficient way of rapidly increasing business.—*Board of Trade Journal.*

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Process of and Means for Preventing Oxidisable Metals and the like from Rusting after they are Electroplated. C. Mason. 13,715. June 29th.

Electrodes and Resistances for Electric Furnaces, Radiators, Lamps and the like. C. Cornaro. 13,734. June 29th. (Date applied for under International Convention, June 27th, 1907.)

Regulating Device for Electric Circuits. F. Ritchie. 13,957. July 1st.

Astronomical Compass and Time Indicator. H. Reeves. 14,008. July 2nd. (Cognate application No. 14,523/08.)

Combined Telephone and Telautograph Exchange System. F. Ritchie. 14,401. July 7th.

Automatic Electromagnetic Switch or Cut-out for Disconnecting Charged Conductors in Overhead Systems of Electric Traction or the like. W. Barraclough. 14,463. July 8th.

Electrolytes for Electrolytic Cells. British Thomson-Houston Co., Ltd. (Gen. Elec. Co., U.S.A.) 15,792. July 24th.

Electroplating and like Processes. H. Hutton and R. S. Hutton. 18,246. August 31st.

Electrical Ignition Systems of Internal-Combustion Engines. J. P. Bell. 19,883. September 22nd. (Cognate application No. 20,226/08.)

Stranded Electric Cables. C. J. Beaver and E. A. Claremont. 20,447. September 29th.

Protective Devices for Electric Distribution Systems of the Type known as Lightning Arresters. British Thomson-Houston Co. (Gen. Elec. Co., U.S.A.) 22,135. October 19th.

Electric Cooking and Heating Apparatus. E. Coiseur. 22,551. October 23rd.

Manufacture of Filaments for Incandescent Electric Lamps. British Thomson-Houston Co., Ltd., and H. H. Needham. 23,726. November 5th.

Incandescent Electric Lamps. Soc. Francaise d'Incandescence par le Gaz (Système Auer). 24,211. November 11th. (Date applied for under International Convention, November 12th, 1907. Application for Patent of Addition to No. 12,720/08.)

Mechanical Connectors for Electric Cables. J. Stratton and E. A. Claremont. 26,796. December 10th.

Wireless Telegraphy and the like. S. Eisentein. 2[illegible],738. December 23th.

1909.

Magnetic Separating Machines. Rapid Magnetting Machine Co., H. H. Thompson and A. E. Davies. 335. January 6th. (Date applied for under Rule 13, July 14th, 1908.)

Aluminium Electrolytic Cells. British Thomson-Houston Co. (General Electric Co., U.S.A.) 1,345. January 19th. (Date applied for under Rule 13, September 4th, 1908.)

Armature Windings for Dynamo-Electric Machines. N. W. Storer. 3,831. February 16th. (Date applied for under International Convention, March 2nd, 1908.)

Magnetic Locking Device for Locking Railway Carriage Doors, Safes, or for other Purposes. G. P. Fairless and W. T. Dixon. 4,863. February 27th.

Electric Motor-Generator Sets. British Thomson-Houston Co. (General Electric Co., U.S.A.) 5,119. March 2nd.

Means for Use in Connection with the Electric Ignition Gear of Motor Road Vehicles to Prevent Starting of the Vehicle by Unauthorised Persons. J. G. Hay. 6,105. March 13th.

Device for Converting a Series of Electrical Contacts of Short Duration into a Contact of Longer Duration. R. Plato. 6,646. March 20th.

Alternating-Current Arc Lamps. M. Korting. 4,122. February 9th.

Electric Arc Lamps. H. P. Bleckly and R. Brown. 9,516. April 21st.

Oil Transformer Explosion.—Referring to the partial destruction by fire of the station of the Trinidad (Col.) Electric Light and Power Co., the *Electrical World* learns that the total loss was somewhat under $100,000, and that the fire was primarily due to the arcing over of a rotary converter, which short-circuited coils in three oil transformers installed on a wood floor in the same building. Probably owing to low oil, an explosion took place in the case of one of the transformers, which blew the top off, rent holes in the side and scattered burning oil over the wood floor. Within a few minutes the engine room was untenable, and by the greatest effort only were the fires drawn under boilers and danger of explosion averted before the boiler house roof fell in. The fire department was helpless when it did arrive, as oil had been by that time blown about from all the transformers in the station. The switchboard was dropped through to the basement. The new high-tension portion of the station was not cut off by a fire wall, and was completely destroyed. The only pieces of apparatus in the entire station not seriously injured were the boilers, two steam turbine units and the storage battery, which latter was only partially cut off, and suffered considerable damage from broken plates and jars. No insurance policies were in force, as upon the reorganisation of the company a few years ago the risk was re-rated with increases owing to wood floor in bad condition, oil transformers on wood floor, and large masses of combustible insulation beneath the wood floor from generators to switchboard. As a consequence the company concluded that it could better afford to carry its own insurance, though the result has hardly borne out this belief.

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ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

CLOSED FOR THE HOLIDAYS.

When summer has really happened, and the weather makes high noon at breakfast time, the smallness of the post bag brings some relief, marred a little, perhaps, by violently-tinted postcards of the impossibly pleasant places where most of the staff is concealing its address; every season is reflected in the mail, advertisements of a thousand and one devices to help one to enjoy or withstand the particular brand of weather which the almanac indicates as being due, notices of stocktaking, and appealing little slips on the overdue account which really must have escaped your notice.

But the particular characteristic of the August letter is a tendency to break out into a little red rash informing the recipient that the sender's establishment will be closed for a more or less lengthy period for the annual holidays.

This growing tendency to overcome the difficulties of the staff holiday list, by making a short clean sweep of it, is not without interest, although often causing inconvenience to the clients of the "resting" enterprise.

From the point of view of a directorate, there is possibly much to be said for a system which leaves the full staff available for 49 weeks out of the year and closes the works during the slackest period, but the older method of extending the holidays over several months was evolved slowly with the growth of the modern yearly holiday from home system, and has much to recommend it to both employer and employed.

It means that so far as the customer is concerned, the works are never closed or reduced in output capacity, judicious arrangement will secure that men who are mutually dependent are seldom away together, and an excellent opportunity is afforded of bringing forward the assistants and generally preventing different departments and classes of work from falling too completely into the hands of any individual. The arrangement of holiday relief is a reminder to the management of the need for competent under-studies to every official of importance, and renders it easier to deal with absence through illness or other emergencies. However trustworthy and competent a departmental superintendent may have become, it can only be advantageous to himself and his chiefs for him to realise that at regular intervals he must hand over his "dossier" to another; a strong incentive to "clearing up" and proper record keeping is obtained.

Possibly, in the case of works producing materials and specialities which are sold from accumulated stock, some of the objections to entirely closing down do not apply, but in engineering works a large proportion of the orders are executed specially for customers, and so long as the holiday closing is not universal, few manufacturers are in a sufficiently independent position to be certain that their clients will wait for them in time of emergency, even if it were wise to cause the inconvenience of so doing to established customers—always the most valuable class of business connection.

Apart from these considerations, the week or fortnight's cessation from work must be reflected in the total turnover. At present, public holidays account for at least one week in 52; two more would decrease the working hours of the year by nearly 4 per cent., or £4,000 on an annual turnover of £100,000. Taking 10 per cent. of this as available for distribution as profit, £400 would be obtained—a sum which might be applied to some system of holiday bonus to those members of the staff who are obliged to accomplish whatever work falls to them in the year, irrespective of recognised hours of duty or holidays; some recognition of the extra work thrown on each by the holidays of all would remove a grievance, tend to keep work from getting into arrears and minimise the inconvenience of the holiday season, removing to a great extent the objection that to many persons in responsible positions a holiday entails the clearing-up of a mass of accumulated work upon their return.

The social aspect of this question is also, perhaps, worthy of attention. Any general system of closing large businesses in August must increase the congestion which is already so apparent at pleasure resorts and on the trains and boats which serve them, the railway and the hotel managers would find their summer peak increased and narrowed, which could only result in the cost and incidental discomfort of summer holidays becoming greater also, whilst the immense temporary increase which takes place each summer in the population of certain resorts already presents problems of some difficulty to the local authorities.

Generally there appears to be much in favour of spreading out the vacations over the few months which in this country still enjoy some reputation for fine weather; this method, at least by the laws of chance, should offer a man the probability of a higher average of fine weather over a term of years than would be likely if he invariably went away in the same month.

A Question for Electrical Contractors.

Our attention has been directed to an agreement which has been entered into by a leading firm of conduit and electrical supplies manufacturers and the Electrical Contractors' Association in regard to the conditions under which the principle of direct trading between the said manufacturer and the general public is approved. We have not received a copy of the complete agreement, save in the columns of the *Electrical Contractor*, though it is true that an abstract in which the wording is not always identical and with the omission of two clauses, one of them of considerable importance, appears in the publicity organ of the manufacturer who is party to the agreement—*Installation News*, just to hand.

Almost as long as we can remember electrically has the question of direct trading on the part of some of our electrical manufacturers and factors given rise to considerable ill-feeling and no little actual friction.

It was this question perhaps more than any other that led to the formation of the Electrical Contractors' Associations which desired to get level with the firms who sometimes deprived the contractor of profit by going out competitively and offering the actual user lower terms than the contracting middleman could possibly quote. Our readers are already acquainted with the fact that at the "Electric Home" in the grounds at the White City an effort—as worthy as we understand it is proving successful—is being made by the firm alluded to, to popularise the domestic applications of electricity with the general public; one feature of this undertaking is an understanding between the firm and the Contractors' Association that on all sales effected at the Exhibition by the former, it shall pay 5 per cent. to the latter organisation. This, by some, would be described as a sop to the electrical contractor for giving official approval to the principle of direct trading. Of course, the firm could have done as it pleased at the White City without consulting the contractors or their Association, but by entering into the agreement the Association recognised that there was nothing extraordinary, or little more than already obtained, in the elimination of the middleman under certain circumstances. But the principle involved is now further acknowledged and approved in the present agreement. There is, however, in the complete copy a clause of some significance and great potentiality which does not appear in the *Installation News*. This clause says that "nothing in this agreement shall prevent the Association from entering into a similar agreement with any other manufacturing firm or company," so that the Contractors' Association has not bound itself or the individual contractor hand-and-foot to buy from the firm alluded to in order to secure his share of trade discounts when his customers go direct to the firm with or without his card. Really, as far as we can see, there is nothing to prevent the Association from entering into similar agreements with all the other manufacturers of conduits, or any electrical supplies, although by Clause VI the Association has agreed, in consideration of the firm's undertaking, to urge its members to "purchase their requirements from the company, and to give the company's goods preference in case of equal value and equal prices." Nor are we clear that any advantage given by the firm is to be confined to contractors who are members of the Association; in the absence of specific statements to the contrary, we infer that the offer is open to contractors all and sundry, though, no doubt, primarily intended for members of the organisation.

In Clause II it is provided that if the user or his agent calls as a direct purchaser without the contractor's recommendation or introduction, and has goods charged to his own account, then, if the company "know of or can trace the customer's electrical contractor, they shall pay him one-half the difference between the list and trade price." This is interesting if at first blush it appears somewhat idealistic. It is followed in Clause III by a provision that "in cases where the user or his agent has no electrical contractor, or where the company are unable to trace same, then the company shall pay into the central fund of the Contractors' Association an amount equal to one-half the difference between list and trade prices." We suspect that the Association Central Board will have little need to appeal to its local branches in future for small loans, as it has recently been doing, for we cannot imagine any busy manufacturing firm going out anxiously on the hunt for possible claimants to its conscientious generosity. We can imagine cases, however, where more than one contractor would claim to be the contractor for a particular customer who had succeeded in arranging a direct deal with the manufacturer. The company are to render to the Association statements and cheques quarterly, and "if necessary" such statements will be certified by the auditor of the company.

We do not wish it to be gathered that we are querulously inclined toward efforts that are made in the direction of harmonious co-operation between manufacturers and the contractors, but we make the foregoing observations in the conviction that the question is not one to be handled precipitately. The agreement is only for one year in the first instance, and when that period has elapsed we shall be able to tell whether it works to the full satisfaction of both parties. There were differences of opinion among contractors at its birth! If it is not renewed, however, the fact will remain that the contractors of this country as an organised body have given their august and authoritative approval to the principle of direct dealing between manufacturers and users, under certain circumstances. Therein may lie important possibilities of which the contractors may not then speak quite so highly. We have no doubt that other manufacturers will watch the experiment with more than ordinary interest, for the subject of arranging special terms between the manufacturers generally and the members of the Contractors' Association, has already been fully considered by the members of the National Electrical Manufacturers' Association and a number of outside manufacturers, as we recorded in our issue of July 9th (page 64). The meeting was an open one, and it endorsed the decision of the Manufacturers' Association, that the terms put forward by the Contractors in April, involving, *inter alia*, preferential dealing with the members of their Association, could not be entertained. In this connection a contemporary last week stated that it had been *found impossible* to arrange an agreement with the Contractors' Association. This is stretching the words circulated by the secretary of the Manufacturers' Association to make them mean something that they were never intended to convey. There are some things which cannot be entertained, not because they are impossible, but because the general consensus of opinion is that they are *undesirable*.

That was the feeling in the case alluded to, and if one company has succeeded in agreeing with the Contractors on the lines indicated above, it merely means that they have done so because many firms, when they had deliberated carefully upon the matter, declined to enter into what they regarded from various points of view as an undesirable arrangement.

Brussels Exhibition.

We have received a *brochure* from Mr. H. Greville Montgomery, M.P., which forms an excellent corollary to the remarks on the Brussels Exhibition in our last issue. Mr. Montgomery writes with exceptional qualifications: as secretary to the late Baroness Burdett-Coutts, by his long connection with a trade journal, and by his great experience as the promoter and organiser of successful Trade Exhibitions,* he has accumulated such a mass of knowledge of all sorts and conditions of men that he has had no difficulty in reaching that goal of so many ambitions—the British House of Commons.

The opinions of such a man are entitled to respect, and it is with satisfaction that we note his agreement with the views expressed in these columns as to the advantages that would accrue from the formation of a body of manufacturers and other commercial men similar to the Associations of Exhibitors formed on the Continent. "Before this country is committed to any great International Exhibition," he writes, "the commercial aspect of the venture should be submitted to a Representative Committee of Manufacturers, appointed by an association of not less than 2,000 members, so as to cover every industry in the United Kingdom." Needless to say how cordially we agree with Mr. Montgomery; and we would go further, and suggest that no better promoter of such a scheme could be found than Mr. Montgomery himself, who would know how and to what extent to apply that *legitimate* pressure on manufacturers (and, we would suggest, others interested in trade and commerce), whereby alone the success of the venture would be possible. As a preliminary we would recommend the study of the *Historique du Comité Français des Expositions à l'Etranger*, given in the *Bulletin* of the Association; the special knowledge thus acquired would be found invaluable, and would enable the promoter to materialise what may be called the motive power of all such undertakings, or to use a homely phrase, "The horse that draws the cart."

This leads us to a part of the *brochure* in which we find it impossible to follow the author, viz., in his criticism on what he calls "putting the cart before the horse," and making arrangements for participating in an exhibition before consulting such an Association. Now, as this "horse" is not yet in being, some other motive power had to be found for propelling the "cart." According to an American report which the author quotes, in the United States "Special letters were written to individual firms, urging them for patriotic and commercial reasons to exhibit. Much was also done by the directors at the heads of the various groups, who travelled about energetically using their personal influence to induce producers to exhibit, and the Commissioner-General himself, who visited nearly all the principal centres of industry, where he addressed meetings and generally stimulated interest in the exhibition." This, says the author, is what was done in the United States, and he goes on to say "we believe that a similar course is being adopted to induce British manufacturers to go to Brussels next year." We may add that all the Chambers of Commerce of the kingdom have been approached with the same object; this he calls "unfair pressure," for firms "of their own free will would rather not exhibit," "undue influence is habitually brought to bear upon them to conquer that reluctance." Is not this placing the British manufacturer in rather a sorry light? And what form should *legitimate* influence and pressure take?

Lastly, Mr. Montgomery, without justification, falls foul of the *personnel* of the new exhibition branch. No more experienced man than the gentleman in charge of the Art Exhibition at Rome could possibly have been found, and if Mr. Montgomery would only read and inwardly digest the report of the Royal Commission as thoroughly as the secretary had of necessity to do, he would rise from the task with the conviction that he had acquired a thoroughly liberal education in the subject which, if accompanied by youth, energy and enthusiasm would make him an ideal organiser; and this we take the present Commissioner-General to be—for besides possessing the above qualifications, he has proved himself to be willing to take upon himself responsibility to an almost "sporting" extent and far removed from ordinary red-tapeism. On the cover the title of the *brochure* is "Great International Exhibitions. Are they of Commercial Value to British Manufacturers?" The only persons that can give an authoritative answer to this are those to whom the question relates, and such answers are to be found in great variety in the report of the Royal Commission—but not in the pamphlet. The title inside is: "Should Great Britain take part in Them? Manufacturers' Interests v. Government Policy." In some cases political considerations are of paramount interest; but even in these rare cases it is not correct to assert that this policy is antagonistic to traders' interests; what is good for the country as a whole must necessarily be of some benefit to anyone having a stake in it. No panacea for the various ills enumerated by Mr. Montgomery is given in his pamphlet, nor any hint as to how it can be ascertained beforehand what benefits are likely to accrue to manufacturers from exhibiting, or whether they can count upon any commercial returns from Brussels whatever, except the formation of the Association mentioned above; the sooner this is done the more will the new department be relieved of some of its most irksome duties, and the better it will be able to devote its energies to the other and very onerous tasks imposed upon it.

Tramway Competition.

One is so accustomed to a half-yearly wail at the South-Eastern and Chatham Railway meetings in regard to the depredations of the wicked tramways in South London, that there is usually little incentive to probe deeply into the respective chairmen's remarks. For of all the companies which cater for the suburban traffic of the Metropolis in competition with the tramways, these close friends alone have tacitly agreed that discretion is the better part of valour, and retired ingloriously from the fray.

If we look for reasons—and the allied chairmen are perfectly frank about it—we find that any move on their part would have to be a drastic one, and would result in the tramways throwing "all their energies into meeting any effort which might thus be made"; also that enormous expense would be involved in electrification, if that were adopted. And so these good friends modestly leave the arena of their peaceful, if slumbrous, activities.

One would have liked to let the matter rest here, but some further remarks by the Chatham chairman seem to demand attention. This gentleman (Sir W. Hart Dyke) having glanced (casually, we suppose, to be in keeping with S.E. & C. traditions) at the last L.C.C. tramways report, discovered that the receipts per car-mile averaged 11·81d., and "that ⅔d. per mile was estimated as ample for all renewals." He proceeded to remind his hearers that the average figure in the case of railways for renewals of permanent way and rolling stock was at least 1s. per mile, and with these most misleading figures to urge the impossibility of competition.

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* ". . . . upon individual manufacturing firms . . . . the great burden falls (whilst the profits too often go elsewhere)."

The facts, of course, are that the ⅔d. represents the Council's contribution to its renewals fund—a fund established partly on account of the uncertainty as to the life of the tramways material—which is in addition to the annual expenditure on repairs to electric lines, charged to revenue, and amounting last year to over £140,000.

We do not admit that a real comparison is possible between two widely different concerns such as these, but in order to show where Sir William's 1s. per mile comes in and to emphasise the fact that it has nothing in common with the L.C.C. renewals fund, the following figures may be of interest.

The Council on its electrical routes earned 11¾d. per car-mile; operating expenses amounted to 6·8d., including 1·4d. expended on repairs and maintenance—the percentage of operating expenses to revenue being 57. Now the South-Eastern and Chatham joint lines earned, during the last half-year, 66¾d. per train-mile; operating expenses figured at 39½d., and included, roughly, 14d. per train-mile expended on maintenance, repairs, &c., of track, locomotives and rolling stock, the percentage of working expenses to revenue being 68.

Now this is not a bad showing for a railway which is admittedly wanting in many respects from the passenger's point of view, and one may, therefore, be pardoned for taking a rather more sanguine view than the chairman as to what might happen if the London routes were electrified.

Copper.

Messrs. Merton's monthly return, now to hand, chronicles further considerable increase in the visible supplies. These have now reached 76,559 tons, a figure which would have seemed impossible in 1907, when the highest return did not amount to 20,000 tons. Of the total, 62,573 tons are stocks in London, Birmingham and British ports. The analysed returns present no marked departure from the average, but it is noticeable that during the last four months the supplies from North America to Europe have increased considerably.

The Power of Concentration.

We are sometimes tempted to suspect that among those in responsible executive positions the power of concentrating their attention upon the various matters submitted to them is becoming almost a lost art.

The managers of large business undertakings are constantly having brought to their notice mistakes which have arisen owing to the careless manner in which subordinates have read their instructions. Let a customer, for instance, who has hitherto taken delivery at his own premises, order a machine to be sent direct to some other destination. Quite an appreciable percentage of instructions such as this are overlooked, the goods being sent to the usual address. Apparently the order is read through hurriedly, and the note as to destination entirely passed over. Many other examples could be given of failure to thoroughly grasp the contents of an order or letter, the results often causing delays and annoyance.

Fortunately modern inspection methods go a long way towards checking mistakes of this nature, and the use of printed forms has a further beneficial effect.

At the same time, the habit of glancing through written or printed matter without thoroughly understanding the meaning is an exceedingly bad one to get into, and unless it can be overcome, the memory is certain to suffer.

The power of concentration is often under-mined amongst heads of departments by the constant demands for their attention to all kinds of petty difficulties amongst their assistants. We cannot help thinking that in many cases such a state of things implies lack of competency on the part of the officials in question. If the department be properly organised and work carried on in the most effective manner, the head of it should not be troubled by a constant flow of small difficulties, his attention being mainly taken up with important matters which he should have ample time to go into thoroughly.

In organising a new or chaotic department, minor troubles will be continually in evidence, but for this state of things to continue is strong evidence against the methods adopted.

The Collection.

Years ago, when engineering undertakings were smaller and almost exclusively in private hands, periods of service were of much longer duration than is now the case, and office staffs might be looked upon as more or less happy families. Under these conditions retirements, or removals to other firms, were important events, and they were invariably celebrated by a presentation to the departing official from his less fortunate *confrères*. When you have come closely in contact with a man daily for many years, it is generally a pleasure to contribute towards a testimonial to commemorate his departure. You may have quarrelled with him most of the time, but these differences will be forgotten, or looked back upon with leniency, under such circumstances. Weddings were also marked in a similar manner, and as these events only took place at long intervals, everyone could afford to give liberally according to the position he occupied.

The size of modern undertakings, together with the large staffs employed and the frequent changes now customary, have entailed the making of collections for the purposes above mentioned at very frequent intervals; furthermore, the individuals to be benefited are often personally unknown to some of the contributors.

One may be willing to help the victim of misfortune without having come in contact with him, but there is no rhyme or reason in giving a leaving or wedding present to someone you have barely spoken to. The "essence" of a present is pleasure or eagerness on the part of the giver, and if this feature be absent, the reasons for giving are not by any means flattering to the recipient.

It is no uncommon occurrence for a junior assistant, getting, perhaps, 30s. a week, to be asked to contribute towards a leaving present for a man he has never spoken to, with five or six times the salary, and who is substantially bettering himself by making the change.

Then, again, these frequent collections are a serious expense to members of a large staff. We have in mind a large electrical undertaking having works in the country and a London head office, an extensive contracting business being attached to the latter. In this case the staff at the works were always asked to contribute towards wedding and leaving presents for officials even in the London contracting department, their names being sometimes unknown to many of the contributors.

Few people like to refuse when asked to give towards such objects, whilst the unfortunate heads of departments and managers are left no choice in the matter, blank spaces being provided at the heads of the lists for their names and amounts after the remainder of the staff have been filled in. This final stage is very simple; the departmental heads give double the amount contributed by the next name below them, and the manager has to double again.

This public present giving in large commercial undertakings is becoming out of date, the relationship between the members of the staff under modern conditions being more of a short business acquaintance than a long family connection; and in view of the tendency of salaries to decrease, the custom should be limited in scope or put a stop to entirely.

MESSRS. ARCHIBALD SMITH & STEVENS'S ELECTRIC LIFTS.

We recently paid a long-promised visit to the "Janus Works," Queen's Road, Battersea, where, for many years, Messrs. Archibald Smith & Stevens have been engaged in the manufacture of lifts and hoists, mainly of the electrically operated type. The accompanying illustration, fig. 1, is a view of the main bay in the fitting shop, where the winding engines and controllers are assembled and tested, showing several machines in various stages of completion; besides the mechanical shops, which are well equipped with machine tools for the manufacture of winding gear, controllers, switchgear, &c., there is a large department devoted to the cabinet work involved in the manufacture of the cages and other woodwork. The whole of the firm's machines are entirely British made, and they claim that they were the first to produce an all-British electric lift. In this connection it is interesting to note that Messrs. Smith & Stevens have developed a large export trade, in addition to the steady demand for their machines in the United Kingdom.

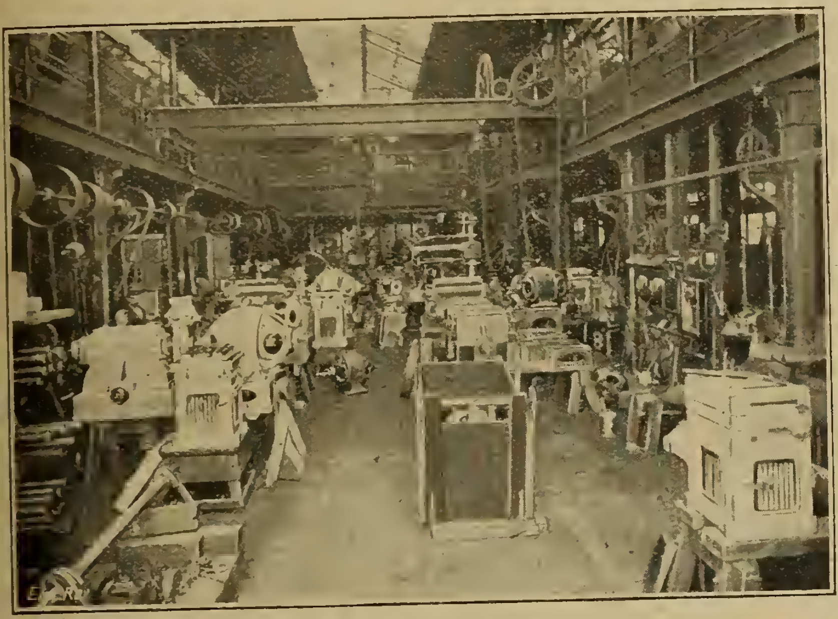

Fig. 1.—Main Shop, Janus Works.

While the firm are willing to supply winding gear driven by a continuously running countershaft, where the necessity for keeping down the initial cost to the lowest possible figure is the paramount consideration, they regard this system as distinctly inferior to the direct-coupled system, in which a reversing motor is used, driving the winding engine directly and running only when the lift is running; in the latter case the consumption of energy is strictly proportional to the traffic, whereas in the former, in view of the large proportion of time during which the cage is at rest, the waste of energy involved in driving the shafting continuously may far exceed the amount of energy usefully employed. The special feature of their work, therefore, is the direct-driven winding engine, and this is adopted in conjunction with either mechanical or electrical control, the latter again being automatic or hand-operated as desired. The full automatic push-button lift in particular has been carried to a high degree of efficiency by the firm.

The winding engine in all these modifications consists in the main of essentially the same parts, namely, the motor and worm-gear, brake and controller. In the earlier designs the firm combined all these parts on a single bed-plate; experience, however, pointed out the desirability of separating the controller from the other parts, with the result that the design illustrated in fig. 2 has been developed. Here we see the motor on the left, with the magnetic brake between it and the worm-gear case, and the controller at any convenient distance, actuated by a sprocket wheel and chain from the main winding shaft. The motor is supplied of any desired pattern, open or enclosed, and is shunt-wound, with a few series starting turns. The magnetic brake, which is actuated by a single long-pull solenoid in series with the armature, is provided with strong springs and wooden brake-blocks acting on the periphery of the motor coupling; the brake is of the balanced type, exerting no side pressure upon the shaft, and stands clear of the brake-drum when the shaft is running.

The worm runs on the top of the worm-wheel, the lower part of which runs in an oil bath, thus ensuring the ample lubrication which is indispensable to the efficient working of such gear; the working surfaces of the gear and of the main journals are made exceptionally large, to reduce the unit pressure below that at which the oil would be squeezed out, with the result that wear, it is claimed, is entirely obviated. The gearing is machine cut, and is so designed that it cannot be driven backwards by the load under any conditions, the brake being employed merely to ensure a quick stop. The main shaft carries a rope-wheel with vee-grooves, round which the suspension ropes pass from the cage to the balance weight; the makers strongly recommend this system in preference to the winding-drum type, claiming for it lessened wear and tear on the ropes, and greater safety against over-winding, for if either the cage or the balance-weight reaches the end of its travel, the ropes are no longer gripped in the grooves, and their motion ceases. The "slack rope" trouble is also eliminated, and there is a saving in the amount of rope required.

The controller may be operated by means of a hand rope passing through the cage; fig. 3 shows one of this type, with the rope-wheel at the right. The rope-wheel is geared to a shaft carrying a compound cam, cast in one piece, which actuates levers coupled to the horizontal contact bars seen at the top of the figure. These bars carry contact blocks bearing on contact studs, by which the various connections for running in either direction and for cutting out the starting resistance are made. The resistance wires are enclosed in a cast-iron frame, and are of ample proportions to withstand the effects of rapidly recurring starts without heating to an injurious degree. The resistance bar, it will be noticed, is actuated by a double chain attached to a drum, in such a way that no matter which direction the drum may move in, the bar is always pulled outwards. The chain drum is driven through a friction clutch by a chain and sprocket wheel, geared to the winding engine, so that the latter by its own motion cuts out the starting resistance; thus it is impossible to cut out the resistance unless the motor has actually started, and the speed of cutting-out is proportional to

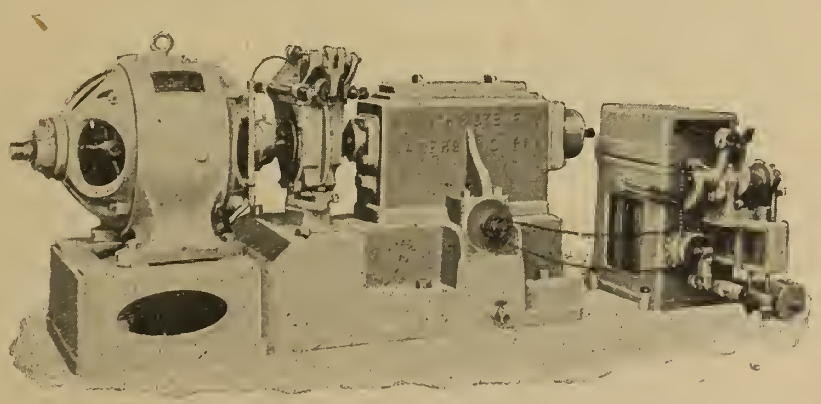

Fig. 2.—Complete Winding Engine and Controller.

the speed of the motor. Whenever the cage is stopped, the whole of the resistance is at once automatically replaced in circuit. When a short journey is completed, the direction-controlling bar is not replaced unless it is desired to reverse the motion, and as the whole of the circuits are automatically interrupted before these bars can be moved, the reversing contacts never break a current.

Fig. 4 shows the electrically-operated controller, which is actuated by two solenoids of special design, acting on a cam-shaft to control the reversing bars; the cam shaft also controls the friction clutch which brings into action the resistance bar, no matter which solenoid is energised. The resistance bar is driven from the winding engine, as before, and on the release of the solenoid it is set free, and promptly returned to the "off" position by the double spring shown on the left hand. By lifting off the cast-iron cover of the controller, the whole of the contacts are at once exposed for inspection or repair; where currents have to be interrupted, a multiple break is employed, with very satisfactory results.

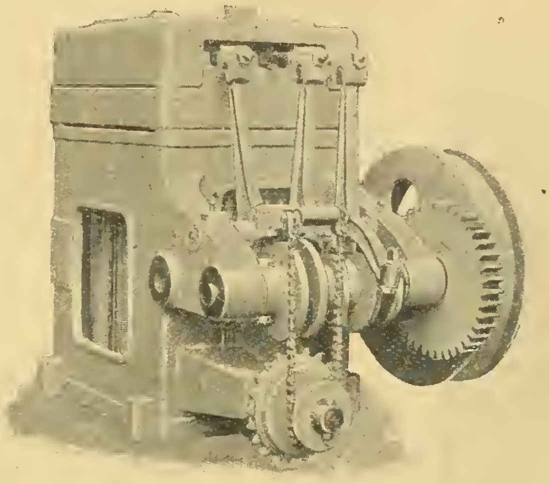
Fig. 3.—Controller for use with Hand-Rope.

With the electrical controller just described there are three systems of control to choose from. A switch in the cage is the simplest form, and needs no description. Again, two push buttons can be fixed on each floor, and two in the cage; pressing one button of any pair causes the cage to ascend, and pressing the other causes it to descend, the motion continuing only so long as the button is pressed. Interlocking devices are provided, so that it is impossible for the controller to be actuated from two points at once; the gates are also interlocked, so that none of them can be opened except when the cage is in place before it, and the cage cannot be moved unless all the gates are closed.

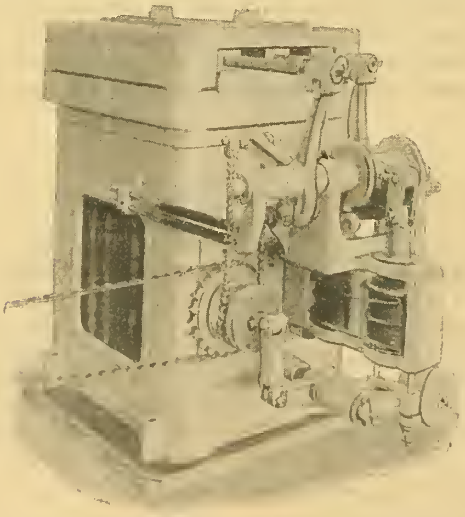
Fig. 4.—Electrically-Operated Controller.

The most highly developed system is the single push-button or full automatic system. In this case there is only one button at each floor; when any button is pressed for an instant, the cage is automatically brought to the corresponding floor, where it stops and unlocks the door, which cannot be opened until the cage arrives at the specified landing. The cage cannot move again until the door is closed and locked. Inside the cage are buttons corresponding to the different floors, which enable the passenger to convey himself to any desired landing. This is the usual equipment of push-button lifts, but in addition Messrs. Smith & Stevens provide a master button in the cage, with which the lift can be stopped at any point—as, for instance, when the wrong button has been pressed—and restarted by pressing the proper button. The system depends upon a system of relays controlling horizontal contact bars under the cage; a wiper is provided at a suitable position on each floor, and as the cage arrives in position, this wiper pushes back the bar which has been actuated, and stops the cage always in the correct position, quite independently, of course, of any stretching of the ropes, or of the load in the cage.

Safety in operation in all these cases is provided for by the use of four steel wire ropes in the case of passenger lifts, and a special safety gear which grips the guides the moment any of the ropes fails or stretches unduly. Other safety features have already been mentioned, and in particular we should refer to the new design of automatic gate lock which has been evolved by Messrs. Smith & Stevens in the course of their wide experience. We understand that, including their hydraulic and steam-operated lifts, they have some 7,000 machines in operation, some of them for many years, and have never had a single failure.

While the electric lift costs some 15 to 25 per cent. more than the hydraulic type, it is a recognised fact, based upon unimpeachable records, that the running cost of the former, as a rule, amounts to only from one-quarter to one-half of that of the latter. Alternating current can be employed as effectively as direct current, though with somewhat lower efficiency, and Messrs. Archibald Smith & Stevens have installed many lifts on single-phase and polyphase circuits.

THE AUTOMATIC TRANSFORMER SWITCH.

By "STUDENT."

Great attention is now being given by manufacturers and others to the design of a reliable automatic switch to save the "no-load" losses in small transformers.

It seems, however, that this is far from being a necessity, and the real use, and hence sale, of it *should* be quite small; that is, of course, from the consumer's point of view. Anything that sells does good to the seller, but it is doubtful whether it is always good for the community at large.

Those users of transformers—such as hotels, underground offices, tube railways, &c.—who have at least one or two lights on all day and night have no use for an auto-switch. Users of large transformers will not require a switch, because the no-load loss in these large sizes can fairly easily be reduced to about 0·75 per cent. of full load, which is very small in comparison with the total amount of energy expended, and the amount which would thus be saved would easily be outshone in 99 out of every 100 cases by exercising a little economy in the quantity of energy consumed. Also, where large transformers are used, they will either be always on load, or only put on for a short period at full load. The latter would be the case in such places as theatres, kinematograph shows, &c., when of course a switch would be used on the primary side of the transformer.

It will thus be seen that the only person who would benefit (?) by an auto-switch would be the user of the small transformer up to, say, 1 kw.

Now, the losses in this size, at the worst, are about 20 per cent. of the full-load current, that is, 10 watts on the 500-watt size, this being the size of the majority of transformers for house and small shop lighting.

Taking the average lighting hours as $4\frac{1}{2}$ per day, this would give $19\frac{1}{2}$ hours loss per day of 10 watts = 195 watt-hours. This is equal to 71 units per annum, which, at 4d. per unit, would cost 23s. approx. By spending more money on the original cost of the transformer for a better quality of iron, this loss may be reduced by 40 per cent., *i.e.*, to about 14s.

The cost of the 500-watt transformer is something in the neighbourhood of £2, so that an extra 10s. or 15s. or so is not a great item to pay for the better iron and lower loss.

The cost of the auto-switches at present on the market is about £3 each. Therefore, by using a £3 switch, 14s. per annum can be saved on a bill amounting to £6 or £7 after 4¼ years, which time is wanted to pay for the switch. Four and a quarter years is a very long time when dealing with electrical matters, and it is doubtful whether there are many installations which, during the next 4¼ years, will not need altering in some way or another; this always affects the supply, *i.e.*, the transformer, and hence, if installed, the auto-switch. All these savings and calculations, however, are based on the assumption of perfect working of an automatic device, which, unfortunately, is rather a rarity in practice.

Contractors and others should be cautioned to exercise great care and circumspection before installing an automatic switch, for it must be remembered that it *can* go wrong, but it has the delightful property (to the maker) of not always betraying itself if it fails. Who can say whether a switch acts or not, so long as the light comes on? It may be stuck *in* for years, and so have losses going on all the time without anyone knowing anything of its misbehaviour. Perhaps what the eye does not see the electrician will not grieve over!

The metal-filament lamp is quite delicate enough, without adding to our present many chances of failure.

As has been shown, it is generally only the private householder or small shopkeeper who needs to save the "no-load," and in his case undoubtedly the best way to do so would be to put in two two-way switches, one in the hall and one upstairs, interconnected so that the transformer may be put on or off from either point. This would only cost a few shillings.

In conclusion, let us remember that we cannot afford to run risks, and that we must look before we leap.

"FOUNDATIONS."

We are all familiar with the care and attention which is rightly bestowed upon the superstructure of the edifice of our national defence, but few of us concern ourselves with its foundations.

Our Empire is founded upon the character and training of its citizens, and the efficiency of our fighting forces is dependent upon the nature of the training and education that obtains in the community.

As a nation we are tacit believers in our capacity to "muddle through" when a crisis comes along, and as a preliminary to this process the muddled and unsystematised state of our foundation layer does not seem to the majority of us to be in any way alarming, and to some may even appear to be appropriate.

It is not our purpose at the moment to deal with the costly foundations in our existing system of elementary education, but rather to briefly review the state of our secondary and higher educational systems which bears directly upon our industrial progress and success.

On inspecting these foundations we find, firstly, a number of large blocks or corner stones scattered irregularly about the site. These corner stones are the universities; some of them are old and some new, and most of them differ from one another as to the nature of the test-ring through which their constituent material has to pass before incorporation. We commend this matter to the consideration of the Engineering Standards Committee.

Grouped in an irregular manner around these corner stones, and in a few cases connected to them by a trace of cementing material, are a number of other blocks of varying dimensions. These are the technical and secondary schools, but of any ordered design in their relation to one another or to the corner stones there is but the faintest trace.

We find on inquiry that the Government architect, in the form of the "Board of Education," is responsible for this design.

The attention of the Board is largely taken up in inspecting, measuring up, and pricing according to schedule, the work done and attendances made by the students in the technical and secondary schools, and in the issuing of certificates and money grants based on elaborate and voluminous returns. So engrossed is the Board in the detail of this work that it has no time to pay attention to design; it therefore instructs the clerks of works and foremen (the "Directors of Education" for the counties and county boroughs) that they have a free hand to develop along their own lines and to meet local needs. This is an excellent notion in its way, but is hardly conducive to good general design.

The Directors of Education and secretaries of Education Committees restrict themselves almost entirely to their own territories. It is true that they have formed themselves into an association which sometimes holds meetings, and that they have even gone so far as to partition the country into provinces, with a vague notion of somehow or other co-ordinating the educational work in these districts; but of real effective work in this direction they have done nothing.

It is apparent that the division of the country into counties and county boroughs does not lend itself well to a proper co-ordination of the educational machinery. The real focus points should be the universities, and these are located quite independently of the county system.

It should, however, be possible to create around each university a "sphere of influence," the affairs of which would be guided by an advisory committee composed of members representative of the educational authorities concerned, together with a leaven of business and professional men of high standing and of teachers.

Such committees could do much to regulate and harmonise the educational activities of their districts, and, by preventing overlapping and by making more definite the aims of the institutions concerned, would increase their efficiency. They would act as a sort of Conservancy Board for our educational rivers and streams, and would supervise their channels from the source to the point where they discharge their contents into the great sea of our national life.

They would see to it that we had some sort of common standard for admission to the universities in the shape of a leaving-certificate from the secondary schools, and, within limits, that a student could transfer from one university to another without the heavy sacrifice in time and money that he is now frequently called upon to make.

It may be urged that some such system is already in existence, as the universities frequently appoint representatives on the education committees and on the boards of management of the chief schools of their districts; but it must be admitted that their action on these bodies is rather that of isolated units, and that as the result of their labours the desired co-ordination has not been achieved.

BELGIAN ELECTRICAL INVESTMENTS ABROAD.

During the concluding years of the nineteenth century an enormous amount of French and Belgian capital was invested in, among other industries, iron and steel works in Russia, but since that time an entire change has been brought about by the transfer of the attention of the former two countries to participation in electrical enterprises of various kinds, both in Europe and on other continents, particularly on the part of the Belgians. The primary reason for the alteration of policy is to be found in the circumstance that investments in Russian metallurgical works have resulted in considerable losses of capital, and have assisted in developing the undertakings from the point of view of capacity of production considerably beyond the actual needs of the country, either at that or the present time. On the other hand, the assumption of an interest in electrical schemes afforded a fresh opportunity for the employment of capital in directions likely to be of eventual financial advantage. The outward flow of Belgian and French capital to iron and steel and other industrial establishments has practically ceased for several years past, except in cases where it has been deemed advisable to provide additional money in connection with projects of reconstruction or reorganisation, in the hope of still being able to prevent the absolutely total loss of the original investments; but no diminution has occurred in the availability of funds for foreign electrical undertakings down to the present moment.

The Société Générale Belge d'Entreprises Electriques, which is one of the Belgian investment companies of the kind concerned, enumerates in its report for 1908 25 different undertakings in which it is financially interested to the total amount of £429,000. Of these only four are situated in Belgium, and three are lighting companies and one a manufacturing works. With one exception, all the remainder are located in France, Russia, Italy, Spain, Austria, Denmark, Turkey and South America, the latter country being represented by the Compagnie Générale de Tramways de Buenos Aires, which is absorbing the whole of the tramways in this Argentine city. The largest individual participation of the Belgian company refers to the Buenos Aires tramways, and amounts to £128,000; the second position is indicated by an interest of £53,000 in the Lyons Omnibus and Tramway Co, and these are followed by £30,000 invested each in the Adamello General Electric Co., and the Bilbao Tramways and Electricity Co. The annual report makes brief reference to each of the undertakings, showing the development which is proceeding in each instance. The dividend declared at the recent meeting was at the rate of £1 10s. per ordinary share, being the same as was distributed for 1907.

The Société Générale de Chemins de Fer Economiques, whose combined share and loan capital amounts to £1,280,000, is apparently the owner of the Brussels tramways, which represent the sole instance of the company's investments in Belgium. Among the other participations may be mentioned various towns in Italy, which country is particularly favoured by the company; Spain, France and Austria, together with the Cairo tramways and the Société de Chemins de Fer de la Basse Egypte et Tramways de Port Said, the Damas tramways and lighting undertaking in Turkey, and the Buenos Aires tramways. Several of the investments apply to identical companies in which the Société Générale Belge d'Entreprises Electriques is interested, and this circumstance either points to the probability of co-operation between the two companies, or to the entertaining of similar expectations in regard to the prospects of the undertakings concerned. The net profits realised in 1908 reached £69,000, and a dividend has been declared at the rate of 12 per cent. on the ordinary capital of £640,000.

The Societé Financière de Transports et Entreprises Industrielles represents a third Belgian investment company which commands a share capital of £600,000, and an obligation loan of £200,000, whilst its holdings in undertakings are entered at £760,000. In this case also, and apart from the shares held in the Charleroi and Borinage electricity supply works and in the manufacturing firm of the A.E.G.—Union Electrique, most of the external investments are in the identical enterprises in which the two preceding companies are interested in various European countries. The company likewise has a participation in the Compagnie Générale de Tramways de Buenos Aires, but unlike the other two Belgian investment companies, it has also an interest in the German Transmarine Electricity Co., of Berlin, whose developments in the course of the past two or three years have conferred upon it a practical monopoly of light and power supply at Buenos Aires, quite irrespective of what has been accomplished by it at Santiago, Valparaiso and Monte Video. The net profits of the Société Financière in 1908 were £61,000, and a dividend at the rate of 7½ per cent., or £1 10s. per share, has been declared on the ordinary shares, as contrasted with 7 per cent., or £1 8s. per share, in the preceding year.

The Compagnie Internationale d'Orient of 48 Rue Namur, Brussels, which has an ordinary share capital of £400,000, is a general investment company mostly in connection with undertakings in the Far East. Among these are to be found the names of two banks, the Chinese Engineering and Mining Co., and two other mining enterprises, and several railways in China. Obligations and shares are held in the Electric Traction Co., of Hong Kong, the Singapore Electric Tramways, Ltd., and the Compagnie Générale des Tramways de Buenos Aires; whilst shares only are represented by participations in the Compagnie Française de Tramways et d'Eclairage Electriques de Shanghai (the French concession), the Shanghai Electric Construction Co. (the international concession at Shanghai), and the Compagnie de Tramways et d'Eclairage de Tientsin. The company is also interested in obligations in the Tramways de Mexico, the Société Générale d'Entreprises au Canada and the Sumatra Caoutchouc Co. The accounts show a net surplus of £21,000 for 1908, which has allowed of the payment of a dividend of 5 per cent. on the share capital.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, of 75, Boulevard Haussmann, Paris, is representative of French investment companies. It has a share capital of £2,000,000, and is very largely interested in the Paris Metropolitan Railway, the Société d'Electricité de Paris, and the Jeumont manufacturing works known as the Ateliers de Constructions Electriques du Nord et de l'Est. The Société d'Electricité, has large works at Saint Denis, and the kilowatt-hours of consumption which in 1907-8 amounted to 33,864,000, are expected to exceed 54,000,000 KW.-hours in 1908-9. The Société Parisienne also has investments in the Belgian Gas and Electricity Co. of the Hainaut, in Belgian and French tramways, the Tramways en Russie, the Cairo Electric Railways and Heliopolis Oases Co., and in other undertakings. The net profits amounted to £132,000 in 1908, and these have permitted of the distribution of 6 per cent. on the share capital.

The principal feature of the Belgian and French investment companies, of which only a few have been referred to, is that the interests assured in other enterprises are, generally speaking, not of a temporary character, but are representative of what may be termed permanent holdings in so far as the duration of the concessions owned by the individual undertakings is concerned. The circumstance is probably partly explained by the fact that some of the tramways or lighting works are initiated either in Belgium or France, or indicate the joint endeavours of promoters in both countries. But no general policy of buying shares or bonds for a rise, in order to sell at a profit, appears to be pursued, although such a method may be practised in isolated instances for comparatively small parcels of securities.

ARTESIAN WELLS.

By W. H. BOOTH.

In London the action of the Water Board recently drew attention to the question of independent water supplies. For very large quantities it would not be desirable to attempt to secure water by means of an artesian well, though there are some few wells in London which yield something like 15,000 gallons per hour.

But any place may count upon obtaining a sufficiency of water for boiler feeding purposes. Even a large generating station, if it has water for condensing purposes unfit for boiler feed, may obtain its make-up feed from a well.

London is by no means an area of copious supply. The surface stratum next below the merely superficial gravels is the London clay. This, of course, is waterless. There are other sandy and clayey beds between the London clay and the chalk from which deep wells are supposed to draw their supply; supposed, because it is probable that much of the supply really comes from the Thanet sand which overlies the chalk. The chalk surface is undulating, and, therefore, its depth below surface varies with the locality, and the yield of water is also very variable. There is one well defined area of so-called dry chalk which extends from about Deptford, westwards to Newbury in Berkshire; the writer has proved the comparative dryness of this band of chalk at numerous points between and at those extremes.

Though the London clay and the chalk beneath it are practically horizontal, this dry band does very much represent the edge of the so-called London basin, in so far as to the south of the band the water is much more copious and stands at a higher level and to the north it is also more copious, but partakes, as to level, of the general character of the London area over which there is a slow depression in progress, the water-level becoming lower every year. South of the dry band the water-level was till recently maintained, in parts, nearly 20 ft. above the surface. This seems to show that the dry band of chalk is a band of compression, past or through which water cannot travel from the southern outcrop in a northerly direction. Hence the overflowing of water from wells pierced on the south side of the dry band, one of which, well known to the writer, has been flowing since the year 1834. This well probably draws from the Thanet sand.

It is a peculiarity of chalk wells when bored through the overlying strata, that they yield water very much less hard than that from boreholes put down into chalk which is bare—that is, boreholes put down upon the surface outcrop of the chalk. The softness is attributed to the Thanet sand effect.

Taking England generally, the dip of the various rocks is so great that the whole surface of the country is divided into a frequent succession of dry and of water-bearing beds. There are, therefore, very good prospects at all places of some supply without boring to extraordinary depths.

There are few spots indeed where the ordinary factory cannot obtain a supply, though there are places, of course, where the artesian engineer would hesitate to advise even the attempt to bore.

Artesian borings divide themselves into two main classes: (*a*) those bored directly into the water-bearing stratum upon its surface outcrop and (*b*) those bored through the stratum, at the surface, into the water-bearing rock below. An example of the first would be a well bored on, say, the downs where the chalk is at the surface, while all the London chalk wells are examples of the second class. This second class cannot usually be depended upon to give the same free and copious yield as can the first class, because the supply to the second class must of necessity travel down to the stratum either through the strata above or, when these are impervious, through the water-bearing stratum itself from its surface outcrop. As in the case of London wells, the outcrop may be miles distant, and the supply is limited by the resistance of the stratum to horizontal penetration.

Speaking generally, water does not travel through the rocks by penetration of the actual substance of the rock. Chalk, for example, is by no means a freely pervious rock. The water travels by way of fissures or along the veins of nodular flints. Clay will not fissure permanently, and is, therefore, practically waterless. Fissures are produced in rocks by earth movements, and are formed in clay strata equally with rock strata, but in clay they automatically close owing to the plasticity of the material. In a hard rock they do not close so completely, and form a ready passage for water.

It is the work of the expert to estimate the probabilities of a supply in any locality. One hears a good deal of the diviner's art, but it appears to be chiefly guess work, for the expert artesian engineer will diagnose a dozen cases with greater accuracy than the diviner. In contemplating the putting-down of a well, one must consider what is the stratum to be tapped? How far is it below the surface? What is the superficial area of the rain-receiving outcrop which feeds the rock? What is the level at which the stratum is drained? For this determines the water level in the bore hole. This is very important, since it might happen that the proposed stratum at the intended site would be pierced through before the water horizon had been reached. In such a case the next lower stratum which was water-bearing might have to be tapped.

On the water level much depends. If the water rises near the surface, it may be drawn by a surface pump, or it may be lifted out of the bore by an air-lift pump. But if the water level is far down, the air-lift pump demands a lot of power to work it, and also a bore hole very much deeper than the water level. A low level well will often require to be pumped by an inserted low level single-barrel pump, but a well to hold a pump must be much larger than if it has only to contain air-lift tubes. Thus each case must stand on its own merits. It is very desirable that the above matters should be estimated with fair accuracy beforehand, because any error in estimating the water-level may completely change the subsequent plans as regards pumps.

Bored wells should be lined with stout iron or steel butt-jointed and socketed tubes. In a London well, these tubes will extend from the surface to a point 15 or 20 ft. in the chalk. It is in fixing them in to the chalk that well borers often exhibit carelessness and ruin the work by allowing the sand above the chalk to creep through to the bore-hole.

In some rocks of a loose nature, the hole may require lining through the water-bearing horizon. In that case, the pipes must be perforated to admit the water. The writer has bored wells which gathered their supply from three separate rocky strata, divided from each other by strata of clay. Such cases require particular and careful treatment, so as to secure the maximum results; and it is very important that minute records of the stuff passed through should be kept by the foreman and submitted to the engineer, in order that the lining shall be designed for the best results.

PROCEEDINGS OF INSTITUTIONS.

Electricity Applied to the Reduction of Waste.

By A. B. Gridley.

(*Abstract of paper read before the* Cleveland and Durham Engineering Society.)

During the last 10 or 15 years, the electrical engineer has almost entirely changed the leading industries on Tyneside, and great progress has been made on Teesside, although a public supply of electricity on a comprehensive scale was not seriously attempted there until 1907; several private plants have been superseded, and no fewer than seven central supply stations have been shut down, except for emergency use. The two main principles governing centralisation are decreased capital outlay per kilowatt, and the effect of the diversity factor. The big supplier has the advantage not only in the purchase of plant, but also in the reduction of coal, stores, labour and repairs, while the power user benefits by a reliable and cheap supply through duplicate mains from several interconnected generating stations. Although the supply of power to a colliery would seem difficult to justify, no fewer than 45 collieries in the district are being, or about to be, supplied from the public mains.

Experience on the North-East Coast shows that works whose installations aggregate 120,000 KW. can be supplied with 40,000 KW. of plant; if these works had their own generating plant, about 106,000 KW. would have to be installed, costing £3,180,000, whereas the supply authority's capital outlay would be only £1,060,000. There is still in the district some 200,000 H.P. not yet electrically operated, and, calculating on the same basis for the supply of this, there would be a capital saving of the order of £2,750,000.

In addition to the saving of labour due to the concentration of the generating plant in large units, there is a saving in labour in the works supplied; one man can look after 1,000 H.P. of motors of various sizes, and there is a saving due to the absence of coal and ash handling, &c. Mr. C. H. Merz has pointed out that if all the colliery owners in the district purchased their coal from an outside source, 1,750,000 tons of coal per annum, worth say £500,000, would be set free for sale; and Mr. Beilby states that if the power used in all our factories and mines were supplied from central stations, the coal used—sixty million tons a year at present—could be reduced by one-half, representing an annual saving of over £11,000,000, and materially prolonging the life of the British coalfields. The local Power Supply Co. having complained of the excessive charges for carriage of coal, the railway company showed that the demand for coal from the works supplied by the company had fallen off to a trifling amount, while the coal consumed by the company was far less than the previous aggregate consumption of the works supplied. There is also a substantial saving in water, which is of great importance to local authorities and their ratepayers.

The use of electric power reduces waste of time, owing to the rapid acceleration obtained with electric motors, which is typically illustrated in the electrification of railways; this further results in increased mileage from a given amount of rolling stock, a better service, and a greater volume of traffic.

The removal of boilers, engines, buildings, &c., from works on their conversion to electric driving sets free a large amount of space, which is frequently of great value; the electric motors substituted take up very little room, and can be mounted on walls or overhead, without occupying floor space at all. Messrs. Musgrave, of Bolton, now take 1½ million units a year from the Corporation supply, and have reclaimed ¾ acre of land formerly occupied by generating plant.

The waste of energy in shafting, which in many mills amounts to from 30 to 70 per cent. of the whole consumption, is greatly reduced by the adoption of electric motors.

By the reduction in capital outlay, the assessments for rates and taxes may also be reduced, and savings are possible in boiler, fire, accident and workmen's insurances—facts which are often ignored when a manufacturer is comparing his own costs with an offer from an outside source, as these charges are usually allocated to general establishment charges by accountants.

The amount of waste in the form of exhaust steam, waste heat or combustible gas in the Teesside district is very great; it has not hitherto been utilised, owing to the absence of a market for the continuous supply of energy necessary to its economical employment. It is only by co-operation that the ideal of a 100 per cent. load factor becomes feasible; and this has now been accomplished. A network of mains stretches from Blyth, in Northumberland, to Loftus-in-Cleveland, through the Northumberland coalfield and Tyneside, across the Tyne in two places, through the East Durham Coalfield, to the Iron Mines District, with numerous branches, loops and connections with important centres. Eight power stations are in operation, and three others are under construction. The main regulating coal-fired stations are at Carville and Grangetown; the waste-heat stations at Blaydon, Weardale, Newport, Bankfoot and Tees Bridge, are, or will be, run at their full capacity day and night. There is now no difficulty in disposing of as much energy as can be generated from waste heat in the district, and the owner of the waste heat receives energy for his own use at the lowest rates, while a reliable stand-by is secured by the linking-up of each waste-heat station to the transmission system. While the erection of a number of small waste-heat stations appears to be in contradiction to the policy of centralisation, it should be remembered that each of these stations is run constantly at full load, so that there is a very large number of units generated over which to spread the increased capital and operating charges, and at the same time the distance of transmission to the point of use is reduced. Although figures cannot be given, in no case has a proposal on co-operative lines been submitted to a waste-heat owner that has not ultimately been accepted by him. The accompanying diagram, fig. 1, shows the result of the system at the works of the Weardale Steel, Coal and Coke Co., Ltd., the space between the upper and lower lines showing the energy sold to outside consumers.

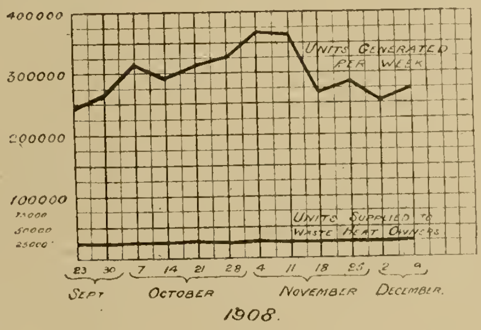

Fig. 1.

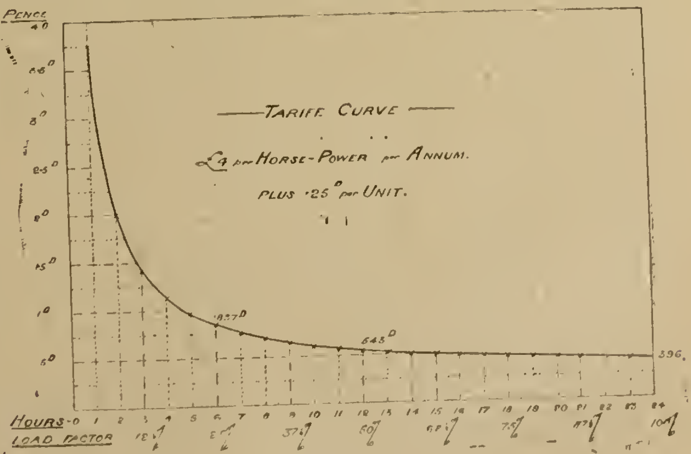

Fig. 2.

In addition to actual economies, benefits are derived from the increased output due to the adoption of electric driving, with its higher speed and even turning moment; extensions of manufacturing plant are also facilitated, at small outlay. Perhaps the most important point of all is the general supply of power at prices comparable with those charged in water-power localities, attracting new industries to the district, with the accompanying increased employment and prosperity.

In discussing the price of electrical energy, both producers and consumers have drifted into the bad habit of reducing their calculations to cost per unit. This, by itself, conveys no information of material importance; it must be accompanied by a definite statement as to load factor, total annual consumption, &c. It is this fact which is leading all suppliers of electricity for power purposes who really appreciate the economics of electricity supply to avoid the quotation of flat rates, as they may be unfair to both parties. A charge which is framed to cover, first, the capital and fixed costs, and secondly, the running or variable costs of giving the supply, is sound. Capital cost is of paramount importance. The varying conditions are met by a tariff based on a fixed charge per kilowatt or E.H.P. demanded—which demand is not "peak," but an average taken over half-hourly periods—plus a running charge per unit consumed, as, for example, £1 per quarter per E.H.P. demanded, plus ·3 or ·25d. per unit. Such a tariff is embodied in fig. 2, which shows the average price per unit at different load factors.

The Development of the Large Gas Engine.*

Though Mr. Bechtel's recent paper on the above subject was largely based on his particular knowledge of the Nurnberg gas engine, it may usefully be read as showing the general status of large gas engines. In order to give an idea of the extent to which these are now employed, the author gives a table of engines of 1,000 B.H.P. and upwards. The total is about 1,030,000 B.H.P. Nearly 850,000 of this is driven by blast-furnace gas, and 68,000 by coke-oven gas. Producer gas drives 36,000; town gas nearly 25,000; and natural gas—all in the United States—nearly 50,000. Driving dynamos, there are over 515,000 B.H.P.; blowing engines aggregate 404,000 B.H.P.; rolling mills nearly 17,000; other purposes about 54,000 B.H.P. Electricity, therefore, has benefited to the extent of one-half the total power developed, as Thwaite anticipated. Turning now to the countries where the large gas engine has been chiefly developed, we find that Germany leads with nearly 482,000 B.H.P.; the United States, though late in the field, stands for 337,000 B.H.P.; Belgium possesses about 51,000 B.H.P.; Great Britain, 24,986; France, about 55,000; Austria a little over 25,000; other countries aggregate some 65,000. There is no reason why Great Britain should lag behind Germany, almost her equal in iron production, for all the blast furnaces in Great Britain are close to great industrial centres requiring power. Moreover, the use of blast-furnace gas was first shown to be possible by an Englishman, and the gas was first used in a gas engine in Scotland. The only reason must surely be sought in the supineness of those who might have benefited by what Germany has gained so much in carrying out.

Mr. Merz is, we believe, on record as having endeavoured to show that with a gas-engine plant there must be also a steam plant as a stand-by. Mr. Bechtel points out in answer to this that on the Continent there are numerous works entirely denuded of steam plant. There is a steamless plant, for example, at Hayingen, where, when furnaces are started up, the blowing plant is driven by electric motors from a plant several miles distant. Another steamless plant is that at George-Marienhütte, at Osnabrück. The works there are all electrically-driven, the motive power being entirely gas; while at the Haspe works in Westphalia, producers have been erected to supplement an insufficient gas supply from the furnaces. Thus, there is no reason at all to maintain steam plant, and such statements are unfair, and show want of inquiry into facts.

Then much is heard of the heavy upkeep of gas engines. At 11 iron and steel works the annual costs of repairs and repair wages are only 1 to 2 per cent. of the first cost of the gas plant itself. The 2 per cent. rate refers only to older plants. The following costs of repairs per kilowatt-hour are given with plant load factors of various degrees:—

Load factor.	Cost per KW.-hour in pence.
57 per cent.	0·01000
66·5 ,, ...	0·00875
62·5 ,, ...	0·01220
33·0 ,, ...	0·01300
66·0 ,, ...	0 00640

The average is 0·00851d. per unit. Thus, if so much as 2 per cent. be allowed for repairs and 7 per cent. for depreciation and 4 per cent. for interest, the total charge for a 1,000-B H P. plant will be 24s. per B.H.P.-year and about 19s. for a plant of 2,000 B.H.P.

About 1 gramme of oil per B.H.P. per hour will run the engine, dynamo and auxiliaries. This amounts to 2,111 gallons per year, at 1s. 6d. to 1s. 9d. per gallon.

A 2,000-H.P. gas blowing plant ran during 19 months 13,639·5 hours, and stood for 230·5 hours. The plant wages were £662; materials, oil, waste, &c., cost £665, and repairs £133; the total cost of running was £1,460, or 0 0128d. per B.H.P.-hour. The stoppages were only such as were required for tap-hole repairs to the furnaces.

The cost of attendance is to be determined by taking one unskilled labourer as oiler for each tandem engine, and for two tandem engines together, or a twin tandem, one driver per shift. Tandem engines, *i.e.*, engines with two double-acting cylinders, are built in sizes of from 400 to 3,000 B.H.P., and the wages cost is relatively smaller for the larger sizes. The manager of one of the largest ironworks reports that in his own experience the cost of upkeep and repairs has been considerably less for gas plant than for steam plant of the same output. In the face of all this evidence, there can no longer be any justification for refusing to accept modern gas engines on the score of unreliability.

That there have been failures, goes without saying; but certain failures that have occurred have been almost invited, for they have been due to an improper choice of plant. Steam plant has been known to fail even when the engines have been copies or attempted copies of some well-proved design. With gas engines, as with steam engines, there are makers and makers, and it is the province of the engineer to select the right maker.

The author puts in a special plea for his own engine, to the effect that in all cases where the manager and staff have become familiar with the engine it has again been installed when an extension or alteration has become necessary.

Considering how immense has been the output of electrical machinery that the blast-furnace gas engine has brought about, it is a pity that our own ironmasters have done so little to help the electrical industry, and that the electrical engineer has in turn done so little towards persuading the ironmasters out of their time-worn groove. That an awakening is now in progress, however, may be gathered from the foregoing abstract of Mr. Gridley's paper, which indicates the vast possibilities of electrical development from waste heat.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Samples with Tender.

Among recent specifications issued for arc lamps was one in which 80 lamps in all were asked for, both alternating and continuous current. These lamps were to burn four in series, and the specification stated that four lamps of each sort, eight lamps in all, *must* be sent with the tender. It is therefore obvious that if there were 10 firms tendering for this contract, the total number of lamps supplied to satisfy the requirements for 80 lamps would be practically double that number.

As you, Sirs, have always taken up a strong position in regard to such improper clauses, we draw your attention to this matter in the hope that some way may be found to remove such unfair impositions from an industry which is already sufficiently handicapped.

One of the Tenderers.

[The samples would, presumably, have been returned, but the requirement in question was certainly unreasonable; after two or three tenders had been selected, it might have been in order, but not before.—Eds. E.R.]

X-Ray Tubes.

I am interested in the construction of a form of apparatus in which the maintenance of a constant degree of vacuum is essential, and shall be glad of any hints as to how this may best be ensured.

Is the phenomenon of the degree of vacuum increasing with use peculiar to X-ray tubes, as distinct from other forms of vacuum tubes; and, if so, why?

Jaccy.

Electric Lighting Acts (Amendment) Bill.

The arguments put forward by "Another Borough Electrical Engineer" I am afraid will not create much support for a Bill intended to grant such wide powers as are demanded by the proposed Electric Lighting Acts (Amendment) Bill.

I always understood that the cry for statutory powers to do wiring work was based on the ground that it should be done on free wiring or instalment lines (otherwise as cheaply as possible) to compete with gas companies; it is news to me to learn that the powers are wanted to improve the quality of the wiring work as much as anything else.

Perhaps "Another Borough Electrical Engineer" can explain how the work of these plumbers, decorators, &c., is passed and connected up to his supply if the same is not up to his tests and rules, as his remarks would have everyone infer. A very large amount of wiring is done by this class of workman at prices which would not pay a municipal wiring department or the writer, but all the same it gets connected up, and the legitimate contractor has to face this competition.

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* "The Nurnberg Gas Engine," by Richard Bechtel; paper read before the Birmingham Association of Mechanical Engineers.

"Contractor's" contention is that it is practically impossible for a municipal wiring department to pay at the wiring prices prevailing to-day, and I am sure anyone intimately acquainted with this branch of electric lighting will agree with him.

"Borough Electrical Engineer" must live in some place unknown to the ordinary contractor, and I would advise him not to disclose his identity, otherwise his district may be invaded by a few more men anxious to find a spot where good work is appreciated, although probably not insisted on.

The lines on which he runs his free wiring department in conjunction with his two real electrical contractors (who, by the bye, do not sell electric lamps) are distinctly unique, and I would ask him for what purpose he employs a staff of electricians when they do not do the work they are specially engaged for? Free wiring by a corporation is to be done as cheaply as possible, consistent with a good installation, and surely a properly organised branch of wiremen, under the supervision of a competent engineer, ought to be able to do an installation at a lower cost than any contractor could, especially as the former has only to avoid making a loss, whilst the latter has to be sure of a profit.

I am unable to reply to "Another Borough Electrical Engineer's" question concerning the prospective electrical consumer who intends using gas for another year, as he puts forward no facts, giving only his own feelings on the matter; but even if there were dozens of these cases each year, and it was proved that in each case the consumer would have had electric light installed, it would be an expensive departure to install wiring departments to secure them.

"Borough Electrical Engineer" does not intend to see the strength of "Contractor's" arguments; if the positions were reversed, and the former could see a possibility of his losing his living and his money invested in his business through unnecessary and unwarranted encroachments by the latter, then perhaps he would admit that the 4s. 2d. in the £ or the 1d. rate is hardly the point at issue.

Municipalities do not need to speculate with the ratepayers' money by entering into this field, where competition is already so keen that its effect is felt on the quality of the work done; their representatives, the borough electrical engineers, could, with beneficial results to their respective stations, devote a little more of their attention to the business they are expected to manage by maintaining a *continuous* and *steady* supply, and by seeing that their consumers' installations are fitted up as they should be.

The materials used and the workmanship are seldom even superficially examined, and the test and the passing of the installation is left to the jointer and meter-fixer.

Repeatedly one can read in the daily papers of towns in darkness through burnt-out cables or machine breakdowns (faults which under proper management should not occur), and it is extinctions such as these which form the most powerful argument a canvasser has to meet when applying for new customers; he is not called upon to prove that his installation work will be done properly, but how will the electric light bill compare with the gas bill? and can the supply be relied upon now?

A large number of municipally-managed electric light stations do not pay for one or more reasons, and I think it is to be regretted that "Borough Electrical Engineer" and many of his colleagues should make such frantic efforts to start wiring departments when few contractors can even manage to scrape along. To expect the majority of these stations to become remunerative by the simple addition of a wiring section, which would have to stand up against an army of established contractors, fighting in many cases for their lives, is, in my opinion, very bad business.

I think if more of these stations were run by men with commercial as well as electrical experience, many of them would have a different tale to tell, and would not even attempt to hold wiring contractors responsible for the present state of their undertakings.

Municipal finance is generally regarded with suspicion, and to most people who come in contact with it, the prospect of any addition to present operations is cause for alarm.

As an illustration of what is going on to-day in the town from which I am writing, I will mention the following: The tramway department pays the electric light department (both municipal) about 20 per cent. more for its current per unit than an ordinary consumer can obtain it for for power purposes on certain rates; the tramway demand is a regular one, and can, of course, be estimated for in advance, yet a consumer with his uncertain consumption obtains better terms, and on lines such as these we must concede the wiring departments would be run and shown to pay.

Borough electrical engineers are responsible for the existence of the jerry wireman, and it is surprising that they cannot bring themselves to acknowledge this fact; if they wish to exterminate him, why not do it now with the weapons they are armed with?

Another Contractor.

Failures of Exciters.

I shall be glad to learn the many causes of this trouble, and how to remedy the same. The experience of some engineers who have had to contend with these difficulties would be welcome.

H. G. J. Barrow,
Colliery Manager.

Maesteg, *August 5th*, 1909.

TESTING CONDENSERS FOR LEAKAGES.

By "HARBEE."

Every year the number of condensing plants (chiefly surface condensers) installed is rapidly increasing, and competition is becoming keener between engine builders with regard to water consumption or pounds of water per B.H.P.-hour on the various engines. These tests are often carried to the third decimal place.

If this minute estimation is likely to continue, I think it high time we had it more widely known how simple, yet very reliable, tests can be made for leaky condensers. The makers' usual practice is to put a light water pressure, first on cooling surface side and afterwards on condensed water side, at the same time carefully looking out for any water trickling through.

The station engineer, if doubtful, will run condensing plant for several hours with only circulating water going through the cooling surface, and carefully note if any condensed water is thrown up by the pump. Both of these methods for ordinary working conditions may suffice, but for a close competitive test they would not be to my mind sufficiently accurate, because I have known the behaviour of leakages to be very different when both waters are going through, than when one only is used. My contention is that a condenser, like any other machine, should be tested under its full-load working conditions, and so far as I know, there is no mechanical means of doing this, it is purely one for chemistry and, personally, I consider the silver nitrate test for chlorine or chloride to be the most suitable.

Even in the hands of an amateur it is possible to trace salt in water, although it may be only one part of salt to one hundred-thousand parts of water. Therefore the leakage, however slight, is quickly disclosed by the test mentioned.

The water frequently used for cooling purposes is that generally known as surface water, drawn from rivers, canals, &c., and such is always found to contain, among other things, sodium chloride, or common salt, in variable quantities. This, together with the fact that condensed water should never contain sodium salts, enables one to make a very reliable test for any leakage in a condenser. To carry out the test, we shall require a standard solution of silver nitrate, which can be purchased from any qualified chemist, or to those who care to make it themselves, the particulars are as follows :—Dissolve 2·394 grams of pure recrystallised silver nitrate in distilled water, and make solution up to 1 litre. We shall also require a solution of potassium chromate, made by dissolving potassium chromate in distilled water ; one part of chromate to 10 parts by weight of water.

This potassium chromate solution is used as a colour indicator. The principle upon which the indicator depends is that silver combines with chlorine in preference to chromic acid, and that accordingly no red chromate of silver is capable of being formed so long as chlorides are in the water, but that red chromate of silver instantly forms the moment nitrate of silver is in the slightest excess. Therefore, if we take a sample of water known to contain chlorine salts, and into this drop, spot by spot, the silver nitrate solution, a white precipitate of chloride of silver will form, and continue to do so, until all the chlorine in the water has been precipitated. But, as will be seen upon making the experiment, there is a difficulty in observing the exact point at which the formation of the precipitate ceases, and this difficulty is overcome by the use of the colour indicator, potassium chromate.

The details of analysis are as follows :—Measure out carefully 50 cubic centimetres of the condensed water, which should then be passed through a filter paper into a clean porcelain dish. To this add about half a dozen spots of the colour indicator, potassium chromate, at the same time stirring with a glass rod, the colour of the water then will be distinctly yellow ; this being so, the silver nitrate solution, which should be contained in a properly graduated burette, is carefully dropped, spot by spot, into the water, which should be constantly stirred the whole of the time. As will be observed, the first few spots will become red directly they touch the water and die away to a pale yellow on stirring, that is, if sodium chlorides are present. The dropping in of silver nitrate solution should be continued, as well as the stirring, until the water becomes permanently red.

The very earliest moment at which the chromate of silver begins to form, or the redness becomes persistent, the addition of silver solution should be stopped and the amount used read off from the graduated burette ; from this we can ascertain the quantity of salt present in the water.

One cubic centimetre of silver nitrate solution practically corresponds to one grain of salt per gallon of water. If on adding the first one or two spots of silver nitrate solution, the condensed water (which had previously been coloured by indicator) becomes permanently red, it is quite certain that there is little or no salt in the water, consequently the condenser may be considered quite bottle tight. If, on the other hand, it requires several cubic centimetres of silver nitrate solution to bring about a permanent red colour, then the condenser is certainly leaking ; to what extent may be judged by the quantity of salt found to be present.

NAVAL VOLTAGES.

On board a warship it is necessary to fix some standard of voltage that will serve a variety of purposes. There are the ship lighting, the various motors, the searchlights ; and now even the gun and telephone circuits are beginning to derive their energy from the ship's dynamo.

The problem of settling what voltage is most suitable for general service purposes, is not quite so easy as it might appear at first sight. Until recently 80 volts was considered sufficient, but latterly it has been found necessary to increase this amount up to 200 and even more.

The reason why so low a voltage was originally selected is to be traced to the introduction of the searchlight. When men-of-war were first supplied with dynamos, the sole *raison d'être* of the dynamo was the searchlight ; accordingly all instruments were calibrated to suit the searchlight dynamo, the voltage of which was fixed by the requirements of an arc light, with the customary ample margin of safety to allow for contingencies.

The arc light requires at least 40 volts to work satisfactorily, was the argument ; there are certain losses to be allowed for ; also it may be desirable on occasion to burn the light at a distance from the ship, incurring further losses in the long feeders necessary. We can afford to be generous ; let us double the minimum voltage required.

Accordingly a searchlight resistance was designed to absorb the surplus, and 80 volts became the standard pressure.

Later, when electric light was introduced as an alternative to the "purser's dip," it was necessary to proceed with caution, as behoved the pioneers of a rash experiment.

Eighty-volt lamps were chosen, to suit the ship's dynamo, and on rare occasions, when steam was raised in the ship's boilers, the officers basked in the luxuriant brilliance of the Ediswan lamp. Slowly the electric light crept through the stages of luxury and convenience until it became a necessity, and the lighting of the ship became perhaps the most important duty that the dynamo performed. True, it could light the searchlight when required, but that was now quite a side issue.

Gradually experimental motors began to make their appearance. The manner in which the engineer had wrested the capstan from his grasp was always a sore point with the sailor, and it lay to the honour of the torpedo man to reclaim it. A cautious Admiralty at length presented the torpedo staff with an electric capstan to play about with. True, they refused to go to the expense of providing him with a really efficient toy, but since they placed it on the quarterdeck where it was not of much use to any one, this did not matter a great deal. If it was really required, the motor could be disconnected and bars shipped in the ordinary way for working it by hand.

The torpedo man, however, refused to be discouraged ; he made the best of circumstances, and, wading through an unmerciful amount of chaff, at length succeeded in getting a footing. Electric motors began to appear in all parts of the ship.

In the ammunition hoists, the turrets, and the ventilating plant step by step, hydraulic machinery and steam began to give place to electricity. Finally the boat hoist was recaptured from the engine room, after a stout resistance, and the engine-room staff was driven below, behind the armoured belt. The dynamos were further called upon to supply the initial current for wireless telegraphy—and all this on 80 volts. Through all its evolution from two poles to six, from gauze to carbon brushes, the Gramme ring, drum armature, lap winding and wave, the dynamo sang its old refrain, "Forty volts for the arc light and forty to spare." No matter that the distant glow lamps began to grow dim, and the motors ran slow. Larger cross-section in the feeders and lower voltage lamps, was the reply. But this sort of thing could not go on indefinitely. Desperate characters among the torpedo staff urged a few more revolutions out of their dynamos and manipulated their instruments. It was whispered that voltmeters had come back to the dockyards registering as much as 5 volts under standard, and engineers began to complain about the coal consumed for the number of watt-hours logged.

The matter was serious, and called for immediate action. Something had to be done, and the Admiralty decided to do it handsomely ; with unprecedented generosity they presented the torpedo staff with another 120 volts.

It was a big leap ; the note of the dynamo became changed. The glow lamps, the motors, the wireless transformer, was the cry, let the searchlights come in where they can.

And now mark the irony of fate. The two searchlights, one on either side of the bridge, have been multiplied by four ; the wireless transformer has given place to a motor alternator. Busybodies are introducing low-voltage lamps of high efficiency which bid fair to oust the carbon-filament lamp, dynamo firing has superseded battery power at the guns, and even the communication system, fire control, bells and telephones are going to the dynamo for their energy. All these things demand low voltages, and what has been saved in lighter wiring may be more than counterbalanced by weighty motor transformers, which are springing up everywhere and occupying much valuable space within the armoured belt.

The time is not far distant when all guns will be electrically trained, more ammunition will have to be carried, and its supply by electric power will have to be accelerated. Already electricity has displaced hydraulic power in the turrets of one of our latest warships. Everywhere electricity is in demand; the bigger the ship, the longer the wiring and the stronger the demand for a margin of voltage.

What, then, is to be the terminal voltage of the main dynamo? On what is it to be based? Forty volts for the searchlight is a cry which still makes itself heard, and cannot be disregarded; 200 amperes is the least that must be supplied in the way of current, and with high voltages and eight arcs or more to deal with, a large surplus is no insignificant matter to handle.

The old-fashioned seamanship with its hundred uses for a single spar was built upon the solid foundation of experience and necessity; it accepted an appliance for what it was worth, in the work for which it was designed, as a starting point, and then began to enlarge its field of application. The same spirit that saw in the spare topmast, a jury rudder, a lifting derrick, and a spare mainyard as well, has elevated the little searchlight dynamo to a far more dignified position. We live in an age of experiment and reform, but, though the older methods of advance by measured stages may have erred on the side of caution, they were founded on material solid to the core.

LEGAL.

Devonport Corporation *v.* Devonport and District Tramways Co.

Judgment was given at Devonport Police Court on Wednesday last week in this case, which was reported in our last issue.

Dr. G. A. Rae, in giving judgment, said there were two sets of summonses, one for non-running of the service of cars as required by the Corporation in the public interest, and the second for the non-supply of the workmen's cars, as specified and required. The Court found against the defendant company, in both cases, and fined the company the maximum—£5—and costs for the first day in the first set of summonses. There were 83 summonses of the same character following that, and in those the fine was 2s. 6d. and costs for each day. On the second set there were 71 summonses; the company would be fined £2 and costs for the first day for non-running of workmen's cars, and for the subsequent dates 1s. and costs in each case.

On Friday Mr. T. H. Gill applied to the Bench to grant a special case for appeal in respect of the decision, for the determination of the King's Bench Division, as the defendants alleged that the decision that the magistrates gave was erroneous in law.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

30-Amp. Fuse-Switch.

The British Electric Calibrated Fuse Co., Harpenden, have sent us particulars of a fuse-switch, designed for small capacities. It is manufactured only in one size, and can be fitted with calibrated fuses up to 30 amps., 500 volts. The cast-iron case is securely fastened with a small brass clip, which opens with a touch of the finger, and when the box is opened the circuit is automatically broken. When replacing a fuse, no screws have to be touched, the fuses being held in specially-designed phosphor-bronze clips. The operation of renewing a fuse takes only one second. The cast-iron box is lined throughout with asbestos, and the slates are also insulated from the box by bushes.

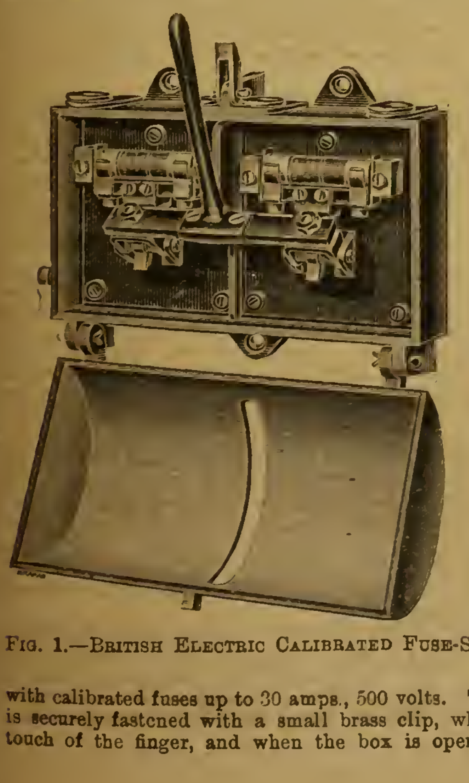

Fig. 1.—British Electric Calibrated Fuse-Switch.

The only part of the switch which has any tendency to wear is a small leaf that makes contact between the main terminals and the fuse; this is readily renewed by the users themselves. Simplicity and compactness are obvious features of the design.

"Cantie" Switches.

The "Cantie" Switch Manufacturing Co., of 67, Mount Street, Nottingham, send us particulars of their latest line in switches—the "Cantie" patent switch No. 3. The construction of this device is shown in the accompanying fig. 2. The switch is mounted on a strong non-hygroscopic china base, provided with fillets and a central division, which make it very difficult to touch a live part when the switch is off. The switch itself is of the knife pattern, but, thanks to the ingenious arrangement at the pivot, the blade is given a longitudinal motion in the contact jaws as well as a radial motion, and snaps in or out; there is no possibility of producing an arc. The contacts are of phosphor-bronze, with a smooth bend of new form, and are so designed that both front and back contacts break at the same time. The sweating thimbles for the cable ends fit closely into split holes, and cannot work loose when once tightened in position. The 25-amp. size here illustrated has been tested at the National Physical Laboratory, and reported on as suitable for 500 volts; the insulation resistance was over 100 megohms.

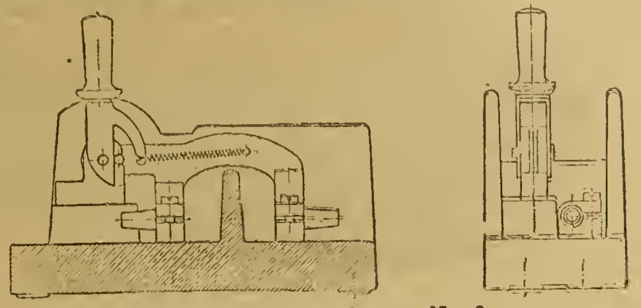

Fig. 2.—"Cantie" Switch No. 3.

The switch is also to be had mounted in a watertight cast-iron self-locking case, which cannot be opened unless the switch is off; nor can the switch be put on till the case is closed. The joint is made with tallowed asbestos in a groove, and the spindle is also packed with asbestos, while the lead holes are tapped for conduit. Fig. 3 shows the watertight switch and fuse, the case just described being enlarged to receive the two fuses. The connecting bars are of mica.

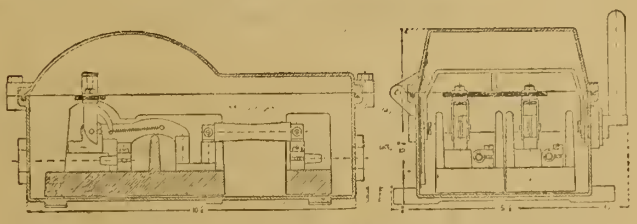

Fig. 3.—"Cantie" No. 3 Double-Pole Switch and Fuse.

We have examined samples of both the switches illustrated, and have no hesitation in expressing approval of the design.

Bamag Elastic Couplings.

Mr. C. A. Matthews, of 12, Newport Road, Chorlton-cum-Hardy, agent for the "Bamag" couplings in the North of England and Scotland, has sent us particulars of these devices. The coupling consists essentially of a pair of disks with axial holes *f*, fig. 4, near the circumference, into which are fitted studs of leather or rubber, *e*; the

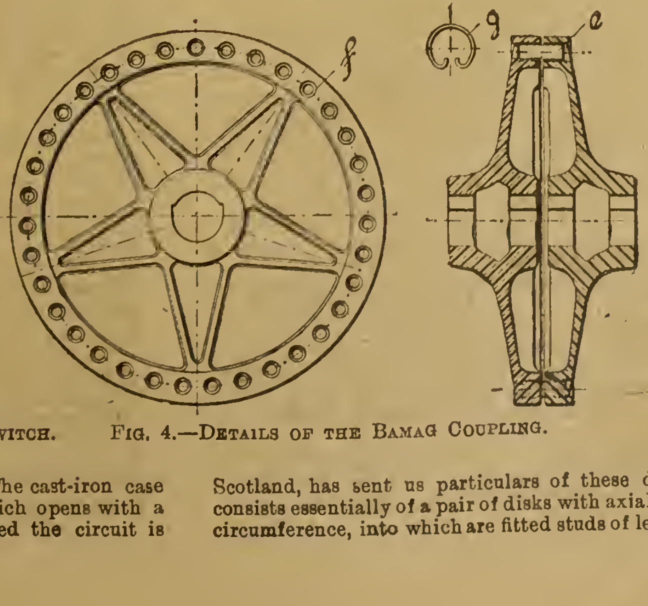

Fig. 4.—Details of the Bamag Coupling.

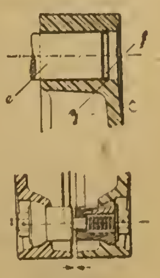

Fig. 5.

torque is transmitted through these studs, which are in shear, the large radius being adopted to reduce the stress upon them. The studs are held in place by spring rings fitting into grooves, as at *g*, figs. 4. and 5. If desired, spring joints can be provided, as in fig. 5, which permit of slight longitudinal movements of the shafts without allowing them to touch; this is especially recommended for electrical driving. In larger sizes the disks are made of cast-steel, up to 9 ft. in diameter, with a correspondingly increased number of studs; a coupling of this size can transmit normally nearly 7,000 H.P. continuously, and weighs rather more than 7 tons. Such couplings are suitable for rolling mills and haulage machinery, and have been used to transmit 5,000 H.P. at 108 R.P.M., in an ironworks. Fig. 6 shows the steel disks and the studs separated.

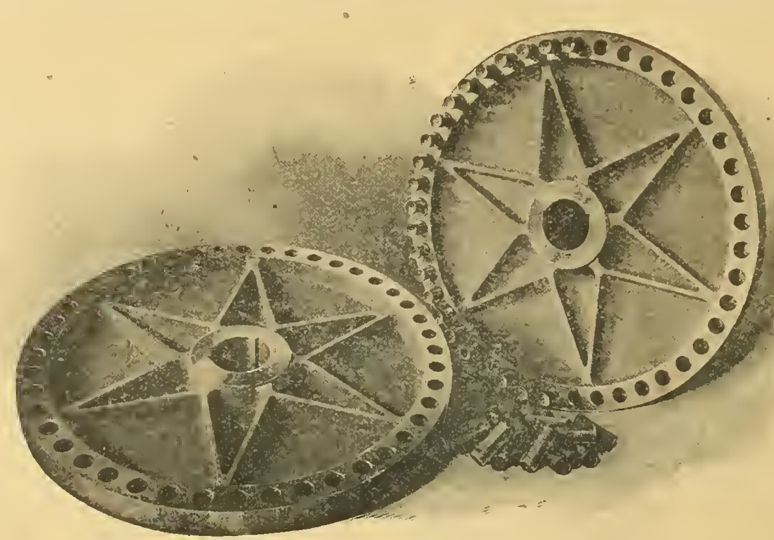

Fig. 6.—Bamag Elastic Coupling.

The couplings are suitable for reversing drives, and are readily unshipped when required, without moving the shafts; uncoupling can be effected by taking out the studs. Momentary overloads of 100 per cent. can be carried, and 20 per cent. overload can safely be transmitted for half an hour.

BUSINESS NOTES.

Consular Notes.—Japan.—The British Consul at Osaka reports that in the supply of electrical machinery, equipment, &c., there is active competition between British, American and German manufacturers. Until recently an American firm had practically a monopoly in the district, but latterly British and German firms have secured contracts. With the opening up of electric railways and the extension of various electric light companies it is probable that large quantities of electrical machinery, &c., will be required during the next few years. Generally speaking, the engines and boilers in Osaka factories are of British make. At present there is considerable demand for boilers made by a British firm, who seem likely to secure a monopoly in the future. It is impossible for British manufacturers to secure contracts for machinery, &c., unless they have an experienced representative on the spot, as a knowledge of local and personal considerations and the methods of tendering is absolutely essential.

Portugal.—The British Consul at Oporto reports that considerable attention is now being paid in Portugal to the matter of the utilisation of water-power. Some water-power is already being utilised for industrial and lighting purposes, and its development in the near future is likely to be considerable. The Consul states that, to the best of his knowledge, the Swiss and German manufacturers of both turbines and electrical machinery have so far received all the orders that have been placed.

Peru.—The British Consul at Iquitos reports that the installation of wireless telegraphy of the German system known as Telefunken was completed on July 28th, 1908, but was not opened for public service till September 15th. It has proved very successful, but as the wireless stations only extend as far as Puerto Bermudez on the River Pichio, messages for Lima and Europe have to be sent thence by wire and telephone, and it is here that interruptions are continually occurring. However, it is understood that one or two more stations will be erected to ensure continual communication. The distance between towers is about 300 kiloms, and their height varies from 45 to 65 metres. The price charged per word to Lima is 44 c. (about 10½d.).

Mozambique.—The British Consul at Beira, in a recent report, states that the installation of an electric light plant has been undertaken by a partnership firm consisting of an Italian and a Frenchman. The supplies have all been purchased in Italy. The street wires have already been erected, but further progress is obstructed by the non-arrival of the dynamo from Italy. The use of electric light, if the installation is completed, is likely to prove an expensive luxury to the consumer.

The British Consular Agent at Quilimane reports that during 1908 commerce has benefited much through the opening of a British cable station at Quilimane which places that town in direct communication with the outer world; the result is that telegrams now reach their destination, which was not always the case previously.

Turkey.—The British Consul at Adana reports that electric appliances were in the past supplied by Germans, but there is no reason why British firms should not enter the market. There are two projects for utilising water power for light and power at Adana, Tarsus and Mersina. Tarsus has already an installation of electric light set up by a Swiss engineer. Of the two projects for light and power, details, as far as obtainable, have been sent to the Board of Trade. The other project—which the Consul fears is a rival one—is for 3,000 H.P. from water turbines some eight miles from Tarsus. The promoter is the owner of the new cotton mill at Tarsus. The Swiss engineer already on the spot has, the Consul believes, the order for the machines should the concession be granted, but he does not know if the bargain is concluded. In addition to these large projects electrical appliances of all sorts will be wanted in the three towns when and if light and power arrive.

Siam.—In a report on the Western Siamese States, H.M. Consul states that the prospects of rubber in Kedah are excellent, but only one estate has any trees of a tappable age at present. The majority of the trees are from two to four years old, but all are looking very well, even when planted in what would appear to be an uncongenial soil. The great difficulty which planters have to contend with is the labour supply, as the local labour is unsatisfactory, and the Straits Government do their best in accordance with the agreement with India to prevent Tamil coolies from migrating to Kedah where they are beyond the paternal care of the British Government. If Kedah is to become a protected State of the United Kingdom, the difficulty will doubtless cease to exist, and Kedah will obtain all the Tamil labour she requires. Another much-felt want is a proper survey, and as a result, sound title deeds.

The Azores.—The British Consul reports that in the summer of 1908, operations were commenced for the establishment of wireless telegraph stations at Ponta Delgada and St. Mary's, and when these are completed, stations will also be opened on some of the other islands.

Italy.—The British Consul at Genoa reports that the Italian State railway has given the work of electrification of the Campasso-Busalla line to the Westinghouse Co. at Vado. This line carries the traffic from Genoa to Piedmont, Lombardy, the Venetian provinces and Switzerland, and runs parallel to the other line, carrying similar traffic, as far as Ronco, where the two join. The length of the electric line will be 11½ miles, and it will be a double track throughout. The steam power for the generating station will be supplied with boilers and with turbo-generators and switchboards manufactured in England. For the four transformer sub-stations the switchboards will also be procured from England, while the transformers—four single-phase for each sub-station—will be manufactured at Vado. Elsewhere in his report the Consul states that a Marconi wireless station has been erected at the end of the Molo Vecchio at Genoa, but is not yet working. Adjoining is a workshop for mounting and repairing wireless plant and apparatus; as it is the only one in the Mediterranean, the Consorzio has granted special facilities to Mr. Marconi. New electric grab and hydraulic cranes have been erected on the piers, which, effecting an economy in cost of discharge, are a profit to the Consorzio, so that it is proposed to order 13 more to be placed on the Caracciolo jetty when finished; these cranes will be ordered in Berlin, whence the others came.

The British Vice-Consul at Savona reports that the electrification of the Savona-San Giuseppe Railway line, about 13 miles long, has been definitely decided on by the Italian State Railway. The steam electric central station will probably be built at Vado, a village 3 miles from Savona. The plant will consist of two turbo-generator groups of 5,000 KW. each, producing an electric current at 13,000 volts, three-phase, 15 periods, carried to the line by two principal feeders, supported by iron poles with wire of $\frac{5}{16}$ in. diameter. Four sub-stations will be erected. A decision has not yet been taken as to which overhead line system will be adopted. The electric locomotives will be of the five-axle type, all coupled and provided with two three-phase motors with direct action at the tension of 3,000 volts, 15 periods. These locomotives will have two normal speeds—one of 14 miles and the other of 28 miles—which will be obtained in the first case by inserting the two motors in cascade connection with each other, and in the second by connecting the two motors in parallel. The order for 15 of these electric locomotives has been placed with the Società Italiana Westinghouse, and they are already being built at their works at Vado. The Savona-San Giuseppe line will carry the traffic from Savona to Piedmont, 38 goods and eight passenger up trains a day, and 18 goods and six passenger down trains, will be run on this line; the maximum gradient to be met is of about 25 per 1,000. The ascending goods trains have a weight of about 400 tons, and will be hauled by two locomotives.

Spain.—The British Consul at Corunna reports that the lighting of the town is undertaken by two companies, the Société d'Eclairage de la Corogne et Vigo and the Sociedad Co-operativa Electrica, which both receive their power from the same source—a stream near Puentedueme, near Ferrol. Great competition existed between these two companies by which the consumer benefited, but they have now come to an arrangement and work together. The lamps and fittings employed all come from Germany, and are supplied by agencies in Madrid. The number of lamps used annually is about 55,000, and they are nearly all of the bayonet-holder pattern.

The British Consul at Gijon reports that the tramways in that town have been taken over by one of the Thomson-Houston companies, and are now being converted from horse to electric traction. No extension of the line worthy of mention is to be made at present, but as soon as the new Government road from Gijon to the port of Musel is open, it is proposed to run a line to that harbour.

China.—The British Consul at Tientsin reports that, within the last two or three years, the system of tramways worked by the Cie de Tramway et d'Eclairage Electriques de Tientsin, a Belgian company, has been considerably extended. Originally designed only to make a circuit round the Chinese city along the boulevards formed by the demolition of the old city walls, with an extension along the Chinese Bund, the system was carried across the river to the Austrian concession by a bridge opened in November, 1906; and in May, 1907, an agreement was concluded with the Japanese concession for running the line through the main street of that concession and thus providing a direct route between the foreign settlements and the Chinese city apart from the route through the Russian, Italian and Austrian concessions on the other side of the river. Until this extension was carried out, the tramways did not pay, but it is now believed that their success in the future is assured. There are between 8 and 9 miles open to traffic, nearly all double track. The receipts from the tramways alone are given as £13,120 in 1907 and £19,400 in 1908, but the Consul has been unable to ascertain the cost of working. The electric lighting business of this company has also greatly increased. In 1907 the receipts were £4,680 and in 1908, £6,240.

The British Consul at Chungking reports that the Chungking Electric Light Co., a Chinese company, started operations on a small scale in June, 1908. They are running 220 lamps of 16-C.P. each, and the dynamo is driven by a 5-in. belt from a small vertical engine of about 22 H.P. The company is now considering tenders from various firms for the erection of a big plant to light the whole city, and a piece of ground has been bought outside the Tai Ping Men on which to erect the plant.

The British Consul at Wuhu reports that a Chinese company was formed there some two years ago to supply the town with electric light, and expected to commence operations early in April, 1909.

United States.—The British Consul at St. Louis reports that the output of electric cars during 1908 was not more than one-third to one-half of the usual number turned out. Passenger coaches for steam railway service have been one of the features of the industry, but during the past year only a few were manufactured. A loss of more than 50 per cent. is to be noted, approximate value being about £60,000. Of new cars made and those repaired, the business for the year amounted to not more than one-fourth its usual volume, or a total of about £1,200,000, making the car-building industry of St. Louis for 1908 about £1,800,000.

The British Consul at Baltimore reports that the Winchester and Washington Electric Railway Co. has constructed a dam of concrete across the Shenandoah River at Millville, Jefferson County, West Virginia, about 10 miles south of Harper's Ferry. It is built on a rock foundation; its length is 1,000 ft., and it is 12 ft. in width at the bottom and 4 ft. at the top. The cost is given at £61,700. It is used for furnishing power that operates an electric light and power plant which supplies Winchester, Virginia and other places, and as far as Harper's Ferry, over high-tension lines at 22,000 volts. The construction of the dam across the Susquehanna River at McCall's Ferry has ceased for the present, owing, it is said, to the money stringency.

The British Vice-Consul at Richmond reports that there are 457 miles of electric railway in operation in Virginia, of which 30 miles were constructed during the year 1907. The total earnings were £755,804, the percentage of expenses to earnings being 70·86. The average daily wage to the 3,581 employés was 7s. 7d.

French West Africa.—The British Consul at Sakar reports that the total amount of rubber exported from French West Africa during 1907 was 3,713 tons, valued at 30,000,000 fr., equal to £1,200,000. The rubber industry has been seriously depressed during the last two years, prices in Europe having dropped from 12·50 fr. (10s.), to as low as 4·50 fr. (3s. 7½d.) per kg. The Ivory Coast and French Guinea are the principal rubber producers in French West Africa, and the crisis in the rubber industry was severely felt by merchants and importers of these Colonies. The price paid to the native gatherers of rubber, which in ordinary years was on an average 7 fr. per kg., was reduced during 1907 and 1908 to 3 fr. per kg., an amount about sufficient to enable him to pay his taxes, but insufficient to allow him to purchase imported manufactured articles. The chief exporting ports are Assinie, Bassam, Labon and Sassandra on the Ivory Coast; Conakry, in Guinea; and Ziguinchor, Dakar and St. Louis, in Senegal. The exports from Togo and Portuguese Guinea amounted to 164 and 224 tons respectively in 1907, and to 147 tons from the former in 1908.

Brazil.—The British Consul at Santos reports that it may be affirmed that the State of Sao Paulo has been the cradle of the utilisation of hydraulic power in Brazil for generating electricity; that at present turned to account, however, is but insignificant in comparison with the immense undeveloped resources which the State possesses in the numerous large waterfalls, mostly State property, and to a large extent still unexplored. The principal hydro-electric stations constructed in the State are that of the Sao Paulo Tramway, Light and Power Co., at Parnahyba, with a capacity of 8,000 H.P., and those of various other companies, viz.:—At Jundiahy, generating 1,000 KW.; Sorocaba, generating 1,000 KW.; Rio Claro, generating 580 KW.; Mococa, generating 500 KW.; Peracicaba, generating 450 KW.

The important hydro-electric station in course of construction by the Santos Dock Co. at the Italinga Falls near to Santos, which should be completed in a year's time, will transform and transmit electric energy of 3,000 KW., which will be used in working the cranes on the quay at Santos, and the supply of light and power to that city. The principal waterfalls surveyed, but so far not utilised, are:—On the River Parana: Urubu Punga 447,000 H.P. On the River Grande: Patos 400,000 H.P., Maribondo 61,000 H.P., Avanhandava 57,700 H.P., Itapura 40,000 H.P., Juqueryquere 40,000 H.P., Cruzes 40,000 H.P., Ilha Secca 40,000 H.P.

The British Vice-Consul at Curityba reports that the only existing tramway line is worked by mule traction. The company has the concession to electrify the line and to extend it to neighbouring towns and villages. It is petitioning the State and municipal Government to assist by giving a guarantee on the necessary capital. Until now no work has been begun. The most important enterprise in this branch of industry is the Empresa de Electricidad de Curityba, which possesses a concession for 30 years to supply the electric light to the capital. The company is German, and nearly all the material used is of German origin. It is doing well, and last year made 20 per cent. net profit on the capital invested. The same enterprise has another concession for 50 years, to explore the waterfall of Cayacanga, on the River Iguassu, distant 40 miles from Curityba, for the production of electric light and power. There are several electric plants in other towns through the State, and others are in construction. They are generally built by Germans, and with German material.

The British Consul at Porto Alegre reports that during the year 1908 the municipality completed the installation of an electric lighting system principally for the public illumination of the suburbs and parts of the city not lighted by gas. A very limited number of private consumers is also supplied where gas cannot be obtained, but the installation is not large enough to supply electric lighting in a general way. A concession for supplying electric light to private consumers within a limited zone of the city, was held by a native company (Fiat Lux), but expired in April, 1909, and the whole of the town and suburbs is open to all comers.

Russia.—The British Consul at Odessa reports that, in spite of the Government approval of their scheme for the electrification of the Odessa tramways, the tramway company have not yet been able to begin work owing to fresh preliminary difficulties. The tender of the Société Anonyme des Tramways d'Odessa was accepted for the construction of an electric supply station. A telegraph cable was laid from Sevastopol to Varna by a British firm during 1908, and it began work on August 2nd of that year.

The British Vice-Consul at Nicolaieff reports that although the Town Council decided in principle to grant a concession for the electrification of the existing horse tramways in May, 1908, nothing definite has as yet been settled. The Government has assigned a sum of money for the improvement of the existing telegraph and telephone communication between Nicolaieff and Odessa. This work should be undertaken during 1909.

The British Vice-Consul at Kharkov reports that an electric tramway was built some years ago by the municipality to the goods station of the South-Eastern Railway, but in the rest of the town, and to the fine Central Railway Station, a Belgian company runs dilapidated horse tramways. The proposal of this company to introduce electric traction on the condition of extension for another 31 years of the existing concession is now being hotly discussed, but it is likely to be refused, although the municipality cannot provide the funds for the improvement independently.

The British Vice-Consul at Kherson reports that the municipality are now discussing the terms of a concession to French capitalists for building electric tramways in the town and to the railway station, of an aggregate length of about 11½ miles. The electric lighting of the town and port was put into operation in March, 1909.

The British Vice-Consul at Sevastopol reports that the project of an electric railway to Jalta and the south coast, which has been under consideration for some years, is now coming somewhat more to the front. Surveys and estimates have been made, and three different routes are projected; one is from Simpheropol to Aloushta and Jalta, another from Bachtchi-Serai to Jalta, and a third to Sevastopol by way of Balaclava and the south coast. The cost of the line, according to whichever route may be decided upon, is estimated at 10,000,000 to 15,000,000 roubles (£1,055,000 to £1,583,000). A society has been formed in St. Petersburg with the object of forming a share company of electric railways in the Crimea, but the necessary capital seems hard to find, and the Government seems disposed to grant a concession to a Russian company only.

Simplex Lamps.—MESSRS. SIMPLEX CONDUITS, LTD., inform us that they can now supply high-voltage lamps of 25 C.P., suitable for burning direct on circuits from 200 to 250 volts.

Annual Outing.—The employés of MESSRS. COX-WALKERS, LTD., had their annual excursion to Scarborough on Saturday, July 31st.

Heywood Contract Arbitration.—The award of the arbitrator (Mr. S. L. Pearce) in the matter of the Heywood Corporation and Messrs. Whipp & Bourne, with respect to the contract for the supply of a balancer booster set, is against the Corporation.

Russian Platinum Agreements.—A further stage in connection with the Russian platinum question is reported from Paris as having been reached between the Compagnie Industrielle du Platine and the Demidoff heirs. The negotiations between the two parties, which were suspended some time ago in consequence of legal difficulties, were recently resumed, and have led, it is stated, to the conclusion of an understanding between the company and M. Ratkoff, manager of the Russian undertaking, which only requires the settlement of details to complete the agreement. The understanding desired on both sides has been difficult to arrive at on account of legal considerations, as the Demidoff heirs are not owners of the mine, but only have a provisional and non-defined right of working, which can at any time be ended by the Russian Government under certain preliminary conditions. On the basis of the new arrangement it is now proposed, with the full consent of the Government, to conclude an agreement whereby the Compagnie Industrielle will take over the ore produced in the mine from the present holders, and this agreement would remain in force in the case of their successors. This agreement is to come into operation on the expiration of the existing contract between the Demidoff heirs and a London firm. By means of the agreement the French company is to obtain a more effective control over the market, especially as the company will then devote attention by improved organisation to the reduction of the thefts at the mine, which are declared to be extensive. The company will make large advances to the Russian undertaking by the creation of fresh bond capital, which will be all the more easily raised, as the existing bonds, excepting a small sum, have already been redeemed.

Book Notices.—*Electric Storage Batteries for Load Peaks at Power Stations*—In this little brochure, recently sent us by the D.P. Battery Co, Ltd., of Bakewell, an attempt is made to drive home certain facts and to expose certain fallacies in connection with the use of storage in electricity works. The undoubted fact, for instance, that a storage battery is the most reliable source of electrical energy that can possibly be installed is emphasised; the readiness of manufacturers to undertake the maintenance of batteries at their full capacity at a rate of about 7 per cent. on their capital cost (on a 10-year basis) is proof of their durability, and while their efficiency, considered alone, is admittedly only 70 to 75 per cent, the effective efficiency is a totally different matter; for not only does the inefficiency of the battery affect only a small proportion of the total output (that constituting the "peak") but, in addition, the battery is usually charged under conditions which enable the cost of the charging energy to be reduced to a fraction of the usual generating cost, thus practically counteracting the inefficiency. Following the paper read last year by Mr. A. M. Taylor, and the discussion thereon, the company builds up a strong case in favour of the storage battery, and drives it home with a practical example of material reduction of fuel consumption per unit generated by a Diesel set, due to the installation of a battery.

The Press Album. Edited by Thos. Catling. London: John Murray. 1909. Price 21s. net.—This handsome volume is a symposium by various well-known authors, artists and others, issued in aid of the journalists' orphan fund, which was founded in 1892, and has done admirable work. The proposal to bring out the book originated at a Press dinner, and was warmly taken up on every hand; the only difficulty arose in connection with the title, with which, however, we see no reason to quarrel. The album (*édition de luxe*) is bound in white and gold, and has for frontispiece a portrait in colours of His Majesty the King. The contents include many beautiful collotypes, half-tones and other illustrations, some now published for the first time; numerous autographs testify to the interest of distinguished men in various walks of life in the Orphan Fund, while the bulk of the contents consists of short stories, poems and essays by well-known authors. Apart altogether from its charitable purpose, the book is well worth purchase on its own merits, and we recommend it to our readers on the double basis—by buying it they will minister to their own pleasure, and will at the same time benefit the fatherless children on whose behalf it was produced.

American Street Railway Investments. 1909 Edition. New York: McGraw Publishing Co. $5.—This is the sixteenth annual volume of what is known as the American Electric Railway Red Book. It is, as most of our readers are aware, a big volume of some hundreds of pages issued yearly by the publishers of the *Electric Railway Journal*, and it is used mainly by bankers, brokers, capitalists, investors and others interested in street and interurban railway companies in the States. It contains many maps, and an abundance of general and financial information relating to more than 1,500 operating and controlled companies in the States and Canada.

"Proceedings of the Forty-second Annual Convention of the American Institute of Architects." "Annuary of the American Institute of Architects for 1909." Washington: The Institute.

"Year Book of the Michigan College of Mines." 1908-9. Houghton, Mich.: From the College.

"Electrical Installations." By Rankin Kennedy. Vol. V. London: Caxton Publishing Co. 1909. Price 7s. 6d. net per vol.

"Patents and Marks in all Republics of Latin America." 1909. By Messrs. Leclerc & Co., Rio de Janeiro, Brazil.

Stoker Contracts.—We have received a list of orders recently booked by the Underfeed Stoker Co. for stokers for a number of works and buildings, including the following:—General Post Office, Mount Pleasant; City of Carlisle Corporation; City of Bath Corporation (repeat order).

Bankruptcy Proceedings.—Under the failure of Charles Scott Snell, civil and electrical engineer, 25, Victoria Street, S.W., the first meeting of creditors was held on Monday last at the London Bankruptcy Court, before Mr. W. Boyle, Official Receiver. The statement of affairs submitted by the debtor showed total liabilities £13,588, of which £8,588 is unsecured, and assets, "a doubtful book debt, £75." When before the Examiner, the debtor stated that up to 1895 he was employed on various electrical and incandescent-gas matters. In 1899 or 1900 he invented a gas lamp and sold the patent to a company registered as the Scott Snell Gas Lamp Co., Ltd., with a nominal capital of £1,000,000. As vendor he received £9,000 preference, and £250,000 ordinary shares, and £4,000 cash, and he was appointed director at a remuneration of £500 per annum. The company had an existence of only three years when, owing to insufficient working capital, it was wound up by the Official Receiver in Companies' Department. The assets realised insufficient to meet the claims of the debenture holders, and no dividend was paid to the shareholders. The failure of the company left him without means, and with an indebtedness of £8,000 to the London Joint Stock Bank. Since then he had spent his time in inventing things, but had earned very little, and had lived mainly on money borrowed from friends. The inventions included a steam boiler, now derelict; a bolt, which was provisionally protected, but of no value; a vacuum gas compressor, which he sold to the Vacuum Gas Compressor, Ltd., for £900 shares, also now of no value; and an apparatus for public amusement in the shape of a patent captive aeroplane. He sold the latter invention to the Scott Snell Scenic Aeroplane, Ltd., but it happened that it had been anticipated, and the share consideration that he received was valueless. The debtor added that when he was a director of the Scott Snell Gas Lamp Co., Ltd., and was worth £50,000, he bought an estate at Wimbledon for £8,000, the money being advanced by the London Joint Stock Bank on the security of his shares in the company and a mortgage on the freehold property. The bank are returned as unsecured creditors to the extent of £3,000, owing to depreciation in the value of the property and shares. The debtor attributes his insolvency to the failure of the Scott Snell Gas Lamp Co, Ltd. In the absence of any proposal, the case was left in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy.

The creditors of J. W. Sydenham, 65, Seymour Street, W., met on Tuesday, at the London Bankruptcy Court, before Mr. Walter Boyle, Assistant Official Receiver, who reported that the debtor had stated when before the Examiner that he had never been in business on his own account, but had been engaged as an electrical engineer on the commercial side by various electrical companies. Whilst so engaged in Edinburgh he was led into dealings on the Stock Exchange, and he owed £365 in respect of differences. He had no personal debts and no assets. In the absence of any offer, the case was left with the Official Receiver to be wound up in the ordinary course of bankruptcy.

On the same day the first meeting of creditors was held under a receiving order made against Fordyce James Sheridan, 5, Ingram Court, Fenchurch Street, E.C., who assisted in the flotation of various electrical and motor undertakings. Mr. Walter Boyle, who again presided, reported that it appeared from the debtor's statements when before the Examiner, that this was his second appearance in the court. He was bankrupt in 1897 or 1898, with total liabilities £57,000; no dividend was then paid, and he had not applied for a discharge from those proceedings. He had since earned a living by assisting in the flotation of various public companies and in introducing businesses to purchasers. Among the companies which he had asissted to promote were the Electric Railways Co, Ltd., which was registered about nine years ago, and had gone into liquidation: the Brighton Electric Railway and Motor Roads, Ltd., and the Great Eastern Omnibus Co., Ltd. In the case of the Brighton Electric Railways, he assisted with advice respecting the Bill in Parliament; the Bill was thrown out, and no company was formed. The Parliamentary Bill for the Motor Roads, Ltd., only reached the Standing Orders stage, and was abandoned, but the Great Eastern Omnibus Co, Ltd., was floated two years ago, and had become a flourishing concern. He, however, now had no interest whatever in it. He had been engaged in some other matters of the same nature, but they came to nothing. The present bankruptcy proceedings were brought against him by the assignee of a judgment debt, which he disputed, and had unsuccessfully appealed against. He now owed £1,509, and had no assets whatever. The present bankruptcy was due to the failure of the various enterprises in which he had been interested.

In the absence of any offer the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

W. T. Garnett, electric cable and wire manufacturer, Bradford.—A second and final dividend of 9½d. in the £ is payable on August 18th.

Catalogues and Lists.—The Hagen Accumulator Works, 41, Snow Hill, Holborn Viaduct, E.C.—Illustrated pamphlet, giving prices, dimensions and other tabulated figures relating to the Hagen accumulators in celluloid, ebonite, glass and lead boxes for motor-cars, cycles, boats and other purposes.

Messrs. Haslam & Schontheil, Western Mail Chambers, Cardiff.—New list of 10 pages, giving illustrations of a variety of their cast iron water-tight fittings—single-light vertical, cluster, hand lamps, also cast-iron guards for bulkhead or sconce fittings, and fuse boxes. Prices are clearly indicated in close proximity to the illustrations.

The United Electric Car Co., Ltd., Preston.—Illustrated pamphlet describing the Preston semi-convertible car—a closed car, an ordinary drop-sash car and a semi-convertible car combined. When the side lights are lowered, there is a clear opening of nearly 4 ft.; when the top light only is lowered, there is a clear opening of 1½ ft. The sashes work in a very simple manner, and when lowered drop into a narrow pocket, no seating room being lost.

The roof is not affected in any way, and the window arrangement can readily be adapted for single-deck or top-seat cars of the ordinary English design. The car illustrated is intended for South America and other countries where a semi-convertible is required.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—Leaflets relating to the "Metaflect" lamp, new electric flashing signs, and new 25-c.p. high-voltage tantalum lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Pamphlets describing, with prices, carbon-filament lamps of various patterns, including tubular and radiator lamps and coloured lamp varnishes; Siemens tantalum lamps, suitable for both direct and a.c. circuits, with adapters, fittings, &c.; and "wireless" electric light fittings, in which the cluster body is supplied complete with internal connections ready made, according to requirements. The last-named list, No. 29b, shows a variety of wireless clusters, "tantalum arcs," lanterns and reflectors for indoor and outdoor use.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet relating to the "Eclipse" metallic-filament lamp, with particulars and prices.

Messrs. Neville Kaye & Co., Ltd., 231-2, Strand, W.C.—Illustrated pamphlet drawing attention to the firm's electric lift gear, pulley blocks and overhead travelling cranes.

Edmundson's Electricity Corporation, Ltd., Broad Sanctuary Chambers, Tothill Street, Westminster.—Thirty-two page pamphlet entitled "Electric Light and Power," wherein the company gives a good deal of well-illustrated matter regarding electric lighting, heating and power installation work that it is prepared to undertake for country and town mansions, public buildings, factories and so forth. Suction gas plants, small water turbine, oil and petrol sets are briefly outlined. A full and imposing list of some of the clients for whom the company has installed electrical plant occupies a number of pages. The intention of the company to again develop this department of its business was referred to by the chairman in his speech at the recent annual meeting.

Messrs. Francis & Sons, 41, Hampden Street, Bolton.—List relating to the Francis (patent) hand-feed arc and proscenium lamps for stage work.

Condensing Plant.—The Mirrlees Watson Co., Ltd., have recently received orders for a number of condensing plants, among which are the following:—

A. Williams, Mexico.—Three sets of barometric condensing plants, 38,500 lb. steam per hour.

Clifton and Kersley Coal Co., Ltd.—Barometric condensing plant, 30,000 lb. of steam per hour.

Baldwins, Ltd., Port Talbot.—Surface condensing plant, 30,070 lb. of steam per hour.

Broken Hill, New South Wales.—Low level jet condensing plant, 10,000 lb. of steam per hour.

For Great Boulder Prop. Mines, Ltd.—Surface condensing plant, 21,100 lb. of steam per hour.

Chas. Walmsley & Co., Ltd., Bury.—Surface condensing plant, 15,600 lb. of steam per hour.

P. J. Mitchell, London, for Whitehaven Coal Co.—Surface condensing plant, 13 000 lb. of steam per hour (condenser only).

The Linde British Refrigeration Co., Ltd.—Surface condensing plant, 8,000 lb. of steam per hour.

Bolckow, Vaughan & Co., Ltd., Middlesbrough, for South Bank Turbo Plant.—Surface condensing plant, 43,000 lb. steam per hour, repeat order.

Okura & Co., London, for Formosa.—Barometric condensing plant, 36,250 lb. of steam per hour.

Dissolutions and Liquidations.—Thomas Parker, Ltd.—The creditors of this company must send particulars of their debts, &c., to Mr. W. A. Nelson, the liquidator, Lichgate, Wolverhampton, by August 28th.

General Electric Sign and Engineering Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. E Hayes, the liquidator, 28, Basinghall Street, E.C., by September 7th.

Sharpe & Waters, electrical engineers, 34, Uverdale Road, Chelsea.—Messrs. Enoch Sharpe and Alexander Waters have dissolved partnership. Mr. Sharpe attends to debts.

J. H. Holmes & Co., electrical engineers, Newcastle-on-Tyne, also W. H. Holmes & Sons, paint and colour merchants, &c., and the Castle Brand Co. (paints, varnishes, colour, &c.).—Messrs. A., J. H., Elwood and Leonard W. Holmes have dissolved partnership, Mr. L. W. Holmes retiring. The remaining partners will attend to debts.

Trade Announcements.—Messrs. Stewart and McDonald, 245, Buchanan Street, Glasgow, inform us that they have commenced business at the above address as electrical engineers, &c., and will be glad to receive catalogues and lists from manufacturers and merchants.

Mr. A. Whittaker, late with Whittaker's Arc Works, Rochdale, is about to open business as electrical engineer and X-ray and medical apparatus maker at 34, Princess Street, Barnsley, Yorkshire, and will be glad to have catalogues relating to all electrical work and tools.

Messrs. J. & H. Grevener, of Eldon Street House, E.C., are introducing special facilities for North of England customers, and are opening a branch at 40, Brazennose Street, Manchester, where special efforts are to be made to push the sale of their "Arco-flame" lamps, cables, watertight fittings, &c. Mr. H. J. Booker of their London office, has been deputed to organise and open up this branch in conjunction with Mr. A. Albrecht, of the Newcastle office. Ample stocks will be held at Manchester and Newcastle. Northern clients are asked to take a note of the address.

The "Omega" Electric Lamp Co., Ltd., have now moved into their new factory premises at Palace Works, Crab Tree Lane, Hammersmith, W., where they are carrying out orders for all voltages of the "Omega" metallic-filament lamps. A circular announcing prices of stock lamps has been received.

For Sale.—Certain electrical plant, a coal-cutter and other plant, &c., at Conyer's Colliery, Dewsbury Moor, Dewsbury, are to be offered for sale by auction by Mr. R. S. Balden. An announcement appears among our advertisements.

"Metalik" Lamps.—Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C., inform us that they are able to supply 25-c.p. high-voltage "Metalik" lamps.

LIGHTING and POWER NOTES.

Belfast.—Street lighting occupied the attention of the Police Committee last week, owing to the proposals of a special sub-committee which had made certain recommendations as to experimental electric lighting, and the discussion which took place illustrated the rivalry which frequently exists between gas and electricity committees. Councillor Doran said that gas was being supplied at cost price, and (he assumed) that electricity would be supplied under cost. He asked how could the Council expect the Gas Committee under such circumstances to go on giving £15,000 a year to the rates, if they allowed competition of this kind? The Police Committee is not satisfied with the gas lighting of certain thoroughfares, but apparently this does not matter, if only gas is the illuminant.

Bodmin.—At a meeting of the T.C. recently, the Council in committee reported having considered the application of Messrs. Meagor regarding a proposed electric lighting scheme for the town, and resolved that they be informed that the Council would be disposed to favourably entertain their proposals, provided they would submit details of a suitable scheme, and furnish an acceptable guarantee that they will be able to carry out a workable contract. The borough surveyor was authorised to confer with Messrs. Meagor, if they so desired.

Bradford.—The last year's operation (to March last) of the electricity undertaking showed a surplus of £2,142, as against £1,135 in the previous 12 months. Against this, however, had to be set £1,491 for adjustment of liabilities on March 31st, 1908, and a sum of £1,200, rebate to the tramways department in consequence of the failure to provide it with transforming sub-stations. The general supply showed a drop of £217 during the year, but this was more than compensated for by an increase of £4,064 in bulk supply.

Brazil.—The American Vice-Consul at Santos reports that there is a plan in the city of Joinville, the principal foreign trade centre of the Brazilian State of Santa Catharina, to build an electric railway to Lake Sagaussu, an ocean harbour 10 miles distant, where vessels can enter successfully. At present Joinville freight is handled by barges *via* the port of San Francisco, but the irregular condition of the river has caused the plans for the new method.

Burslem.—The assessment of the Corporation Electricity Works has been reduced from £1,180 to £1,000.

Canada.—There is under construction at Cobalt an 11,000 h.p. power plant. The works are being carried out by the Mines Power, Ltd., on the Matabitchoun River, 24 miles south-east of Cobalt, at a point where the river has a fall of 300 ft. The generating equipment consists of four units of 1,500 kw. each, normal rating, and four turbines of 2,750 h.p. each at 600 r.p.m., also two Pelton driven exciters. The hydraulic plant is being supplied by Jens Orten-Boving, of London. The transmission is to static sub-stations at Cobalt, Kerr Lake, and South Loraine, at 44,000 volts, and will be carried over two three-phase circuits on separate pole lines, over a right of way 135 ft. wide. The transmission cable will be of No. 00 aluminium supplied by the Northern Aluminium Co., of America. These works are to supply power to the mines of Cobalt, and are expected to be completed in the autumn.

A staff of Toronto engineers has been making extensive surveys for Simcoe Railway and Power Co. at Big Chute on the Severn River, 30 miles from Midland. It is expected that 4,000 h.p. can be developed and distributed.

The Nipisseng Power Co. is constructing a power plant on the South River, 19 miles from the town of North Bay, to supply that rapidly growing town with electric power. A 90 ft. head will be developed, giving about 1,000 h.p. The transmission will be at 22,000 volts.

The famous Heally Falls on the Trent Valley Canal will be developed by the Dominion Government by the construction of a dam on the canal; the water will be taken through the upper canal cutting and at the first lock discharged into pipes to the power house below. A head of 76 ft. will be developed and power supplied to several towns on the lake front.

According to the *Canadian Electrical News*, a consolidation of all the electrical development companies in and about the city of Quebec, is likely in the near future. The concern will be capitalised at $8,000,000.

Consett.—The Durham County Electric Power Co. has applied to the B. of T. for consent to erect an overhead low tension transmission line between the Co-operative Stores and the Theatre and Guardian Offices.

Continental Notes.—Norway.—In the report for 1908, which has just been published, of the Christiania Municipal Electrical Works, there are many interesting details showing what progress has been made in Christiania, which has a population of about 230,000. The balance-sheet shows a total income of 1,323,360 kr. (£74,000) as against 1,164,861 kr. (£64,600) for 1907. The expenses including 288,585 kr. (£16,000) for interest, new plant, and extensions, are 692,612 kr. (£38,500), which deducted from the income leaves a profit of 630,740 kr. (£35,000) or 216,898 kr. (£12,000) more than was estimated. The net profits amount to about 9 per cent. on the capital expended. In October the works increased their capacity by contracting for 2,000 kw. from a pulp manufactory in the neighbourhood; 36 large factories are being supplied from the works, apart from lighting and tramways. The maximum load on the direct-current system was 2,944 kw., and on the alternating system 1,950 kw., and 1,020 kw. on the tramways. Extensions of cables during the year amounted to 926 km. ($5\frac{3}{4}$ miles) for the D.C. system, and 39·57 km. (25 miles) for the alternating system. At the end of the year the total length of cables was 521·22 km. (316 miles). The number of sub-stations was 37, and in addition there were 16 kiosks. On December 31st last, 11,130 kw. was connected. The total capital spent on the whole plant at December 31st last was 7,034,071 kr. (£388,889).

A factory has recently been started at Salterod, near Arendöl, for the purpose of producing silicious iron by means of electricity. The raw material to be used is scrap iron. The name of the company is the General Electrometallurgical Co., with the head offices at Christiania.

Russia.—The municipal authorities of Koslov are considering a project for the establishment of a central electric lighting station in the town.

Sweden.—Last week-end the workmen at the Stockholm electricity works went out on strike, and as a result the city was without the electric light. The tramway service was also suspended.

Dublin.—The Corporation has agreed to a proposed loan of £18,650 for electrical purposes from the Royal Liver Friendly Society at the rate of £3 15s. per cent. per annum, repayment to be effected in 20 years.

Glasgow.—An arrangement has been come to between the T.C. and the Clyde Valley Electrical Power Co. for the laying of cables between Rutherglen and Cathcart. At a recent meeting of the T.C. Committee it was decided to give the company power, as requested, on condition that (1) the company undertook not to supply any energy off its mains within the city boundary, and (2) did not use the permission granted as an argument for getting authority to lay additional cables or to supply electrical energy within the city boundaries. Besides agreeing to the above conditions, the company has decided to remove its cables from the streets within the municipal area when required by the Corporation, and to pay a nominal rent of 10s. per annum to the T.C.

Govan.—From the report of the Electricity Department of the T.C., it appears that 2,877,979 units were generated and 2,356,367 units were sold up to the end of the financial year ending May 15th, as compared with 2,653,794 and 2,161,494 respectively last year. The total revenue was £16,072, and the total charges £15,544, leaving a net profit of £528. On the total charges an increase of £464 was shown, while the net profit decrease was £100, of which £78 was due to bad debts. The accounts were considered satisfactory in view of the prevalence of dull trade.

Halifax.—The T.C. has reduced the price of energy for the tramways to $1\frac{1}{16}$d. per unit as from April 1st, 1908.

Hastings.—In order to comply with regulations of the Home Department, the T.C. has sanctioned the expenditure of £1,230 for new transformers at certain sub-stations.

Hull.—At the meeting of the Electric Light Committee some complaint was made that the Committee had been allowing a special discount to firms using electricity for motor purposes, and that firms were being supplied at less than cost price. Mr. Costello pointed out that an injustice was being done the users of electricity for lighting purposes. The chairman (Mr. Hanger) explained that the accounts for electricity for motor purposes were sent out monthly, and discount was allowed when the accounts were paid within 14 days.

Japan.—A hydro-electric scheme is being carried out by a Japanese syndicate, by which the water from Lake Biwa will be deflected through a series of tunnels and canals to a power house seven miles distant at Uji, some little way down the Uji River which forms the outfall of the lake. The Uji River Electric Co., Ltd., which is carrying out this scheme, has a franchise to take 2,000 cb. ft. of water per second, and with the head of 205 ft. which can be obtained, can develop some 40,000 H.P., and with further hydraulic works 60,000 H.P., which would be the largest power development in Japan. From Uji the company proposes to supply power to Kyoto, eight miles away, and to Osaka, 22 miles away, by means of aerial transmissions; it is also proposed to establish an auxiliary factory for the supply of electrical plant. The capital of the company is 12,500,000 yen; it is expected that the works will take some three or four years to complete.

Leigh.—A correspondent states that the Chairman and Vice-Chairman of the Electricity Committee are to confer with the Chairman and Deputy-Chairman of the Gas Committee and with two members of the Council, with respect to the working of the two departments.

Luton.—A L.G.B. inquiry was held on August 5th, relative to the application of the T.C. for a loan of £11,707 for electricity purposes. There was no opposition, but the inspector (Mr. H. R. Hooper) left open a question of £4,500 on the surplus account for future extensions, in order that he could see the finances and start clear on April 30th, 1909. Consequently the inquiry respecting this sum was adjourned *sine die.*

Middlesbrough.—Last week-end the experimental lighting of Corporation and Newport Roads by 20 Crompton arc lamps was commenced. The arcs will be in use until midnight, two incandescent lamps being substituted after that hour.

Newport (Mon.).—The T.C. has arranged to give a supply of power to Messrs. Guest, Keen & Nettlefold and to Messrs. King & Co. when the cables are laid; lighting mains will also be put in.

New South Wales.—The North Sydney Council has had under consideration an application from the Kirribilli Electric Lighting Co. for permission to erect pole lines with a view to supplying electricity in the locality. It was decided to defer the matter for a month, owing to opinions expressed in favour of municipal working.

Oulton Broad.—The U.D.C. has decided to invite tenders for working the electric lighting order.

Rosyth.—It has been decided by the contractors for the new naval dockyard works at Rosyth, on the Forth, to lay down plant to supply their own electrical power and light. For a time the idea was entertained of obtaining power from the Fife Electric Power Co. A large installation of electrical machinery is being arranged for. In addition to requiring power for the many electric cranes to be employed on the contract, there will be a great development of lighting, as much night work is on the contractor's programme.

Southampton.—At a recent meeting of the T.C., Mr. Street, the electrical engineer, submitted a long report in regard to free wiring. He said that the Southern Free Wiring Co., which had carried on work in the town, had, for reasons that had nothing to do with the Corporation, practically given up canvassing for new work, although, of course, the Corporation was still collecting the money due to it on account of existing contracts from sundry consumers. The method adopted was to charge 1d. per unit extra to all of the Free Wiring Co.'s consumers, which money was paid over to the company. He considered it much the best to leave the wiring work to the contractors, who had better facilities for doing it than the Corporation, as the class of men employed was quite different to that employed by the municipality. The whole of the necessary expenditure could be defrayed out of revenue or the reserve fund. Assuming that they invested £2,000 of their fund in free wiring, they could install about 2,600 lamps at a cost of 15s. per lamp, which was above the average cost of installation in Southampton. The revenue on this from sales of electricity at ordinary rates would be no less than £600, to which would be added the extra cost for free wiring, which, say, at 1d. per unit, would amount to not less than £200. With assisted wiring, the revenue would be greater. They had the support of all the principal wiring contractors of the town, who saw in the proposal a considerable increase of business coming to them. They would not hurt the builders who desired to wire houses as they were built, but would be of assistance to them. A large number of ratepayers also wanted the scheme. The Committee recommended the Council to obtain Parliamentary powers for the purpose suggested by the electrical engineer. An amendment referring the matter to the Parliamentary Committee was carried after discussion.

Stretford.—Eighteen street lamps are to be converted to electric incandescent lamps on the present columns at a charge of £1 per lamp. The charge for electric current to these and all similar existing lights is to be reduced from 45s. to 42s. 6d. per lamp per annum. At the expiration of 12 months the matter is to be reconsidered with a view to a further reduction, if possible, to 40s. per lamp. 1d. per unit is to be charged the Tramways Department for energy for three years, subject to adjustment according to the price of coal.

St. Helens.—The Corporation Electricity Committee has decided to supply electricity to Messrs. Bickford, Smith & Co., Ltd., subject to a three-years' guarantee and an annual consumption of £100, the company to provide a brick chamber for use as a sub-station. A similar supply is to be given to the Magnum Steel Co., Ltd., subject to an annual consumption of £300.

Wimbledon.—An electrical exhibition is to be held in the Baths Hall during 10 days in November next. Messrs. Babcock & Wilcox's chain-grate mechanical stokers are to be installed on two boilers at the generating station, at an estimated cost of £600.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Something of an unique description is to be ventured upon by the Corporation in connection with tramway fares. For the first time in Scotland the T.C. at their recent meeting decided to introduce a system of universal penny fares from the centre of the city to the various termini of the different routes, while the halfpenny fares are, with one exception, to be abolished—the exception being in Union Street—the principal thoroughfare in the city. This decision was arrived at after consideration of the annual report of the Tramways Committee. Mr. John Contts, who submitted accounts, pointed out that the revenue from passenger traffic was £70,325, against £70,754 in the preceding year, a decrease of £429. The total working expenses amounted to £40,794, against £38,666 last year—an increase of £1,525. The cost of electricity for power increased from £8,971 last year to £9,564, explained by the fact that, while the rebate on the amount paid to the electricity department last year amounted to £741, the rebate this year was only £90—a reduction of £651. The balance of revenue after deducting working expenses amounted to £31,485 as compared with £33,261 last year, a decrease of £1,776. The total capital expenditure of the undertaking now stood at £318,593, and the mortgage loan debt amounted to £260,853 at May 31st last. Although they had been able to put by a very substantial sum to reserve account, that account was not yet so high as it ought to be, because very heavy calls would be made on it almost immediately. He therefore thought the Corporation should pursue a policy of caution and not make any alteration on the present fares which would jeopardise their present position.

Canada.—Canadian engineers are considering the electrification of the Grand Trunk Pacific Railway from the St. Lawrence River to Monckton—460 miles—the electricity to be developed by harnessing the Grand Falls on the St. John River.

Chesterfield.—The annual report on the tramways undertaking for the year 1908-9, shows a net balance on the working of £600, as compared with £978 in the previous year; the surplus was added to the reserve fund, which now amounts to £3,627. Some 2,481,321 passengers were carried, and 293,380 car-miles run during the year, the results of which, considering the limitations of the system, undoubtedly reflect credit on the manager, Mr. Acland.

Continental Notes. — Germany. — The municipal authorities of Spandau (Brandenburg) have just acquired the electric tramways in the town from the Allgemeine Electricitäts Ges., of Berlin, for the sum of £175,000.

Eccles.—The Corporation has joined the Salford Corporation in an action against the South Lancashire Tramways Co.

Ecuador.—According to the terms of a draft contract recently published, Mr. Julio H. Cardon is empowered to arrange for the construction of a 3-ft. 6-in. gauge electric railway from Babahoyo, capital of the province of Los Rios, to Balzapamba, in the province of Bolivar, with further powers to extend the line to Gnaranda, capital of the province of Bolivar. The cost of construction is estimated at 1,380,000 American gold dollars (about £287,000), which amount will be guaranteed by the Government of Ecuador. The concessionaire will have the right to work the railway on certain terms for a period of 50 years.—*Board of Trade Journal.*

Elland.—The U.D.C. has decided to call upon the West Yorkshire Tramway Co. to carry out its undertaking to extend the tramways between Elland and West Vale, which, under the Act, should have been opened in July.

Fife.—After a delay of some years, the work in connection with the laying of the line of tramways to connect Lochgelly and Cowdenbeath with Dunfermline has been begun. The contract for the supply of the current has been secured by the Fife Electric Power Co., which is constructing an aerial transmission from its station at Townhill, Dunfermline, to Cowdenbeath. The company has also an order for additional dynamos of the latest type for the purpose of coping with the load which the tramways will impose. A shed is being constructed at Cowdenbeath to accommodate 30 cars.

Glasgow.—The plan adopted by the Tramway Department of placing boxes at the ends of the cars as a depository for used tickets, in order to keep the cars and streets tidy, has met with such success that their accommodation is quite insufficient, and it is now proposed to place an extra box at each end of the car. Many tons of tickets are collected every month, and these are disposed of at a profit by the cleaning department. Mr. Dalrymple, the manager, is receiving inquiries from other large centres as to the system; London, Birmingham, Manchester and other cities being anxious to solve the problem of keeping the cars tidy.

Hull.—Reports have been prepared for the Corporation in connection with the proposal to extend the Corporation electric car service to Hessle, a further stretch of five miles.

Isle of Man.—A Ramsey man, named Knight, was killed on the Manx Electric Railway on Tuesday. He was employed as conductor on the electric cars, and whilst crossing from the trailer to the closed car as the train was in motion, he fell between them. The wheels went over his body and inflicted fatal injuries to the head and lower limbs. He died in 15 minutes without gaining consciousness.

Japan.—Mail intelligence from the United States says that the Department of Communication in Japan, under which the railroads are operated, is considering a plan for electrifying the railways of the island empire. The Japanese Government recently appointed a special commissioner to investigate electrical railways in England, Europe and the United States, and he is now about to make his report. In an interview the Commissioner said that it would only be a short time before all the branch lines were operated by electricity, for the sake of economy.

Leith.—An inspection of the new portion of the Council's tramways between Bonnington Terrace and Goldenacre took place on the 3rd inst., the members of the Council and officials subsequently proceeding over the whole of the extension to Granton and Newhaven. According to some remarks made by Bailie Hall, the portion of the new route open has yielded receipts of 10·07d. per mile, as compared with 7d. per mile on the original system, and great things are expected of it.

L. and Y. Electrical Lines.—Presiding at the general meeting of the Lancashire and Yorkshire Railway Co. on Wednesday, last week, the Chairman, Sir Geo. Armytage, said that though the total number of passengers carried showed a decrease, he was glad to say that residential traffic was still on the increase, and especially on the electrified lines between Liverpool and Southport. They had decided to extend the electrification from Aintree to Maghull, and that work was now in progress.

Musselburgh.—The eastward extension of the Musselburgh Electric Light and Traction Co.'s line, from Levenhall to Cockenzie, was inspected by the B. of T. last week and opened for traffic. The line will ultimately end at Port Seaton; at present it gives a continuous route, 11 miles long, with one change, from Edinburgh. After the official inspection by Col. von Donop, the directors of the company entertained the representatives of the local authorities on the route to luncheon at the Prestonpans Town Hall.

Newcastle-on-Tyne.—At a meeting of the T.C. on the 4th inst., the annual financial statement of the Corporation tramways undertaking was submitted and adopted without discussion or comment. This, says our Newcastle correspondent, is somewhat surprising, as a warm debate was anticipated on the old question of depreciation. The statement of accounts could not be regarded as strikingly satisfactory, for the absolute net gain on the year on an undertaking which has a capital expenditure of about one and a quarter millions, was £377. It is a fact that the reserve and renewals fund account shows an appropriation for that purpose of £7,557 from the profits of the year, but the same account shows also an expenditure for the year ended March 31st, 1909, of £7,181. The items of expenditure on the renewals account were: Batteries, £2,844; switchboard, £512; pumping plant, £2,989; permanent way, £834. The reserve fund balance is now £62,699 as against £62,323 for the preceding year. For the year the gross revenue had dropped from £211,318 or 11·50d. per car-mile for 1908, to £204,123 or 11·42d. per car-mile, for 1909. The total working expenditure had increased from £116,852 = 6·36d. per car-mile, to £122,609 or 6·86d. per car-mile. The balance carried to net revenue account was £81,513 or 4·56d. per car-mile, against £94,466 or 5·14d. per car-mile for the preceding 12 months. The net profits decreased from £19,477 or 1·06d. per car-mile, to £7,557 or ·423d. per car-mile, and this latter sum has been in effect reduced to the £377 mentioned, because the system has not been maintained (as it is claimed has hitherto been, and would be, the case) out of revenue, but replacements paid for out of the reserve fund.

Plymouth.—The tramways manager has submitted the following return to the Tramways Committee of the T.C. for the year ending March 31st, 1909. The gross income was £34,150, against £32,931 for the year ending March 31st, 1908. The expenditure was £26,084, leaving a gross profit of £8,065, against £8,424 last year. On the net revenue account there was an income of £9,323, of which £4,785 went to dividends and interest, and £4,429 to stock and mortgages redemption, leaving a net profit of £108, against £815 in 1908.

Radcliffe.—The Electricity and Tramways Committee of the local D.C. is about to adopt a scheme for the carriage of goods from the railway station to the local mills and works through the medium of the tramway service.

Sheffield.—The municipal tramways undertaking made a net profit of £36,635 during the year 1908-9, of which sum, £15,000 was devoted to the rates.

Southend-on-Sea.—The T.C. has been granted a revival of powers for extending the tramways to Shoeburyness.

Walsall.—The local Tramway Committee has reported adversely against the project for linking together the various mining villages of Brown Hills, Chase Town, Chase Terrace, Five Ways, Cannock, Wyeley and Newtown. The scheme, if carried out in its entirety, would cost £168,000, or about £12,000 per mile.

Wigan.—Mr. James Slevin, the engineer and manager of the tramways undertaking, has been experimenting with a sprinkler, locally made, for disinfecting the inside of tramcars. The results have been very satisfactory. The disinfectant used dries immediately, and all germs are destroyed. Mr. Slevin is to report later upon the cost.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Government of the Commonwealth state that their cables to Tasmania are laid from Flinders, Victoria, to Low Head, Tasmania, and the lengths are respectively 346,783 and 344·229 km. These are the two cables replacing those of the Eastern Extension, Australasia and China Telegraph Co., which are to be picked up.

Australian Telephone Service.—The telephone question has reached an acute phase in Australia, where protest meetings such as were common in this country last year have been held, and the Government has decided to defer the introduction of the new tariff for a time, pending an actuarial inquiry by a committee of accountants as to the actual cost of the service. An inquiry has been instituted into the conditions of work at the exchanges, in which many complaints have been put forward on the part of the employés on the score of overwork, too little pay, petty tyranny, and so on. Defective equipment and organisation formed the substance of many complaints, and if all the evidence given by the staff were accepted without qualification, the conclusion that the telephone system was in a chaotic state would be inevitable.

Jamaica.—For the financial year 1907-8 the revenue from telegraphs was £6,489 8s. 8d., against an estimate of £6,000; £832 was spent on the maintenance of telegraph lines. The cost of official telegrams was £414 4s.

London—Berlin.—It is stated that preliminary negotiations are proceeding between the interested Governments with a view to the establishment of a direct telephonic connection between London and Berlin. An inquiry on the subject, made by the representative of a Berlin newspaper at the Imperial Post Office in that city, elicited the statement that apart from the large expenditure which such a scheme would involve, the question at issue was very difficult, as technical progress had not yet so far advanced as to permit of the construction and laying of submarine cables for telephone working of such lengths as would be necessary in this particular case. Another question was whether it would be possible to secure the object in view in a roundabout way by inducing a third country to become interested in the scheme, so that permission might be obtained to erect an overland line to the English Channel and thence to London.

New Regulations.—The General Post Office has issued notices to merchants, stating that since the 1st ult. the new regulations passed by the Lisbon Telegraph Conference are in force. According to these, artificial words or groups of letters or trade marks must not contain the accented letters ä, á, å, é, ñ, ö, ü, and in code words or trade marks ae, aa, ao, oe, ue will be counted as two letters each. In artificial code words or trade marks "ch" will count as two letters.

Codes can be submitted to the British, German and French Administrations for approval, and owners may obtain a certificate of approval after this has been done. Cipher composed of letters and figures is not admitted, nor are combinations or alterations of proper words.

Telegraphic Interruptions:—

Tangier-Cadiz	May 19, 1909
Assab-Perim	July 8, 1909
Trinidad-Demerara	August 6, 1909
Dakar-Conakry...	August 6, 1909
Gibraltar-Tangier	August 6, 1909
Cueta-Tangier	August 7, 1909
Melilla-Chafarinas	August 7, 1909

Windsor Castle.—A complete new installation of fire-alarms has recently been installed at the Castle. There are 35 alarm boxes, and when any one of these is operated, a distinctive number is sounded on a gong in the residence of each member of the fire brigade.

Wireless Telegraphy.—The Inter-Ministerial Commission on Wireless Telegraphy has drawn up a Bill prohibiting the employment of any radio-telegraphic apparatus on French territory, or on board of any French vessel, without State authorisation. Heavy fines are to be imposed in the case of persons who have caught and divulged radio-telegraphic or radio-telephonic messages.

The *Times* reports that the Russian Military Department has made some very successful trials with wireless telegraphy between St. Petersburg and Sebastopol, a distance of about 1,900 miles.

The Halifax (N.S.) *Herald* states that Sable Island is no longer feared by ships, owing to wireless telegraphy, by means of which they are warned of their proximity to its dangerous coast. During the past year Sable Island had to its credit the largest number of wireless messages handled during the year, viz., 8,118 private and 5,000 official communications. Not a single wreck occurred near the island after wireless was installed. The Canadian Government's marine signal service is being very much extended. There are over 20 wireless stations in Canada, of which five are situated on the Pacific Coast. The latter will shortly be increased by two or three, the superintendent of the Government wireless stations having recently left for British Columbia with a view of installing new stations. During 1908 there were received and sent from the wireless stations 13,549 private messages from and to steamers, 13,526 signal service messages, and 38,532 messages between Government steamers and light stations.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

New South Wales.—Telephone material for the P.M.G. See "Official Notices" July 23rd.

Ballinasloe. — September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Belgium.—September 1st. Tenders are being invited by the municipal authorities of Ixelles, a suburb of Brussels, for the concession for the electric lighting of the district.

Cleckheaton.—The U.D.C. wants tenders for the purchase of two battery regulating switches. See "Official Notices" July 30th.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

September 4th. Electric light installation at the new slaughter-houses, Gorgie, for the Corporation. Specification (one guinea deposit) from Mr. F. A. Newington, electricity supply works, Dewar Place.

France.—Paris.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" to-day.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" to-day.

London.—Battersea.—August 21st. The Council wants tenders for motors and controllers, D.C. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" August 6th.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G. G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

Plymouth.—September 2nd. Steam turbo-dynamo for the Corporation. See "Official Notices" to-day.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-KW. Diesel set and a 50-KW. steam dynamo. See "Official Notices" August 6th.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Todmorden.—August 14th. The Corporation wants tenders for a 150-KW. steam dynamo, switchboard, condensers and piping, and pump. See "Official Notices" August 6th.

Turkey.—The Ministry of Marine, in Constantinople, invites tenders for the supply of electrical apparatus for the Imperial fleet. Inquiries should be addressed to the Conseil de la Marine, Constantinople.—*B. of T. Journal.*

Wishaw.—August 30th. Three-wire D.C. switchboard for the Craigneuk sub-station for the Electricity Department. See "Official Notices" to-day.

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Barnstaple.—The B.G. received the following tenders for wiring the workhouse for the electric light:—

Mr. Malone, Barnstaple	(accepted)	£122
Mr. Rippin, Exeter		120
Baker & Co., Newport		130
Bristol Electricity Co.		135
Harris & Co., Exeter		141
Messrs. Edmonds, London		186
Messrs. Pullen, Bradford		191

Belfast.—The Electrical Committee has accepted the tender of Messrs. Cowans, Ltd., for feeder panels for the lighting switchboard.

Bury (Lancs.).—The T.C. has accepted the tender of Messrs. Clarke, Chapman & Co., of Gateshead, for three water-tube boilers, with superheaters and mechanical stokers, for the new power station.

Canada.—Messrs. Jens Orten-Böving & Co. have just received the order for two water turbines (output 3,750 H.P. each) for the Calgary Electric Power Co., Calgary, Canada. The same firm have also received the order for four "Böving Patent" governors for four Francis turbines of 2,750 H.P. each for the Mines Power, Ltd. The consulting engineers in both cases were Messrs. Smith, Kerry & Chace, of Toronto, Winnipeg.

China.—It is reported that the contract for the establishment of a telephone service in Pekin has been awarded to the Western Electric Co., the amount of whose tender was $150,000.

SHANGHAI.—The Chloride Electrical Storage Co., Ltd., has secured an order for a 550-volt battery and an Entz booster, capable of handling 2,000-amp. peaks.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for distributor cables, troughing, service cable and bitumen.

Clyde Navigation.—Tenders for 46 electric capstans for Yorkhill and Rothesay Docks, Glasgow, have been received by the Clyde Navigation Trust.

Darlington.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., for a switchboard for the new turbo-generator; and that of the Whessoe Foundry Co. for pipe work.

Denmark.—The contract for the supply of copper wire for the new municipal electrical works of Bergen has been given to the Westphaelische-Kupfer & Messingwerke, in Germany. The contract in question amounts to 240,000 metres of wire, at a total cost of 90,000 kr. (£5,000).

Dundee.—The "D.P." Battery Co., Ltd., of Bakewell, have received an order for a storage battery of 50 cells for Dundee University College from Messrs. Steinthal & Boydell, Ltd., of Manchester and Bradford, who are supplying the whole of the electrical equipment of the college.

Dunfermline.—Messrs. John Munro & Co., Edinburgh, have secured the contract for the electric lighting of Dunfermline Technical School extension, at £258.

France.—La Société de la Canalisation Electrique, of Saint Maurice (Seine), has just secured a contract from the French Posts and Telegraphs authorities for the supply of 200 kilometres of telephone cable.

Glasgow.—The Tramways Committee has recommended for acceptance the tender of the British Thomson-Houston Co., Ltd., for controller arc shields.

Halifax.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for cables, at £2,104.

Hastings.—The Corporation has accepted the tender of Messrs. W. Cory & Son, Ltd., for the supply of 1,500 tons of the best Welsh smokeless coal for the electric light works, at 23s. 9d. per ton. The coal specified is Nixon's Navigation large coal. For the supply of 1,350 tons of coke, the tender of the Hastings Gas Co. has been accepted, at 17s. 6d. per ton.

London.—SHOREDITCH.—The B.C. has accepted Mr. William Boby's tender for a water-softening plant for use at the electricity works.

Maidenhead.—The T.C. has accepted the tender of the Diesel Engine Co., Ltd., for a 150-KW. Diesel engine and generator, at £2,504 16s. Messrs. Mirlees, Bickerton & Day tendered at £3,038.

Maidstone.—Regarding the note under this heading in our last issue, the Union Electric Co., Ltd., inform us that they did not tender for any feeder or other cables for Maidstone.

Salford.—The T.C. has accepted the following tenders for the annual supply of coal for the electricity works:—

Clifton and Kersley Coal Co., Ltd.—20,000 tons washed slack, in boxes, in boats, 8s. 11d. per ton.
A. Knowles & Sons, Ltd.—12,000 tons washed slack, in boxes, in boats, 9s. per ton.

Stretford.—The U.D.C. has accepted the following tenders:—

W. T. Glover & Co., Ltd.—741½ yards of 0·2 cable, 8s. 8⅜d. per yard.
Beecroft & Wightman.—600 yards troughing, 8½d. per yard.
Callender's Cable and Construction Co., Ltd.—500 yards of ·05 cable, £28.

Tunbridge Wells.—The T.C. has accepted the tender of Henley's Telegraph Works Co., Ltd., for cables.

Wallasey.—The U.D.C. has accepted the tender of the Premier Accumulator Co., Ltd., for a battery of 264 cells, booster plant, and maintenance for 10 years.

Wolverhampton.—The Corporation has accepted the following tenders for the electricity department:—

Mobberley & Bailey, Stourbridge, £123, fire bricks for lining the steel chimney.
C. W. Hartley, Sheffield, £110, labour, tools, and tackle in connection therewith.
Electric Construction Co., Ltd., one 100-KW. reducer set, at £203 10s. and two low-tension switchboard panels, at £86.

NOTES.

Municipal Electrical Contracting: Proposed Test Case.—From the current issue of the *Electrical Contractor* we gather that the Secretary of the Electrical Contractors' Association has issued a letter to members asking for guarantee of support in the event of failure of the test case it has been decided to fight to test the legality of municipal electrical contracting upon isolated installations without special Parliamentary authority. In announcing this fact our contemporary says:—"Particulars of innumerable cases have been received, some of the most flagrant character, and Counsel has advised the Law and Parliamentary Committee that corporations have no such powers, and that an action would be likely to be successful. A test case decided in favour of the contractor would act as precedent in other instances, and a growing abuse, which is making vast inroads into the contractors' turnover, would be thus removed. Nevertheless, the possibility of failure must not be overlooked, and as any corporation we fight will have ample funds from the ratepayers' purse at disposal, it is only reasonable to assume that in the event of an adverse judgment the costs will be heavy. The member whom we nominate to fight the test case would of course be personally responsible for the costs of the other side if the case went against him, and it is this event, and this only, that members are asked to guarantee provision for. Mr. Tate has already circulated suitable forms to be filled in, but in case there is any member who has not received one we enclose a copy with this number of the *Electrical Contractor*. You are asked to guarantee any sum from £1 upwards. The amount of £3 has been suggested, because if each member guarantees this amount it is considered that sufficient provision will have been made."

Copper.—A writer in the *Financial Times* for July 30th, in the course of an interesting article on the copper outlook, attributes the continued maintenance of prices to the influence of the large copper interests. He takes the average prices of copper, noting that in 1908 the average price was £60 0s. 6d. per ton, compared with £86 1s. 8d. in the previous year and £86 5s. 2d. in 1906; while in 1905 it was £69 2s. 6d., and, for the three years previous, in the "fifties." Working to the average for the last 40 years, excluding sensational movements due to artificial causes, he arrives at the conclusion that the normal value is between £60 and £70 per ton. Passing to production, the author considers the huge stocks, both here and in America, to be the direct results of over-production. This, of course, is a natural outcome of extra high prices. The immediate course of values, says the author, depends—outside of manipulation pure and simple—upon the consumption. From statistics of the United States Copper Producers' Association, he finds that deliveries for consumption and import are steadily increasing. According to the Association's statistics, also, the stocks are unmistakably on the down grade. These, however, when analysed, do not appear to take into account that stocks in Europe are steadily accumulating. Considering, then, that copper can be produced at £37 to £38 per ton, the author inclines to the view that the manufacturer is content to work at his full output, taking his profit on quantity. In conclusion, the author does not anticipate a rapid improvement in the engineering and shipbuilding trades, and points out that every £1 added to the price of copper stimulates the output, and ultimately reopens mines at present shut down on account of too expensive winning.

Electrical Trades Union.—A meeting of the electrical workers of Liverpool and district was held on Friday evening in the Common Hall, Hackins Hey, when an address was delivered by Mr. Robert Ferguson (organiser of the Electrical Trades Union), in which he described the present position of the union, and urged non-members to join it. A resolution was passed strongly condemning the so-called workmen's registration scheme of the Electrical Contractors' Association, and urging all electrical workers of Liverpool and district to become members of their own Trades Union, in order that it may be strengthened sufficiently to protect their interests and better the conditions of labour in the future.

Inquiries.—A correspondent wishes to hear from British firms who specialise in electric head-lights and in electric carriage lighting for use on steam-driven trams.

Cable Dispute.—According to the daily Press, the Commercial Cable Co. alleges that the Newfoundland Government has committed a breach of faith, by repudiating a contract made a few months ago, on the strength of which the American company invested £200,000 in the landing of a new cable at St. John's. The company has addressed a strongly worded letter of remonstrance to the Premier of Newfoundland.

Terrestrial Magnetism.—The magnetic survey yacht *Carnegie*, which has been built almost wholly without the use of iron, and has a displacement of 568 tons, will be engaged in making a magnetic survey of the oceans during the next 15 years, with the object of correcting the magnetic charts at present available. According to *Nature*, her first voyage will be to Hudson Bay and the North Atlantic Ocean.

Electric Pumping for Irrigation.—The water for the great system of canals and ditches of the Mercedes, Tex., irrigation system is pumped from the Rio Grande by means of electrical energy which is supplied from a central power plant situated in the town of Mercedes, seven miles from the pumping station. The Mercedes enterprise will be one of the largest electrical pumping irrigation propositions in the world when the plans are fully rounded out. Water will be supplied for more than 200,000 acres of land, situated in the valley of the lower Rio Grande. The central power plant at present generates at 6,600 volts, the three-phase currents being transmitted to the pumping station, situated upon the bank of the river, seven miles distant, and operating an induction motor-driven pump, which has a capacity of 60,000 gallons per minute. The equipment of the central power plant consists of two generators of 300 KW. each, and a 15-KW. lighting set for the town of Mercedes, when the main set is shut down. The main canal of this system is already completed for many miles across the valley land, and carries a stream of water 145 ft. wide and 10 ft. deep. The canal is capable of being navigated by barges and boats. There are a number of other small electric pumping plants along the upper course of the Rio Grande River, particularly in the vicinity of Laredo, where a number of farmers receive electrical energy for operating their respective pumping stations from the electric power plant in the town.—*Electrical World.*

Producer Gas.—The principal constituent of producer gas being carbonic oxide, which is a very actively poisonous gas, it is necessary that its use be accompanied with special precautions. Death has been caused of men in a cabin by gas that had found its way there through the earth; thus it is desirable that a gas producer plant should stand upon a sound and practically air-tight floor, and it is preferable that the plant should be covered by a roof only, and that it should not be shut in by side walls, though there may be roller shutters as a wind guard on the more exposed side of the house.

The producers may very well be placed under a lean-to roof outside the engine house. If a gas producer is to be housed inside a building, and especially if it is placed in a cellar, there ought to be an open chimney to serve as a ventilator, and a very direct air inlet from outside. The warmth of the producer will suffice to keep the chimney at work. Unless out of doors, the escape pipe for use when blowing up the producer on starting the fire, for example, should open to a chimney. Very small percentages of carbon monoxide in the air will produce frontal headache and sickness; long-continued breathing of extremely small amounts produces anæmia, for the gas absorbs oxygen from the hæmoglobin of the blood, changing or destroying the red corpuscles. Complete insensibility is produced by inhaling the gas in bulk. A single inhalation is sufficient, but recovery would be rapid.

The curious fact about hæmoglobin is that its combination with CO is more stable than is its combination with oxygen. Thus CO will oust the oxygen, and the hæmoglobin is then incapable of carrying oxygen to the tissues. Haldane says that when the percentage of CO in air is 0·08, the hæmoglobin will ultimately become half saturated with the gas. With 0·04 per cent., saturation will be one-third only, while with 0·16 per cent. the saturation will be two-thirds. So long as saturation is not complete, recovery is possible, and the removal of the victim into pure air before death enables the CO to be gradually eradicated, especially with the aid of oxygen and artificial respiration.

The presence of CO is not apparent to the senses. A man may go a long way in a mine where it is present, and be unable to get back again. Fortunately, carbon monoxide is of less specific gravity than air, and does not introduce the further danger of accumulating in sunken places, as carbon dioxide does. Small animals such as mice, and also small birds, are particularly susceptible to carbonic oxide poisoning. If they thrive in a room containing a producer, this will be good evidence that there is no serious leakage in progress.

In our climate there is no reason for a producer plant to be housed in from the cold, though when a plant is at rest any water vessels should be drained, and water supplies should be arranged to be shut off by taps in a protected situation. These remarks apply particularly to gas engine jackets, which should be drained even for short stoppages in frosty weather. In some localities it may be found necessary to provide means for warming up the cooling tanks sufficiently to provide a flow to the jackets. Once the circulation is secured, and the engine is running, the complete thawing out will be completed without further heat than that from the jackets.

Appointments Vacant.—Shift engineer for Lanark County Council (Cambuslang). Practical instructor in electric light wiring and cable jointing for the Northampton Polytechnic Institute.

The Influence of Silicon on the Electric and Magnetic Properties of Iron.—Dr. E. Kolhen has recently carried out an important series of experiments on silicon and its effects on iron, and we take the following particulars of these from *Elektrische Kraftbetriebe und Bahnen* for July 8th. Pure silicon was found to have a specific resistance varying between ·043 and ·08 ohm per cm. or 430 to 800 ohms for 1 metre length of 1 sq. mm. section, the corresponding values for copper being ·017 ohm, for iron ·11 ohm, for arc lamp carbons 70 ohms, and for ordinary carbon 100 to 800 ohms. The temperature coefficient of silicon is extremely low, being between −·0002 and +·00006 for 1° C., whilst for carbon it varies between −·0008 and +·0003. As regards magnetic and thermo-electric effects, silicon also stands somewhat by itself:—

Material.	Hall effect coefficient.	Thermo-electric E.M.F. against lead.
Silicon, 99 %	− 120	—
Silicon, 95 %	— 28	− 400
Copper	−·0005	+ 3·8
Iron	+ ·011	+ 17
Tellurium	+ 532	+ 502

When iron is alloyed with silicon its effect on the specific resistance does not increase indefinitely with the percentage, but reaches a maximum with about 4 per cent. of silicon. The following results were obtained from a series of alloys made by the Bismarckhütte, the samples tested being in the form of ·5 mm. sheets:—

Reference letter ...	A	B	C	D	F
Per cent. of silicon—					
minimum	·026	1·07	2·28	—	3·5
maximum	·3	1·54	3·15	3·25	3·53
Specific resistance (ohm)	·118	·287	·355	·50	·595
Per cent. increase in resistance for 100° C. temperature rise ...	41	19	14	7·5	5
Tensile strength with the minimum per cent. of silicon ...	30·8	35·1	47·3	—	61
Elongation	11	7·5	6	—	3·5
Steinmetz hysteresis coefficient η... ...	·0015	·0014	·001	·0009	·0009
Hysteresis loss per kg. of iron	2·5	2·2	1·65	1·45	1·45
Eddy-current loss per kg.	1·3	·8	·7	·6	·4
Total iron loss per kg.	3·8	3	2·35	2·05	1·85
Flux density produced by a magnetising force H = 140	17,600	17,300	17,000	16,700	16,400
			per sq. cm.		

It will be seen that the tensile strength is increased by moderate additions of silicon, whilst the elongation diminishes. The material was, however, found to be very variable, probably owing to slight differences in manufacture. Experiment has repeatedly shown that chemical additions to iron, such as the silicon in this case, do not greatly affect the hysteresis loss, but have a marked effect on the eddy-current loss. Thus, whilst the hysteresis coefficient a few years ago was normally about ·0025, the highest value now considered permissible is about ·0015. The eddy-current loss, however, is reduced to less than one-third of the older value. The alloys with the higher percentages of silicon are especially suitable for transformers, but are somewhat too brittle for use in the rotating parts of high-speed armatures. Such samples as B or C, however, are quite suitable for the latter purpose. The ageing difficulty is entirely absent with an addition of as much as 3·5% of silicon.

Early Central-Station Practice.—In an interesting address recently delivered at the first annual convention of the Brooklyn Company N.E.L.A. Section, Mr. Caryl D. Haskins recalled some experiences of 21 years ago, when he was on the staff of the London Grosvenor Gallery central station. The station had no heavy-current ammeters, and the deficiency was supplied as follows:—A slot-like trough was cut in a block of wood, and terminals attached at either end of the slot, with a body of mercury connecting the terminals. This crude apparatus was calibrated against a Kelvin balance, using an ordinary glass-bulb thermometer immersed in the mercury, and in routine use the current passing through the "instrument" was determined by a reading of the thermometer. In the same plant knife-blade switches were used to handle the 2,200-volt circuits, and for use in switching there were provided pieces of 2-in. belting about 2 ft. long, each with a wooden handle. The rule was to take the switch firmly in the right hand and the piece of belting firmly in the other, pull out the switch, and then "swat" the arc with the belting. Referring to early power service in this country, Mr. Haskins quoted the following rule established by a central station for testing recording meters on power service:—"Examine the installation. Estimate the work being done by the motor in horse-powers. Multiply by 746. Test the meter by the customary formula. If meter checks within 10 per cent., correct. If not, estimate the horse-power again."—*Electrical World.*

A "Non-Electrical" Fatality.—In the case of a lamp-trimmer employed by the Battersea Borough Council, named Ernest Leonard, aged 36, who was supposed to have been killed by an electric shock, the Coroner's jury on August 10th returned a verdict of "Death from natural causes," the man having died of heart disease.

An Open Letter.—Dear Mr. Zadkiel,—

In the issue of *Electrical Industries* for the 4th inst., you state that the Electrical Review in making a commentary on the chairman's speech at a recent annual general meeting, says: "Much might be written of what the trade thinks of the Press. . . . . ." *Facetiæ*! We assert that we made no such remark in the article to which you refer, therefore the point is narrowed down to one of veracity.

It seems to afford a fellow a heap of satisfaction to pull the trigger for himself and see if the shooting iron is loaded, and a lesson learned at the muzzle has the virtue of never being forgotten

Parliamentary.—Torquay Tramways.—On Friday last week the Bill promoted by the Torquay Tramways Co. passed the Unopposed Bills Committee of the House of Commons. The measure provides for an extension of the company's tramways from Torquay to Paignton.

The Neasden Turbines.—Just as we are going to press with the last pages a letter arrives from Mr. Newcomb Carlton, managing director of the British Westinghouse Electric and Manufacturing Co., Ltd., in which he asks us to correct an alleged inaccuracy in our report of the half-yearly meeting of the Metropolitan Railway Co. (Elec. Rev., August 6th, p. 226). He writes:—

"You say:—Replying to a shareholder, the chairman said . . . . considering the fact that the British Westinghouse Co. were putting down fresh turbines for them *at their own expense*, &c. There is no doubt that Sir Charles M'Laren did not make use of the words in italics, since the statement is the direct contrary of the fact. Will you kindly publish this letter by way of correction."

Unfortunately our representative who attended the meeting is away on holidays, and it is impossible to confer with him in the few moments remaining before the Review must be on the printing machine. In his absence the shorthand notes are also inaccessible.

Junior Institution of Engineers.—The summer meeting of the Junior Institution of Engineers opens to-morrow morning at Leamington, with a welcome by the Mayor; in the afternoon Warwick Castle is to be visited, and in the evening there will be a concert in the Jephson Gardens. Numerous works in the neighbourhood are to be visited, as well as at Birmingham and Coventry, during the week. The Institution's summer dinner takes place on Friday evening at Birmingham, and on the following morning the Summer Lane electricity works of the Birmingham Corporation will be seen, the afternoon being occupied with a visit to the electrical signalling apparatus of the Great Western Railway at Snow Hill Station.

A Japanese Deal at Seoul.—It is reported from Seoul that the American firm of Collbran & Bostwick, who own gold and copper mines in the north of Corea, and a bank in Seoul, have sold to the Japanese Gas Co. the Seoul electric tramways and lighting station, together with accessories, for the sum of £175,000. The purchase price does not include the shares of the former Emperor of Corea, of the value of £75,000. It is said that the time for the sale was very appropriate for the Americans, as the gas company was about to open its works. The tramway is of great importance to the Japanese, as its acquisition places the whole of the traffic in the city and environs in their hands.

Closed for the Holidays.—Messrs. Ferranti, Ltd., Hollinwood, announce that their works will be closed for the annual district holidays as follows:—Switch department, August 28th to September 4th, inclusive; meter department, August 28th to August 31st, inclusive. The offices will be open as usual.

Educational.—University College.—Prof. J. D. Cormack has been elected Dean and Prof. J. A. Fleming vice-Dean of the Faculty of Engineering for the session 1909-10, which will begin on Monday, October 4th. Special and postgraduate courses have been arranged to meet the needs of the following classes of students:—(*a*) Postgraduates and engineers in practice; (*b*) others whose qualifications are, in the opinion of the lecturer, such as to enable them to follow the courses. Each course will include lectures and exercises, and the numbers will be strictly limited. The following are some of the special courses for next session:—"Steam Turbines," by Mr. W. J. Goudie and Mr. E. G. Izod; "Railway Engineering," by Mr. H. Deans, of the Great Western Railway; "Roads, Street Paving and Tramways," by Mr. W. N. Blair, borough engineer of St. Pancras; "Electrical Design," by Mr. H. M. Hobart.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Electricity Committee has recommended the Wolverhampton T.C. to appoint Mr. Ernest Stubbs as technical and general assistant at the electricity works at a salary of £160 per annum, in succession to Mr. H. A. Howie, who has accepted a situation under the Sheffield Corporation; Mr. J. S. Dudley, present station superintendent, as maintenance engineer, at his present salary of £156; Mr. C. Bellhouse, as boiler house superintendent, at £125; Mr. E. Forder, the senior shift engineer, as engine room superintendent, at £120; and Mr. F. C. Platt, as junior assistant, at £78.

At the last meeting of the Bridlington Town Council the salary of the borough electrical engineer, Mr. A. J. Beckett, was increased by £25, with a further increase of £25 in 12 months to £300. The salary of the chief clerk of the electricity department, Mr. T. E. Mott, was increased by £13 to £117 per annum, with two further yearly increases of £6 10s., to £130 per annum.

Mr. Mordy Lambe, borough electrical engineer, East London, Natal, has intimated to the T.C. that he does not wish to continue in the service of the Council after the expiration of his agreement in November next.

At the Bradford Corporation Electricity Works recently, Mr. Chas. W. Salt, chief assistant to Mr. Thomas Roles, city electrical engineer and manager, was presented by the staff and employés with a brass-mounted oak clock and a calabash pipe on the occasion of his marriage with Miss Ida Potts, of Bradford. Mr. Roles, who made the presentation on behalf of the subscribers, spoke of the high esteem in which Mr. Salt was held in the department, and several members of the staff cordially endorsed his remarks. Mr. Salt suitably responded.

Tramway Officials.—At the Tynewydd Hotel, Porth, Glamorgan, a smoking concert was recently held to celebrate the anniversary of the opening of the Rhondda electric tramways; Mr. H. J. Nisbett, the engineer and manager of the undertaking, was presented with a large portrait of the entire staff and employés.

The Keighley T.C. has appointed Mr. Eli Murgatroyd as tramways manager.

The Morecambe T.C. has appointed Mr. E. Walling as traffic manager of the tramways.

Whilst watching the progress of the work of the renewal of the permanent way of the tramways at the junction of Babington Lane and St. Peter's Street, Derby, the manager of the Derby Corporation tramways, Mr. F. Harding, was knocked down and run over by a tandem cycle. Mr. Harding was badly bruised on his right side, and also suffered from shock.

General.—The managers of the new College to be opened in Dundee next month have appointed Mr. Robert D. Archibald, B.Sc., A.M.I.C.E. and E.E., who is at present principal assistant to Dr. Magnus Maclean, Professor of Electrical Engineering in the Glasgow and West of Scotland Technical College, as lecturer on electrical and mechanical engineering. Mr. Archibald has an excellent record as a student in the Glasgow University and Technical College, was trained in mechanical engineering with the Fairfield Shipbuilding Co., of Govan, and as an electrical engineer with Messrs. Mavor & Coulson, of Glasgow, and the Electric Construction Co., of Wolverhampton. With the last-named company he was assistant for the design of electrical plant for several years.

Sanction has been given for the appointment of Lieut. H. C. Hawtrey, Royal Engineers, as Adjutant of the London District Telegraph Companies, Royal Engineers, Territorial Force, and he will take up his duties about October 1st next. Mr. Hawtrey joined the "Scientific Corps" in August, 1900, and he is presently employed with the Royal Engineers at Limerick.

At a meeting of the Council of the Leeds Local Section of the Institution of Electrical Engineers, held at the Hotel Metropole on May 17th, 1909, Mr. W. M. Rogerson, President, in the chair, it was resolved that, in view of the approaching marriage of the Honorary Secretary, Mr. Harold Dickinson, and as some acknowledgment of his valuable services in founding the Leeds Section of the Institution of Electrical Engineers, and as its first chairman, together with the keen interest displayed by him in the interests of the Section as honorary secretary, and as a tribute of the high esteem in which he is held by all the members, a suitable wedding gift should be presented to him. The presentation was made on Thursday, August 5th, when an ornamental silver table centre was presented to him, along with the hearty good wishes of his fellow-members of the Society.

At Glasgow, on Saturday last, the marriage took place of Mr. James Edmund Sayers, M.I.E.E., consulting engineer, to Margaret Wilson, only daughter of the late Mr. T. O. Robertson, C.A., of Glasgow.

With reference to the announcement in our last issue regarding the appointment of Mr. Ben Bailey, we are asked to state that he has taken up the position of "engineer," not "engineer and manager," to Messrs. J. & H. Grevener.

It is announced that Sir H. Babington Smith, Secretary of the General Post Office, will shortly resign that office, he having, at the request of the Government, accepted the post of President of the National Bank of Turkey. Sir Henry is to proceed to Constantinople in September.

Will Mr. H. Thurston Owens, consulting engineer of New York City, kindly forward a note of the address where he is staying in London.

Mr. Henry W. Warde, manager of the Glasgow branch of the General Electric Co., Ltd., sails on August 19th for Australia, on a tour of investigation on the company's behalf.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Ignition Syndicate, Ltd. (91,175).—Issue on July 12th of £500 debentures, part of series created November 12th, 1908, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £4,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).—Trust deed dated June 30th, 1909, to secure £687,500 debenture stock (with power to increase to a sum not exceeding half the nominal amount of the fully-paid capital, if the share capital fully paid be increased beyond £1,375,000), charged on the company's electrical undertakings, subject to Acts and Provisional Orders relating thereto, certain freehold and leasehold premises and the company's general assets, except uncalled capital. Trustees: Right Hon. Viscount Ridley and W. Cunliffe.

North Metropolitan Electrical Power Distribution Co., Ltd. (61,592).—Particulars of £20,000 debentures created June 17th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Potteries Electric Traction Co., Ltd. (57,968).—This company's annual return was filed on July 16th, when 245,000 preference and 245,000 ordinary shares had been taken up out of a nominal capital of £600,000 in £1 shares (300,000 preference). £423,340 has been been received on 178,340 ordinary and 245,000 preference, and £66,660 is considered as paid on 66,660 ordinary. Mortgages and charges: £245,000.

Europe and Azores Telegraph Co., Ltd. (39,452).—This company's annual return was filed on June 24th when the entire capital of £200,000 in £10 shares had been taken up. £144,320 has been paid, and £55,680 is considered as paid. Mortgages and charges: Nil.

Evershed & Vignoles, Ltd. (43,206).—This company's annual return was filed on July 8th, when the entire capital of £30,000 in £10 shares had been taken up. £30,000 has been received. Mortgages and charges: £10,800.

Robertson Electric Lamps, Ltd. (39,316).—This company's annual return was filed on July 14th, when 6,750 shares had been taken up out of a nominal capital of £100,000 in £10 shares. £66,845 has been paid on 6,650 shares, leaving £15 in arrears. £1,000 is considered as paid on 100 shares. Mortgages and charges: £10 000.

British Aluminium Co., Ltd. (41,104).—Two mortgages, charged on the company's undertaking and property, present and future, including uncalled capital, dated July 17th, 1909, and created by the receiver and manager for debenture stock holders, each to secure £20,000. Holders: (1) Sir Julius Wernher, Bart., L. Phillips, F. Eckstein and L. Breitmeyer (trading as Wernher, Beit & Co., at 1, London Wall Buildings, E.C.); and (2) W. H. and J. A. Morrison, 53, Coleman Street, E.C.

Wolfram (Tungsten) Metal-Filament Lamps, Ltd. (95,312).—Particulars of £40,000 debentures created April 30th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £30,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Yorkshire Electric Power Co.

The directors in reporting on the progress of the company for the half-year from January 1st to June 30th, 1909, state that the receipts from the sale of energy and for work charged out to consumers, &c., for the half-year ending June 30th last amount to £11,169; against, for the half-year ending June 30th, 1908, £8,698; and for the half-year ending June 30th, 1907, £4,700. The gross profit on the revenue account for the half-year is £2,599; against £1,250 for the half-year ending June 30th, 1908; and a gross loss of £403 for the half-year ending June 30th, 1907. After payment of mortgage interest the net revenue account shows a profit on the half-year just ended of £1,070; compared with a profit for the corresponding half-year in 1908, of £363; and a loss for the half-year ending June 30th, 1907, of £1,211. During the half-year further agreements have been made with power users to an extent equal to the average of preceding half-years; these include a number of contracts with collieries and other consumers on the Barnsley extension. The full benefit from these arrangement does not appear during the period under review. The demand for energy per horse-power connected has been low owing to the depressed state of nearly all the industries in the company's area; notwithstanding the adverse conditions of trade there has been a steady increase in the use of the company's supply. Owing to these increases it will shortly be necessary to install further generating plant for which space was reserved when the Thornhill power station was erected. The whole of the issue of £45,000 of second mortgages has been applied for and allotted. The directors are glad to report that Mr. Walter Geoffrey Jackson has consented to fill the vacancy on the board, and they have appointed him under the powers conferred upon them.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held at Newcastle-on-Tyne on 10th inst., Dr. J. T. Merz, the chairman, presiding. The report to June 30th showed that the surplus of receipts over expenses was £3,746, which, with the balance brought forward of £642, makes a total to the credit of profit and loss account of £4,388, and, after deducting interest on debentures, loans, &c., amounting to £1,142, there remains an available balance of £3,246. The directors propose the payment of dividend on the preference shares at the rate of 5 per cent. per annum, less income-tax, £574; dividend on the ordinary shares at the rate of 1 per cent. per annum, less income-tax, £669, placing to reserve for renewals, depreciation and other contingencies, thus increasing the amount to £7,000, £900; and setting aside for the reduction of registration and formation expenses, £330, leaving to be carried forward, £773. The amount available for division shows an increase of £790 as compared with the corresponding period of last year. The traffic receipts are £748 better than they were last year, though the depression in the trade of the district continues. Of the unissued preference shares 92 were applied for and allotted during the half-year, leaving 656 still unissued.

The Chairman, in moving the adoption of this report, said the traffic receipts showed an increase of £748, against a decrease of £1,251 last year. The causes of that decrease had not been really removed yet. It was true that the strike which was unfortunately existing last year had been settled, but, at the same time, the depression in trade was still very great. It was doubtful if there was actually much more work doing on the river now than at the corresponding time of last year. They must not forget that they were reaping some benefit by the stoppage of the river ferries. The tram-mileage was 338,790, against 332,100 in the corresponding period of last year. This increase was almost entirely due to workmen's traffic. The number of passengers carried was 147,676 more than in the corresponding half-year, which had shown a decrease on the previous half-year of 318,108. The receipts per car-mile were 8·26d., as against 7·89d.; and the expenditure per car-mile 5·84d. against 5·79d. The balance brought forward was £642, against £423 last year, and the balance carried forward was £773, against £728. The dividend that was proposed, compared with nothing last half-year. The depreciation fund had been increased from £5,500 to £7,000. In conclusion, he mentioned that the receipts for the first five weeks of this half-year showed an increase of £100, as against a decrease last year at this time of £211.

Mr. G. E. Henderson seconded the adoption of the report, which was agreed to.

South American Light and Power Co.

The sixth annual general meeting of this company was held on Tuesday at the London offices, 6, Lloyd's Avenue, Mr. F. H. Jackson presiding.

In moving the adoption of the report (see Electrical Review, August 6th, page 224) the Chairman said it would be seen from the profit and loss account that the receipts showed an appreciable increase over those of the previous year, an increase which was equal to 40 per cent. The result of the company's progress was that Clause 16 of the agreement made with the Bahia Blanca and North-Western Railway Co. in 1906 came into force. Under that clause the company paid to the railway company one-half of the profits earned after deducting debenture interest up to £5,000, that was to say, they received half of any profits made by the company up to a total of £10,000. The profit made by the company this year was £10,816, but out of that they had to pay the Bahia Blanca Co. the £5,000 to which he had referred, and the amount available for distribution was £5,274, as compared with £2,309. They had not been able to get rid of the dynamo which came into their possession when the Railway Co. took over the working of the company's business, but they had written it down to such a low figure that they had hopes it would soon disappear from the books. The capital now issued was £113,000, of which the £13,000 was for capital expenditure, and which had been paid for by the issue of shares to the Bahia Blanca undertaking.

Mr. T. P. Gaskell seconded the motion.

Replying to a Shareholder, the Chairman said the company were given to understand that the Bahia Blanca Co. were erecting a large station for the generation of electricity, and any further developments of the company would not, therefore, have to be met by large capital expenditure. It was reasonable to suppose that the expenditure in the future would not be on a large scale.

The report was adopted.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from August 18th to August 31st, 1909 (both days inclusive) for the preparation of warrants for interim dividends payable 31st inst., on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1900.

Charing Cross, Euston and Hampstead Railway Co.

The directors' report states that during the half-year ending June 30th, 1909, the capital expenditure amounted to £145,799, representing the expenditure which at the close of last half-year remained chargeable to the capital expenditure account No. 4. The gross receipts on revenue account amounted to £105,183, being an increase of £16,300 on the receipts for the corresponding half of last year. The working expenses amounted to £57,795, being an increase of £1,303. After providing for interest and rents, and reserving £3,000 for contingencies and renewals, there remains a balance of £18,813 available for ordinary dividend, and the directors recommend that a dividend at the rate of $\frac{3}{4}$ per cent. per annum be declared on the ordinary shares, payable on August 14th, leaving £2,591 to be carried forward. The following table gives a summary of the working expenditure in comparison with the corresponding period of last:—

	Half-year ending June 30, 1909.	Half-year ending June 30, 1908.	Increase or decrease.	Per cent.
Maintenance of way and works, &c...	£4,053	£3,595	+ £458	+ 12·74
Repairs and renewals of rolling stock	3,357	3,021	+ 306	+ 11·12
Lift expenses	4,981	5,581	— 600	— 10·75
Train working and traffic expenses ..	38,134	37,290	844	+ 2·26
Other items..	2,403	2,161	242	+ 11·20
	£52,928	£51.648	1,280	+ 2·48
Rates and taxes	4,867	4,845	22	+ ·45
Total	£57,795	£56,493	1,302	+ 2·30

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June 30, 1909.	Half-year ending June 30, 1908.	Increase.	Per cent.
Passengers, including workmen and season-ticket holders' journeys	14,862,882	12,132,639	2,730,243	+ 22·50
Passengers at workmen's fares..	2,728,029	2,174,601	553,428	+ 25·45
Passenger receipts..	£100,787	£84,648	£16,139	+ 19·07
Average receipt per passenger..	1·63d.	1·67d.	Dec. ·04d.	— 2·40
Train-mileage	991,747	773,874	217,873	+ 28·15
Car-mileage	3,037,858	2,596,525	441,332	+ 17·00

Passengers (including season-ticket holders) carried since the opening of the railway:—

Half-year 30th June, 1907 (8 days)	421,466
31st December, 1907	9,881 357
30th June, 1908	12,132,639
31st December, 1908	13,015 363
30th June, 1909	14,862,882

Metropolitan District Railway Co.

The report of the directors for the half-year ending June 30th, 1909, which was submitted at the ordinary general meeting held on the 11th inst., shows that the expenditure on capital account during the half-year has been £34,959. The company's revenue continues to increase satisfactorily. During the half-year the gross receipts on revenue account have amounted to £273,318, being an increase of £25,419 on the receipts for the corresponding half of last year. The working expenses have amounted to £148,096, being a decrease of £6,733. After providing for interest and other charges and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £19,108 13s. 6d., and the directors recommend that a dividend at the rate of £3 per cent. per annum be declared on the 4 per cent. guaranteed stock payable on August 13th. The following table shows the working expenditure in comparison with the corresponding period of last year:—

	Half-year ended June 30th, 1909.	Half-year ended June 30th, 1908.
Maintenance of way and works	£21.844	£19 682
Maintenance of rolling stock	25,287	20,778
Train working and traffic expenses (including joint stations), after deducting the balance of accounts for work done for and by other companies	72,453	81,296
Rates and taxes (including joint stations) ..	16,386	19,721
Other items	12,126	13,352
Total	£148,096	£154,829

The following table gives a summary of comparative figures for the first halves of the years 1908 and 1909:—

	Half-year ended June 30, 1909.	Half-year ended June 30, 1908.	Increase.
No. of passengers, including workmen and season ticket holders' journeys ..	32,949,895	29,626,586	3,323,309
No. of passengers carried at workmen's fares	6,005,454	5,462,794	542,660
Passenger receipts	£254,020	£229,532	£24,488
Average receipt per passenger	1·85d.	1·86d.	Dec. ·01d.
Train-mileage on District Railway ..	1,557,559	1,448 347	109,212
Car-mileage on District Railway ..	6,201,738	5,944,783	256,955

Lanarkshire Tramways Co.

The directors, in their report for the half-year ended June 30th, 1909, state that the half-year's working resulted in the earning of revenue amounting to £32,199 16s.; the expenses amounted to £17,686 12s., leaving a balance of £14,513 4s.; contributions to local authorities absorbed £794, and interest on debentures, £608, leaving £13,111, which, with £865 brought forward from December 31st, 1908, left a balance of £13,976 for distribution. The directors recommend a dividend of 5½ per cent. per annum for the half-year on the share capital issued prior to January 1st, 1909; also a dividend at the rate of 5½ per cent. per annum on the issue of 3,500 shares from due date of the instalments to June 30th, 1909, and that £5,282 18s. be carried to revenue new account. The directors regret to report that owing to continued trade depression the traffic receipts show a decrease of £1,764 as compared with the receipts for the corresponding half-year of 1908. The expenses, however, show a reduction of £1,306, mainly owing to the reduction in the car-mileage, to the price of coal being considerably lower, and to the fact that this half-year no legal expenses have been incurred in connection with Parliamentary Bills affecting the company's interests. The 3,500 shares offered for subscription in February last were fully applied for and allotted, and the construction of the extensions to Uddingston and Newmains completed and inspected by the Board of Trade on June 29th last. The new capital has, therefore, been quite unremunerative during the past half-year. Several additional cars have been purchased and are now in service. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Continental Notes.—Switzerland.—The report of the Banque pour Entreprises Electriques, of Zurich, for the last financial year shows a net profit of £175,167, as contrasted with £174,396. A dividend at the rate of 10 per cent. is maintained.

Poland.—La Compagnie d'Electricite de Varsovie, of Warsaw. reports a net profit of 240,204 roubles for the last financial year, as contrasted with only 178,683 roubles in the preceding 12 months. A dividend at the rate of £1 4s. per share is being declared.

City of Buenos Ayres Tramways Co. (1904).—The directors have declared a dividend of 1s. 3d. per share, less tax, for the three months ended June 30th. The dividend was the same last year.

Guildford Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the preference share capital of the company for the half-year ending June 30th, 1909, at the rate of 6 per cent. per annum.

Consolidated Electrical Co., Ltd.—The directors have declared a dividend of 3 per cent. (7$\frac{1}{5}$d. per share), less income-tax, on the ordinary shares for the year; £7,385 is carried forward.

Telegraph Construction and Maintenance Co., Ltd.—Sir James Pender presided at the half-yearly meeting held on July 27th, and, in the course of his address to the shareholders, stated, according to the *Times* report, that the works were actively employed and the ships were at sea. The *Colonia* was laying a new cable and picking up an old one, and the *Cambria* was away replacing a broken cable, both ships being on the other side of the Atlantic. They had fitted them during the last six months with the Marconi wireless apparatus, which they hoped might prove of use in the future. The transmission of news to a ship at sea was a special preserve of wireless telegraphy. As to their new vessel, the *Telconia*, the completeness of her arrangements had been generally appreciated by experts. This year the company had made and laid a heavier type of cable than they had ever had to deal with before. It weighed 62½ tons to the mile, and was designed to resist the crushing strain of icebergs grounding on the coast of Newfoundland.

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

Wednesday, August 18th.—National Telewriter Co., Ltd.—77,039 preferred ordinary shares of £1 each, 12s. 6d. paid, Nos. 30,001 to 107,039.

And ordered the undermentioned securities to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—640,000 5 per cent. cumulative first preference shares of £5 each, fully-paid, Nos. 1 to 640,000; 500,000 5 per cent. cumulative second preference shares of £5 each, fully-paid, Nos. 800,001 to 1,300,000; and £1,732,237 4½ per cent. debenture stock, in lieu of the first, second and third preference shares now quoted.

Application has been made to the Committee to appoint a special setting day in and to grant a quotation to—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Scrip, fully and partly paid, for £248,500 4½ per cent. Consolidated first mortgage debenture stock.

Prospectuses.—*Sahang Rubber Estates, Ltd.*—The list was to close on Wednesday in an issue of 40,000 ordinary shares of £1 each. The company acquires the Soengei Sahang Rubber Estate, 3 miles from Pontianak, Dutch West Borneo. Out of 2,060 acres, 230 are already planted with Para rubber, some 16,000 trees being 2 to 2½ years old, and 7,600 from 17 to 19 months old.

Beira Rubber and Sugar Estates, Ltd.—The list was to close yesterday in an issue of 150,000 6 per cent. participating cumulative preference shares of £1 each. The estates to be purchased are on the Buzi River, Beira, East Africa, and have a total area of 50,000 acres. 60,000 rubber trees are already planted, and planting is to proceed at the rate of 100,000 trees per annum.

Pará Rubber and Produce Estates, Ltd.—This company has been offering 39,947 shares of £1 each for subscription at par.

National Boiler and General Insurance Co., Ltd.—The dividend and bonus for the year is 20 per cent. £9,000 has been added to current risk and reserve fund, £6,865 being carried forward.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend in respect of the half-year ended July 31st at the rate of 5 per cent. per annum, less income-tax.

Great Northern and City Railway Co.

The Earl of Lauderdale, chairman, presided on the 4th inst. over the half-yearly general meeting of the above company, held at Salisbury House, E.C.

In moving the adoption of the report (see Electrical Review, August 6th, page 227), the Chairman said the total receipts were £40,802, as against £46,476 for the corresponding half-year of 1908, a difference of £5,674. The working expenses were £21,040, as against £23,286, giving a saving of £2,246. The percentage, however, was slightly higher, owing to decreased revenue, viz, for the half-year under review it was 51·56 per cent, against 50·10 per cent. for the corresponding half-year. The result of the accounts was that they were short by £3,209 on their fixed charges. With regard to the general balance-sheet, taking it shortly, the capital account was £197,066 in debt, the same as last half-year, with available capital assets, £580,200. Revenue account was in debt £24,518, towards which there was a cash balance of £11,856; stores, £6,165; account due to company, £6,283; and accounts paid in advance and amounts adjusted £214. There had been a reduction of 80,472 car-miles, which was correspondingly greater than the decrease in traffic. The train-miles had, however, only decreased to the extent of 4,164. The reason these had not diminished to correspond with the decrease in traffic, was that the train service had been maintained at a high level, although the trains had been shortened in length, thus reducing the car-mileage. There had been no material change in the position of the company as regarded capital, but they had since the 1st inst., in conjunction with the City and South London Tube, commenced to run an earlier service on Sunday mornings. It was on July 1st of last year that the Great Northern Railway Co. altered their train service which affected them so adversely, and on July 9th the electrification of the L.C.C. tramways to Finsbury Park was completed. Since those dates there had been no change in external conditions. The total traffic showed a decrease of 833,847 passengers. The falling off experienced in the previous year had continued, although to a less extent, for whilst in December, 1908, they showed a loss of 27 per cent., as compared with December, 1907, in the year under review, they had lost only 13 per cent. He had little doubt that during the current half-year they would show better results than they did last year. During the past half-year the board had been giving full attention to traffic problems, and perhaps he might say that the tube railways of London were now working in close harmony by means of frequent meetings amongst the chief officials of the railways, which led to joint advantages. As he explained at the last meeting, their fares were governed by an arrangement with the Great Northern Railway. The necessary notice to terminate the arrangement had been given, and the required period had just expired. They had not yet made any alteration, owing to the discussions which were in progress with that company, and which might obviate any necessity for doing so. Until those negotiations culminated in some understanding one way or another, they had refrained from making any changes. Meanwhile, the deficiency of £3,209 in their fixed charges had again been provided from the same source as on the last occasion. The time for extending to the Bank as sanctioned by Parliament, expired next August, and the directors were not yet in a position to say whether application for an extension of the period should again be made. In conclusion, the chairman referred to the death of the late secretary and the appointment of Mr. W. M. Ballingall to the office.

Mr. Charles Steel seconded the motion.

Mr. Fell congratulated the board on the economies they had effected, but hoped they would persist in an effort to "moralise" the Great Northern Railway directors. He trusted also that the L.C.C. would be brought to see the unwisdom of running tramways at fares which were unremunerative.

The motion was then carried.

Central London Railway Co.

Sir Henry Oakley (chairman) presided on August 5th, at the Holborn Restaurant, W.C., over the twenty-eighth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, July 30th, page 188), the Chairman said there was practically no change in the capital account. In round figures they had £100,000 of unissued capital, but with what they had put to reserve, and their daily receipts, they were enabled to keep going without issuing any further capital. The revenue would interest them chiefly because the circumstances of the times had rendered necessary some alteration in their dealings with the fares, and because also, through the weather, or the dullness of trade, or both, there had been a damaging effect on the receipts. Whilst the expenses remained practically unaffected, the receipts for the year were £20,000 less than in the corresponding period. The bald statement might, however, convey a more serious impression than the facts really justified. In the first place, in the previous year they had the exhibition traffic, and so far as they could ascertain, the traffic last year benefited them to the extent of £6,000. That traffic had practically been a net loss this year. A further striking fact, however, was the loss of workmen's traffic. As they knew, workmen were carried for any distance for 2d., and there was no question of the fare or the accommodation being responsible for the loss. They had lost 445,000 workmen passengers, and it could only be accounted for by a diminution of work, because there was no better means for them to get to it and no better attraction in the shape of fares. The next and most important point was that of the fares for their general traffic. They found that week after week there was a very heavy falling-off in the general traffic, and especially in regard to short-distance passengers. They took censuses to find out whether this was due to any accidental circumstances, and they examined the rival modes of conveyance, and they found that without doubt the means of locomotion in the streets were so numerous and so convenient, that passengers preferred to ride on a 'bus and pay 1d. rather than to descend to the railway and pay 2d. The board accordingly determined to face the experiment of charging 1d. for any three stations. The results had been that their traffic week by week gradually increased, until within the last six weeks they found they were conveying rather more than double the number of 2d. passengers they had lost prior to the date at which they made the change. The consequence was that they had got the money back, but they had to carry double the number of passengers for it. They hoped, however, there was a gradual indication that the number of passengers would still further increase. They had not as yet had a sufficiently long experience to make calculations with actual certainty, and, therefore, they had withheld any announcement as to whether they would go on with these fares or not. Further, he would point out that as the result of the system of through bookings they had carried 3,000,000 of passengers, which was an increase of rather more than 1,000,000 over the corresponding period. There were indications month by month that these facilities were appreciated by the public, and that the traffic would increase. At the same time, it must not be forgotten that they did not receive so large a fare as if people travelled altogether on their line and paid the local fares. Notwithstanding what he had said, they were able to pay 3 per cent. dividend as before, and to carry £40,000 forward, which was practically equal to the amount brought into the accounts. Therefore, they had not trenched on the savings they had in hand, and they had been able to maintain the dividend. The only other point was their Bill to extend to Liverpool Street, which had passed both Houses of Parliament, and was awaiting the Royal Assent. The result of the inquiry, aided as it was by the Great Eastern Railway Co. and the London and North-Western Railway Co., satisfied the board that there was no point so rich in promise and so full of traffic as that which centred round Liverpool Street.

Lord Rathmore seconded the motion.

Answering questions, the Chairman said the company had tried to coax their competitors to adopt reasonable fares, and failed. He was told the 'bus traffic was not paying, so perhaps they would yet come to their senses. The buildings over the stations did not belong to the company, but were erected by private persons, who paid handsome ground rents.

The report was adopted.

Chilian Electric Tramways and Lighting Co., Ltd.

Sir Julius Wernher (Chairman) presided on August 5th, at 1, London Wall Buildings, E.C., over the eleventh ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, August 6th, page 224), the Chairman said the operations of the company during the past year had shown an improvement both in the tramways and lighting departments. The tramways had shown increased earnings of £10,000, and the lighting department of about £8,000, and these results, he thought, were an earnest of better things to come. They had carried over 7,000,000 more passengers than last year and supplied more current to the extent of one million pesos without satisfying all the demands, and both branches were capable of further development. If the return did not make a better showing, it was to a great extent due to the low rate of exchange, and he was sorry to say there was not much improvement this year. Last year he mentioned that Mr. Carl Müller was appointed as managing director, and he proceeded to Santiago in February of last year, and remained till April of this year. During that period he completely reorganised both the tramway and lighting departments, and the results were beginning to show themselves in the improved character of the returns for the six months of the present year, both departments showing increased profits over the same period of last year. By the terms of the concession, the company was entitled to double the tariff at night, but that had been contested by the municipality of Santiago; the arbitrators were called in and decided in the company's favour. The municipality were not satisfied, and asked for a decision of the courts, and again a verdict was given in favour of the company, and the result should have a favourable effect on the tramways returns, as for months past they had been deprived of what was lawfully due to them. They were still endeavouring to come to a final compromise with the municipality on the tariff and other matters. It was anticipated that the water power scheme would be in full operation before the end of the year, and it ought at once to make its influence felt in their operating expenses, and consequently increase their profits. Their coal bill had been enormous, and owing to bad transit facilities, notwithstanding all their care, they had been left with a very small supply of coal which had caused great anxiety to the staff. Since the departure of Mr. Müller, Mr. Kolkhorst, who had been general manager of the Valparaiso tramways for some years, had been appointed general manager of the company.

Mr. Ludwig Breitmeyer seconded the motion, which was adopted without discussion, and £1,200 was granted to the directors as their remuneration.

Liverpool Overhead Railway Co.

In presenting the half-yearly statement of capital and revenue accounts to June 30th, 1909, the directors have to report that the gross revenue receipts amount to £35,188 and the working expenses to £27,373. The number of passengers carried during the last two years is as follows:—Half-year ending December, 1907, 5,804,629; June, 1908, 5,367,286; December, 1908, 5,167,464; June, 1909, 4,900,216. There has been a further shrinkage in passenger traffic during the past half-year, resulting in a reduction in the revenue of £2,487; this decrease in traffic is mainly attributable to the depression in trade. The directors, by introducing a more frequent but less costly service of trains and effecting other small economies in working expenses, have made a saving of £3,138. The structure and the rolling stock have been maintained in efficient condition. The sum of £1,500 has been carried to the credit of renewal fund, which now amounts to £38,082. The directors have to record with regret the death of Sir Edward Lawrence, who was one of the original directors, and who has rendered to the company very valuable service. The total revenue amounted to £35 188 and the working expenses and transfer to renewal fund to £27,373, leaving £7,815, from which is deducted interest on mortgage debentures and on calls paid in advance (£4,329), leaving £3,486; this amount, together with the balance brought forward (£4,210), leaving available for dividend £7,696. Out of this balance the directors recommend the declaration of a dividend at the rate of 5 per cent. per annum on the (1892) preference shares, less income-tax, leaving a balance of £4,696 to be carried forward to next half-year.

Singapore Electric Tramways, Ltd.

The ordinary general meeting of this company was held on the 3rd inst. at the London offices, 19, St. Swithin's Lane, E.C., Mr. Edmund Davis presiding in the absence of Sir Frank A. Swettenham.

The Chairman, in moving the adoption of the report (see Electrical Review, August 6th, page 224) said that in reference to the item creditors and credit balances on the debit side of the balance-sheet which stood at £6,701, that was a reduction of nearly £4,000 as compared with 1907, when it stood at £10,693. Turning to the other side of the accounts, on the tramway undertaking there had been an outlay of £12,884, or nearly £4,500 more than last year, though they had written off a little over £10,000, as against £13,000 in 1907. That re-arrangement of the provision for depreciation had been arrived at after careful consideration, and on the advice of the general manager, who had advised them that owing to the excellent condition of the plant, the reduced rate was justified. They had only £6,000 on loan against security to compare with £15,000 in 1907. Debit balances and stocks and stores, tickets, coals and sundries were about the same for the two years, and the balance of profit and loss account had been increased by £4,040, making the total under that head £16,217, which was caused by the large amount debited to the profit and loss account from year to year by way of depreciation. The total receipts for the year were £917 less than in the previous year, and they had debited the profit and loss account with depreciation amounting to £10,233, debenture interest, 17,500, and the royalties payable to the Singapore Municipality, and the accounts showed a loss for the year of £4,040. The item, commission and discount, £740, was again heavy, but that was due to the loss incurred on the sale of subsidiary companies, and although they had been in communication with the Government, they had not, up to the present, been able to come to any satisfactory arrangement. The total traffic receipts amounted to £55,985, or very nearly 4 per cent. less than in 1907; the receipts per car-mile being 6·89d., as against 7·41d. in the previous 12 months. The falling off in revenue was due to a large extent to the depression in trade. The receipts for the current year up to July 1st showed an increase over the corresponding period of 1908 of $7,070. The tramway expenses amounted to £36,086, or an increase of about 2·8 per cent., though the cost per car-mile was 3 99d., as against 4·07d, the reduction being due to the fact that 63,104 more car-miles had been run. Turning to the other side of the business, the receipts from the sale of energy for lighting and power purposes showed a gratifying increase of $31,126, as against $15,999, or a little short of double the amount in 1907. That branch of the company's business was full of great potentialities, and as further connections were made the returns should increase largely. Up to April 30th of this year the receipts showed an increase of 48 per cent. when compared with 1908. The section of the tramways over the Singapore river had not yet been completed owing to the bridge which was being built by the municipality not yet having been completed. The general expenditure at Singapore would in the future show a reduction, as they had made arrangements with their local agents whereby their remuneration would be greatly reduced.

Sir Charles Petrie seconded the motion, and the report was adopted.

Baker Street and Waterloo Railway Co.

The directors' report for the half-year ending June 30th, 1909, states that the capital expenditure during the half-year amounted to £71,880, representing the expenditure which, at the close of last half-year, remained chargeable to the capital expenditure account. The share capital still remaining to be issued to the contractors under the construction contracts, amounts to £33,000. The gross receipts on revenue account during the half-year have amounted to £91,510, being an increase of £7,982 on the receipts for the corresponding half of last year. The working expenses have amounted to £42,224, being a decrease of £3,228. After providing for interest, rents and preference dividend and reserving £4,000 for contingencies and renewals, there remains a balance of £18,304 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1½ per cent. per annum be declared on the ordinary shares, and an additional dividend at the rate of 1½ per cent. per annum (making 3 per cent. per annum in all) on the ordinary shares other than those held by the Underground Electric Railways Co. of London, Ltd., or their nominees, leaving a balance of £3,106 to be carried to next half-year's account. The directors propose that the dividends shall be payable on August 14th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending June, 1909.	Half-year ending June, 1908.	Inc. or dec.	Per cent.
Maintenance of way and works, &c.	£2,996	£2,564	+ £432	+ 16·85
Repairs and renewals of rolling stock	2,939	3,687	— 748	— 20·29
Lift expenses	4,207	4,619	— 412	— 8 92
Train working and traffic expenses ..	24,787	27,574	— 2,787	— 10·11
Other items	2,905	2,692	+ 213	+ 7·91
	£37,834	£41,136	— 3,302	— 8·08
Rates and taxes	4,390	4,317	+ 73	+ 1·69
Total	£42,224	£45,453	— 3,229	— 7·10

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June, 1909.	Half-year ending June, 1908.	Inc.	Per cent.
Passengers, incldg. workmen and season-ticket holders' journeys	14 325,065	12,940,801	1,384,264	+ 10·70
Passengers at workmen's fares ..	1,922,539	1,874,140	48,399	+ 2·58
Passenger receipts..	£86,861	£79,869	£6,992	+ 8·75
Average receipt per passenger ..	1·46d.	1·48d.	Dec. ·02d.	— 1·35
Train-mileage	637,202	522,406	114,796	+ 21·97
Car-mileage	1,918,562	1,770,126	148,436	+ 8 39

The terms of the agreement with the North-West London Railway Co., referred to in the directors' last half-yearly report, which provided for the working by this company of the projected railway from Edgware Road to Brondesbury, were settled, subject to confirmation by the shareholders, but it did not become necessary to seek such confirmation, as the Bill of the North-West London Railway Co. did not pass through Parliament. After the decision of the Committee of the House of Commons on the North-West London Bill, the Bill of this company for an extension of time for constructing the authorised Paddington extension was withdrawn. The policy of the company in relation to any future proposals which may be made by the North-West London Railway Co. as to constructing a railway from Edgware Road to Brondesbury is being considered. The extension to Paddington, which this company have power to construct, was so laid out on the Parliamentary plans that if it were constructed any extension beyond Paddington would be practically impossible, and its construction would also debar the company from arranging to work, as a continuous line, any extension in the direction of Brondesbury and Cricklewood, which, in the opinion of the directors, would be of more value than the Paddington extension. In these circumstances, the directors recommend that the Paddington extension, as authorised, should be abandoned, and all questions as to extension of the railway beyond Edgware Road left for future consideration.

Great Northern, Piccadilly and Brompton Railway Co.

The directors' report for the half-year ending June 30th, 1909. The capital expenditure during the half-year amounted to £169,488, representing the expenditure which, at the close of last half-year, remained chargeable to the capital expenditure account No. 4. The gross receipts on revenue account amounted to £157,993, being an increase of £10,230 on the receipts for the corresponding half of last year. The working expenses amounted to £73,405, being a decrease of £1,579. After providing for interest, rents and preference dividend, and reserving £6,000 for contingencies and renewals, there remains £33,592 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving a balance of £8,352 to be carried to next half-year's account. The dividends will be payable on August 14th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending June 30, 1909.	Half-year ending June 30, 1908.	Inc. or dec.	Per cent.
Maintenance of way and works, &c...	£5,890	£4,235	+ £1,655	+ 39·08
Repairs and renewals of rolling stock	4,696	5,055	— 359	— 7·10
Lift expenses	7,153	7,480	— 327	— 4·37
Train working and traffic expenses	41,585	47,513	— 5,928	— 12·48
Other items	6,005	3,172	+ 2,833	+ 89 31
	£65,329	£67,455	— £2,126	— 3·15
Rates and taxes	8,076	7,528	+ 548	+ 7·28
Total	£73,405	£74,983	— £1,578	— 2·10

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June 30, 1909.	Half-year ending June 30, 1908.	Inc.	Per cent.
Passengers, including workmen and season-ticket holders' journeys ..	19,155,888	17,446,477	1,709,406	+ 9·80
Passengers at workmen's fares ..	2,442,573	1,977,422	465,151	+ 23·52
Passenger receipts	£151,073	£142,111	£8,962	+ 6·31
Average receipt per passenger ..	1·89d.	1·95d.	dec. ·06d.	— 3·08
Train-mileage	1,236,820	956,933	279,887	+ 29·20
Car-mileage..	3,671,512	3,742,507	dec. 70,995	— 1·90

The number of passengers carried, including estimated journeys by season-ticket holders, is as follows:—

Half-year ending June 30th, 1908	17,446,477
" " December 31st, 1908	16,990,501
" " June 30th, 1909	19,155,888

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc,a
Aberdeen	Aug. 4	3,131	— 619	9	14,142	— 827	..	..
Ayr	„ 7	999	— 61	12	4,804	— 232	8	..
Bath	„ 4	2,231	+ 45	31	23,505	+ 943	..	..
Belfast	„ 6	7,788	+ 279	18	71,182	+ 3,015	37	..
Birkenhead.. ..	„ 7	2,286	— 58	18	20,098	— 515	13·63	..
Birmingham Corp.	July 31	13,701	+ 167	18	116,628	+ 3,349	..	..
Blackburn	„ 21	2,252	— 151	17	19,357	— 628	13·97	..
Blackpool-Fleetw'd	Aug. 7	3,648	+ 47	5	7,315	— 81	..	..
†Bolton	„ 1	2,210	— 290	18	41,989	— 990	26	..
Bournemouth ..	„ 4	4,282	— 201	18	30,841	— 224	21·96	..
Bradford	July 31	9,732	— 310	17	86,444	+ 1,061	54·9	..
†Brighton	Aug. 1	1,218	— 66	18	17,128	..	9·5	..
Bristol	„ 6	13,567	+1,096	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	July 30	394	+ 6	30	6,491	— 198	3·65	..
Barnsley	„ 30	335	— 33	„	4,976	— 237	..	..
Barrow	„ 30	558	— 88	„	6,716	— 568	5·37	..
Cavehill	„ 30	214	+ 7	„	2,526	— 182	..	..
Devonport ..	„ 30	750	— 251	„	10,939	— 2,554	8·85	..
Gateshead ..	„ 30	2,054	..	„	29,728	— 816	11·25	..
Gravesend ..	„ 30	542	+ 60	„	6,864	— 159	6·5	..
Greenock.. ..	„ 30	1,373	+ 30	„	15,942	+ 222	7·25	..
Hartlepool ..	„ 30	549	— 63	„	6,750	— 223	6·72	..
Kidderminster ..	„ 30	268	— 37	„	3,019	— 240	..	..
Leamington ..	„ 30	423	— 12	„	5,004	+ 151	..	..
Merthyr	„ 30	425	— 12	„	6,330	+ 44	2·9	..
Metropolitan ..	„ 30	13,683	+ 575	„	180,713	+14,019	22	..
Middleton ..	„ 30	714	— 123	„	9,977	— 832	8·5	..
Mid. Joint Com'tee	„ 30	11,529	— 172	„	168,972	— 2,270	..	..
Oldham—Ashton	„ 30	1,166	— 56	„	16,664	— 1,084	9·13	..
Peterborough ..	„ 30	265	— 25	„	3,426	— 305	5·31	..
Potteries	„ 30	3.529	— 198	„	52,976	— 1,443	29	..
Rothesay	„ 30	1,464	— 160	„	5.578	— 230	2·75	..
Southport.. ..	„ 30	720	— 50	„	8,340	— 288	8·17	..
S. Metropolitan ..	„ 30	1,715	— 178	„	22,960	— 480	..	..
Swansea	„ 30	2,023	— 36	„	27,895	+ 452	12·5	..
Tynemouth ..	„ 30	905	+ 110	„	6,521	+ 156	3·75	..
Weston-s-Mare ..	„ 30	542	— 100	„	3,334	— 64	3	..
‡Worcester ..	„ 30	643	— 13	„	8,024	— 141	5·75	..
Wrexham ..	„ 30	199	— 23	„	2,861	— 146	..	..
Yorks. Wool. Dist.	„ 30	2,087	— 60	„	26.811	— 566	17	..
Miscellaneous ..	„ 30	472	+ 2	„	6,015	+ 3	..	..
Burnley	Aug. 7	2,639	— 185	..	..	..	..	..
Burton-on-Trent ..	„ 8	623	— 29	19	5,084	— 163	6·63	..
†Bury..	„ 1	2.208	— 237	$17\frac{4}{7}$	21,073	— 759	22·6	..
†Cardiff	July 24	2,429	+ 93	17	36,338	— 910	..	..
Carlisle	Aug. 7	400	— 24	31	5,108	— 212	..	..
Chatham and Dist.	„ 5	1,982	— 174	31	24,626	+ 1,172	14·98	·61
Cork	„ 5	1,088	— 12	31	13,334	— 876	..	..
Croydon	July 30	3,006	— 98	..	26,119	— 29	11·25	4·75
†Darlington.. ..	Aug. 7	191	— 26	19	3,555	+ 258	..	..
Darwen	„ 6	449	— 42	18	4,616	— 224	4·36	..
Dover..	July 31	491	— 132	18	3,660	— 478	4·75	..
†Dublin	Aug. 6	12,483	— 238	..	31,423	— 286	54·25	..
Dundee	„ 4	2,439	— 135	$11\frac{4}{7}$	13,852	— 613	·15	..
East Ham	„ 7	2,096	+ 76	$18\frac{1}{2}$	19,081	+ 2,692	8·43	·68
†Exeter	July 30	340	— 30	18	6,212	+ 514	5·5	..
Glasgow	Aug. 7	31,344	—1,423	..	162,017	— 4,566	90·5	1·5
Hastings	„ 5	3,011	— 324	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	„ 7	5,496	+ 280	18	46,496	+ 684	13	..
Ilkeston	„ 4	299	— 46	18	2,449	— 219	..	..
Ipswich	„ 7	1,076	— 41	19	7,712	— 24	10·5	..
†Kilmarnock ..	July 31	236	— 7	11	1,748	— 86	4·25	..
†Lan'kshire Trm. Co.	„ 22	3.035	+ 113	29	36,202	— 1,697	17·62	1·18
Lancashire United	Aug. 4	2,696	— 494	31	40,702	— 339	..	..
Leeds	July 31	13,639	— 123	18	120,355	+ 227	54	..
†Leicester	Aug. 7	4,931	— 257	..	..	..	..	..
†Leith	July 24	1,403	+ 114	10	6,432	+ 534	6	..
Liverpool	„ 31	22,201	— 280	30	322,407	— 3,331	104	..
‡L.C.C.	„ 24	75,832	+ 4.125	..	598,609	+22,523	121	4·25
London United ..	Aug. 7	15,343	—3,806	..	187,490	—20,076	..	..
Lowestoft	July 24	480	— 85	43	6,585	— 785	3·5	..
†Manchester ..	Aug. 7	30,825	—3,027	19	282,793	— 4,557	90·5	6
†Newcastle	July 31	8,8 0	+ 10	..	69,231	— 1,416	..	..
†Newport	„ 31	672	— 41	18	11,874	— 382	14·5	..
Oldham	Aug. 8	3,790	— 420	19	37,051	— 2,650	23·75	..
Pontypridd	„ 7	893	— 14	$18\frac{1}{2}$	7,963	+ 1,076	5·5	1·75
Portsmouth.. ..	..	..	..	..	..	..	..	..
†Preston	„ 4	1,442	— 90	..	..	..	..	..
Rotherham	„ 5	1,179	— 157	18	10,902	— 481	10	·66
Salford	„ 2	8,914	—1,216	$17\frac{5}{7}$	82,622	— 3,017	..	..
†Sheffield	„ 1	5,452	— 322	$18\frac{3}{7}$	103,787	— 1,618	37	1·25
Southampton ..	„ 4	2,560	— 216	18	19,643	— 686	..	..
Southend-on-Sea ..	„ 4	1,788	+ 228	18	10,079	+ 1,711	..	..
†South Shields ..	July 31	1,209	— 111	$17\frac{3}{7}$	9,975	— 56	..	..
Swindon	Aug. 7	260	— 62	..	..	..	..	..
Tyneside	„ 4	964	— 52	5	2,384	+ 100	..	..
Wallasey	July 31	1,982	— 96	$17\frac{1}{2}$	16.725	+ 413	..	·22
Walthamstow ..	Aug. 7	1,568	— 221	19	12.957	— 7	9	..
West Ham	July 29	4,739	+ 251	17	40.940	+ 2,411	15	·8
Wolverhampton ..	Aug. 4	1,745	— 132	18	14,907	— 908	12·5	..
Baker St.-Waterloo	„ 7	5 895	+ 525	5	15,430	+ 950	4·25	..
Cen. London Rly...	„ 7	9,851	—3,301	5	26,180	— 9,775	6·32	·55
Char. +, Eus. Hamp.	„ 7	7,365	+ 650	5	19,185	+ 2,650	7.75	..
City & S. Lon. Rly.	„ 8	6,162	+ 339	5	15,421	+ 976	7·3	..
Dublin-Lucan Rly.	„ 6	360	— 13	5	866	— 7	7	..
G.N. and City Rly.	„ 7	2 382	— 3	5	6,351	— 27	8·5	..
G.N., P'y. & Brmtn.	„ 7	9,610	+ 316	5	26,045	+ 825	9·25	..
L'pool Overb'd Rly.	„ 8	3,111	— 10	5	8,937	— 53	6·3	4·3
†Llandudno-Col. Bay	July 30	534	— 8	85	7,544	+ 1,628	..	..
Mersey Railway ..	Aug. 7	3,988	+ 164	5	9,772	+ 469	4·5	..
Metropolitan Rly...	„ 7	30,907	+ 692	..	80,785	+ 1,702	24·5	..
Met. District Rly...	„ 7	18,533	+1,470	5	49,863	+ 4,757	24	..
Anglo-Argentine ..	„ 5	74,079	+3,553	..	1,206,885	+69,073	..	..
§Auckland	July 16	13,418	+1,503	28	96,514	+13,296	22·3	3·1
Bombay (B.E.T.) ..	„ 8	5,298	+ 367	26	68,178	+ 4,081	..	..
§Brisbane	„	16,140	+2,114	..	..	..	..	..
§Brit. Columbia Rly.	June	41,365	+8,826	..	..	..	..	..
Calcutta	Aug. 7	6,406	+ 157	..	..	..	..	..
§Cape Electric T. Ld.	June	11,208	..	..	..	..	..	..
§Kalgoorlie, W.A...	July	3,509	..	30	26,188	..	20·5	..
Madras	„ 31	1,276	+ 83	30	17,662	+ 170	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	Aug. 6	2,580	— 12	30	43,956	— 47	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Markets in the Stock Exchange are mostly hard as regards prices, limp as regards business. The electricity sections synchronise with the other departments, and the principal divisions display a fair amount of strength. The telegraph list contains a number of small improvements. But the holiday spirit is very much in the air, and the closing of the Stock Exchange on Saturday week was announced amidst cheers.

Central London stocks are looking up again, and the success of the company's policy of penny fares is no longer in doubt. Regarded as rather a bold experiment at the time of its initiation, a good many proprietors were inclined to criticise the innovation as being likely to do the company more harm than good; but the event is apparently falsifying these objections, and the market has taken a distinct turn for the better, a rise of 2 in the Ordinary being the immediate outcome.

Other tube issues are steady. The excellent reports of progress lately published by the Underground Railways group has directed further attention to the various Debenture stocks, amongst which Baker Street and Waterloo stands at 99, Great Northern and Piccadilly at 95 and Charing Cross at 93. Piccadilly Preference are 8¼.

City and South London Ordinary is without change, and would-be buyers of the Preferences find much difficulty in getting the offer of any of the stocks. Of the old undergrounds, Metropolitan Consolidated is a trifle easier, while Districts remain at 17½. After arousing a little interest in connection with the coal-trade dispute and its settlement, the Home Railway market has relapsed, as a whole, into its usual condition of stagnation.

Anglo-American Telegraph stocks play the leading part in their particular market, and the Deferred has jumped up more than two points. There is a report current to the effect that the company has picked up the cable that for so many years has been lost, but a more prosaic explanation of the rise in the stock is that which credits the company with doing very good business at the present time. The Ordinary and Preferred are also better.

Great Northern Telegraphs are firmer, notwithstanding the shrinkage in the profit for the last financial year. Direct United States shares recovered half their fall of a week ago, and Cuba Telegraphs are 2s. 6d. higher. Eastern Telegraph Ordinary hardened, and "China" shares kept firm. A rise of 5s. in Globe Preference shows that investors are not unmindful of the recent improvement in Telegraph descriptions.

Telephones are quiet. National Telephone Deferred gained ½ of its deducted dividend, but the Third Preference slipped back further. American Telephone lost ½ of the sharp rise last week.

The rubber market has been rather badly shaken by a slump occasioned through a rush of profit-taking. As with all markets that are at all limited in extent, a gentle pressure to realise was quickly converted into a kind of *sauve qui peut*, accelerated by the wild efforts of Mincing Lane operators to land the Stock Exchange with the shares. The little burst did not last long, and the market quieted down at the lower levels, which tempted new buyers. However, the incident provided rather a nasty jar for speculators who, rashly gambling with borrowed money, failed to time the slump, and found themselves in such position that they might be called upon to pay differences of substantial amounts.

In the hot weather, electric lighting shares are about the last thing that investors trouble about, so it is not surprising that the catalogue should show hardly a change worth noticing. There is a sprinkling of small declines.

Mexican-Canadians have swung upwards this week; there has been a rise of 5 points in Mexican Light and Power Common. The Tramways Company shares are 1½ up, Rio Trams keep about 90½ and Sao Paulo at 150½ are 3 better. Canadian General Preferred at 118 is up 1, but the Common has not moved from 123. Tramway shares generally are steady. British Electric Traction Debenture stocks have fallen further. London Uniteds are without change.

The manufacturing group is quiet. Babcock gained $\frac{1}{16}$, armament shares are strong, and Henley's rose 5s. Telegraph Constructions are up again. Edison & Swan fully paid shares from £2 were marked down to 1¼. In point of fact the latter price has more correctly represented the actual quotation for some time past, but the dealers prefer to treat their prices tenderly until obliged to put them down.

Liverpool District Lighting Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum, less income-tax, for the past half-year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Aug. 3rd.	Closing Quotations Aug. 10th.	Business done week ended Aug. 10th, 1909.		Rise + or Fall −	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾— 3½	2¾— 3½	..	..	.	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96	93 — 96	..	..	+ ½	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146½—147½	146 —147	146¼	..	− ½	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	58 — 60	59 — 61	59	..	+1	5 6 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	102 —103	102½	101⅛	+1	5 16 6
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	17¼— 17¾	19⅛— 19¾	19 7/16	17 7/16	+2¼	2 0 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 8
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8⅝	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	90 — 92	90½	..	+1	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅛— 8⅞	8¼ — 9	..	..	+ ⅛	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	8 16 8
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	12⅝— 13⅛	12⅞— 13⅜	13	12¾	..	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	.	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —128	126 —129	127½	126	+1	5 8 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½— 86½	84½— 86½	84⅛	84⅝	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½ - 106½	105	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½— 12	11½— 12	11⅞	11½	..	5 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104 xd	102 —104	102¼	102	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	10 ¼	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	10 9/16	10½	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼— 13¾	13½— 14	13¾	13⅝	+ ½	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26¼— 27¼	26¾	26¼	+ ¼	6 12 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	11/16— 13/16	11/16 — 13/16	16/-	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16— 15/16	13/16— 15/16	..	..	..	6 0 7
56,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 13 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 - 107½	106¾	106	..	5 11 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122½—124½	123 —125	123¼	122¾	+ ½	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10¾	10 — 10¾	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10 — 10¾	10 — 10¾	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5½— 5¾	5 7/16— 5 11/16	5½	5 1/16	−1/16	4 7 3
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 - 100	98 —100	98¼	98	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	28/1½	23/-	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 3 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85½ - 87½	85 — 87	..	..	− ½	4 12 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 - 101	99 —101	..	..	..	3 19 3
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7¾	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —132	130 —133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛— 5½	5⅛— 5½	..	..	..	4 10 8
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	22/6	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½— 14	13½— 14	13¾	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½—104½	102½—104½	..	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½— ⅝	½— ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..		4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Aug. 3rd.	Closing Quotations Aug. 10th.	Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9 5/16— 9 9/16	9 5/16— 9 9/16	9 15/32	9 7/16	..	5 5 3
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90¾— 91¾	90¾— 91¾	91⅝	91¼	..	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4¼— 4⅜	4 5/16— 6 7/16	87/6	86/3	+ 1/16	4 9 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼— ¾	¼— ¾	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¼— 1¾	1⅜— 1⅞	..	..	+ ⅛	18 13 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3½	3 — 3½	..	..	..	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	93 — 96	93 — 96	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —148	144 —148	147	..	..	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	119 —123 xd	121 —125	123	122½	+2	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	..	..	..	4 10 11
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	102¾	..	..	4 6 7
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	½— ⅞	½— ⅞	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2 — 2½	2 — 2½	..	..	..	6 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	85 — 88	86½	..	−1½	5 16 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	64 — 68	63 - 67	..	..	−1	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜— 7¾	7⅜— 7¾	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	6 3/16	..	..	4 11 3
600,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 - 106	..	..	..	4 4 11
204,941l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½— 4⅞	4½— 4⅞	97/6	..	..	4 12 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10 — 10¾	10 7/16	10¼	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5¼— 5⅝	..	..	..	4 18 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½—106½	104½—106½	..	..	..	4 4 6
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅞— 2	1⅞— 2	39/3	39/-	.	6 0 0
910,159	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	104 —107	104 —107	..	..	..	3 14 9
1,890,000	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	60 — 62	62 — 64	64	61	+2	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,4[illegible]	City and South London Railway	Stock	1⅞%	2⅝%	2⅛%	1½%	81 — 82	81 — 82	81¾	81	..	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue,	NAME,	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 3rd.	Closing Quotations Aug. 10th.	Business done week ended Aug. 10th. 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	..	..	..	8 0 0
805 000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	..	⅛ — ⅜	⅛ — ⅜	..	..	..	25 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	..	1½ — 2½	1 — 1½	..	..	— ¾	8 6 8
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 5/16 — 1 9/16	1 5/16 — 1 7/16	26/10½	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12⅛ — 12⅞	12¼ — 13	12 9/16	..	+ ⅛	7 2 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14½ — 15¼	14½ — 15¼	15¼	15	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	5 — 6	4½ — 5	..	..	— ¾	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2 — 2½	2 — 2½	45/-	..	..	15 0 0
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	68 — 71	68 — 71	68¾	..	..	5 12 8
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	40½ — 40¾	40 — 40½	40¼	40	— ¼	1 4 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 — 67	65	..	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¼ — 17¾	17¼ — 17¾	17¾	17⅝	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝ — ¾	⅝ — ¾	..	..	..	..
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	23/32 — 27/32	23/32 — 27/32	..	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	95	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	123 —126	124½ —127½	127½	125½	+1½	
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93 — 95	94½ — 96½	95	93½	+1½	5 5 3
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	12/3	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89			..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34 — 35½	34½ — 36	35½	35	..	2 10 9
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—101½	100 —101½	..	..	+ ¼	8 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½—103½	102½—103½	..	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88½	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	36 — 38	35 — 37	37½	36½	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ — 3⅛	2⅝ — 3⅛	58/6	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	78⅛	78⅜	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4½ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	8 — 8½	8 3/16	8⅛	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	83/9	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	..	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3⅞ — 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	8 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞ xd	10⅜ — 10⅞	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾ xd	11¾ — 12¾	12 1/16	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	102	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3⅛ — 3⅝	3 — 3½	..	..	— ⅛	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7¾ — 8¼ xd	7⅝ — 8⅛	8	..	— ⅛	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10⅝	10 9/16	..	5 9 1
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	103 —106	105 —106	105½	10	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	100	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	3/16 — 5/16	⅛ — 5/16	.	..	— 1/32	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	8/6	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	59	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84½ — 86½	84½ — 86½	86⅝	85¾	..	5 16 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½—100½	98 —101	99	..	+ ½	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅞ — 7⅜	6⅞ — 7⅛	..	..	— ¼	5 12 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	98⅝	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	5 11 8
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4¾	4⅜ — 4¾	92/6	..	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	5	..	..	4 10 0
285,000l	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	83 — 85	84½	83¾	+1	5 17 8
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	65 — 69	70 — 74	72	69	+5	4 14 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	105 —108	109	107½	+1	6 8 5
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85½ — 87½	85 — 87	86⅝	85½	— ½	5 14 11
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	2 10 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¼ — 12¼	11 — 12	..	..	— ¼	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 — 1 3/32	31/32 — 1 3/32	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	..	..	..	7 2 10
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	8 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2¾ — 3⅛	2⅝ — 3	..	..	— ⅛	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—104	100 —103	..	..	..	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝ — 2⅛	1½ — 2	..	..	— ⅛	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	76 — 80	76 — 80	..	..	..	5 12 6
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	13/16 — 15/16	13/16 — 15/16	18/1½	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.		13 %	12 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	9⅛	..	+ ¼	5 8 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞ — 5¼	4⅞ — 5¼	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

REVIEWS.

Theory and Calculation of Transient Electric Phenomena and Oscillations. By C. P. Steinmetz. New York: McGraw Publishing Co. 1909. Price $5.

Prof. Steinmetz gave a course of instruction for a number of years to the Senior Class in Electrical Engineering at Union University. This book is founded on his lectures.

A careful perusal of it has convinced us that it will be of great value for many years to come as a storehouse of information, to which the mathematician will come when he wants to discover the physical meaning of his equations, and to which the electrician will have recourse when he wants to find out the reason of puzzling phenomena. It will also prove of particular value to that most deserving individual, the serious student, who wants to do real work in the world, and not to be a mere machine performing by rote operations which must to the half-educated mind appear similar to the rites of astrologers.

The book is divided into four sections. The first, which is entitled "Transient Phenomena in Time," discusses phenomena similar to those of the rise of currents in circuits containing capacity and inductance. "Periodic Transient Phenomena" are considered in the second section. Such phenomena occur in various types of interrupters, such as the one devised by B. Cohen, and in various types of rectifiers, such as the Ferranti and the mercury-arc rectifier. In the third section—"Transient Phenomena in Space"—problems which occur in long-distance transmission and in iron when subjected to alternating magnetising forces are discussed. The theory given illumines the whole subject, showing a clear picture of the actual transition stages. Several of the problems in the last and most difficult section, entitled "Transient Phenomena in Time and Space," have been previously considered by Dr. Oliver Heaviside, more particularly those in connection with the reflection of waves, but the author's method of discussing standing waves and free oscillations in long transmission lines is original and instructive.

Each of the sections is almost complete in itself. This leads to a certain amount of repetition, but will probably be advantageous to most readers. In our opinion, a serious drawback to the book is the practically complete absence of references to other books and papers, which seriously discounts the book from the teaching point of view. A highly original work like that under review is of far greater value than a mere compilation of undigested papers, no matter how valuable the individual papers may be, but there are many places in this book where a line or two giving the necessary references seems almost indispensable. Where the author can give an experimental justification of his theorem references, although sometimes desirable, are not essential, but when he enters into almost metaphysical calculations, we lose confidence unless we can find out how he obtains his figures. For example, on page 73 an oscillating circuit consisting of two spheres each 0·45 in. in diameter, and separated by a 0·3 in. gap, is considered. It is stated that the capacity of the spheres against each other (this is the first time we have ever come across this phrase) is the hundred millionth of a microfarad. No reference is given, and so a large, and, in our opinion, a quite uncalled-for demand is made on the reader's credulity. Formulæ for this case have been worked out by such well-known physicists as Kelvin and Kirchhoff; a reference to either of these would suffice. Possibly it would have been better to give a reference to the much more easily computed formulæ due to the writer of this review.

The definitions of inductance and capacity given on pages 9 and 11 are a little far-fetched, and must be regarded as shibboleths by the student. A brief *résumé* of some of the formulæ recently examined by the able mathematicians at the Bureau of Standards would help to remove this impression. On page 11 the electric strength of air is given as 60,000 volts per centimetre. This number is certainly not correct for large electrodes, and is not in accordance with our reading of the valuable experimental results obtained by the author and published a good many years ago.

The empirical formula given by Fröhlich in 1882 (one of the few historical references given in the book) for the connection between flux and magnetising force is stated to give a parabolic curve. This is a slip, as a hyperbolic curve is meant. In the first section an exceedingly interesting series of curves is given, illustrating excellently the initial disturbances which ensue when a circuit is switched on suddenly to the alternating-current supply mains. The ordinary author avoids the labour involved in these calculations. As there is nothing startlingly new to be found out, he contents himself with giving more or less vague word pictures of what happens. Here we see the actual phenomena at a glance. Pictures such as those given would have saved the reviewer weeks of hard thinking many years ago.

On page 68, lines 10 and 11 from the foot of the page, occurs one of the very few slips in the book—five joules is given instead of 50, and a "hundredth" is given instead of a "tenth." On page 124 the sign "=" is omitted from equation (21). On page 136 it should be stated that $a = 0{\cdot}1$ is the exact root of the cubic equation. We had started to find a closer approximation by Newton's method before we found this out. On page 144 a discussion is given of the currents in circuits containing resistance, inductance and mutual inductance. We were surprised to find that the exceedingly interesting and important case when

$$\frac{L_1 - M}{R_1} = \frac{L_2 - M}{R_2}$$

is not considered.

The last two chapters of the first section discuss the transient term of the rotating field and the short-circuit current of alternators. They are both of considerable practical importance, and contain much novel matter.

Perhaps the most important subject discussed in the second part is arc rectification. A masterly analysis has been given, and the agreement between the theoretical and the actual shapes will convince electricians—if any real electricians need convincing nowadays—of the practical value of mathematics in engineering. This subject Prof. Steinmetz has made peculiarly his own, and he is to be congratulated heartily on his able contribution to the world's knowledge.

The third section is, perhaps, not quite as good as the second. We think that an account of some of Prof. Kennelly's work would have been appreciated by the reader. On page 279 the velocity of light is stated to be 188,000 miles per second; if we remember correctly, Prof. Rosa's experiments make it 186,200 miles per second, and they are practically in agreement with the latest astronomical results. In the formula for the natural period of the line given on the next page there is no mention that the resistance of the line is neglected. The author gives the complete and correct expressions later on, but it would have been better to point out the limitations earlier.

The following extract, page 339, is very instructive:—

"A long-distance transmission line has a definite natural period of oscillation, of a relatively low fundamental frequency, and its overtones, but can also oscillate with any frequency whatever, provided that this frequency is very high.

"This is analogous to waves formed in a body of water of regular shape; large standing waves have a definite wave length, depending on the dimensions of the body of water, but very short waves, ripples in the water, can have any wave length, and do not depend on the size of the body of water."

We appreciate very highly the author's formula for the self-inductance of an antenna. We think it a pity, however, that the results were not given in terms of "sine" and "cosine" integrals, the values of which are tabulated in several books (*vide* "Dale's Mathematical Tables," page 85). The new *sil* and *col* functions of the author can be put at once in terms of these, and are, therefore, unnecessary. The formulæ also would be in many places greatly simplified by introducing hyperbolic sines and cosines, which are now well known to engineers, and many tables of which are readily available. We like the author's method of calculating the power radiated into space. This will be of great importance in wireless work.

On page 405, l is written for l_0 in formula (4). Mentioning this trifle shows how carefully the proof readers have done their work, but in our opinion the wording could easily have been improved in many places. On page 406 we take it that the "thermal" resistance is the same as the "ohmic" resistance. On page 413 tables are given to show the increase in the effective resistance due to the skin effect. We notice that figures for a wrought-iron pipe are given, and we wonder whether the correct formula originally given by Heaviside, and independently verified by the reviewer, was used in the calculation. If not, this table will need to be altered.

The last section is very good, but the formulæ need very careful consideration. There is one minor statement on page 446 which we think needs amending. It is stated that the velocity of light is $1/\sqrt{LK}$. This is certainly true for two parallel wires, provided their resistivity is negligible. In this case $\sqrt{LK} = \sqrt{\lambda\mu}$ where λ is the conductivity and μ the permeability of both the metal and the air. Hence the velocity of light in this case at least is always equal to $1/\sqrt{\lambda\mu}$, and the limitation that both are unity is unnecessary.

Engineers cannot have a better guide than Prof. Steinmetz. His engineering intuition and experience enable him to surmount mathematical difficulties which would prove insuperable to the mathematician with no extraneous guides to help him. This book opens a new chapter in engineering.

A. R.

High-Speed Dynamo-Electric Machinery. By H. M. Hobart and A. G. Ellis. London: Chapman & Hall. Price 25s. 6d. net.

This work deals with the design of generators for coupling to turbines. An important point which the authors make in their introductory chapter is that when designing a machine for a given output, the higher the speed adopted the smaller and therefore less costly the machine; further, that as the speed is increased, we finally arrive at a speed at which, owing to mechanical and other difficulties, the cost begins to rise again, so that for any given output there is a certain economic speed, and this speed is lower for continuous-current machines than for alternators. This question of the economic speed is one which the authors keep before them throughout the book.

In the second chapter the coefficients of output, weight and cost are treated. These coefficients are useful as a basis from which to start a design, and most designers now make a point of having a good collection of them.

In the formula for the output coefficient, which is based on the linear dimensions and speed of the machine, the authors introduce two new values, α = the ampere conductors per unit of length of armature periphery, and β = the average magnetic flux density in the air-gap.

The weight and cost coefficients are taken on the gross length of armature and the square of its diameter, and are principally useful for making rough comparisons, and possibly rough preliminary estimates of weight and cost.

In the third chapter four methods are given for estimating the temperature rise of machines, the results of the four methods being plotted as curves. These curves seem a little discordant, and it would be an advantage if the authors could see their way to supplement them with some experimental figures.

Chapter IV deals with materials, their magnetic and electric qualities, relative cost and mechanical strength, the latter an important point in high-speed electrical machinery, in which the centrifugal forces are so considerable.

The first four chapters form Part I of the book. In Part II the design of alternators is dealt with, the authors, for the sake of variety, departing from the usual custom of taking continuous-current machines first. In this portion of the book each detail of design receives the authors' usual thorough treatment, and complete tabulated figures are given of several designs. The mechanical stresses in rotating field systems due to the centrifugal forces receive a chapter to themselves.

Part III treats in an equally thorough manner the design of continuous-current machines. Owing to the difficulty of designing continuous-current generators of very high speed for large outputs, the authors propose a direct-current generating plant, in which a turbo-alternator supplies current to a rotary converter, which supplies the circuit with direct current of the required voltage.

In the final chapter brushes and brush-holders are treated, and the respective merits of carbon and copper brushes are discussed. This is a subject in which interest is beginning to be aroused, and it is not at all improbable that in the near future a return will be made to metal brushes in some form.

This book having apparently been written in the first place for American readers, the units of money are in dollars, and the metrical system of measurement is used. The value of the book to English readers would be somewhat enhanced if, in another edition, the measurements and quantities were given in English units also.

Electric Lamps. By Maurice Solomon. London: A. Constable & Co. Price 6s. net.

Mr. Solomon explains in the preface that he has been engaged in the manufacture of, first, Nernst lamps, then carbon-filament lamps, and finally, after a brief digression into tungsten filaments, arc lamp carbons, so it is evident that he is well qualified, as far as experience goes, to write this book.

The first chapter discusses the aims and objects of illumination. The second, entitled "The Production of Artificial Light," treats of such interesting things as black-body radiation, emissivity and selective radiation.

Chapter III is entitled "Photometry." The laws governing photometric measurements are very clearly explained, and a few typical photometer heads are described. We note that the flicker head is objected to, on the ground that it has not yet been proved to measure equality of illumination.

Chapter IV—"Methods of Testing"—discusses distribution curves, mean spherical candle-power, and so on. The unfairness of comparisons based on mean horizontal candle-power only is insisted upon, even for lamps of the same class, as their reduction factors frequently vary during life.

The fifth chapter describes the process of manufacture of carbon-filament lamps; the sixth chapter treats of Nernst lamps, and the seventh of metal-filament lamps.

Chapter VIII is entitled "The Electric Arc," and is mostly a clearly expressed *résumé* of Mrs. Ayrton's historical researches. The next chapter, on "Arc Lamp Carbons," is well written, and includes some very interesting tests and comparisons.

Chapter X is about arc lamps, and Chapter XI briefly touches upon the magnetite arc, mercury-vapour lamps, and the Moore tube light.

Finally, a chapter is devoted to discussing the relative merits of different types of lamp, especially with regard to cost of operation.

Verdict: A mostly interesting book, clearly expressed, and written by one evidently familiar with his subject.

ELECTRIC LAMP TAXATION IN GERMANY

The German Parliament has now approved the new taxes on electric lamps and gas mantles, which will come into operation at the commencement of October. It is estimated that this new source of taxation, of which details are given below, will yield an annual income of £1,000,000.

Scale of Taxes on Lamps.

Consumption.	Carbon-filament lamps. d.	Metallic-filament lamps, Nernst burners and other glow lamps. s.	d.
1. Up to 15 watts	⅝	0	1¼
2. Over 15 watts to 25 watts ...	1¼	0	2½
3. " 25 " 60 " ...	2½	0	4 8
4. " 60 " 100 " ...	3¾	0	7¼
5. " 100 " 200 " ...	6	1	0

Carbon-filament lamps which have a higher consumption than 200 watts are subject to an additional tax of 3d. each for each further 100 watts or portion thereof, and metallic-filament lamps, Nernst burners, &c., are liable to a further impost of 4·8d. per lamp for each further 100 watts or portion thereof. The tax on mantles for incandescent gas lighting is 1½d. each.

The tax on pure carbons for arc lamps is 7·2d. per kilogram, and 1s. per kilogram for carbons made of carbon with illuminating admixtures or other carbons. Burners for mercury-vapour and similar lamps up to 100 watts are to be taxed at 1s. each, with an addition of 1s. per lamp for each further 100 watts or portion thereof.

The tax is to be paid by the manufacturer by the employment of revenue labels on the packages, before the finished and packed products are removed from the rooms of the place of production. In the case of imported articles, the tax has to be paid by the importer on clearing the Customs House, or, if this does not take place, it has to be paid within a period of three days after reception. The Federal Council will make detailed regulations respecting the amounts of the value of the revenue labels, their shape, style, sale and the method of their use. The council will determine the conditions under which compensation is to be allowed in regard to the amount of taxes paid in the case of revenue labels which have become unuseable; and labels which are not used in the prescribed manner will be regarded as not used. The employment of revenue labels is not requisite if the taxable articles are notified for export under official supervision before removal from the rooms of the place of production. The payment of the tax can be postponed for three months without guarantee, but it can be deferred for six months when a guarantee is given. Stock under a revenue seal can be considered as security.

The manufacturer will receive compensation for the taxes in the case of articles which are placed at his disposal by the recipient as being unserviceable. This can be granted in a lump sum, which will be calculated according to the taxation value of the revenue labels used by the manufacturer in the course of the year.

Articles liable to taxation are only allowed to be placed on the inland open market from the producing establishments and from abroad when they are contained in completely closed packages, which cannot be opened without indications that can be recognised. Packing according to regulations has to take place before admission to liability to taxation, and is considered as a part of the manufacture. The Federal Council will determine the method of packing and the size of the admissible packages, on each of which the contents are to be stated. In the case of incandescent electric lamps and mercury-vapour and similar lamps, the package is to indicate the number contained and the consumption in watts; in that of gas mantles, the number; and in that of arc lamp carbons, the weight of the carbons, their respective classes, whether pure carbon or carbon with illuminating admixtures, together with the designation of the packed articles (trade mark) and a denotation from which the revenue authorities can determine with certainty the person liable to taxation. In the case of imports, the packing can be permitted to take place inland under special measures of security. The Federal Council is empowered to take special measures of security in regard to the retail trade of taxable articles.

The question of exemption from compulsory packing is vested in the Federal Council. It is provided, for instance, that in the case of its being proved to be required, the council can release the manufacturer from the compulsory packing and the use of revenue labels on the basis of special book-keeping and the otherwise requisite measures of security. Imports which are not intended to be placed on the market can also be exempted from the use of revenue labels and compulsory packing.

The revenue labels are to be kept intact on the packages until the latter are required to be opened for retail sale or are handed to the purchaser. Opened or wholly or partly emptied packages are not allowed to be filled again with taxable articles. The retail sale is only permitted to take place with or out of the accessory wrappers. Empty wrappers, without previous removal of the revenue labels, are not allowed to be returned either to manufacturers or merchants, nor to be accepted or used again by the latter. Dealers who receive articles which are not packed in the prescribed manner, or which are not designated or provided with revenue labels, have to make a report to the revenue authorities within three days.

ARBITRATION OR LITIGATION?

[BY A LEGAL CONTRIBUTOR.]

The Arbitration Act of 1889 has been in force for over 20 years. Dissatisfied with the tedious delays occasioned by having recourse to the recognised tribunals of the land, commercial men sought for some tribunal, recognised by law, in which the numerous disputes arising in trade could be determined with the least possible delay and expenditure, and with impartial justice to all concerned; and in answer to this appeal the Legislature passed an Act which recognises the Court of Arbitration as a tribunal of which the decrees can be enforced. It is true that thousands of arbitrations take place in the course of the year, to the satisfaction of the parties interested therein; and it is also true that time and money are saved by recourse to the tribunals. But a glance at the law reports is sufficient to show, in the first place, that courts of arbitration often lack that "finality of decision" so essential to every court of justice; and in cases where the arbitrator's decision must be regarded as final, and incapable of being reopened by the party who thinks himself aggrieved, serious injustice is sometimes done.

The statute to which allusion has already been made was passed in order to reduce these evils as much as possible. Ordained to enable the parties to a commercial contract to have recourse to their own domestic forum, it gives power to any judge of the High Court to stay any action brought before him which has for its object the settlement of a dispute which should be submitted to arbitration. In this roundabout way the parties are compelled to seek justice, or, at any rate, a decision upon the questions at issue at the hands of their self-appointed judges.

It is easy, of course, to criticise the reference of matters to arbitration, and to suggest that parties are better advised to go to law; but cases are sometimes referred to arbitration without the consent of the parties. Thus, if a case which is coming before the courts in the ordinary way involves matters of long and complicated scientific inquiry, the Judge will refer it either to an Official Referee or else to arbitration, without the consent of the parties. We propose, however, in this article to confine ourselves to those cases in which arbitration is voluntarily resorted to by the parties.

One would have thought that the primary objects of an Arbitration Act should be (*a*) to render the decision of an arbitrator final, except in cases of obvious injustice; (*b*) to compel parties to have recourse to their agreed tribunal, however constituted. Certain recent cases, which it is proposed to consider, show that unless the parties give close attention to the wording of the submission clause in their agreement, one or other of them may find his right to call for arbitration defeated at a critical moment.

A party to an arbitration—or, at any rate, the party against whom the award is made—sometimes forgets that by fleeing from a court of justice to a tribunal of his own, he well-nigh forfeits all right of appeal. It is some consolation to a disappointed litigant that he can proceed to a higher court; the first reflection of a defeated party in an arbitration is that he is stopped from carrying his case any further.

"In references by consent the general rule is that, as the parties choose their own arbitrator to be the judge in the disputes between them, they cannot, when the award is good on its face, object to his decision, either upon law or the facts." Such is the conclusion arrived at by a learned text-book writer upon the law of arbitrations and awards. Let us consider a few cases which illustrate the hardships inflicted by the rigorous enforcement of this doctrine.

In a case which was heard in 1847, the plaintiff sued for the price of goods sold and delivered. The defendant pleaded the Statute of Limitations, which, as is well known, prevents a claim of this kind being made after six years have elapsed. The arbitrator refused to abide by the law of the land. He decided in favour of the plaintiff for the full amount, and the Court declined to disturb his finding, apparently because the mistake was not manifest on the face of the award.

In cases where disputes are referred to one arbitrator, as distinguished from those in which the tribunal consists of two or more members, a man voluntarily places his interests in the hands of one man, who may or may not be biased, and a mere suspicion that an arbitrator is biased does not invalidate the award. It not infrequently happens that disputes between building owner and builder are referred to the architect; while, to take a more pointed case, questions arising between a railway company and a contractor are often determined by the company's engineer. Far be it from us to suggest that any engineer of standing would allow his natural leaning towards his employers to affect his better judgment; but still there is an element of risk, which the contractor is almost compelled to undergo. To consider an instance: We recollect a case in which an agreement between a company and a contractor contained the ordinary clause, that any dispute should be referred to the decision of the company's engineer. A dispute arose, and the engineer, in a letter to the contractor, expressed an opinion upon it. The company proceeded to arbitration, appointing the engineer as arbitrator in accordance with the submission. The contractor brought an action. Mr. Justice Kekewich restrained the arbitration, on the ground that the arbitrator had committed himself beforehand, and had not kept an open mind. The Court of Appeal, however, discharged the injunction, and ordered the arbitration to proceed, on the ground that the engineer had only expressed his opinion as engineer, and that as the contractor had submitted by his contract to refer all disputes to the engineer, who would necessarily have to express his opinion on disputes as they arose, he must abide by his contract.

In fact, as the law at present stands, in order to upset an agreement to refer to an arbitrator who, from his position, is necessarily interested, the party must attack the character of the arbitrator to the extent of showing that he will not act fairly; and it has been decided that the mere fact that he will have to adjudicate on his own or his son's professional conduct is not sufficient to upset the agreement to refer matters to arbitration.

It cannot be denied, however, that the Courts always endeavour, as far as possible, to see that the spirit as well as the letter of an arbitration clause is attended to by the parties. Thus a policy of insurance contained a clause which empowered the insurance company to nominate an arbitrator. They nominated their own manager. The Court held that such a proposal was monstrous, and gave them seven days to appoint another arbitrator, or in default ordered rescission of the submission.

Seeing that submission of all disputes to the arbitrament of one individual is open to these grave objections, business men are wont to select a tribunal of three, two of whom are appointed by the parties, and the third by the two so appointed. Whether the two arbitrators so appointed act as advocates or not, detracts but little from the efficiency of a court so formed; for the third member, who is appointed by persons who have but an indirect interest in the dispute, will generally be quite impartial.

But what recognition has the Arbitration Act of 1889 conferred upon a tribunal of this kind? The answer to this question, which affects the construction of a clause in nearly every charter party, serves to show that, to use the language of Lord Justice Lindley, there is a serious blot in the Act.

In order to understand the way in which the Arbitration Act is defective in this particular, it is necessary to go back a step or two. Arbitration clauses refer disputes either (*a*) to a single arbitrator; or (*b*) to two arbitrators to be selected by the parties, the arbitrators appointed having power to appoint an umpire in case of disagreement; or (*c*) to three arbitrators, the third of whom is appointed by the first two, who are themselves nominated by the parties.

The Arbitration Act of 1889 (by Sub-secs. 5 and 6), makes provision for cases in which the parties fail to agree upon an arbitrator, or in which one or other of them refuses to appoint his arbitrator. In such cases the party willing to proceed to arbitration may, after certain formalities, himself make the appointment; but, by an extraordinary omission, no mention is made of a Court consisting of three arbitrators. What must happen, supposing one party to an agreement of this kind fails to make an appointment? The discussion of this point in a recent case discloses a serious defect in the Arbitration Act of 1889; a defect, moreover, which practically renders ineffectual every arbitration clause now in existence, which refers disputes to three arbitrators. To introduce this point in an intelligible manner, it is necessary to refer to a case which was heard in 1890.

A charter party contained the following clause:—"Should any dispute arise between the owners and the charterers, the matters in dispute shall be referred to three persons, one to be appointed by each of the parties hereto, and the third by the two so chosen; whose decision, or that of any two of them, shall be final; and for the purpose of enforcing any award, this agreement may be made a rule of Court." The Arbitration Act was in force at the time. A dispute having arisen, the shipowners gave notice to the charterers that they had appointed an arbitrator, and called upon them to appoint one also; but the charterers took no notice, and appointed no arbitrator. The shipowners applied for and obtained an order that the charters should appoint an arbitrator upon the terms of the submission, and this order was upheld by the Divisional Court. The charterers appealed. The Court of Appeal, consisting of Lords Esher, M.R., Lindley and Bowen, L.JJ., came to the unanimous conclusion that they had no power to direct either party to appoint an arbitrator, and that the fact of the submission being made a rule of Court had no bearing upon the question. They also decided that Sub-secs. 5 and 6 of the Arbitration Act, 1889, had no application to a reference to "three arbitrators as distinguished from two arbitrators and an umpire." Upon this point Lord Justice Lindley said: "It certainly looks like a blot in the Act that, by reason of there being no provision as to three arbitrators as distinguished from two arbitrators, the submission should be irrevocable."

The following conclusions can be drawn from the above case:—(1) The Court has no power, whether by virtue of the Arbitration Act or otherwise, to order either party to appoint an arbitrator. (2) That the Arbitration Act, 1889, had no application to a tribunal consisting of three arbitrators. (3) In a case where three arbitrators are to be employed, the only remedy against a party who refuses to appoint an arbitrator is an action for breach of agreement.

Whatever other theoretical conclusions may be drawn from this case, its practical result was that the Court refused to enforce the settlement of disputes by arbitration, and the shipowners were told that they might sue for the breach of agreement to arbitrate. It would be interesting to see what damages would be awarded in such a case, and more interesting still to be informed upon what basis they would be calculated.

Until quite recently the above case has merely been regarded as a satisfactory authority for the proposition that the Court has no jurisdiction to compel either party to appoint an arbitrator. It has also been quoted in support of the statement that a reference to three arbitrators is without the pale of the Arbitration Act, 1889. A case which was decided in the summer of this year throws more light on the question. An action was brought by shipowners against charterers for freight alleged to be due under the terms of a charter party. The charter party contained an arbitration clause couched in precisely similar terms to those under discussion in the former case. On the application of the defendants, who were ready and willing to appoint their arbitrator, and proceed to arbitration in accordance with the terms of the submission, Mr. Justice Bigham made an order under Sec. 4 of the Arbitration Act, 1889, staying the action. The shipowners appealed to the Court of Appeal (A. L. Smith and Vaughan-Williams, L.J.J.). After dealing with the case mentioned above, and having pointed out that it only decided that the Court had no power to compel a party to a submission to appoint an arbitrator, Lord Justice A. L. Smith, in alluding to Sec. 4, said:—"There is nothing in the words of this section to show that the section does not apply to a submission to arbitration in which there are to be three arbitrators. Nor is there anything in the definition of "submission" which is given in Sec. 27 of the Act to lead to such a conclusion. The present case seems to me to fall exactly within the provision of Sec. 4, and the learned Judge had jurisdiction to make the order against which the plaintiffs are now appealing." Lord Justice Vaughan-Williams concurred, and the appeal was dismissed.

There is no reason to doubt that the above decision was correct, for a submission within the Arbitration Act means "a written agreement to submit present or future differences to arbitration, whether an arbitrator is named therein or not." But what an extraordinary state of things results from placing the decision in this case side by side with that in the first case! The question whether a reference to three arbitrators shall or shall not be enforced depends entirely upon the taste and fancy of one of the parties to the agreement. If he is of opinion that an action-at-law would better suit his purpose, he may refuse to appoint an arbitrator, and the Court has no power to compel him to do so; while his opponent, anxious to proceed to arbitration in accordance with his agreement, cannot do so, but is compelled to issue his writ in a Court which it was his original purpose to avoid.

City men have been driven to arbitration by the law's delays and by dread of the technicalities with which the wheels of legal machinery are said to be clogged. Here was a statute which purported to establish tribunals unhampered by technical rules, to which both parties might be compelled to proceed. It now appears that no party to an agreement can be compelled to have recourse to a tribunal which, upon the face of it, appears to be the most satisfactory of all, and to which, moreover, he has solemnly agreed to go. Surely this is a serious blot in the Arbitration Act of 1889.

This anomaly becomes all the more absurd when it is pointed out that a reference to two arbitrators and an umpire will be enforced by the Courts. This tribunal, which is referred to in the schedule to the Arbitration Act, is unsatisfactory in the extreme. The schedule says:—"If the reference is to two arbitrators, they may appoint an umpire at any time within the period during which they have power to make an award." Surely the method of procedure here prescribed is not well calculated to bring about the appointment of an open-minded Court. Arbitrators named by the parties often seem to think, notwithstanding the objectionable nature of such a course, that they are to represent their respective nominators, and act rather as advocates than judges; while the umpire assumes that his active interference is not to commence until the others have differed finally. References of this sort have been strongly condemned by the judges themselves as "being senseless and mischievous, founded on a totally wrong principle, expensive in their operations, and constantly ending in failure and disappointment." On the other hand, upon a reference to three or more arbitrators together, when there is no clause providing for an award made by less than all being valid, each of them must act personally in performance of the duties of his office as if he were sole arbitrator; for, as the office is joint, if one refuse or omit to act, the others can make no valid award. As they must all act, so they must all act together—be present at every meeting and at the examination of every witness. And, even supposing that the decision of the majority is to be final and binding, their close attendance is assured, for the arbitrators appointed by the parties must ever watch the interests of their "clients," and the umpire, who is *ex hypothesi* an impartial person, is not likely to absent himself for any sinister motive. And it has been decided that the decision of such a tribunal must be the result of their joint deliberations.

Allowing that the Arbitration Act has failed in this very important particular, it must be admitted that the danger which is likely to arise is not very serious, for, as a general rule, the parties will each be anxious to arbitrate and abide by the award of their own Court.

Other signs, however, are not wanting to show that, although "finality" and "speedy justice" are the avowed objects of lay tribunals, the disappointed party is frequently compelled to return to the Supreme Court, and so to pile litigation on top of arbitration, without the added satisfaction of obtaining what he looks upon as justice in the end. Legal procedure, however we endeavour to simplify it, must always be attended with some troublesome rules, which too often escape notice until too late.

Let us see how some of the rules under the Arbitration Act work in practice. It is an established principle that an arbitrator cannot be directed by the Court or a judge to state a special case for the opinion of the Court under Sec. 10 of the Arbitration Act of 1889, when no request or application to state a case has been made before the award has been made and the arbitration concluded. In a recent case, the Court took the opportunity of saying that an award will not be remitted for the reconsideration of an arbitrator upon the sole ground that he has made a mistake in law—the alleged mistake being that he had entirely omitted to consider or apply the ordinary rules of law as to the measure of damages. In considering the effect of Sec. 19 of the Arbitration Act, 1889, Lord Justice A. L. Smith said: "What is the meaning of that section? Without any authority upon the question, I should say that it is applicable only to a case where the question of law is raised during the pendency of the reference, and that a party cannot wait, and then, after the whole matter has been decided and finished in the arbitration, ask that a special case shall be stated." And later on, he said: "I, for my part, have always understood the general rule to be that the parties took their arbitrators for better or for worse, both as to decisions of fact and decisions of law."

The reports of cases arising out of arbitration usually contain but a short statement of the facts of the dispute, and scarcely ever contain any note of the reasons put forward by arbitrators for their decision. This absence of any *ratio decinendi* from an award leads one to suspect that the judgment of a Court of lay arbitrators is not always based solely upon matters which are brought to light at the hearing by the parties or their representatives; while a refusal on the part of arbitrators to state their reasons makes it doubly hard for a dissatisfied party to obtain a review of the matter in a superior Court. In a case which was heard in the Court of Appeal in 1897, the directors of the Liverpool Corn Trade Association had acted as an appeal court for the final settlement of a dispute in connection with a delivery of corn, which had already been determined by arbitration. The directors upheld the award, stating their reasons thus: "After careful consideration of the appeal, and of the application to state a case for the opinion of the Court, and of the reasons for such application, I and my co-directors were of opinion that the award of the arbitrators should be confirmed, that we were competent to deal with the case, and that there were no grounds or necessity for seeking the assistance of the Court." This resolution was passed, in spite of the fact that application for a special case or for an adjournment had been made in order to allow one of the parties to bring a point of law before the notice of the Court.

It may be that, if it is agreed on all hands that the award of the arbitrator shall be finally binding on the parties, however erroneous on points of law or fact, the arbitrators should be careful to avoid giving reasons. Upon this point the principle to be collected from the later case is plain, viz., that the Courts will not look at anything for the purpose of reviewing the decision of an arbitrator upon the matter referred to him, except what appears on the face of the award, or some paper so connected with the award as to form part of it. We recollect a case which arose out of a dispute relating to a ship at sea, where the arbitrator delivered with his award a paper stating his reasons. The Court treated his statement as embodied in the award, which was eventually set aside on the ground that the arbitrator had acted on some marine law, and not on the law of England, in deciding the question of damages.

ELECTROMOBILES FOR TRAMWAY SERVICE.

The rapid extension of automobile fire services in Germany has shown the electric car to be better adapted than any other car to serve as an auxiliary vehicle. Comprehensive comparative tests against petrol and steam cars, have demonstrated the superiority of electromobiles in this special field.

Similar conditions to those of fire-brigade service prevail in connection with tramway operation, there being likewise a demand for cars which in the case any breakdown on the track will quickly arrive on the scene with the emergency crew and their tools. A specially advantageous feature in this connection, is that the care of electromobiles and their accumulators can be entrusted to men employed in other branches of the service who possess the necessary technical knowledge for their operation and maintenance.

The cars described below have been designed and constructed by the Siemens-Schuckert Works as the result of their extensive experience in tramway operation.

The electrically-propelled tower car (fig. 1.) carries a substantial frame capable of being moved up and down by a side lever. This frame is mounted on a very stable chassis, which even at maximum speed, and when traversing curves does not show any tilting tendency. On the frame is mounted a platform turning on rollers, which affords a radius as large as possible. Its lowest level is 3·17 m. and the highest 4·87 m. above the ground. A convenient ladder gives easy access to the platform. The interior of the frame contains a large case which serves for carrying tools and spare parts. The car accommodates two men besides the driver.

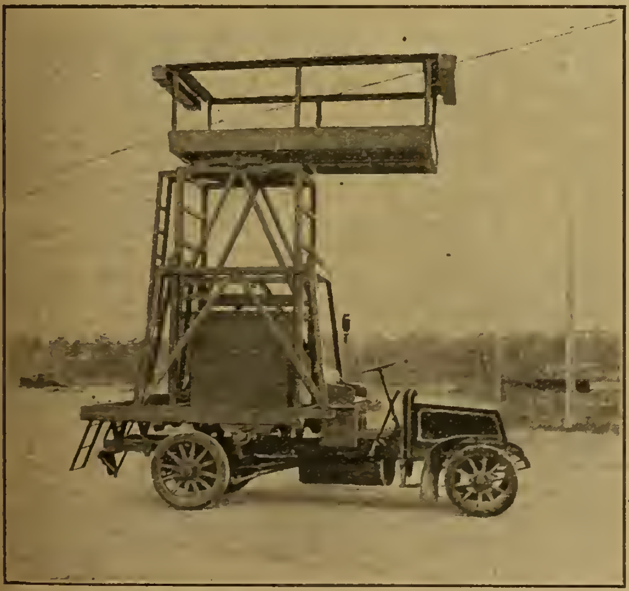

Fig. 1.—Electrically-propelled Tower Wagon.

The electrically-propelled car represented in figs. 2 and 3, carries a large and stable standing ladder, which when extended is 5 m. in height. This ladder is readily erected or folded up, and allows any part of the tramway trolley wires to be reached. A number of auxiliary tools, such as capstans, levers, crow-bars, scissors, arc lamps, fire-extinguishing implements, &c., are provided for use in case of accident.

Four seats are provided on each of the two longitudinal sides of the car for the crew, as well as two beside the driver and two at the back, so that the car may carry as many as 12 men, Instead of fitting these seats outside the car, they may be arranged like those of a 'bus, in the interior of a special structure.

The chassis is especially remarkable for the ease with which the battery, arranged in a readily accessible position in front of the driver's seat, can be exchanged. The single-motor system in this case allows of a more effectual protection of the motor against dirt and damage, while the efficiency of the motor on bad roads and steep gradients, in spite of heavy loads, drops only slightly. This is due to the low ohmic resistance of the motor and the fact that the efficiency of the toothed gear rises as the load increases.

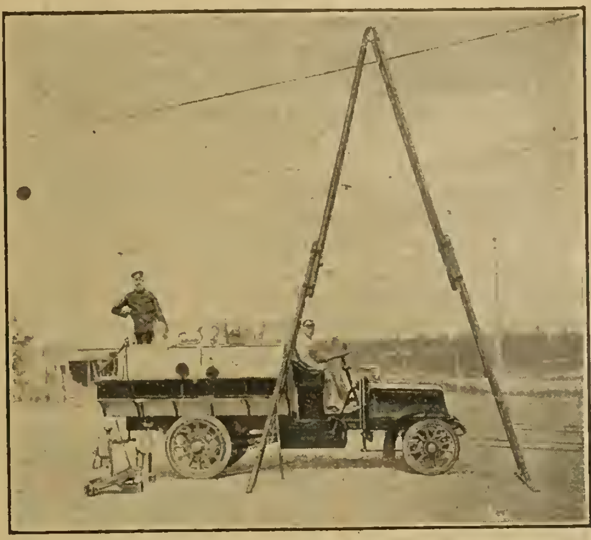

Fig. 2.—Electric Ladder Wagon; Ladder in use.

Tests made on the motor have shown that its efficiency is well maintained in the case of considerable overloads, being as high as 80 per cent. at 80 volts, with a torque three times as high as the normal figure. In the case of a lower working pressure (35 volts), the two halves of the battery being connected up in parallel, the motor is able safely to yield for short periods seven times its normal torque.

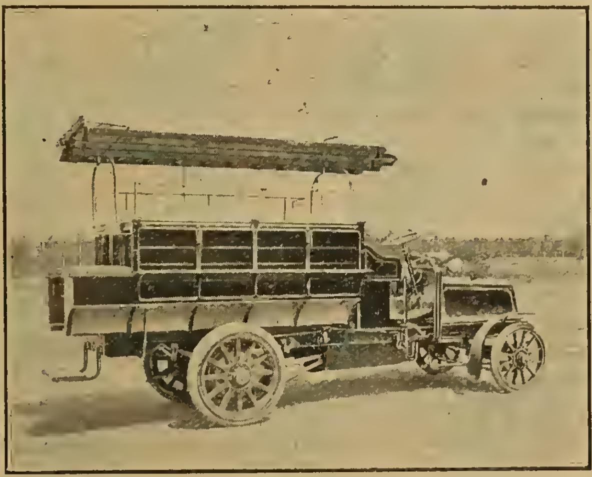

Fig. 3.—Another Form of Ladder Wagon.

Carbide of Calcium.—The Brandenburg Carbide and Electricity Works Co. has been registered at Berlin with a capital of £175,000 to take over the undertakings of the Brandenburg Carbide Works and the East German Water Power Co. for the sum of £118,500 in shares. The balance of the share capital has been subscribed by various banks, including the Zurich Bank for Electrical Enterprises. In addition to continuing the production of carbide of calcium and calcium cyanamide hitherto carried on by the Carbide Co., the new company will develop the hydro-electric works in the district of Schneidemühl for the execution of contracts arranged by the East German Co.

Centrifugal Pumps.—A further order which Messrs. Jens Orten-Böving & Co. have received for centrifugal pumps manufactured to their designs by Messrs. Willans & Robinson is for two pumps to deliver 200 gallons per minute against a head of 535 ft. at 1,440 r.p.m. The main contractors for the work are the British Westinghouse Electrical and Manufacturing Co., Ltd., and the consulting engineers are Messrs. Rendel & Robertson.

WHAT IS THE "EXPRESSION" FOR "SUCCESS IN THE ELECTRICAL ENGINEERING PROFESSION?"

By "ARAMIS."

In all the numerous published letters and articles recently written by unsuccessful disappointed "engineers" bemoaning the want of sympathy on the part of the world in general, and of their individual employers in particular, not one such complainer has said anything about "human qualifications." It seems to be firmly fixed in the minds of at least nine-tenths of the men who are striving to attain success in the engineering profession that all that is required is to have a natural liking for pulling things to pieces (either actually or verbally), to study a little mathematics in a fairly intelligent way, and to know enough about electrical science and kindred subjects to be able to argue in a stupid sort of way about points which do not matter at all. On this knowledge they expect to attain to high positions. If they do not, they say it is because they lack influence; they never dream that they may lack ability, neither does it ever cross their minds that their knowledge may not be of the kind required.

The most difficult subject they, as a rule, know nothing at all about—never even suspect its existence—but without a good working knowledge of this subject, they will never be able to show what they are really capable of in the way of technical achievements. This subject is not taught in the technical institutions, nor is it heard of much outside them. To a few—the born leaders—it comes as a gift of Nature, but by careful study and observation it may be acquired by all, in a degree varying according to the ability of the student. This subject is a somewhat difficult one to define, but a perusal of what follows will show the reader what it embraces. It can, perhaps, be best expressed as the French express it, by "savoir faire," which is traditionally rendered into English by the word "tact," but this is a very weak translation. Taking the two French words "savoir," and "faire," and translating each separately, their meaning in combination becomes clearer. "Savoir"—"to know," "to have a knowledge of," "to understand"; and "faire"—"to do," "to arrange," "to manage." Their joint meaning may thus be expressed by "to have a knowledge of management."

It is just this knowledge which these "disappointeds" have not. It is just this part of their education which they have neglected—thinking that technical education being the greater includes the lesser, whereas technical education is in reality itself the lesser; consequently their estimate of the world and its ways is an inaccurate one, and their vision is blurred. They have neglected to get into right relationship with their fellows, consequently they are never able to give full expression to their technical ideas, because they are never able to rise to positions where their technical knowledge would be most useful. If, instead of going on studying hard at technical subjects which they may never want, these disappointeds, and others following in their groove, would devote some of their time outside business to intelligently reading history, classical literature (which is not necessarily dry and uninteresting), biographies of great men in all professions, and other subjects which would give them some idea of the relation of man to man, and of men to the world, they would be doing something to make themselves happier, more useful to themselves, and much more interesting to those outside the engineering business, who come in contact with them. Besides, they would be really in almost every case making a greater step towards the improvement of their positions, than if they continued technical study entirely. Of course, it is not suggested that technical study should be given up, but only that less time should be given to it until such time as each individual sees there is some likelihood of profound technical knowledge being of real use to him. The reading of subjects in which "man, and his ways and habits" are treated, will reflect itself in the reader's work, and improve his relations with those people with whom he has to deal, either as superiors, equals, or subordinates. Many a great man owes his life's success and the fortune and satisfaction it has brought with it, to his good relationships with other people, which have caused him to become a favourite and to be advanced from position to position, thus giving him the opportunity he wanted to show what things he was capable of accomplishing. It is just the lack of this opportunity which the disappointeds complain of, but let them give up the study of volts and amperes for a time and turn to the study of their fellow-creatures. If they apply themselves as assiduously to this study as they do to the study of technical subjects, they will find themselves gradually becoming more and more able to make and improve opportunities for themselves, and it will give them that knowledge of *savoir faire* which at present they despise, but of which their ignorance is keeping them down in subordinate positions for which their technical knowledge is already very much too great.

Some time ago, in one of the American technical papers, a great engineer, who is connected in an administrative capacity with companies employing many thousand men, stated that it was his constant experience that it was very much easier to hire "engineers" than "men;" by which he meant, as he went on to explain, that he found no want of technical knowledge among applicants or acting engineers, but nearly always defects in character, such as want of courage, initiative, ambition, imagination, tact, &c. These defects kept many otherwise brilliant engineers down in small positions. It is exactly the same with us here. Our "engineers" will persist in believing in technical education as the source of all good. Technical education, however, is only one of the many means by which men of strong character may attain success. If it is only by various forms of technical education that great names and large fortunes are to be made, how does it come about that men can build up huge retail businesses from small beginnings, as Lipton, Whiteley and many others have done? Their businesses cannot have been built on profound technical knowledge. They have been built up by great masters of *savoir faire*, masters instructed by Nature. Their mastery of this subject has made their dealings easy and pleasant to both the public and their staffs. Great leaders have always been remarkable for the good relationships existing between them and their subordinates. Take any one of these complaining disappointeds and place him in charge of a few men, and it will almost certainly be found that he cannot get the best results out of his charge; he either drives those he should coax, and so coaxes those he should rule firmly that they soon start leading him; or, by his tone and manner, he stirs up little dislikes in every one of them, and turns the whole lot against him.

In any case, few, if any, of the men are satisfied, and doing their best. This applies to staff or workmen. With all their technical skill they have none of that knowledge of which all management, either of staff or men, is the practical application. If they so easily stir up dislikes in subordinates, it is also highly probable that they equally stir up dislikes in those above them, but as these latter are men of character, this has only the effect of keeping the man down, and there is no active manifestation of the dislike such as comes from below. Consequently it is never brought to the man's notice that it is simply his want of tact, and ignorance of *savoir faire*, that is keeping him back. The overtrained technical man is usually strongly given to forcing his own opinions down the throats of all those who have dealings with him. This, with his usual crass ignorance of anything not "technical," causes him to be shunned and detested by all except those other technicians who are in his own groove. The study of humanity does not mean that he must become a Socialist—if he studies the subject intelligently there will be no fear of his doing that—but it does mean that he will find more interest in his daily work, that he will gain tact, that he will soon begin to take the lead among the technical men he is working with; and this is the first step towards a better position. Why does such study do all this? Because, by broadening the mind and the outlook on life, by giving correct ideas of man's relations to man, it strengthens the character and gives it force, determination and energy: qualities rare among "technical" men, but without which no great success is possible.

Force of character, by making a way for itself, increases the value of any knowledge with which it may be associated, for it is obvious that it is the knowledge of the capable forceful one that will be used, while the knowledge (perhaps greater) of the less energetic one will lie idle, and be of no more use to its possessor, or the world in general, than if it never existed.

Force of character stands outside the brackets in the expression for success—all other qualifications are only terms inside them. Thus, for the benefit of those who only appreciate facts when set out in a formula—

Success in the engineering (or any other) profession

= Force of character (A + B + C + D + E + . . .),

where A = Technical knowledge,
B = Practical experience,
C = Natural aptitude,
D = Commercial knowledge, and so on.

LEAKAGE CURRENTS.

By "H. P. M."

Much has been said of "leakage currents," and still a large field is left open to be explored; the disastrous results which have from time to time shown themselves, go to prove that a real danger does exist, and should be fought with every care, for there are a good number of towns, whose electrical installations have been in use for some time and who have not in the initial stages of the undertaking been sufficiently acquainted with the dangers of these leakages to protect their mains, or take the precautions which have been taken in the more modern systems.

It is only intended in this article to give a short description of some of the damage its and causes, which have been observed by the author in actual practice.

One case which was brought to his notice a short time ago had several interesting features. The system was a three-wire direct-current one; the cables, lead-covered and armoured, laid direct in the ground, the distributors being three single cables; the leads had been made continuous by bonding, the bonding being done by the clamping of the joint box on to the lead, by drilling the gland on the box slightly smaller than the diameter of the lead.

In the course of time the tramways systems was electrified, and shortly after the troubles commenced on the lighting mains. Naturally the tramway return currents were blamed for this, and investigations were commenced on this basis, the result being that additional return feeders were laid, the return feeders being connected to the nearest point of the rails to the station; but the troubles still continued, the mains frequently breaking down to earth, services being burnt out, and general interruptions occurring; the earth currents gradually became larger on each occasion until as much as 600 amperes out of balance were obtained. This large out-of-balance showed clearly that the insulation of the neutral wire was in very bad condition, and it was afterwards found that no less than 18 absolute dead earths were cleared off from the neutral cable; this clearing of the faults on the neutral obviated the danger to the continuity of supply, for any leakage had then to return to the earthed neutral at the station which was controlled by a resistance.

After these neutral faults had been cleared up it was decided to search closely for the source of the trouble, for after the first hour of 600 amperes going to earth anything could be accounted for. It was obvious that the one great fault had been in neglecting to keep up a proper system of testing the neutral wire, which had, no doubt, broken down to earth some time previously to the faults occuring on the outers, and it was eventually found that a leakage current had been circulating on the leads of the cable due to the faulty connecting up of the earth connection on the neutral wire at the station; this had been coupled to the rail bus-bar of the traction system under the impression that it was at earth potential, whereas it was at a varying point between 5 and 15 volts below earth the whole of the time the tramways were in operation, according to the amount of load which happened to be on at that particular time, thus causing a local circuit as shown on fig. 1.

The path of the current from the rails to the fault at the neutral would naturally be the path of least resistance, say at a point where the rails and mains were brought close together, such as a road crossing; the leads of the cables then would carry a current of from 2 to 6 amperes (tested) to the neutral fault, and this current flowing along the leads and through the faulty bonding at the joint boxes, eventually burnt away the lead, and thus brought on the faults.

A great deal of damage may also have been caused previously to the tramways being electrified by the neutral fault alone, for if the insulation of the neutral had been broken down, a local circuit would have been set up between the neutral fault and the earthed neutral at the station due to the difference of potential at the two points of the neutral according to the load; the author measured this leakage current up to ·3 ampere in places where a small section of cable was used for the neutral.

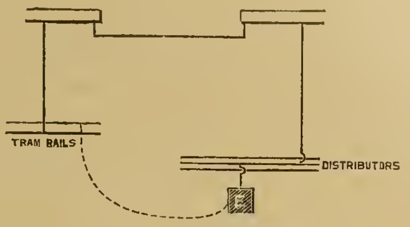

Fig. 1.

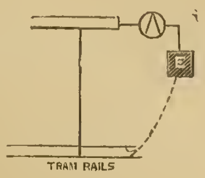

Fig. 2.

Another case which was brought to his notice was on a similar system—the troubles commencing shortly after the tramways had commenced, and due to the wrong connections on the traction switchboard, the ammeter for measuring the current from rails to earth having been connected from the rail bus-bar and earth at the station as in fig. 2; the result was an additional return feeder along all conducting materials between the rails and the station, the chief conductor unfortunately being the leads of the lighting feeders.

Another system with which the author is acquainted gave similar troubles, which were put down to tramway leakage. The matter was investigated, but it was some considerable time before the source of the current could be located; it was eventually discovered that one of the return feeders had been damaged just outside the cable trench, and was making a good earth connection, thus causing the earth to be used as a parallel return feeder. This points to the importance of keeping a careful test upon the return feeders, for the positive feeders quickly show when they are in trouble.

A case which came under the author's observation was one in which the insulation of a lead-covered cable was found to be gradually dropping; in this case it was a feeder, on a direct-current system, and it was at last considered necessary that the cable should be inspected; upon inspection it was found to be covered with a white corrosion. The feeder was lead covered, with a layer of impregnated jute on the lead, and was laid in a wooden trough filled with pitch. On examining the cable more closely, it was found that the corrosion was in layers corresponding to the wrapping of the jute covering, giving the appearance of the pitch being the cause of the trouble, and only attacking the lead where it could get between the layers of jute; but on further investigation, it was found that the corrosion was only taking place on the feeder where it was laid parallel to the distributors. In places where there were no distributors, no sign of any corrosion could be traced, but it may also be noted that in each case tramway rails ran parallel to the feeder, so that it appeared to be due to no effect of the return current from the tramways. On searching further into the matter, it was found that the neutral of the distributors alongside of which the feeder was laid had several small leakages, this pointing to the fact that the corrosion was apparently due to this small current having some direct effect upon the lead, or else acting upon the lead due to some foreign matter in the compound with which the jute was impregnated, or else in the pitch.

It will, therefore, be seen from the few instances given above that the troubles arise not from the cables in which the danger is supposed to lie, but in those cables which, by reason of their being nominally at "earth potential," are treated with disrespect, and in a great many cases with contempt.

WELDING RAIL BONDS.

From the earliest days of electric traction with rail return, the bonding of the rails has been a troublesome and costly operation, and, even when carefully carried out on the most approved methods, it has always remained a possible and probable source of trouble and expense, owing to the liability for moisture to find its way between the contact surfaces and to corrode them, thus introducing resistance into the return circuit to a serious extent. The only absolutely reliable method of completely obviating this trouble is that of actually welding the bond to the rails; this expedient has not up to the present been adopted in this country, so far as we are aware, though the equivalent process of welding the rail joints has been used to some extent, but it has been successfully employed in the United States for some two years, and the results have proved so satisfactory, we are informed, that the Forest City Co. has decided to introduce the system here, and has just issued a booklet in which particulars of the system are given.

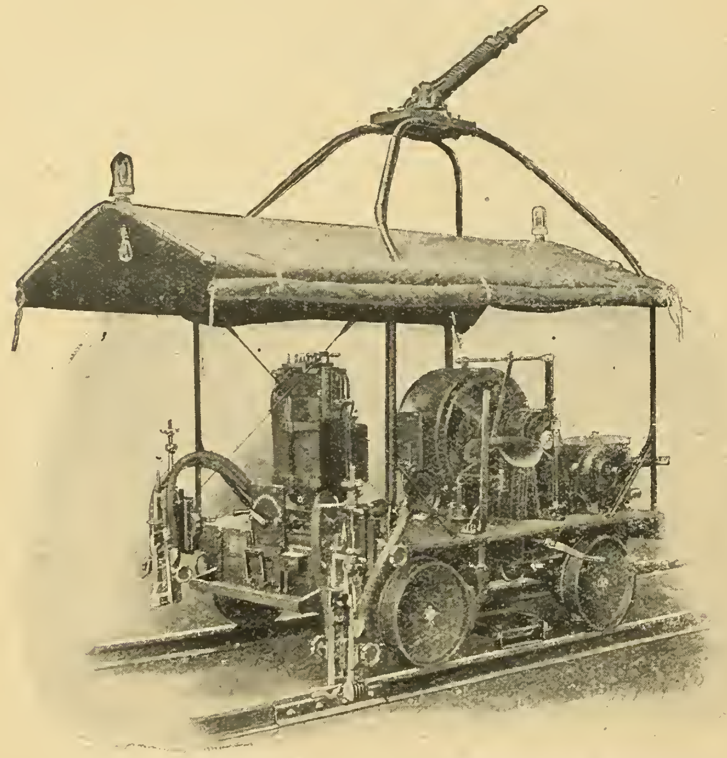

Fig. 1.—Combination Car and Apparatus for Electrical Welding.

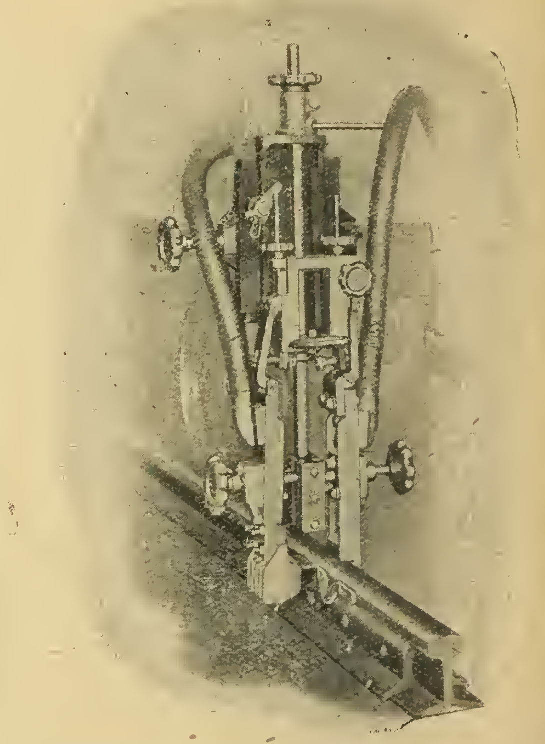

Fig. 2.—Electrodes in Position for Electrically Welding Bonds to the Rails.

Two methods are employed, electric welding and copper welding, both of which are fully protected by patents. The former process resembles that of electrically welding the joints of the rails, and is carried out with the aid of a small car, upon which the apparatus is mounted, consisting of a rotary converter with the necessary switchgear and the welding transformer; the converter also serves to propel the car along the track, a trolley pole being provided on the top of an iron framework, which carries the canopy and side curtains to protect the gear from the weather. In order to remove the car from the track when necessary to prevent interference with the ordinary traffic, a screw-jack worked with bevel gears and cranks is fixed under the centre of the truck, so that the car can be raised from the rails, turned round and wheeled off the track. The general appearance of the car is shown in fig. 1 herewith. When trolley current is not available, a petrol engine is employed to drive the converter as an alternator.

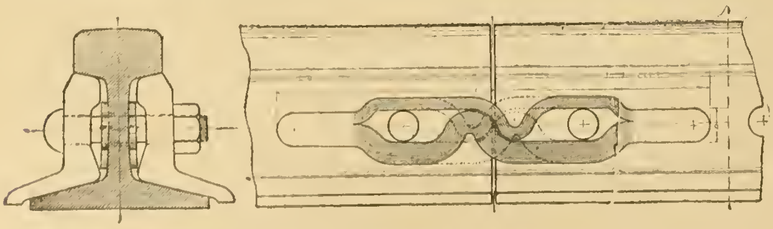

Fig. 3.—"Protected" Bond Electrically Welded to the Web of the Rail.

The converter, which is rated at 18 kw., is fed with a current of about 20 amperes at 500 volts from the trolley wire, and supplies the transformer primary with single-phase alternating current; the secondary of the transformer is connected to the welding clamps, the electrodes of which consist of copper and carbon respectively (fig. 2).

To perform the welding process, the surface of the rail is first ground bright at the place where the bond is to be applied, either on the web or at the side of the head of the rail. The copper electrode is then applied to one side of the rail, and the copper bond, with its terminal enveloped in brass, is placed in position on the other side, after which the carbon electrode is pressed against the bond terminal and the current is switched on, amounting to about 2,000 amperes at 5 volts in the case of a No. 0000 bond. The resistance at the contacts between the carbon electrode, bond terminal, and rail causes these to attain a high temperature very quickly, and the operation of welding is completed in about one minute. Fig. 3 shows a "protected" bond thus welded to the rail.

The copper-welding process is effected by pouring molten copper into a mould surrounding the bond terminal. The copper is melted in a small furnace carried on a car, which may conveniently be a combination car equipped with the apparatus for both systems of welding, as in fig. 1, where the furnace is seen at the right-hand end, together with a small fan blower, which is driven by a belt from the converter. The mould is made of refractory material, and is provided with an enlarged chamber connected with the chamber containing the bond terminal by a narrow channel, as shown in fig. 4. The rail having been cleaned, the bond and mould are placed in position, and the molten copper is poured through the gate, impinging upon the end of the bond and the rail, and flowing into the adjoining reservoir. When the latter is filled, the copper backs up into the terminal mould and fills it; the object of the additional chamber is merely to contain the excess of copper required to bring up the bond and rail to welding temperature. When the mould is removed, the block of copper in the chamber, shown in fig. 5, is cut off with a chisel, leaving the finished terminal thoroughly welded to the rail, as in fig. 6. This process is especially suitable where very heavy bonds are required, as in the conductor and return rails of electric railways, which are bonded up to the full carrying capacity of the rails, or when welding feeder cables to the rails.

We are informed that some 40 welding cars of this type are in use in America, and the Forest City Electric Co., who have recently removed into larger premises where they will have facilities for manufacturing the bonds and demonstrating the processes, claim that bonds thus made will remain permanently efficient, the copper being truly welded with the steel. The cost of bonds fixed by either of these processes, we learn, is no greater than that of bonds fixed in the ordinary way; no bond holes are required, the bonds having no terminal shanks. Any of the standard types of bond can be welded to the rails. The short "Protected" type of bond under the fish plate is especially recommended, as it is economical both in copper and in resistance—the resistance of, say, two No. 0000 bonds over the fish-plates being something like three times that of

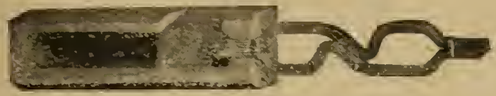

Fig. 4.—Bond Wires in Mould, in Copper-Welding Process.

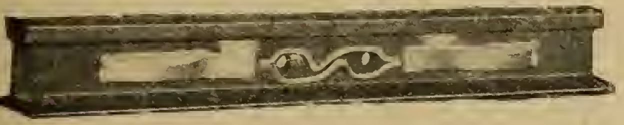

Fig. 5.—Bond after Pouring Molten Copper.

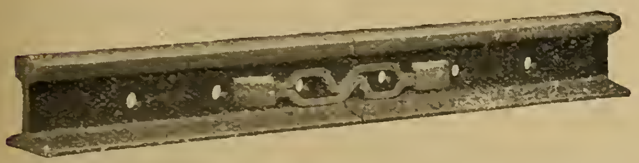

Fig. 6.—Finished Bond, after Cutting Away Surplus Metal from the Terminals.

the corresponding length of rail; with the welded joint the bond requires no inspection, and the fish-plate protects it from mechanical injury.

The New Argentine Cable Question.—Some further particulars relating to the agreement concluded between the Argentine Government and the Western Telegraph Co, for the laying of a cable between Buenos Ayres and Ascension Island, on terms which are said to give the company a veiled monopoly of establishing cables touching the Argentine coast, have been forwarded to a German newspaper by a Buenos Ayres correspondent. It appears that the German Government made an inquiry on the subject, through the Argentine Ambassador in Berlin, and at the same time pointed out Germany's right to the most-favoured-nation treatment. In reply, the Government of Argentina stated that the agreement did not grant a monopoly, and, moreover, protested that it was not compelled to listen to foreign claims in respect of any such agreement. It is not known what reply the German Government has given, but the Senate has now adopted the agreement without discussion, and the correspondent states there is no doubt that the Lower House will also do so. The Reporter of the Commission of Public Works, in introducing the authorising Bill in the Senate, referred to Clause 17, which is said to represent the alleged monopoly. This clause provides that if within a period of 25 years from the date of the notarial completion of the agreement, any undertaking should make proposals to the Government, which would appear advantageous to the latter for the laying of a new submarine cable between Argentina and another country, preference will be granted under the same conditions to the Western Telegraph Co. The Reporter stated that the preference embodied in the clause could only probably be directed against fresh English competition, as the British Government from the beginning would not be likely to permit a French or German cable to utilise a British possession as a landing place, and no nation other than England possesses its own islands within reach in the South Atlantic Ocean. But if Germany or France wished to undertake to lay a cable direct from Buenos Ayres to a point belonging to either of them on the African coast, the German or French Government would conversely in this case render it impossible for an English competitive company to obtain a landing there, so that the Western Telegraph Co. could not compete in regard to such a cable. The correspondent remarks, however, that this alternative is incorrectly formulated, as it might be convenient for France or Germany to lay a cable from a Brazilian station to Argentina, and that in this event the Western Telegraph Co. could all the more easily hinder foreign rivalry on the ground of its preferential right, as the company has common business interests with the cables passing *via* Brazil. Apart from this preferential right, the position of the company will become still more unassailable, as it receives by Clause 13 a monopoly of the transmission of all official cable messages, and of all those trans-marine messages reaching the State telegraph offices which do not expressly specify another route. The company is also granted exemption from import duties for all materials, freedom from dues for its cable ships, and exemption from all State, provincial and municipal taxes for the period of 25 years. The only return given by the company, the correspondent concludes, is a reduction of at least 15 centavos per word in the tariff for messages *via* Brazil, or the so-called Madeira line, but this concession is illusory, as all large customers of the Madeira line, which s virtually identical with the new cable, enjoy a rebate.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE—GUADELOUPE.—The duties are the same as fo France, with certain exceptions. Certain octroi duties are also levied on imported goods, as follows:—

Cement of all kinds	·30 fr. per 100 kg
Pipes and moulded articles of cement ...	1 „ „
Tars and bitumens	1 „ „
Heavy oils, petroleum, residues and other mineral oils	6 „ „
Iron or steel in bars, rails	·60 „ „
„ „ „ other	1 „ „
Axles and tires of iron or steel	12 „ „
Iron wire, even covered with other metals	7 „ „
Copper in wire of all dimensions	15 „ „
„ „ on thread or silk	30 „ „
Electric incandescent lamps	10 % ad. val.
Manufactures of cast-iron	6 fr. per 100 kg.
Iron and steel tubes...	5 „ „
Copper tubes	15 „ „
Copper manufactures	15 „ „
Lead pipes and other manufactures ...	3 „ „
Electrical machinery and dètached parts...	6 % ad. val.
Machines and machinery, other	3 „ „
Boilers...	3 „ „
Railway carriages, fitted	20 fr. each.
„ „ not fitted	5 „ „
Telephone and telegraph apparatus ...	10 % ad. val.

The following are free of octroi duty:—Articles of all kind imported by the Administration: instruments, cables, wire and othe materials necessary for the construction and service of telegrap and telephone lines subsidised by the Colonial Government turbines, multitubular boilers, steam pumps, locomotives, truck rails, &c., under special conditions.

FRANCE—MADAGASCAR.—The same duties are levied as o goods imported into France, with some unimportant exceptions.

FRANCE—MARTINIQUE.—The same duties are levied on similar goods imported into France, with some unimportant exceptions; in addition, certain octroi duties ar also levied on imported goods, as follows:—

Cast-iron	·50 fr. per 100 kg.
Iron in bars, angle, rails, plates, &c. ...	1 „ „
Tin plate	1·50 „ „
Iron wire, tinned, galvanised or not ...	1·50 „ „
Steel in bars, rails, &c.	1 „ „
Copper and copper wire	9·65 „ „
Machines and machinery of all kinds, boilers, machine tools, &c.	As the metal of which composed.
Railway sleepers of iron	·50 fr. per 100 kg.

FRANCE—MAYOTTE.—The same duties are levied as on similar goods imported into France.

Large Mexican Hydro-Electric Plant.—Manue Cuesta, of Guadalajara, who is at the head of the Chapala Power and Irrigation Co., which has just been organised with a capital stock of $8,000,000 Mexican money, says that the hydro-electric plant which the company will construct for the purpose of providing water for irrigation will cost more than $2,000,000. It is probable that two of these power plants will be built—one to be located on the Santiago River near Guadalajara and the other on a stream that empties into Lake Chapala. Transmission lines will be built to operate the pumps, which will be located upon the shore of Lake Chapala, the water of which will be used to reclaim 75,000 acres of land. The Government loan of $3,000,000, which was recently made to the company, is secured by a lien upon the land that is to be reclaimed on a basis of $100 per acre. An additional loan of $2,000,000 has been made the company by the Caja de Prestamos, or Loan Bank, of this city. This money will be used to build about 110 miles of main irrigating canals and to establish three pumping stations. While the first unit of this great system of irrigation will provide for the reclaiming of 75,000 acres of land, the plans, when completely rounded out, will involve the irrigation of more than 500,000 acres. The Pimintel interests of the City of Mexico, which own the street railway, light and power systems of Guadalajara, are associated with Mr. Cuesta in the enterprise.—*Electrical World.*

Porcelain Ware on the Continent.—It is announced that the International Syndicate of makers of porcelain ware for electrical purposes, of Berlin, which is composed of German and Austrian firms, was compelled to release prices in the spring from the fixed rates, owing to the competition of outside makers, and thus left it to the syndicate constituents to arrange their own quotations individually. The contest which has taken place in the meantime has been so severe as to result in losses both to the constituents and the outside makers. Some of the latter are declared to have become involved in financial difficulties, whilst others have discontinued the manufacture of porcelain ware for electrical purposes.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,317. "System for maintaining the electric circuit of metallic-filament incandescent lamps burning in series on failure of one or more such lamps." N. R. Booth and J. Hamer. July 26th.

17,326. "Improvements in or relating to hangers and the like for electrical conductors." E. M. Munro and Railless Electric Traction Co., Ltd. July 26th.

17,342. "Improvements in electric furnaces." Aktiebolaget Elektrometall. (Date applied for under Sec. 91 of the Act, August 1st, 1908, being date of application in Sweden.) July 26th. (Complete.)

17,353. "Improvements in or relating to electrical heating apparatus." A. F. Berry. July 26th. (Complete.)

17,355. "Improvements relating to telephone apparatus." E. A. Graham. July 26th. (Complete.)

17,370. "Improvements in and relating to the control of polyphase motors and the like." British Thomson-Houston Co., Ltd. (Allgemeine-Elektricitäts Ges., Germany.) July 26th. (Complete.)

17,424. "Improvements in automatic electric piano players." G. E. Hermes and E. F. Paventa. July 27th.

17,448. "Improvements in or relating to arc lamps." T. L Carbone. (Date applied for under Sec. 91 of the Act, November 9th, 1908, being date of application in Germany.) July 27th. (Complete.)

17,450. "Improvements in wireless signalling." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, March 8th, 1909, being date of application in United States.) July 27th. (Complete.)

17,459. "Improvements relating to the separation of substances by the wet magnetic process." W. E. Lake. (F. Krupp, A.G. Grunsonwerk, Germany.) July 27th. (Complete.)

17,473. "Improvements in telephonic transmitters." P. Stragiotti. (Date applied for under Sec. 91 of the Act, August 11th, 1908, being date of application in United States.) July 27th. (Complete.)

17,486. "Improvements in or relating to the lighting of gas burners electrically." M. Delage and P. Wooo. (Application for Patent of Addition to No. 16,341, 1909.) July 27th. (Complete.)

17,488. "Appliance for preventing fraud in connection with electricity meters." G. Berardi. July 27th. (Complete.)

17,490. "Improved electromagnetic separator with rotating magnet drum." F. Steinert and H. Stein. (Date applied for under Sec. 91 of the Act, July 27th, 1908, being date of application in Germany.) July 27th. (Complete.)

17,516. "Improvements in means for preventing overwinding and underwinding electrically-driven cranes, capstans, lifts and the like." H. Wardale and W. R. Storey. July 28th.

17,520. "Improvements in induction motors." J. H. Holmes. July 28th.

17,542. "Improvements in micro-receivers or translators." P. Stragiotti. (Date applied for under Sec. 91 of the Act, August 11th, 1908, being date of application in United States.) July 28th. (Complete.)

17,555. "Improvements in and relating to electrical and other recording, signalling, measuring instruments and the like." E. S. Heurtley. July 28th.

17,561. "Improvements in and relating to electric fly switches." C. J. Baker. July 28th. (Complete.)

17,564. "Improvements in and relating to rotary converters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 28th.

17,610. "Improvements in balancers, auto-transformers and boosters for use on direct-current systems." A. M. Taylor. July 29th.

17,627. "Electric incandescent lamps with metal-filament loops." H. Kuzel. (Application for Patent of Addition to No. 15,017, 1907; date applied for under Sec. 91 of the Act, January 4th, 1909, being date of application in Germany.) July 29th. (Complete.)

17,654. "Improvements in relay apparatus particularly intended for use in connection with telephonic and telegraphic systems." S. G. Brown. July 29th.

17,663. "Improvements in high-tension magnetos." T. M. Mueller. (Date applied for under Sec. 91 of the Act, August 4th, 1908, being date of application in United States.) July 29th. (Complete.)

17,664. "Improvements in magneto-electric machines." T. M. Mueller. (Date applied for under Sec. 91 of the Act, February 25th, 1909, being date of application in United States.) July 29th. (Complete.)

17,711. "Improvements relating to pendant electric light fittings." S. K. Thompson. July 30th.

17,739. "Improvements in and relating to the automatic regulation of dynamo-electric machines." H. M. Taylor and R. H. Scotson. July 30th.

17,740. "Improvements in flexible tubular conduit systems for electric installations." G. Evans. July 30th.

17,742. "Improved apparatus for rectifying alternating currents." E. Giglio. (Date applied for under Sec. 91 of the Act, April 29th, 1909, being date of application in Switzerland.) July 30th. (Complete.)

17,758. "Improvements in and relating to the control of polyphase motors and the like." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, July 31st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,759. "Improvements in and relating to condensing systems." A. Wolf. (Date applied for under Sec. 91 of the Act, August 1st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,761. "Improvements in or relating to closed circuit transformers." Electric Reductor Co. m.b.H. (Date applied for under Sec. 91 of the Act, July 31st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,763. "Improvements in recording devices especially applicable for use with measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 30th. (Complete.)

17,774. "Improvements in or relating to electric telegraphy." S. G. Brown, W. Judd and A. R. Hardie. July 30th.

17,783. "Improvements in and relating to devices used for recording a copy of an invoice, receipt, telephone message or the like." J. W. Tunstall. July 31st.

17,790. "Improvements in devices for indicating rise in potential of trolley standards or other metal work of electric tramcars." A. Imbery. July 31st.

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17,812. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. July 31st.

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17,847. "Improvements in reversible variable-speed dynamos." H. Leitner. July 31st.

17,863. "Improvements in and relating to electric motors." D. Maggiora and M. Sinclair. July 31st. (Complete.)

PUBLISHED SPECIFICATIONS.

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1909.

Soldering of the Metallic Filaments of Electric Lamps to their Electrodes. S. Marietti. 14,483. July 8th. (Date applied for under International Convention, July 8th, 1907.)

Starting Switch for Electric Motors. D. Timar and C. von Dreger. 14,513. July 8th. (Date applied for under International Convention, August 19th, 1907.)

Magnetic Clutches. H. W. Ravenshaw, V. G. Middleton and W. E. Townsend. 14,530. July 8th.

Regulation of Electric Motors. British Thomson-Houston Co. and Garton. 14,700. July 10th.

Process for rendering Artificial Stone, Mortar, Plaster and the like Waterproof, Heat and Electricity Non-conducting and Soundproof. J. Kathe. 15,100. July 16th.

Electromagnetically-operated Switches. British Thomson-Houston Co. (General Electric Co.) 16,298. July 31st.

Storage Batteries. J. Bimeler. 16,529. August 5th.

Spark Distributors for use in Electrical Ignition Apparatus for Internal-Combustion Engines. E. Denieport. 18,812. September 8th.

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Measuring-Instruments for Alternating Currents according to Paalzow-Rubens's Bolometric Principle. H. Lux. 21,586. October 12th. (Rights under Sec. 91, Patents, &c., Act, 1907, not granted.)

Portable Switch or Key for Electric-Flash Signalling Purposes. A. C. Davey. 22,345. October 21st.

Universal Joints or Couplings for Electric Light Fitting and other Purposes. C. J. Thursfield. 25,279. November 25th.

Electric Signalling System. A. Blackall and T. Jacobs. 27,436. December 17th.

Means for Indicating Faulty Leads in Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 103. January 2nd.

Electric Flash Lamps. W. D. Whyte. 3,252. February 10th.

Armatures for Magneto-Induction Machines. Firm of Robert Bosch. 3,511. February 12th. (Date applied for under International Convention, November 20th, 1908.)

Multiple-Switch Starting Devices for Electric Motors. H. E. Lake. (Cutler Hammer Manufacturing Co.) 3,517. February 12th.

Sheet-Metal Telephone Cases. C. E. Bilton. 9,999. April 27th.

Commutators for Dynamo Electric Machines. Siemens Schuckertwerke Ges. 11,904. May 20th. (Date applied for under International Convention, July 31st, 1908. Application for Patent of Addition to No. 4,240/07.)

Brush Holders for Dynamo-Electric Machines. Allgemeine Electricitäts Ges. 13,231. June 5th. (Date applied for under International Convention, June 6th, 1908.)

Alternating Electric Current Distribution Systems. J. S. Peck. 13,762. June 11th. (Date applied for under Rule 13, July 15th, 1908.)

Alternating Electric Current Distribution Systems. J. S. Peck. 13,763. June 11th. (Date applied for under Rule 13, July 15th, 1908.)

1908.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 1,270. January 18th.

Machines for Electrically Welding Chains. Akt.-Ges. Stahlwerke Weissenfels vorm. Göppinger & Co. 2,642. February 3rd. (Date applied for under International Convention, February 3rd, 1908.)

Life-guards for Electric Tramcars and the like Vehicles. H. W. Johnson and W. Steele-Brown. 3,280. February 10th.

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Sand Gear "Sanding Pipe" for Electric Tramcars, Motor-Omnibuses, Wagons and the like. E. E. Kenworthy. 24,951. November 20th.

Tape Transmitter for Multiplex Telegraph Systems. O. Murray. 26,916. December 17th.

THE
ELECTRICAL REVIEW.

VOL. LXV. AUGUST 20, 1909. No. 1,656.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

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READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

THE NEWFOUNDLAND CABLE DISPUTE.

THE above has recently become quite a familiar heading in the daily Press, not only in this country, but also in the United States, and under it have been ventilated the grievances of the Commercial Cable Co. and the Anglo-American Telegraph Co. in respect to their respective rights under concessions obtained in this Colony. The dispute apparently was presented from the company's side only, until the Commercial Cable Co. openly charged the Government of Newfoundland with repudiating a "solemn contract," and this called forth a reply from Sir Edward Morris, the Premier of Newfoundland, now in London, denying the allegations, and charging the company with unfairly publishing "an *ex parte* statement of the case without having published side by side the reasons—well-known to the Commercial Cable Co.—why the Newfoundland Government halted before giving their assent."

A partial deadlock has, it appears, arisen between the company and the Government, the latter being unwilling to grant to the former a monopoly of cable traffic passing over the Newfoundland Government lines for a period of 25 years, on the ground that it is unfair, harmful to competition and to existing interests of another company. However, the company claim that the concession was given under the Seal of the Colony and the signature of the Governor, whereas Sir Edward maintains that the above condition could not be brought up for ratification before the Legislature without ample consideration, so that from this it would appear as if the concession had not yet gone through all its final stages before becoming absolute; hence we presume the cause of the dispute.

It is, of course, only natural that the Anglo American Co. should oppose the granting of a concession with exclusive rights, such as above described, to their very active opponents the Commercial Cable Co., who have already secured a landing at Port-au-Basque for the cable to Canso, worked in conjunction with their system, for if granted it would exclude the company from any local benefit apart from that derived from their own lines.

It cannot be said that Sir Edward Morris is acting frivolously when he attempts to protect vested interests, and while the Atlantic companies enjoy practically equal conditions of working in Great Britain, it does not seem unreasonable to work upon this basis in Newfoundland, especially as judging by the statement printed in another column, the Anglo Company is quite prepared to work on a basis of fair competition. It cannot be unreasonable to permit persons or corporations to compete on an equal footing, and we hold that no injury should be inflicted on vested cable or other interests unless their owners give an indifferent, intermittent or bad service, maintain abnormal or high rates, or otherwise do not live up to the modern requirements and needs of the countries or places they connect. It is only right that under these last-named conditions concessionaires should give way, as it would not be proper for them to hamper the population in the race for a commercial existence by charging exorbitant rates or clinging to old-fashioned and out-of-date methods—and we have yet to learn that the Anglo-American Telegraph Co. can be accused of this.

When this latter company obtained exclusive privileges in Newfoundland, landing rights, &c., were not looked upon as a valuable concession, as nations were anxious to obtain the facilities offered by rapid communication, but the days are changed, and such like monopolies are of the past, besides being absolutely contrary to the spirit of the Telegraph Convention to which Great Britain is an adherent.

The tendency of the present age is towards cheapness and the furnishing of as many routes as possible, and this has been proved not only by the laying of the Pacific Cable and the cables from Australia to Tasmania, but also by recent Conferences representative of responsible Home and Colonial opinion.

It will be recollected that the Report of the Inter-Departmental Committee on Cable Communications, 1902 (Cd. 1,056), dealt with the subject of landing rights, which the members of the Committee looked upon as important privileges, and there is no doubt that in the case under review the privilege means much to the Commercial Cable Co., who, by diverting the cables from Canso to Newfoundland, will, on their own showing, be enabled to work their cables at a calculated increase of speed of 35 per cent.

Of course, if on the final conclusion of a bargain it is found that more is given than is received, nothing should be said or done to upset it, and although it is regrettable that any misunderstanding should have occurred, the Newfoundland Government has given to the company the necessary land for landing the cables, which have been laid, landed, and opened for traffic, as evidenced by the posters exhibited by the company, and the main object sought in the concession and by expenditure has been attained. Our Colonies are agitating for an Imperial Atlantic cable and the acquisition, by the Government, of the Canadian landlines, and in view of this possibility alone it would seem a pity to deprive the scheme of any support it might obtain from a British Colony.

Trial and Error.

To a very large extent, the old system of trial and error has been discredited for the development of inventions or the preparation of new designs, and although trials and tests are just as necessary at the present time as they have been in the past, experimental apparatus is now much more often satisfactory when first set to work.

There has been, perhaps, more excuse for the inability to foresee adverse effects in connection with electrical machinery than with any other class of apparatus, but few will deny that mistakes are often made which might have been avoided had the designer made a more careful study of the data at his disposal. As regards the purely electrical design of dynamos, motors, &c., so much experimental work has been made public that there would appear to be little excuse for failure to obtain the results desired with the first trial apparatus. The mechanical features, on the other hand, have not been dealt with to the same extent by scientific experiments, and many of the data available, having been originated at an earlier period, are not so easily looked up. For instance, bearings subjected to continuous downward pressure may often be found with oil grooves cut across their undersides, in the face of the experiments undertaken by a Research Committee of the Institution of Mechanical Engineers, which conclusively proved that oil will not enter through grooves in the pressure area. The power which can be transmitted by belting has been another stumbling block in the design of dynamos and motors, but the mistakes having mainly taken the form of unnecessarily large pulleys, the only effect has been to increase the cost. Here again ample data are available from exhaustive experiments with belts and pulleys, which were published many years before they could be wanted in this connection.

Many other instances of foreseeable errors will occur to everyone connected with the production of electrical apparatus. On the other hand, some recent inventions have been entirely worked out on paper, a single experiment having sufficed to prove their utility.

The designer or inventor of the future will need a sound scientific training, together with a full knowledge of previous experiments and developments in the line he intends to take up, the apparatus for working out such a man's ideas being far less costly than those required by an equally fertile inventor lacking the above qualifications.

Boiler Explosions.

It is often urged that our English construction work is too heavy. The *Locomotive*, the organ of the Great Hartford Boiler Insurance Co., of America, would not appear to be of this mind.

Taking 25 years of explosions in Great Britain, as given by the Board of Trade, which includes as explosions, occurrences of a most trivial order, including, we believe, once the melting of a fusible plug, the total of explosions is 1,705, of deaths thereby 697, and of injured persons 1,460. The annual average is 68·2 explosions, 27·9 deaths, and 58·4 injuries. In the United States, between January 1st, 1883, and December 31st, 1906, there were 7,408 explosions, which killed 7,144 persons and injured 10,874 others. Thus, in a year less there were four times the explosions and over tenfold the deaths. It is certain there is no such difference in the number of boilers.

Then the American explosions are of a worse order, for each explosion kills an average of over double as many as are killed by British explosions, or 0·96 as against 0·41. The British statistics include many steam pipe failures; the American include none of these unless on the boiler side of the stop valve.

The conclusion drawn is that boilers are made here with a larger factor of safety, and there are excellent reasons for believing this to be so. On the other hand, it must not be overlooked that many boilers in America must be off the beaten track, and exposed to less careful handling than is the case in older, more settled, and more populated countries. But, with every allowance made, the danger of American practice must be admitted. Indeed, to read the rules of the U.S. Board of Supervisors of Steam Vessels is enough to show that steam pressures are allowed that would not be considered safe here. An old copy shows that an American single-riveted boiler is allowed the usual pressure of a double-riveted boiler, and certain boilers were, upon this liberal allowance, allowed another 25 per cent. higher pressure.

German statistics for 31 years are also brought forward to show only one explosion for 17 American explosions, and one death for 27 American deaths. In all probability the number of German boilers over the period named—1877-1907—would be much fewer than in either Great Britain or America. The Hartford Co., in America, has consistently striven to mend the state of affairs. It considers that the Board of Trade inquiry—after an explosion—is a good moral influence. It brings the causes of an explosion before the public eye and carelessness of boiler owners is exposed. Though an inquiry will not prevent the explosion which has already occurred, it will undoubtedly lead to the exercise of greater care and bring owners into line.

Too many boiler owners even yet regard boiler insurance and inspection as a means of shifting responsibility, and very properly so, but owners find they cannot shift responsibility unless they have acted on suggestions and advice, and put things in good order. It is regretted that there is no such authority in the United States to exert the same moral effect as results from our Board of Trade inquiries. People are apt to scoff at the Board of Trade inquiry, and we have to confess to witnessing a good deal of apparently wasted time and many silly questions by examining counsel. But the Press is present, and the men concerned tell their story; thus there is publicity and evidence of good or bad material or workmanship, and this all tells upon boiler-makers, plate makers, inspectors, attendants and owners, and leads on to greater safety.

Every inquiry of importance spreads an influence through a given circle and acts as a spur in keeping men up to the top notch.

TWO USEFUL CABLE-LAYING APPLIANCES.

By C. A. SMITH, A.M.A.I.E.E.

When one is working in some remote part of the world, away from the large manufacturing centres where up-to-date appliances and tools can be obtained on short notice, he will, as likely as not, resort to inventing, and make the article required for a given purpose himself.

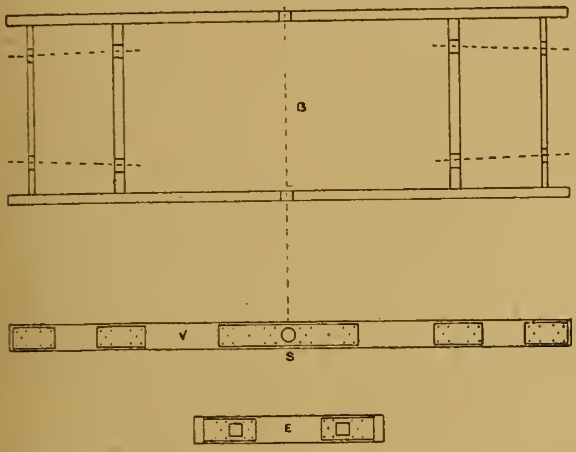


Fig. 1.

It was because the author had to design his own "cable drum carriage" and a special "duct reel" for threading underground cable tubes with draw wires that he thought, perhaps, some of the readers of the Review, who, being similarly placed, would like particulars of these home-made accessories, which, it is believed, while having some novel features, will prove to be of considerable service to the duct and cable-laying gangs.

The drum carriage is essentially a pair of stout wheels with a detachable steel spindle as usual, but, as will be seen from the view, it has a special light frame body through which the spindle is threaded, and is provided with a pair of detachable shafts. It will be seen from the drawing, fig. 1, by the dotted lines, that the shafts can be attached to either end of the body, thus obviating the necessity of turning the vehicle round if required to be drawn in the opposite direction. This has proved to be of no small advantage in the writer's experience, when, for instance, the carriage is run into an alley or becomes stuck in a rut, and it cannot be turned round to get it out, in which case all that is necessary is to alter the position of the shafts—the work of a moment. No doubt objection will be taken to having to thread the spindle through so many holes in rigging up, but the writer's contention is, that as the carriage is usually loaded in the cable yard or stores where the cable gangs meet for instructions, the same hands employed on the job can quickly and easily put the thing together, and the objection becomes lost in view or the great convenience which the design offers when out on the work. As soon as the scene of the cable laying is reached, the shafts are detached by removing four pins, and the front or back end of the frame swung up out of the way as required. For those who wish to construct a drum carriage on this principle, the following measurements will be appreciated :—(See fig. 1, B V and E).

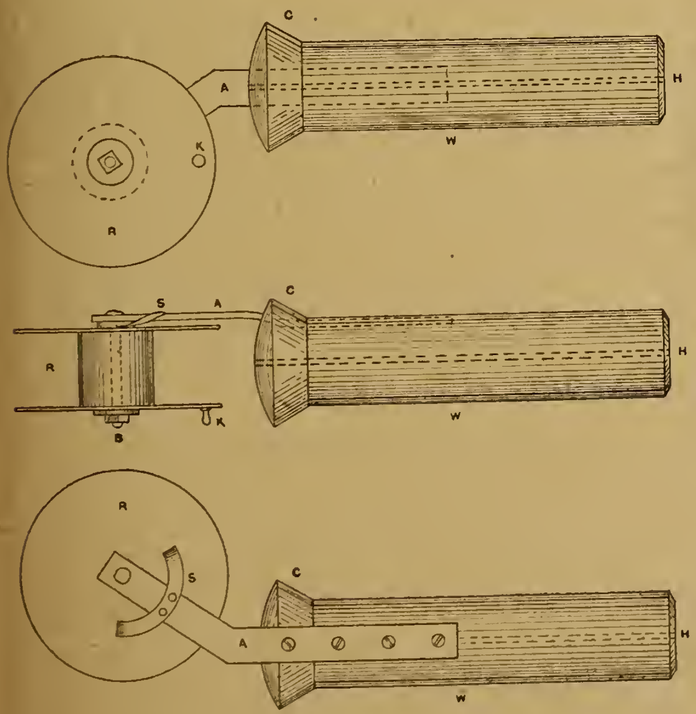


Fig. 2.

Diameter of wheels	2·30	metres
Length of body B	4·00	"
Width of body	1·35	"
Length of shafts	3 20	"
Length of spindle	2 65	"
Diameter of spindle...	7·5	centimetres
Diameter of holes in wheels	8·0	"
Diameter of central hole S...	8·5	"
Size of square shaft holes	9·5	"
Distance between two end stays	58·0	"

The dimensions of the ash or oak frame are 19 × 7 centimetres. In the drawing, V, is a side elevation of the frame, showing how it is strengthened by means of 6 millimetre iron plates bolted on, the bolts passing through angle plates set in the corners and on both sides of the stay pieces on the inside of the frame. Fig. 1 E shows an end view with the two shaft holes. A pair of chain-hook rings with eye bolts are fixed on either side of the shaft holes in the end stay pieces.

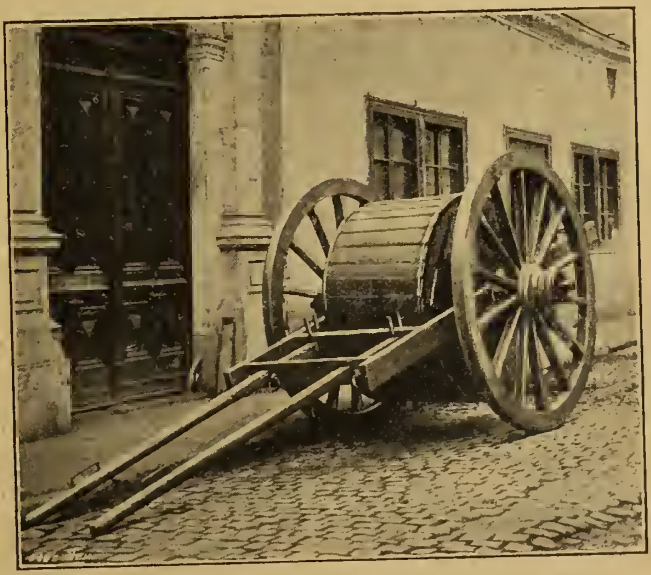


Fig. 3.

The steel spindle has, of course, a pin hole at both ends, through which the hold-all pins pass and are made secure.

The other appliance, the duct reel, will be found in special cases when laying long runs of few ducts to be more serviceable and certainly safer than the rodding process usually employed. It is a small and light contrivance and needs no attention, while the rods required for a run of, say, 125 metres are weighty, and require two or three men to handle them, and are apt to separate in the ducts—a serious matter.

Referring to fig. 2, the appliance consists of a cylindrical hard wood plug W, if for round tubes, about 30 centimetres long, turned up a little smaller than the diameter of the ducts, and with a conical-shaped head C to fit into the bevelled brickwork of the manhole. A hole of 1 cm. dia. is made through the axis of the plug for a cord or line to pass, and let into the side of it, and fixed by screws, is an angle-shaped iron arm A, to which is attached the reel R by a thin bolt with nut B. The reel disks are about 18 centimetres in diameter, made from 3 millimetres sheet-iron, and then galvanised. The core is of wood 6·5 centimetres in diameter by 6·0 centimetres long, to which the disks are secured by radial screws. To prevent the reel from overturning when the line is pulled, a semi-circular flat spring S bears against one of the disks, while a knob K is attached to the other, near the periphery, to rewind the line back like a fishing reel. All that is necessary then is to introduce the wooden plug into the duct and pull the line forward as the ducts are being laid.

The dimensions of the reel will enable several to be used side by side when laying a number of ducts in the same trench. When the next manhole is reached the cord is attached to the draw-wire to be left in the duct, and hauled back, at the same time being rewound on to the reel ready for the next section.

The size of reel given, with a cord of about 3 millimetres diameter, will hold about 135 metres, which should be waterproofed previous to use.

COST OF LIVING IN THE FEDERATED MALAY STATES.

By ONE WHO HAS LIVED THERE.

The settlements forming the Colony of the Straits Settlements are Singapore, Penang, or Prince of Wales's Island (with Province Wellesley and the Dindings) and Malacca. The settlements are on the Straits of Malacca.

The great bulk of the population are Chinese, Malays and Tamils, there being also Bengalis, Patanis, &c., and comparatively few Europeans.

The climate of the Colony may be said to be quite uniform throughout the year, and the foliage is perennial, but owing to its dampness the climate is very enervating, and it is hot, the average temperature indoors being 93° F. during the day, and much more of course in the sun, while at night an average temperature of 82° F. is experienced.

To combat the heat and guard against sunstroke it is necessary to wear a thick pith topi (sun hat) and use a Chinese umbrella, and to protect the eyes from glare a pair of blue goggles are an advantage.

The houses are mostly of wood raised from the ground on piers and they are of the bungalow type, very spacious and comfortable. These are generally granted free by one's employer in the native States and, as a rule, a bachelor's quarters comprise one bedroom, with bathroom annexed, one sitting or drawing room, pantry and veranda; the kitchen, boys' rooms and stables stand away from the house. The houses are detached and generally stand in their own ground, being therefore quite private.

Mosquitos are kept at a distance at night by sleeping on a bed surrounded by a mosquito net and care must be taken if one wishes for perfect rest, to see before retiring that none of these troublesome insects are inside. The sun rises at about 6 a.m. and sets at 6 p.m. all the year round, and if out-door work is to be done, it is well to be up and doing before the heat is too great.

Early tea is usually served about 6.30 a.m., then comes a bath and dressing for breakfast, about 8 a.m.; this usually consists of porridge, eggs and toast, ham or chicken as required, and tea or coffee.

After a morning at the office till about 12 p.m. (if not travelling) comes tiffin (or lunch); this meal is generally made up of soup, curry, chicken and fruit, then after a short afternoon spell at the office till 4 p.m. comes a cup of tea, a bath and a change of dress for the evening, when dinner is served about 8 p.m. At this meal we again have soup, curry, chicken, pudding, &c., and fruit. There is not a great variety in the meat line, chicken being the only real form of meat to be relied upon except tough buffalo meat, which is most unpalatable. There are, of course, tinned meats to be bought if preferred.

One generally feels so done up after dinner that bed is sought about 9 p.m., and often earlier.

The general impression which the griffin (new arrival) receives is that everything goes on so slowly; this is at first irritating, but ultimately one falls into the way of the East, and becomes equally easy going, and after all this is the only way to retain health and to achieve anything, for one cannot hustle in the East. The life is extremely quiet, especially if one is stationed on a tin mine or coffee plantation miles away from anyone and in the jungle, but in the towns things are not quite so bad.

Taking things altogether in this country, I am convinced that one's life is safer, and property, too, than in the towns at home, as if ordinary care is exercised there is not much thieving going on.

House furniture is usually light, and can best be bought on the spot at some sale or other (or even new, the Chinese being fair carpenters and cabinet makers), while the floors are covered with small grass mats or rugs; these are removed daily when the boy sweeps the house, and the harbouring of scorpions and other objectionable vermin is thereby minimised, though bats continually fly through and through the open windows and doors at night.

The clothing is also, of necessity, light, and one must be provided with a good equipment, including evening dress. Say for a start, to provide for one or two changes during the day:—

4 white drill suits at $3.50 (7s.)
4 khaki suits at $4.50 (9s.)
2 flannel suits, say, at $15.00 (30s.)
2 pairs white canvas shoes $2.50 (5s.)
1 topi (sun hat) from $4 (8s.)
6 Indian gauze singlets $2.50 (5s.)

The above are all Chinese made (except singlets) in the native States, and are quite good enough for any one, especially the new arrival, as he will find out, but should European articles be wanted, then our European travellers pay periodical visits and meet one's requirements at a greater cost, but my advice is that one should just purchase what is necessary, say two suits for the tropical part of the voyage out, and leave the rest to be made on the spot, when it is much cheaper.

The average daily garb consists of the following: a sun hat, drill jacket and trousers, singlet and white canvas shoes, nothing else except blue goggles and an umbrella, but these are optional though advantageous.

Servants are either Chinese or Tamil, and can be had from $10 (£1) and upwards per month, but it is better for a bachelor to arrange with a boy to do the cooking and house work for about $15 (30s.). Then one requires a water carrier to look after bathroom requirements and conveniences at $2 (4s.); he also works for others in the vicinity. A dhobi (washerman) will wash either for 4 cents (1d.) per piece or $1.50 (3s.) per month.

If one has a compound and a horse one requires a kabun (gardener) and a syce (groom); these can be obtained at about $9 (18s.) per month each.

Travelling is done by riksha at 6 cents per mile, or ghassy at 15 cents per mile, or by railway, and there are Government Rest Houses (hotels) *en route* for travellers, at reasonable rates.

A European does not engage in manual labour in this climate, his duties being chiefly supervisory in any capacity.

The workers are Chinese, who are clerks, carpenters, jewellers, servants, cooks, storekeepers, and almost anything; Cingalese, mechanics in railway workshops; Tamils, servants, cooks, clerks and telegraphists, also chief labourers on roads and railways; Bengalis, policemen and watchmen, &c.

One does not see so much of the Malays; civilisation seems to have caused them to retire into seclusion, though they make, in some instances, good clerks and interpreters.

The coinage is the Mexican dollar, worth about 2s. sterling, but its value fluctuates with the silver market; to-day, however, I think most Europeans are paid in sterling, and salaries paid depend upon the nature of the work, a very average salary with free house varying from $150 to $200 (£15 to £20) per month, and I should advise no one to take a billet under $150 per month with free house (a house will cost anything from $40 upwards per month, equal £4).

To summarise the cost of living, I subjoin the following list, which is bereft of luxuries and club expenses:—

	Per month.			
One house boy and cook (combined duties)...	$15.00	£1	10	0
One water-carrier	2.00	0	4	0
One gardener	9.00	0	18	0
One washerman	1.50	0	3	0
One groom	9.00	0	18	0
Bread, 31 loaves at 4 cents	1.20	0	2	5
Table food $1 per day (meat, &c)	31.00	3	2	0
Paraffin oil, per case, two tins	5.00	0	10	0
Jams, 25 cents per tin, six tins	1.50	0	3	0
Condensed milk, 25 cents, 12 tins	3.00	0	6	0
Tea, Ceylon, 50-cent packet	1.00	0	2	0
Buffalo milk, per month	1.00	0	2	0
Per month	$82.20	£8	0	5

Though the above is quite enough to go on with for the average bachelor, I also give a list of luxuries, *i.e.* :—

Beer or stout per bottle	40 c.	£0	0	10
Whisky, Dewar	$1.20	0	2	0
Gin, Old Tom	90	0	1	10
Aerated waters per day...	1.20	0	2	5
Excellent cigars, per 100	3 50	0	7	0
Burmese cheroots, per 100	1 00	0	2	0

The Straits Settlements mountains abound with plenty of good water, and, generally speaking, the place is fairly healthy to those who take reasonable care of themselves, though it is somewhat trying to ladies.

Single men are usually preferred, but no one should ever think of going to the Straits without a billet already secured, either in the tin mine or in Government service, for there is nothing more deplorable than a stranded European in a climate of this kind.

Malay is the language, and it is understood by Tamils, Chinese, Bengalis; it is easily learnt, and very useful.

NOTES ON TRADE ABROAD.

In pursuance of our policy of placing before our readers information that we are convinced may go far to assist them in maintaining, strengthening and extending their trade connections with Colonial and foreign markets, we commence in the following article a series of notes brought together from a number of sources. No doubt we shall touch here and there on topics for which we make no pretence to newness or novelty, but we need make no apology on that account, as our experience in matters of this kind has shown us that it is necessary to say the same thing again and again before it receives the attention that is its due. Moreover, not everybody sees the thing when it is written for the first time, and it is our hope that in reiterating some of these bygone pieces of advice and criticism, we may play the prompter to more than one spirit in the electrical industry who will profit by reason of the notes being new to him, however ancient they may appear to be to those who may have read similar passages with apathy and passed them over with incomprehensible negligence.

To no one in this country has the increase in British electrical exports during the last few years been more gratifying than to the editors of the Electrical Review, for ceaselessly have we urged the supreme importance of British manufacturers, engineers and financiers doing everything within their power to stand boldly up against their electrical competitors in all markets, whether in the Far East or in Canada, in South America or in "the Antipodes." Modestly we dare take a certain credit to ourselves for the greater activity of many of our firms, and now once again we take up the same story, and urge these on to still greater enterprise, while we advise others to pull themselves together, bringing all reasonably available resources to bear in the same direction. That the game will prove to be well worth the candle if the undertaking be entered into with sufficient spirit and enterprise, and with the enlightenment that is theirs for the mere seeking, we are thoroughly convinced.

The fact that the powerful electrical interests of other countries are hard at work must, of course, not be ignored, but it is too easy by far to allow oneself to be paralysed with an overwhelming fit of the nerves because of this foreign activity. The electrical manufacturing resources of these rival nations are very large, but so are those of this country—they are, if all accounts be true, far in excess of our immediate requirements—and with the reputation of British manufacturing standing as high as we are continually being told it does in many foreign markets, we have a card of introduction which will at least gain for us a gratifying hearing. And, however great the world's electrical manufacturing capacity, it is interesting to study how great also are the immediate and prospective electrical needs of the world. It is idle to say that all the "plums" have been secured, and that there is little worth trying for now. They seldom, if ever, will be secured by those who do not make an effort to obtain them, and while we do not like the saying that "electricity is in its infancy," we certainly do believe that the electrification of the world has only just begun. The future electrical trade of the world is as much with the British exporter as with any other if he will only take possession. We are glad to receive weekly evidence that this lesson is being learned, and that here and there capable men are being dispatched from headquarters to establish suitable foreign organisations and secure business to fill up the vacant spaces in English factories.

We are the more glad that this is being done, because alternating with these evidences of new effort Colonial visitors arrive and express to us here in unmistakeable terms their own and their fellow Colonials' views concerning the lethargy of the British electrical manufacturer. It is positively their idea that we do not care whether we have their business, or whether it goes to somebody else. Is not the time fully ripe for a general effort to show them that we care a great deal more than they think? The political advice so often given to us as Englishmen to "Think Imperially," is too narrow a conception altogether for the present-day manufacturer. He, of all men, in his business must "Think Worldwide," "Think Internationally." Think Colonially, think Imperially, of course, but think also in Chinese, in Japanese, in Russian, in Portuguese, even think in the mind of the Fatherland, and of the States, for these, too, we can compel to buy from us in certain electrical lines if we only watch well the opportunities, take our courage in both hands, and make the things that are needed. In this subject we are optimists or nothing. We were optimists before, because of what we had heard and seen and experienced. We are optimists now for the additional reason that British electrical firms have begun to taste blood in the markets of the world, and have in their own books, and in their own works, very practical evidences that they are experiencing the same things that had come along our way.

The man who is interested in his export trade must be often brooding over a big map—not the small map of the British Isles that we sometimes see on the walls of factors' offices with this, that and the other town marked off as the place where an agent or a branch is located. That is all good and essential, of course, for the provinces must be well nursed, but the "Home Trade" man must keep that running smoothly, and always up to the pitch of excellence. The export man must have a map of the world, and other maps besides, of all the different continents and countries, and they must be used very much as the boy or military novice used his maps of South Africa during the Boer war, indicating by little flags, the advance from post to post as our forces went onward to victory. In too many offices are such maps absent! We believe that, if more of this obtained, together with much of the kind of thing it indicates, the exportation of electrical goods from the United Kingdom would advance at a far greater rate than it has yet been our pleasure to record. But the close study of the world maps, while it is bound to be always important, is also but an elementary part of the matter, for if our interest once aroused be not sustained and carried on to skilled organisation and determined effort, if it end at a mere academic study, with little beyond a sigh at the vastness of the untilled soil, there will be no practical value resulting. We may slumber again and have to put up with a casual export order for a few small lines, or for one or two motors, where we might have had a large *clientèle* with substantial and frequent requirements for quantities of stuff, both large and small.

It is not our intention to attempt to tell manufacturers how to set about establishing an export department. That is not an overwhelming difficulty once the right spirit is there, for it is not as though Englishmen were strangers to export work, and there is no scarcity of men who have had experience in such matters. There must be the right man or men abroad, and the correspondingly right men at home to see that correspondence, cables, inquiries and orders received are promptly and efficiently handled. The Export Department, further, is not one the expenditure upon which can be stinted. The employés will not be long in catching the "wide world" spirit once their superiors are thoroughly imbued with it. It will extend right down to the small boy who will have a wonderful admiration for his chief as he searches the office basket between or after hours for foreign stamps.

But without any further generalisations and with our world map open before us, and a pile of useful documents at our elbow, we will proceed to particularise on points that have been advanced by authorities.

Sources of Foreign Trade Information.

We have frequently been impressed with the value of the American Consular report, and have made a more or less close study of these daily and monthly documents for some time past. As our readers know, we make a regular practice of publishing extracts from British and some Continental Consular trade reports in our "Business Notice" pages, and in the following notes we shall select from the American reports a variety of points worthy of electrical notice from Englishmen. The fact that they were written by those making a study of the world through American spectacles in order to assist the American trader does not deprive them of educative value to the Englishman, for we can benefit by what our rivals are advised to do and by the corrections that are administered to them. Perhaps, indeed, we may be the better able to see where we stand ourselves, or ought to do, by perceiving the positions occupied and how they are held or lost by others. Further, by observing the faults of others, we may be led to indulge in heart-searchings out of which nothing but good can come. While admitting the superiority of the American Consular report service in general, and wishing that our own Government would, as we have frequently urged, double or treble its expenditure upon such efforts to assist our trade abroad, it would be an unpardonable sin to overlook the usefulness of the Commercial Intelligence Department of the British Board of Trade. We doubt very much whether our electrical firms in search of assistance make all the use that they might do of this Public Department. The very *raison d'être* of these offices is to render such assistance, and we are sure that applications for information regarding the outer markets, if addressed to those in authority in Basinghall Street, E.C., and at the various provincial offices, will not be in the least regarded as intrusions or trespassings, but will be courteously treated to the full limit of the official ability. While on this question of Governmental and Consular assistance, we may mention a suggestion recently forthcoming from the American Consul at Durban. He advised American exporters to file their cable addresses in consulates at a time of sending catalogues and price lists, and quoted an instance showing the usefulness of such a practice, or rather the folly of leaving it undone. A Natal firm desired to purchase a rather expensive plant, and they knew the name of the manufacturer, whose name was also found in various commercial directories in the consulate, but nowhere could the cable address be found. Other instances of a like kind had come under this same Consul's notice. The importance of firms including their cable addresses with the other information in trade directories was also pointed out. It seems strange that such advice should have to be given to Americans, so proud of smartness and alertness, but it is one more interesting commentary on the similarity of the whole human family in proneness to err at times. The desirability for seeing that one's foreign addresses are indicated in advertisements in trade journals was recently drawn attention to by one of our own Consuls in Australia, and was emphasised in the ELECTRICAL REVIEW. We hope the point will not be lost sight of, so while touching on so many other matters, we name it here again.

Before leaving this part of the subject, we may mention that the Bureau of Manufacturers of the Department of Commerce and Labour has arranged for filing with United States Consuls a card index whereby the Consulates may forward the export of American goods. The *Electrical World*, in announcing the decision in June, said: "Major John M. Carson, Chief of the Bureau of Manufacturers, announces that any manufacturer desiring to take advantage of the plan should communicate with him. No fee is to be charged for the service in sending out cards to the Consulates. All that is required of the manufacturer is that he print his cards in the language of the country to which they are sent, and in a prescribed and uniform size for assembling."

We quote this as an illustration of the extent to which American Consuls co-operate in more or less a matter of detail in keeping traders informed. When we are given to blaming defects in the Consular service provided by British representatives we, as traders, must see to it that we are not ourselves to blame in omitting to make full use of these representatives. The trader should let it be known what kind of information he is in need of, if he does not already find what he requires in the Consular reports as published. Though there are of course limits to what can be done without a substantial increase in the Government financial allocations for this class of service, we believe that more might be done than is done at present if Consuls were more frequently appealed to.

Another point of interest, and one to which the attention of the Government has lately been directed by questions in the House of Commons, is the nationality of our Consuls, and the effect that such may have upon the amount of zeal with which our trade interests are watched over. The case of Germany may be cited. Sir E. Grey, replying to Sir Gilbert Parker, said that the number of British Consular officers in the Fatherland was 34, of whom six belong to the salaried service, and these salaried officers are all natural born British subjects. Of the remainder, however, only six were natural-born British subjects, 20 were born and had remained German subjects, one was a naturalised British subject of German origin, and one a naturalised United States citizen of German origin. It was explained that office allowances were made for unsalaried services where the trade did not justify the appointment of salaried officers, and that British subjects were appointed where their services were available. On a later date, further questionings relating to our Consular representation at Kiel, and as to the possibility of having an English subject as unsalaried British Vice-Consul there, instead of a German subject as at present, led Sir E. Grey to say that the primary reason for appointing Consular representatives was to look after trade and commercial interests but they could not be appointed unless a foreign Government was willing to accept them. The Government could not ask for an appointment for special reasons in one place more than in another. No doubt we shall all feel that the interests of British trade are more likely to be well served by people of British blood and birth whose hearts are bound up with ours at home, but we believe it has been stated lately that the principal exporting countries are all in pretty much the same position in this respect. That it is recognised in high quarters as being undesirable would appear from the willingness to alter it when convenient opportunities arise. We believe, however, that it is a fact that the convenient opportunity is only the death or promotion of the existing holder of the appointment. This inclines us to hope for many openings for promotions, for it is, to say the least, unsatisfactory that British trade should have to continue long dependent upon gentlemen who, however well intentioned, are hardly to be expected to go very far out of their way to assist the manufacturers of another nationality. We fully recognise that other nations may suffer under the same grievances when they are dependent upon foreign-born representatives, but this only serves to emphasise the unreasonableness of the position as it now stands. We suppose the question of expense is largely responsible, for the salaried officers in Germany are all British, and it is only where the trade is not considered sufficient that unsalaried officers are good enough. If that be so, increase the vote and negotiate with other powers a mutual interchange of consuls without waiting for the death or promotion sentence. Special trade representatives in all the markets of the world are what this country needs; not "unsalaried officials," but men adequately paid for exclusively collecting trade information, advising manufacturers, and replying to inquiries. No doubt the higher diplomatic agents may possess facilities and qualifications which shall fit them for doing us an important good turn because of the valuable opportunities they have for coming into close official and social intercourse with eminent individuals, but important as these are, might they not be supplementary to those of the special trade agent? The latter would still be a subordinate official of the former. There is something to be said in favour of information being collected by a man already engaged in trade in the particular vicinity, but human nature being what it is, there is also something to be said against it. An independent official in the service of the Home Country—that is the ideal, bnt the cost! As to that, we have already stated that it would be an investment well worth the nation's while. Governmental assistance of this kind is to our mind perfectly legitimate.

No donbt there is some settled basis, some trade minimum, which decides whether a salaried or unsalaried official is to be allowed, and if that is so, then it means that British trade mnst first be privately developed up to a certain figure, when it shall have a salaried official to foster it. This may be all right to some minds, but would it not be somewhat wiser to go one better and let the British trading potentialities of a particular province, as well as what has been already achieved, carry weight? To extend British trade is the moment's need; once we have reached a respectable figure, British firms can do a great deal to maintain that figure year by year.

Let it not be imagined that we desire the Consular service to do that essential pioneering work which private enterprise has done in the past, but there might be more of the latter if the former were more efficient, and an improvement in both directions wonld tend to lessen our home unemployment.

We ought to add in this section that in addition to the facilities provided by the Board of Trade, there is a Statistical and Information Department of the London Chamber of Commerce, 1, 2 and 3, Oxford Conrt, Cannon Street, E.C., where, *inter alia*, it is possible to ascertain names of the principal agents and importers of electrical goods in certain countries.

Packing for Export.

Not much has been written recently in the Press on the importance of machinery and apparatus being properly packed. Is it because there is no room for improvement? We should like to be able to think so, but there still linger in our memory the letters that have been brought to onr notice complaining of the complete hanging up of sadly-needed goods purely because inefficient packing has allowed some small part to be damaged in transit. The whole thing has had to lie *hors de combat* until a new piece arrived in response to an angry cable or a letter, the terms of which are "better imagined than described." American Consuls have belabonred American packers, and English Consnls have scolded our own, for shortcomings in this connection, and have shown how it is the easiest thing in the world to alienate support and to create false impressions. There are circumstances nnder which even poor stuff well packed is better than the best quality goods so packed that it is impossible to bring them into use when required. The packer is an employé of no mean importance, for remissness or incompetency on his part may do nntold harm. We have little donbt that among those who read this will be some who have a very lively recollection of trouble experienced, of reproofs administered, of diplomatic apologetic letters that they have had to write to wrothful foreign clients. The expert packer mnst know his business—there is one way of packing oranges to come to England, and quite another of preparing electrical instruments for their journey to, say, India or some other part where climatic considerations are of great conseqnence. We well remember reading a paper written by an electrical engineer in India, in which the serionsness of the question was dwelt upon. Such contribntions, nnfortunately, have a way of being forgotten all too soon, so we refer those who may be interested to the Electrical Review for August 21st and 28th, 1903, where the paper was reprinted ("On the Preservation of Instruments and Machinery in Bengal," by Paul Brühl, read before the Calcntta Section of the Institution of Electrical Engineers). With a view to arousing an interest in this paper in the minds of those who never read it at the time, let up quote a few typical sentences:—

> As we all know to our cost, a good deal of mechanical injury is often done before the goods reach our hands. It is, of course, useless to expect that the treatment accorded by porters and dock labourers or railway servants in Europe, or by coolies out here, to cases containing scientific instruments will be in any way different from the treatment meted out to cases of cotton goods or bales of jute. They will be banged about, dropped from heights varying from a fraction of an inch to 20 ft. or more, rolled down inclines and turned over regardless of any printed admonitions of the type of "this side up." I do not know whether railway porters and dock labourers are more considerate on the Continent than they are in other parts of our globe. Perhaps they are. At least, that is what one would conclude from a printed label on a case which I received some time ago from a Berlin firm of scientific instrument makers. On the label there was a printed request—in German, be it remembered—addressed to "respected gentlemen," officials or otherwise, to kindly keep that side of the box with its face upwards. Now the first glimpse I got of that box was in the Calcutta Customs House at the moment when one of the "gentlemen" with dhoties round their loins and a blackened cloth round their heads was turning it over and over, round any and every direction for an axis of revolution, until every side had had its chance of being "up." Hence the wisdom of the rule: "Do not expect any side of a packing case turned any way; do not address people in a language they do not understand, and do not indulge in the vain hope that human beings who cannot read are likely to act according to printed directions." I have seen some rather bad cases of breakages, but luckily for us we on this side of the globe are not quite as bad as our brothers on the western hemisphere, where the most expeditious, though perhaps not quite the cheapest, method of breaking stones is to pack them in a strong box and send them by rail to the next town.

Mr. Brühl then proceeds to discuss points that must be attended to in order to avoid breakage of instruments, in spite of rough treatment. We commend this paper and the discussion that followed upon it to the notice of all exporting firms, not only those interested in the instrument business, but those concerned with all other electrical departments who may pick up points of general value.

A practical article on the export packing question as it affects the machine tool business appeared in an American contemporary (*Machinery*) not long ago, and it may, we think, be profitably quoted from here. It is pointed out by the writer—

> That a box containing a machine tool worth a substantial sum in pounds sterling is of no more importance to a stevedore than one containing dog biscuit. It is recommended that special note should be taken of the thorough way in which the accessory parts are cleated down, and the manner in which heavy parts are supported by the framing. The proper preparation of a heavy machine so as to withstand foreign shipment is costly of time, labour, and lumber, and much thought should be given to the design of package. It must be remembered that in lowering a machine into the hold of a steamer it is quite possible that the box will be suspended with the machine upside down, or, what may be worse, from one end if it is too long to go down the hatchways horizontally. No slender part should be in contact with the thin boarding, as a blow or heavy pressure may be transmitted to the part with bad effect. Points that should be observed in packing machines for export are detailed as follows:—
>
> 1. Dismount all projecting slender parts to save space and to prevent breakage by side pressure. Saving of space is important, as 40 cb. ft. is reckoned a ton even if the actual weight is less.
> 2. Avoid packages weighing more than 4½ tons if possible. The freight rate is much higher for packages exceeding this limit than for lesser weights. Keep all weights less than 2 tons if it can be accomplished without making assembly too difficult.
> 3. In dismounting machines take into consideration ignorance of the parties receiving it, and avoid as much as possible dismounting parts that require careful adjustment for the successful working of the machine.
> 4. Fill all the screw holes with wood or waste soaked in slushing oil, to prevent filling with dirt and rust.
> 5. Tag all parts removed, giving their position or use on the machine.
> 6. Prepare a list of all the detached parts to accompany the machine, which will show if any part has been lost in transit or Custom House examination. Assembled drawings or photographs are desirable also, to facilitate erection.
> 7. Cover all finished parts with a reliable slushing oil to prevent rusting during transit. The salt air and dampness of the sea voyage will attack unprotected finished parts to an extent almost unbelievable by one having known only the protection needed for land transport.
> 8. Build the package with strong skids, floor, and framework, reinforced by through-bolts, if large, heavy machines are to be shipped without dismounting the frames from the legs.
> 9. Support all heavy overhanging parts with cross girts from side frames, and pack accessory parts so that they cannot change position even if the case is overturned.

10. Provide a waterproof roof and board the sides so as to resist driving-storms of rain or snow. Leave an opening 12 in. by 18 in. in one side, the cover of which can readily be removed for Custom House examination. Mark the screws holding the panel so that they will readily be found and removed without damaging the case.

11. Mark the case with the gross and net weight, volume in cubic feet, port of destination, names of consignee and shipper, name, number, and capacity of machine; also designate the top or bottom and the nails or screws that should be first removed in unpacking.

Among other things to be borne in mind is the fact that not all foreign ports or landing places are provided with such ample and efficient crane equipments and other handling facilities as, say, Manchester, Middlesbrough, Hamburg. Also, in many of the mountainous districts in the interior of, say, India or Brazil, there is a complete lack of railway facilities, and the motor-car has not yet found its way there for the haulage of goods, so that mules or oxen, camels or elephants, or chains of native carriers, have to convey to their final destination packages, &c., that have been started from home by the smooth running of a modern electric crane.

On this point an American Consul at Saigon, Cochin-China, after alluding to the gratifying improvement recently noticeable in the packing of goods imported by the Philippines from the United States, adds, according to the *Mining World* (U.S.A.), that while it is not yet all that it may be, it is observed that more care is shown in the selection of stock for the casings. "This is sometimes reinforced, as it always should be, with strap iron bands. The necessity for this is apparent to all who have watched the methods of handling, and especially trans-shipping freight by means of coolies. These, with a bamboo pole and piece of rope, carry in a most precarious fashion practically all sorts of merchandise brought to this region, and the package is liable to drop and burst at any moment. Another improvement noted is in the making of uniform packages instead of placing a number of miscellaneous articles in the same case."

Comments of interest on the packing question were recently made by the American Special Agent Dennis, in Moscow. He says: "In a long and most interesting interview with one of the oldest and most successful dealers in Odessa, he called my attention particularly to that oft-repeated complaint of careless packing. In one shipment of 24 machines 19 of them arrived with a road wheel broken. One only needs to take a walk about the docks of any of these foreign ports to appreciate how absolutely necessary good strong packing is to ensure delivery of goods in saleable condition. When the time necessary to secure repairs for such breakages is considered, it really means carrying the implements (agricultural) all the year unsold."

Inattention to Correspondence.

The American special agent at Moscow, whom we have just quoted on the subject of bad packing, says that in the same interview the Odessa dealer called attention to the great lack of interest evinced by many manufacturers in the United States regarding letters of inquiry sent from Russia. "In many cases no answer is received. In others the questions asked are evidently answered by some one not at all conversant with the technical details of the business, and hence are of little or no value. He felt that the least the manufacturer could do was to convey the idea of his interest in the subject-matter of a letter received, and if it was not in a line of goods he made, he might at least suggest the name of some other maker who would be likely to take it up."

In view of the increasing importance of the Russian market from an electrical standpoint, and the desire that exists there to do business direct with English houses rather than through Germans first purchasing in this country, our electrical traders will do well to note these criticisms of American inattention. It appears that Americans already on the spot are prepared to give hearty support and assistance to other Americans "representing non-competitive lines," who care to make an effort to secure a trade anywhere in Russia, "if they send the proper sort of representatives." This equally applies, of course, to our own countrymen, for Englishmen are only too happy to welcome others of a like nationality, and they may be trusted to cordially render assistance so long as in doing so they are not cutting the ground from beneath their own feet.

The "Proper Sort" of Representative.

We might enlarge on this point as showing how important it is to send representatives of standing, "the proper sort," as the American agent says, with whom those already established there would have no aversion to hobnobbing. The "right man" fraternising with the man already possessed of valuable experience as to the people, their ways and customs, needs and predilections, might be able to learn just those things which would make him able effectively and diplomatically to negotiate for trade or for concessions. Some of our friends who have succeeded in establishing satisfactory connections in Russia for electrical specialities, advocate the appointment of Russian agents rather than sending out Englishmen, because the former knows the Russian game of business, "the ropes," as we say, better. That this will not hold in all cases we can readily believe, if for no other reason than that Englishmen who have lived in Russia for half their lives are doing a splendid business in particular trade lines. No doubt their long residence has brought increasing success as year by year they have won their way nearer and nearer to the Russian because of their close intimacy with him and their ever-improving knowledge of his methods and requirements.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Increased Output of Boilers.

Referring to your article on this subject in your issue of July 9th, it is undoubtedly true that an increase in velocity of travel of the gases in a boiler will increase the efficiency of the heating surface, due to the fact that more of the particles of gas are brought in intimate contact with the surface of the boiler in a given time. The losses incurred in attaining this increase in velocity of the gases, however, far outweigh any gain thereby.

Assuming a fixed rate of combustion, if the velocity be increased by increasing the volume of gas by dilution with excess air, the efficiency is very materially reduced, for the temperature of the furnace varies directly with the percentage of CO_2, or inversely with the percentage of excess air, and the rate of absorption of heat depends upon the difference in temperature between the gases and the boilers. Again, still assuming a fixed rate of combustion, the velocity of travel of the gases can be increased by lengthening the path of their travel by increasing the number of baffles.

By applying the laws enunciated by the U.S. Geological Survey, and quoted in your article, the increase in the number of baffles will increase the resistance, and, consequently, the "pressure drop" between the grate and the chimney, leaving a proportionately smaller "pressure drop" available for the grate. This, of course, would reduce the output of the boiler.

Should we resort to mechanical draught to maintain the output of the boiler, we find that the weight of gas passing through the boiler varies as the square root of the "pressure drop," consequently, the increase in "pressure drop," due to the increase in baffling, will enormously increase the power required to operate the fan. Of course, under these conditions, an increase in output from the boilers would be inexpedient, as it would be attended by abnormal cost of operation of the fan.

The writer is quite prepared to agree with "Scrutator" in his comments in your issue of July 30th, especially in regard to the slow unbaffled travel of the gases through a boiler of the Lancashire type, in which such high efficiencies are obtained.

It may interest your readers to know that some of the largest plants in the United States have entirely removed the baffles from their boilers, which are of the B. & W. type, thus reducing the "pressure drop" between the grate and the chimney to a minimum (see *Proceedings*, American

Society of Mechanical Engineers, December, 1906). These boilers are evaporating from 7 to 8 lb. of water per sq. ft. of heating surface per hour, at substantially the same efficiency as when, with chimney draft, they were evaporating from 3 to 4 lb. of water per sq. ft. of heating surface. They have a ratio of heating surface to grate surface of 40 to 1, and are burning a very poor grade of coal. The terminal temperature is 150° to 250° F. above the temperature of the steam, and the flue gases show 15 per cent. to 16 per cent. of CO_2.

These results are accomplished by the balanced draught system, which is now being introduced in Great Britain and on the Continent. By this system the damper in the smoke outlet of each boiler is automatically controlled by a gasometer damper regulator, which so far throttles the damper that atmospheric pressure is maintained in the furnace chamber at the fire door. This condition is maintained automatically for all rates of combustion, the gasometer being actuated by the pressure of the furnace gases.

The air for combustion is supplied by a type of centrifugal fan blower that delivers a constant volume of air for a given speed, at a pressure varying with the resistance. The speed of the fan (volume of air) is controlled by the steam; the pressure at which the fan delivers the air varies in accordance with the thickness of the fuel bed, and is just enough to overcome the "pressure drop," atmospheric pressure being maintained at the fire door for all rates of combustion.

Careful tests in a plant of 5,000 H.P., which was being operated on the balanced draught system at 100 per cent. overdraft load, showed a steam combustion for the blower engines of less than 1 per cent. of the total boiler output.

The writer has had tests made on upwards of half a million horse-power of boilers, and the results of these tests would tend to confirm the conclusions arrived at by the United States Geological Survey. We also believe Prof. Nicholson's statement to be technically correct, but it is not a feasible method of increasing the output of a boiler.

In order to successfully accomplish this result intelligent consideration must be given to the three fundamental laws laid down by the Commission.

Embury McLean.

London, E C., *August* 11*th*, 1909.

Naval Voltages.

One of the daftest effusions I have for some time read in your valued journal is that under the above title. Evidently the recent visit of the Fleet to the Thames, has enabled your contributor to visit some small cruiser or an "obsolete." The article is simply silly, and shows both an ignorance of modern "ships," and of modern naval electrical matters. It is not worth while attacking the article in detail, but a few remarks may be of interest.

Primary voltages have been 60, 80, 100, and the present 220; 200 has never been used, but 500, for arc lighting many years ago, had a brief trial. (The above is exclusive of submarines.)

Your contributor's knowledge of searchlight practice is about 20 years stale. A modern ship will carry 10 or 12, or 24 (*i.e.*, twelve twin) searchlights. There are several types. "Wireless" is a fairly recent innovation, and was taken *back* to 80-volt ships. There are probably 100 to 150 motors, varying in horse-power from tiny $\frac{1}{10}$-H.P. fans to 180-H.P. capstans.

Generators are both oil and steam (reciprocating or turbine) driven, are compounded, and arranged for parallel running, and are either 60, 105 or 210 KW., with voltage and ampere margins. Lighting will probably total 1,200 to 1,600 points, and has its peculiarities. There are a goodly number of arcs, exclusive of searchlights.

Motor-generators, both A.C. and D.C., will probably total 20 to 30, and include interesting special machines. Other uses of electricity are telephones, bells, gun firing, gun telegraphs, gun alarms, torpedo gear, wireless, heating, &c. Battery power has practically ceased to exist. Small secondary batteries have some uses.

Apparatus is installed in many modern ships that would create a load of near 1,000 KW. (this figure is, however, not attained either under peace or war conditions).

In conclusion, may I ask does the contributor imagine an installation costing possibly £130,000, is produced in the amateurish haphazard way the article would suggest? If he would, or could, but get a real show round a modern ship, he would, I imagine, be a very surprised man, and would at least acquire a knowledge, enabling him to write common sense, and an article that was not an insult to shipbuilding firms and Admiralty staffs alike.

The influence of modern Admiralty practice is easily observable in very many works, but it must be stated that manufacturers do not nearly understand the curious conditions obtaining on a warship, and are inclined to think some specified requirements absurd, &c. Possibly some are.

H. P. B.

The Automatic Transformer Switch.

In your last issue was published an article by "Student" on the above subject. Without necessarily agreeing with the argument put forward, I think most people would agree with the first conclusion, viz., that the only person who will benefit by an auto-switch would be the user of the small transformer.

On the basis of the 500-watt transformer, with a no-load loss of 10 watts, it is shown that a saving of 23s. per annum may be effected, assuming the supply at 4d. per unit.

In practice, I think it would be found that the saving is more than this, for the average figure given by the transformer makers for no-load losses on this size of transformer is nearer 15 watts, and again the average price for electrical energy is higher than 4d. per unit.

Then, again, it must be understood that the no-load losses guaranteed by the makers are presumably correct figures, as indicated on an instrument suitable for such measurements. The ordinary house meter working at, say, 1/150 of its normal load, is certainly not a suitable instrument to accurately measure this small amount of energy, and I think it would be found that most meters read fast (some as much as 50 per cent. fast) under these conditions.

Under the circumstances, I think that money spent on an automatic transformer switch shows a better return than if spent on a better quality iron in the transformer.

As regards the reliability of the auto-transformer switches, it will be noted that some makers supply these with a glazed front, so that it is very easy for anyone to see at a glance whether the apparatus is in working order.

There are many disadvantages in connection with the hand-operated switches, on the primary side of the transformer, for disconnecting the transformer from the supply mains when no lights are required, and when this is taken into consideration, there is much to be said for the automatic transformer switch.

The great drawback at present to the more general adoption of these auto-switches is the comparatively high price, which "Student" places at about £3 each, although there is at least one such apparatus on the market which may be obtained for 32s. 6d. (subject), and the writer has one of these installed which appears to be quite satisfactory. With a reliable auto-transformer switch at a popular figure, I think there can be no doubt as to the advisability of its installation, and it will be noted that the cost of the apparatus would be saved in less than 12 months.

Engineer.

London, *August* 16*th*, 1909.

The remarks by "Student" in your last week's issue on the above subject are undoubtedly interesting, and from the supply engineer's point of view, will, no doubt, be fully endorsed, but from the standpoint of the contractor, who has to deal with the complaints of customers who are not saving the 60 per cent. or 70 per cent. so much advertised by metal-filament lamp and transformer makers, it will not appeal with equal force.

Users of transformers, such as hotels, &c., whose full load is a heavy one, but who, as "Student" remarks, have use for only two or three lights during the daytime, would be well advised to have a small transformer capable of carrying the two or three lights referred to, the no-load losses of which would be negligible, and to have an automatic switch in use with the transformer carrying the big load.

It is not at all clear what "Student" means by "exercising a little economy in the quantity of energy consumed." Although the percentage of losses on the large transformers will be slightly lower than on the smaller sizes up to 1 KW., yet the losses on, say, a 3-KW. transformer will be anything from 40 to 70 watts. Assume an average of 60 watts loss, which is by no means unusual, this would, on the same lighting hours as estimated for by "Student," 1,170 watt-hours, and at 5d. a unit (which is more like the average cost of current than 4d.), be equivalent to £8 18s. approximately lost during the year. It appears from this showing that a transformer switch costing even, say, £4, would well repay the outlay.

Your correspondent also makes no allowance for the loss of efficiency in transformers through ageing of iron; of course, the best English made transformers do not age appreciably. On sizes up to 500-watt output, the cost of the transformer switch would take from one year to two years to repay, but that it will pay good interest on the capital outlay involved is obvious, even on the figures given by "Student."

"Student" must have been very unfortunate in his selection of an automatic switch when he states that good working is a "rarity."

The transformer switch used by the writer "speaks" for itself, as at the moment of switching on there is evidence of contact being made in the lighting up of the lamp, which, though in no way detrimental to the user, is satisfactory evidence that the switch is fulfilling its function.

Your correspondent's recommendation to use two-way switches, one in the hall and one upstairs, may have advantages, but the possibility of trouble and inconvenience would be much more likely under this system than with an automatic switch which can be operated from any room in the house.

It would be interesting to know what the effect would be in the case of burglars, or illness, or fire, and all other occasions on which light is instantly wanted, if one had to run to the landing to turn the switch on. "Student" states that "we cannot afford to run risks," but he could hardly "look before he leaps" if he has to go to the landing first to turn his light on.

This being the case, it appears to the undersigned that facilities for switching the light on at any point in the house, at any time of the day or night, which is the case when using an automatic switch of good construction, far outweigh the slight disadvantage of a few shillings extra cost over the two-way switch system, and, as before pointed out, there are a very large number of cases where transformers of from 1 to 5 KW. output are in use in which the cost of the switch is repaid in much less time than a year.

In practice meters generally read very high at 10 watts or thereabouts when the power factor is so low, as with transformers on open circuit, *i.e.*, from ·4 to ·6. This occurred with the writer, who experienced an increase of about 100 per cent. with a meter quite correct at average load.

Climax.

Samples with Tender.

In last week's issue, I notice above the signature of "One of the Tenderers," there appears a letter relating to the submitting of sample arc lamps.

As the communication in question is obviously meant to allude to the specification recently issued by the Swansea Corporation for the supply of arc lamps (88 not 80 as stated), it has occurred to me that the following information may be of interest to your correspondent.

I am strongly of opinion that in deciding tenders for certain electrical apparatus, the only fair plan is to be in a position to examine and test the actual article quoted for. Arc lamps, I consider, in particular come under this class of apparatus. It has been my experience when inviting tenders for arc lamps to have a large number of the manufacturers asking to be allowed to submit sample lamps at their own expense, and it was this fact, coupled with the one above-mentioned, that decided me to make it compulsory for all firms tendering to submit samples, so that their tenders would receive the same consideration.

As the lamps will have to be run four in series, I think you will agree it is more satisfactory to judge of the behaviour of the lamps when burning under the actual conditions required, hence my reason for asking for a complete series of lamps, both D.C. and A.C. It is with sincere regret I now find that in attempting to bring about this fairness in judging the tenders, I am accused of the insertion of an "improper clause."

I have pleasure in sending you herewith a copy of the general conditions and specification, and I feel sure, if you will look over same, you will agree with me that there is nothing "improper," or in any way unfair to the firms tendering. I beg to submit that the merits or demerits of an arc lamp cannot be judged fairly without the lamp being actually examined and tested, and my object in asking for samples from the tenderers was purely with the idea of giving each tenderer an opportunity of having his particular make of lamp judged, not only by price alone, but after the details of construction, &c., had been investigated.

C. A. L. Prusmann,
Borough Electrical Engineer.

Swansea, *August 16th*, 1909.

We are glad to note that you have taken up the matter, in your last week's "Correspondence" columns, of the unreasonable requirements mentioned in a recent arc lamp specification.

We should be greatly interested if the engineer asking for these lamps would state how many firms tendered, and how many lamps were sent as samples.

The mere fact that eight lamps were required as samples does not convey an accurate idea of the total cost to the firms sending in these samples. The lamps were required to be fitted with special cases, an adequate number of carbons for testing purposes free of cost, automatic cut-outs, substitutional resistances and line resistances.

As no indication was given as to the length of time these lamps would be under test, it is possible that they would be returned in a condition unfit for issue as new lamps.

The cost of preparing such lamps for tender would be quite prohibitive in view of the small number of lamps to be eventually ordered.

In cases of this sort, we think it would be well if, when advertising the specification, the onerous conditions for the samples required were clearly stated in the advertisement. This statement would certainly have prevented the preparation of an estimate in order to obtain the return of the guinea by

Another of the Tenderers.

August 17th, 1909.

Testing Condensers for Leakages.

I read with interest the article on this subject by "Harbee" in your issue of August 13th, and I admire the way he tests his feed water for salt.

It is very important to be able to check the starting of a leakage in a condenser when the circulating water is taken from a tidal river where the water is salt, but there is an objection to all leakage tests as far as I know, and that is, they do not give a continual record such as would draw attention to a tube going wrong, unless a test happened to be applied exactly at that time. It is more than likely the first indication would be the feed-water tanks overflowing, and perhaps the boilers priming, due to the large quantity of salt water drawn through the bad tube by the air pump.

Another leakage or loss in a condenser is a drop in vacuum, due to leaky joints, and more often due to dirty tubes. This loss in a turbine station, unless great care is taken, may amount to a serious item in the economical running of the turbines.

It is a good plan to have a barometer in the engine room and a mercury column to each condenser; also means should be provided to take a weekly test of four hours' duration, with 10-minute readings of the load on the turbine, vacuum in the condenser, temperatures of steam inlet, outlet, water inlet and outlet on the condenser, as by these means the engineer has a record of the working efficiency of his condensers.

The writer has several large condensers under his care, the tubes of each condenser are brushed and steamed out about every four or five weeks, and a water test at a pressure of 25 lb. per sq. in. applied on the outside of the tubes; this pressure is slightly above the circulating water pressure plus the vacuum pressure, and shows up any leakage.

Perhaps some reader could describe a reliable method of detecting salt, and continually recording on a chart, similar to a volt or CO_2 recorder chart, the state of the feed water.

William Middleton, A.M.I.E.E.

Newcastle-on-Tyne,
August 16th, 1909.

Electric Meters.

We have noted with interest the article in your issue of June 18th by Mr. Rankin Kennedy, "Mercury Motor Continuous-Current Electricity Meters," and in your issue of June 25th, by Mr. W. Fennell, on "Temperature Errors in Shunted Ammeters."

Referring to the former article in regard to mercury motor-meters, we take the liberty of sending you under separate cover, descriptive matter in regard to the mercury motor-meters which we have made in this country for a number of years, as we believe this matter may be of interest, since our meters embody some of the improvements that Mr. Kennedy speaks of as desirable, and particularly the separate brake feature. We would also draw your attention to the fact that we have perfected and have manufactured many thousands of A.C. watt-hour meters of the mercury-motor type, these being, so far as we know, the only ones manufactured.

Referring to the other article, by Mr. Fennell, we beg to say that we have devoted a great deal of attention to the matter of eliminating the error produced by thermo-electric effect in the junctions of resistance metal and copper or brass, in shunts with our large capacity D.C. meters, and have overcome this difficulty very satisfactorily by taking the shunt leads off the end blocks of the shunts through long strips of the same material as the resistance metal in the shunt, so that any heating effect setting up a thermo-electric potential between the alloy metal of the shunt itself and the end blocks, is off set by an opposing and practically equal potential set up between the end block and the alloy strip leading off from it to the shunt cable. By having this strip of sufficient length and properly proportioned to dissipate the heat transmitted to it from the shunt, there is practically no thermo-electric effect set up between the strip and the copper in the cable where they are joined together, thus giving very satisfactory results with the combination of shunt and ampere-hour meter or watt-hour meter operated from it, even where considerable difference in temperature exists between the two ends of the shunt.

Sangamo Electric Co.,
R. C. LANPHIER, *Secretary.*

Springfield, Ill., U.S.A.,
August 6th, 1909.

Technical Classes Wanted in the Daytime.

It has occurred to me that those people who would possibly use the evening classes of our technical schools most are more or less debarred at present, owing to the fact of being on "shift" work, as, for instance, the great number of power house and sub-station employés of our several large systems here in London.

Many men I have met have expressed the same surprise as myself, that none of the metropolitan technical institutions cater for these men.

I am sure many would welcome any suggestion you would make as to the formation of such classes.

Clifford C. H. Brazier.

London, *August 11th*, 1909.

[The difficulty mentioned by our correspondent has often come under our notice, and is well worthy of the attention of the educational authorities. But unless there is evidence of a widespread demand for a remedy, it is not likely that any active steps will be taken to provide it; we shall therefore be glad to receive the names of any of our readers who are willing to take advantage of such classes, for our own information, and if sufficient support is forthcoming, we shall be pleased to do what we can to further the proposal.—EDS. E.R.]

PROCEEDINGS OF INSTITUTIONS.

The Electrolytic Theory of the Corrosion of Iron.

By WILLIAM H. WALKER (Boston, U.S.A.).

(*Abstract of paper read before the* IRON AND STEEL INSTITUTE, *May*, 1909.)

WHEN a salt dissolves in water, a certain proportion of the dissolved molecules are regarded as dissociated or broken up by the water into component parts called ions. These parts of molecules may be made up of a single atom, or a group of atoms, but, as individuals, differ from real atoms in that they carry relatively large charges of electricity. Water itself is somewhat dissociated into two ions oppositely charged—the positive hydrogen ion composed of one atom of hydrogen, and the negative hydroxyl ion composed of one atom each of oxygen and hydrogen.

Every metal when placed in water, or under such conditions that a film of water may condense upon it, tends to dissolve in the water, or, in other words, to pass from its atomic or metallic condition into its ionic condition. As the atom of metal passes into the water, it assumes a positive charge of electricity, leaving the metallic mass from which it separated charged negatively; this property or escaping tendency of the metal is termed its solution pressure. It is obvious, however, that this action can continue for only a short time; owing to the fact that the mass of metal and solution are of opposite polarity, the electrolytic tension becomes so great that no more atoms can escape to the ionic state, and the solvent action ceases.

When a strip of pure iron comes into contact with water, it sends into the water iron atoms in the form of positively charged ions. Hydrogen as a metal has a much smaller solution pressure than iron, and hence an equivalent number of hydrogen ions plate out on the iron strip (leaving the free hydroxyl ions with their negative charges to balance the iron ions with their positive charges), and an electric current flows from the iron by means of the iron ions to the solution, and by means of the hydrogen ions from the solution back to the iron again, thus completing the circuit. But the deposited hydrogen is a high insulator—a film of gas which offers a great resistance to the flow of the current. Hence, although in the case of the iron strip in water all the conditions for continuous solution are present, owing to the resistance offered by the deposited hydrogen film (called polarisation) the action must cease.

The solution of the iron, in the first instance, depends upon the number of the hydrogen ions present. This number of hydrogen ions, or the concentration of these ions, is increased by the addition of any acid. So weak an acid as carbonic increases the number, but to a relatively small amount; while a strong acid, like hydrochloric or sulphuric, adds to the number to such an extent that the solvent action becomes violent, and the deposited hydrogen comes off as a stream of gas.

It was formerly thought that the action of oxygen as a factor necessary in corrosion was simply to oxidise the iron ions thrown into solution, and to precipitate them as rust. While it is true that this reaction does take place, and is indeed the most striking function that oxygen performs, it is in reality a secondary one, which is simply incidental to corrosion and not a necessary part of the action. Its real accelerating effect is due to the fact that it depolarises the hydrogen which is set free by the reaction, and separates out on the metallic iron.

Before iron can form rust it must first pass into solution, and in so doing cause an electric current to flow from the iron at that point to the iron at some other point; any circumstance which will aid the flow of this current will accelerate the solution of the iron. In other words, any difference in potential which may exist upon the surface of the iron will in itself cause a flow of electricity which will result in a solvent action on the iron. Such differences of potential inevitably result from a segregation or uneven distribution of any impurities which the iron or steel may contain. Hence we should expect that the speed of corrosion would increase in accordance with the percentage of impurities present. It has been found that a steel made under such conditions that the total impurities are reduced to not over 0·05 per cent. resists corrosion to an extent equal to the iron of our forefathers.

Since iron can pass into solution only by assuming the ionic form, and having at the same time an equivalent amount of hydrogen pass from the ionic condition to the gaseous state, the speed of the reaction will depend upon the number of hydrogen ions present in the solution. The effect of free acids has already been noted; but the presence of any metal salt, such as alum or magnesium chloride when subjected to pressure, or other materials which by hydrolysis will form an acid, will also accelerate corrosion.

If, on the other hand, the hydrogen concentration be reduced, the corrosion of the iron will also be decreased. Such a condition may be most easily realised by adding to the water a strong alkali, which, owing to the presence of a large number of hydroxyl ions, decreases thereby the number of the hydrogen ions.

This fact has an important bearing upon the question which has been lately much discussed as to whether concrete will protect iron from corrosion. Inasmuch as Portland cement, when it sets or hardens, liberates a large quantity of caustic lime, which is a strong alkali, and since good concrete is therefore saturated with this strong alkali, the answer to the question must be in the affirmative. Iron or steel will not corrode when embedded in concrete. But caustic lime is soluble in water, and poorly made concrete is not impervious to water. Therefore, if iron be embedded in concrete through which water at any time be allowed to percolate, this calcium hydrate will be slowly but surely dissolved and washed away, and with it will disappear the inhibiting action of the concrete, and iron embedded therein will surely rust. To ensure absolute protection of the reinforcing members of concrete construction, therefore, such concrete must be sufficiently dense and carefully made to render it practically waterproof. This is not an impossible condition.

The fact that the presence of a metallic iron surface accelerates the corrosion of zinc has an important bearing upon the protection of such a structure as barbed wire fencing or any structure where both an iron and zinc surface are exposed. In making barbed wire fencing, for example, the wire is first galvanised and then wound into fencing, the cross wires forming the barbs being cut at an angle in order to make a pointed barb. This freshly cut surface of iron is thus exposed, and so furnishes just the surface required for depolarising the zinc surface, and thus greatly increases the rapidity with which the zinc coating will corrode. As the zinc coating recedes from the iron surface, the latter rusts on account of the low conductivity of the water film on the two, and hence the explanation of why deterioration of a barbed wire fence always starts at the barbs and travels from there along the strands. It also shows the necessity of protecting those places on a galvanised structure from which the zinc, from whatever cause, has been removed.

Since oxygen is necessary to ensure the continuous removal of the hydrogen film, it is obvious that if no oxygen be allowed to reach the iron through the water, no corrosion can take place. This fact teaches us much regarding the corrosion of boiler shells and tubes. Pitting may be entirely avoided if the air be removed from the feed water before its introduction into the boiler. This may best be done by the employment of an open feed water heater, or, what is better still, a feed water heater connected to the dry vacuum pumps of the condenser. If such treatment is not possible, the air may be removed from the feed water by drawing the water through a closed box containing scrap iron; the oxygen in the water is then used up in corroding the scrap iron instead of the boiler tubes. Or, the oxygen in the water may be absorbed by feeding into the boiler with the water a very small quantity of an alkaline solution of a tannin material. Such a solution of alkaline tannate will break up under the pressure and temperature of the boiler, with a formation of a pyrogallate of the alkali, and this rapidly absorbs the oxygen. Soda ash, or rather alkali, is of course useful, but not because of its effect upon the oxygen content, but because, as has already been explained, corrosion is inhibited by thus decreasing the hydrogen ion concentration of the water.

The author has shown that "mill scale" or magnetic oxide of iron is strongly electro-negative to iron. Since mill scale is insoluble in water and cannot of itself enter into the reaction, its only function must be analogous to that of platinum or other insoluble conductor of this kind, viz., to furnish a surface on which the hydrogen liberated by the dissolving iron can separate and be catalytically oxidised to water again. This is also true of the black oxide protective coatings sometimes used upon iron and steel, as, for example, that of the Bower-Barf process. Just as is the case in mill scale, these coatings are very serviceable so long as the whole coating is intact. But as soon as a portion of the metallic iron is exposed, this portion corrodes all the more rapidly on account of the presence of the surface of scale on which the oxidation of the hydrogen and consequent depolarisation can go on. The inevitable result is that a pit forms at the exposed point and grows deeper and more marked in proportion as the scale is dense and closely adherent to the iron surface. Hence, if it were possible to remove the mill scale entirely from steam boiler tubes, for example, pitting would be largely eliminated, and the life of the tubes prolonged.

Energy Consumption of Tramcars.

By R. S. Pilcher.

(*Abstract of paper read before the* Scottish Tramway Officials' Association *at Aberdeen, May*, 1909.)

The cost of electricity may decide the question of a profit or loss on the working of a tramway system. In Aberdeen the cost of energy averages 1·10d. per unit, and the energy consumed works out at 1·25 units per car-mile, making a cost of 1·37d. per mile run. The proportion of this to our working expenses is 23 per cent., or more than half the cost of wages. This large item of expenditure can be regulated to a very great extent by systematic supervision over the men.

I believe the records of most towns in the United Kingdom and Ireland show an increase year by year in the consumption of energy per car-mile, chiefly owing to track and car equipments becoming older, and the great addition there has been in recent years in the number of top-covered cars in use. I believe the increase through top covers is due, not so much to the actual weight of the cover, as to the extra carrying capacity of the car in wet weather, and in consequence, the greater number of stops that the car has to make in a given time.

In Aberdeen the routes which use the most energy are not always those routes which have the steepest gradients; the speed of the car and the number of stoppages have a material effect upon the consumption.

My own impression is that any system of electric tramways which has no special system of checking energy consumption, will use at least 5 per cent. more energy per car-mile than a system which has a systematic check upon its drivers. Five years ago I experimented on one of the English tramway systems with a view to saving energy, and by instructing the motormen in the series-parallel system of controlling motors and by showing how it was possible to save energy without decreasing the speed of cars, a reduction of over 7 per cent. was made. In Aberdeen I started a similar system three years ago, which has been very successful. In the first place, each motorman is thoroughly instructed in the series-parallel system of control by means of diagrams. The motormen seem to have great difficulty in realising how it is that parallel consumes so much more than series, and especially how the first notch in series and the first notch in parallel consume more than the second and third notches.

Each man is instructed how to use the momentum of his car to the best advantage, and to keep up the same speed with less use of the parallel notches of the controller. The men are also instructed not to run their cars on parallel unless they have sufficient clear space ahead to get the full benefit in speed of the extra consumption.

All the motormen are informed of the cost of energy, and it never fails to impress them, because they previously did not appear to realise that electricity cost anything.

After having been thoroughly instructed in the office, each man is given a printed instruction paper, which shows where he should be running in parallel and where in series, also where he should be coasting. He soon learns the instructions, and gets into the habit of abiding by them. All our drivers are kept to their respective routes, otherwise I could not expect them to know the routes so well. A tactful inspector is put on the road to see that the men carry out their instructions.

Previously to this system being introduced into Aberdeen, the rise in energy consumption each year had varied between 6 and 12 per cent. per car-mile; immediately it was introduced there was a reduction in the first year of 6 per cent. on the previous year, in addition to which the gradual increase was checked. Since then we have maintained the same consumption per car-mile for three years, and as we have been adding to the number of top-covered cars at the rate of six each year, I consider that this is equivalent to a gradual reduction.

During the last few months we have had a few ampere-hour meters in use, one meter being placed on each route, and there has been a further decrease in the consumption of energy. I intend to ask the Committee for one meter for each service car. The consumption of energy on each route is recorded, a sense of healthy rivalry thus being created between the men on each of the routes. Although these meters have only been in use for three months, they have already more than paid for themselves. The main point is to get the men interested in the subject, and when they understand they will certainly reduce the consumption of energy.

In Aberdeen, simultaneously with the introduction of systematic supervision of the drivers, I noticed a great improvement in the time-keeping of cars; also, which is very important, there was a great reduction in motor troubles, the number of armatures in for repairs being greatly decreased. The car repairs last year stood at ·36d. per car-mile, and, I believe, this is largely owing to the reduction in energy consumed.

The Bristol Recording Pyrometer.

By Percy Longmuir, B.Met., and Thomas Swinden, B.Met. (Sheffield).

(*Abstract of paper read before the* Iron and Steel Institute, *May*, 1909.)

The Bristol low-resistance thermo-electric pyrometer is designed to meet the severe conditions of ordinary shop use. Platinum thermo-couples have a comparatively short life when used in flues, gas mains, or similar situations, and even in oxidising atmospheres, such as annealing furnaces for the production of malleable cast-iron, the cost of the platinum thermo-couples, when continuously used, is an appreciable factor per ton of castings annealed. One distinguishing feature of the Bristol pyrometer is the use of an inexpensive thermo-element. The electromotive force of these thermo-couples is much greater than that developed by platinum alloys; hence, a Weston milli-voltmeter replaces the delicate high-resistance instrument essential to platinum couples.

The thermo-couple wires are insulated by asbestos cord, and then coated with carborundum paint, further protection being afforded by means of a metallic tube. The couple wires are comparatively thick (about No. 5 gauge), hence the difficulty arising from variations in the resistance of the thermo-element with varying temperature is almost eliminated.

The various connecting cables are fitted with terminals of special design, by means of which it is almost impossible to connect up incorrectly. One couple actuates both indicator and recorder, hence the former is placed near the furnace, and the latter in any position accessible to the management. The switchbox included in the system contains compensating resistances, so that switching out either indicator or recorder does not affect the reading of the one remaining in the circuit.

The recorder presents many interesting features. The records are made on a smoked chart, graduated in time and degrees C. or degrees F. The chart, set to correspond to the time of the day, is revolved by clockwork, and, at short intervals, is brought in contact with the pointer of a milli-voltmeter actuated by the thermo-electric current. This vibration eliminates friction between the pointer and chart, but the intervals are so short that a continuous line results. The chart gives a 24-hours' record, and is entirely visible, so that at any time temperatures may be read directly from the recorder. The charts are subsequently fixed by soaking for a few seconds in a fixative, and, after drying almost spontaneously, are quite hardened, and may be filed for reference. The net electromotive force produced in any thermo-electric circuit is dependent on the difference in temperature of the hot and cold junctions. Many instruments are calibrated and supplied to read correctly with a cold-junction temperature of from 15° to 20° C.; others neglect the cold-junction entirely. Bristol has designed a unique "compensator," which will automatically correct for variations in temperature of the cold junction. This consists of a glass bulb with a short stem, into which two platinum wires are fused. These are in turn connected with the bore of the stem by a loop of fine platinum wire. The compensator is placed in the circuit at the cold junction, and it will be seen that, if the temperature rises, the mercury in the bulb will rise up the stem, thus cutting out a certain portion of the platinum wire, and therefore reducing the resistance of the circuit. The compensator is so calibrated that for a given circuit the reduction in resistance just counterbalances the diminution in electromotive force due to the rise in temperature of the cold junction.

The apparatus was set up to record hot-blast temperatures of the No. 5 furnace belonging to the Sheepbridge Coal and Iron Co., Ltd., Chesterfield. A platinum thermo-couple leading to a Roberts-Austen pyrometer is permanently installed in the same blast main, but the two couples were some distance apart.

The recorder commenced on May 26th, 1908, and shortly after commencing, the temperature read from the recorder was 610° C., against 615° C. by the Roberts-Austen instrument. The recorder worked well, and charts are to hand giving a continuous record of the blast temperature up to the end of July. During August the furnace was damped down owing to a strike.

Comparisons made during the test run showed good agreement in readings obtained. The instrument used by the authors was calibrated for a normal cold-junction temperature of 25° C., and had no compensator in the circuit.

The complete installation was removed to the authors' laboratory on September 23rd, 1908, in order to restandardise, and thereby ascertain the effect of continuous exposure in a temperature range of 600° to 700° C. Visual examination of the thermo-couple and protecting tube showed no change in condition. Comparison with a previously standardised platinum-iridium thermo-couple in a temperature range up to 900° C. gave remarkably concordant results.

The results show that under the conditions described the thermo-electric properties of the couple have not been materially affected. Accuracy has been maintained, and the indications are that the couples will give extremely good life. The mechanism of the recorder is admirably suited to works conditions. The real trouble in the case of most recorders, that of vibration and shock, is practically overcome.

TRADE REVIVING.

Our recent comments on the signs of trade revival, and our quotation of the views expressed by different authorities on their own available evidences in that connection, showed a gradual return of that spirit of greater confidence and hopefulness which is so necessary in order that new enterprises may be entered upon, old ones resumed, and a more extensive interchange of manufactures may proceed between the traders of various nations. Since those articles appeared there have been issued two monthly returns of our imports and exports. The June returns showed an advance of £5,585,963 in imports, and £764,836 in exports, with an increase of £1,936,293 in re-exports, as compared to June last year. The July figures show an advance of £3,547,573 in imports as compared to the corresponding month of 1908, while the exports increased by £1,781,515, and the re-exports by £1,063,303. The electrical exports shared in the increases in both months. From many foreign countries further reports have been received showing that trade generally is very substantially reviving, and the effects are being felt here. Important contracts have been booked by British works in the provinces, and new important shipbuilding and other undertakings of our own are actually placed or now being put out to tender. We make no attempt to prophesy, but we hope that this is but the small beginning of a real turn in the tide leading all the branches of British trade and manufacturing back gradually, and without any unwise forcing or booming, to a period of lasting prosperity for employers, and opportunities for honest and contented labour on the part of all classes of the community.

Middlesbrough.—A transporter bridge across the River Tees is about to be provided by the Corporation. The structure is being supplied by the Cleveland Bridge and Engineering Co., and is somewhat similar to the earlier bridges of this type at Newport and Widnes. The travelling car will be operated electrically, either from the car itself or from the shore; it is designed to accommodate 600 passengers and one tramway car.

PARLIAMENTARY.

Tramways Confirmation Orders.—On Thursday of last week the Tramways Confirmation Orders Bill came before the Unopposed Committee of the House of Commons. Mr. Bonner Moirie, of the Board of Trade explained that the Order confirmed provisional orders granted by the Board of Trade in the case of Bolton Corporation for the construction of about 3 miles of tramway: Keighley Corporation just over a mile: Morecambe Corporation about 2 miles: Portsmouth Corporation a mile, and the Whitworth U D.C. about 3½ miles. The Bill was ordered to proceed.

Electric Lighting Orders.—The Bill for the confirmation of orders granted by the Board of Trade in respect to certain towns, on Thursday of last week passed the House of Commons Committee on Unopposed Bills. The measure enables the Chesham Electric Light and Power Co. to include the urban district of Great Berkbampstead and parts of the rural district of Berkhampstead and Amersham within their area; it gives power to the U.D.C. of Cleethorpes to extend the time with regard to the construction of works authorised under their order of 1900; grants an Electric Lighting Order to the Herne Bay U.D.C; extends the area of the Hindhead and District Electric Power Co. to include portions of the rural districts of Farnham, Hambledon, Alton, Watersfield and Midhurst, and grants a Provisional Order to Messrs. Christie Bros., of Chelmsford, in respect to Holsworthy in the county of Devon.

Royal Assent.—The following Acts have received the Royal Assent.—

Electric Lighting Order Confirmation (No. 2) Act, 1909.
York Town and Blackwater Gas (Electric Lighting &c.) Act, 1909.
Proston, Chorley and Horwich Tramways Act, 1909.
County of Durham Electric Power Supply Act, 1909.
Southport and Lytham Tramroad (Abandonment) Act, 1909.
Wallasey Tramways and Improvements Act, 1909.
Folkestone, Sandgate and Hythe Tramways Act, 1909.
Aldershot Gas, Water and District Lighting Act, 1909.
Oxford and District Tramways Act, 1909.
Gateshead and District Tramways Act, 1909.
Central London Railway Act, 1909.
Holywood Tramways Act, 1909.
L.C.C. (Tramways and Improvements) Act, 1009.
West Kent Electric Power Act, 1909.
Torquay and Paignton Tramways Act, 1909.

ENGINEERING CORRESPONDENCE.

[COMMUNICATED.]

A writer in these columns recently touched upon some interesting points in the handling of correspondence on its reception, and it may not be out of place to enlarge the theme somewhat. Viewed in the light of several years' experience of a bulky mail, in and out, it is fairly evident that this is a rather neglected item in the routine of a great many houses. A few instances may be cited; who with anything of a widespread connection does not know them?

There is the one-man firm—often a most desirable customer, be it said—who corresponds on his billheads with bad ink, and worse pen; as his epistles are usually brief, he is to be preferred to, say, the head of the medium-sized concern who writes letters with his own hand. This gentleman is sometimes voluble, and one feels quite dazed after a page or two of it. Then we have the multigraph book enthusiast; the trouble here is that the carbon paper is usually renewed with the book, and at about page 70 the communication is almost unreadable. Again, the hand-written missive, fairly written but press copied; the result is often fearful to behold.

To come to the now more general type-written document, as in the case of hand-written matter, a great source of annoyance is the badly press-copied letter. There is no doubt that the best method of recording correspondence is by means of loose carbon copies, which are made by the one operation of writing. Probably the net saving in time is small, as the sorting and filing of loose copies takes about the same time as copying and indexing in books. We are looking from the recipient's side, however, and the carbon-copy method ensures that the original written matter will be clean and legible. As an abuse of this method may be instanced the inquiry sent to two or three firms in common, and typed at one operation by means of carbon paper. This is all right if the paper is thin or of smooth texture; but some people revel in thick, spongy stationery, so that the second or third impression is often all but unreadable. Finally, assuming that the faults referred to are absent, a large proportion of letters are made tedious to read by poor typing, bad arrangement, mistakes, erasures, alterations and so on.

Now, we cannot judge a firm's standing by their correspondence, for there are those who have elegant stationery and turn out neatly written letters, but leave their ordinary shareholders in the position of Mr. Micawber year by year. It is safe to say, however, that a letter smartly written, properly arranged, and easily read, will command better attention than one exhibiting any of the defects referred to. Such as the latter are not uncommonly put aside until some amount of leisure can be devoted to them.

The point is well worth considering, and a good standard is easily attained. Much rests with those members of the firm who have control of these matters; the provision of a reputable machine, which should be kept in repair and cared for generally; also a competent and fairly well educated operator—this is where a good deal of the trouble originates, as quite a number of so-called typists are deficient in common knowledge, and often untidy and careless in their work.

There is much variety in stationery. Printing has become such a fine art in these days that nothing more need be said than that it should be possible on receiving a letter to take in the sender's name, address, &c., at a glance—this is the beauty of the stamped heading, which is usually plain and compact. There is no doubt that what is known as quarto or large post is the most convenient size of paper for general use, as the typewriter then has full play and more equal wear, and quicker work is possible. It is also a comfortable size for the recipient to handle, and, not least of all, easiest to file away. As to texture, there are plenty of good papers on the market, and it is possible to write with a machine on almost anything. For general correspondence a firm's letter paper should be invariably of good quality, coupled with the other desirable features referred to.

The all-important thing is the written matter itself, and whatever be the nature of this, it is well worth giving a little attention to style and punctuation. It must be remembered that normally the letter is the accepted means of intercourse, and as such should be a creditable envoy of the individual or combined interests it represents. An excellent rule is to write on a single subject only in any one letter; this undoubtedly makes for prompt attention at the other end. Another useful and time-saving practice is to head each letter plainly with its subject; this will be appreciated if we suppose it is desired to refer to a letter from a firm with whom there is a large correspondence. Much time is lost by having to read through several lines of a letter with no subject heading, to find that it refers to, say, circuit-breakers, when the matter in question is reduction gear.

In conclusion, the object of these few notes is to urge that as those doing business together usually aim for promptitude and accuracy, it is to their advantage to pay some attention to the points here mentioned. Perhaps the idea some writers of uncouth missives have in mind is that quickness of the hand deceives the eye! It might—in any profession other than ours.

STOREKEEPING FOR AN ELECTRICITY WORKS.

By "INTERESTED."

Different people have different ways of conducting their business; but when dealing with the stores of an electricity works, the multifarious goods which have to be handled necessitate one method, simple and effective. The following description of a system may prove of service to some readers. It is simple to put into execution, and, whilst including all that is really necessary, nothing superfluous is added.

No. 1.—Goods Requisition Book.

Date.	Goods required.	Quantity.	For works order No.	Contractor.	Official order No.	Manager's signature.	Remarks.

No. 2.—Stores Order Delivery Book.

Orders.						Deliveries.										Completion.	
Date.	Order No.	Name of Contractor.	Materials.	Quantity.	Date due.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.

Below will be found a list of the books and cards forming the system, and following is a narrative description of each explaining the purpose to which it is put, and its position as a unit of the whole scheme:—

No. 1.—Goods Requisition Book.
No. 2.—Stores Order Delivery Book.
No. 3.—Stores Received and Issued Card.
No. 4.—Stores Received Book.
No. 5.—Stores Issued Book.

At first glance these do not present a formidable aspect, but will be found quite sufficient for the purpose. Those readers who are brought into touch with card systems will notice that one set of cards only are used. Some people are rather apt to overdo the card business, with the result that far too many cards are used, meaning a sacrifice of economy.

No. 3.—Stores Received and Issued Card.

INWARDS.

Article ....
Quantity ....
Delivered by..
Date .... Progressive No. of card .... Contract No. of article ....

	£ s. d.	
Amount charged ..		The above-mentioned Goods are in accordance with our requirements, and can be placed in Stock.
Carriage		
Cases		
Less Discount ..		
Total Cost		

Rate chargeable in J.O. book £................ Engineer....................

No. 1.—*Goods Requisition Book.*—In this book the storekeeper enters any material or goods required to be ordered, either for new work or to replenish the depleted stock. Whenever necessary the book is presented to the Chief for signature, and a strict rule is enforced to the effect that nothing is to be ordered without first being signed for in this manner. After having obtained the required signature, the book passes on to the office for the official orders to be forwarded. Should the Engineer for any reason refuse to pass an item, the entry stands as a record of the storekeeper's requisition, which vindicates him in the event of trouble arising in the future owing to the necessary goods not being in stock when wanted for use. Ordering the goods, and the manner in which the storekeeper is informed of the material necessary for projected works, forms part of the office system, and is not dealt with here.

No. 4.—Stores Received Book.

Date ....

Order No.	Contractor.	Quantity received.	Description.	Rate.	Price invoiced. £ s. d.

No. 2.—*Stores Order Delivery Book.*—Each day it is the duty of the storekeeper to enter in this book full details of all orders sent out the previous day. By daily reference to the entries, deliveries overdue are noted, and a request is sent to the office for a letter to be forwarded hurrying forward the goods. This is an important book, and a real trouble-saver, as it ensures the goods being in stock when wanted.

No. 3.—*Stores Received and Issued Card.*—Directly anything is received the storekeeper makes out one of these cards, giving details of the quantity, quality and size, and presents it to the head of the department responsible for the ordering of the same, whose duty it then is to examine the goods, and, if satisfactory, to sign the card, thus officially accepting the material. By this arrangement the storekeeper is relieved of any responsibility in the way of accepting wrong or inferior stores. The back of the card is ruled in such a manner as to allow entries to be made daily or weekly, as the case may be, of issues, so that at any time the total on the back of the card subtracted from that on the front (the quantity received) shows exactly what amount should be in stock. A constant check is thus kept on the goods, and when stocktaking time arrives it is only necessary to take the cards and check each article, or number of articles, in stock, with the balance shown on the card. A little time then spent in totalling up the amounts on the cards representing the stock in hand gives the value without delay. Again,

No. 5.—Stores Issued Book.

Date ....

Issued to No.	Materials.	Required for Job No.	£ s. d.

with these cards in use time is saved when a request is received for particulars of anything in stock, as, by reference to the proper card, the information can be obtained straight away, without counting or weighing the goods. At the same time, by making a note of the packing and cases received and returned on the cards, a record is always to hand for reference at any time.

No. 4.—*Stores Received Book.*—When goods have been officially accepted, as mentioned above, full details are entered into this book also. It forms a permanent record of all deliveries, and is used for the purpose of checking the invoices.

No. 5.—*Stores Issued Book.*—Everything issued from the stores, no matter how large or small, is entered in here at the time of leaving the stores. Once a day a summary is made up from the entries, and the daily totals duly recorded on the backs of the proper stores cards, as stated in No. 3.

Strictly carried out, this system will be found to work well, and, above all, it has the advantage of simplicity. Whether or not the storekeeper gives a number to each size, weight or make of goods, instead of writing the full description every time, is of not much account here. The use of numbers or letters can be readily applied without in any way altering the system or affecting its working. Many different opinions exist as to the advisability of using numbers or letters to represent goods, but that is not a matter for discussion here, and entails almost a chapter to itself.

ELECTRIC CONVENIENCES IN THE MODERN POWER HOUSE.

By W. S. BURGE.

The interesting article which appeared under the above heading in your issue of April 9th, brought to my mind a recent conversation, in which I was assured that the last word had been said as regards power station design, and that we had arrived at a finality that left little scope for the inventive faculties of our station engineers.

As your article makes evident, there is still fresh ground to be worked upon, and I would for a short space touch upon another view of the same subject, namely, the possibility of operating our central station plant under *continual* test conditions, which can be the only possible way of meeting the continuous steam and thermal losses that are always existent in even the best regulated stations.

The data that would generally be necessary for running the whole station under continuous test are as follows:—

1. Coal consumed by each boiler.
2. Total coal consumption.
3. Steam consumed by each engine.
4. Total steam consumption.
5. Make-up water required.
6. Temperature of hot wells.
7. Flue draught.
8. Vacuum on each condenser.
9. Atmospheric pressure.
10. Station output.
11. Possibly, unit output (where the complete unit system is in vogue).

From the above it will be evident that nothing short of a system of operation entailing special instruments for giving this data, can successfully accomplish the operation of plant under continuous test conditions, and so, before proceeding further, it will be well to consider whether the expense of laying out a power station with a view to such a system would be warranted by the economy effected thereby.

Taking the present-day methods of operation, most central station engineers realise that the best of prime movers and steam generators will only work at their highest efficiency when coaxed by the careful regulation of the various auxiliaries on which they are dependent. In many stations the steam units are occasionally subjected to an efficiency test, and on these occasions everything is most carefully looked to and adjusted. The condensers, hot-well temperatures, boiler feed, stoker feed, flue draught, &c., are all working in unison for the best possible economy, and the net result is often surprisingly good. A few weeks after this event the same plant may be working under the same conditions of load, but probably at a much lower efficiency. The reason for this is fairly obvious. While working under test, each piece of plant is made to give its necessary data, and all the regulation and coaxing is based on the information thus obtained, but when the plant is again working under ordinary conditions, the hourly readings of coal feed, feed-water temperatures, condenser discharge, flue draught, feed water, make up water, &c., are not recorded, and so the manipulation of the plant is purely a matter of judgment, and the result is equally a matter of conjecture.

That there are continuous and recurrent losses in all power plant is only too true, and the very lack of sufficient data to make them continuously evident is apt to make one callous of their existence. It is simply the old case of familiarity breeding contempt. What station is there in which a large number of small losses are not continuously going on? How about low feed-water temperatures, boiler scale, air leakage through boiler settings, dirty flues, unnecessary radiation off steam ranges which might often be isolated but seldom are, hot drainage water running to waste, steam from small auxiliaries heating the air instead of the feed water? and many other sources of waste, each comparatively small in itself, but, when all taken together over the period of 12 months, surprisingly large; and I venture to suggest that a system of operation that would bring these losses into continuous evidence, analyse them, and show conclusively when any were eliminated, would be the means of effecting a considerable saving in the coal bill.

One hardly likes to say that power station operation analyses are in a crude state, for fear of stirring up a storm of indignation from station engineers; but as a case in point, I would merely say that there must be something wrong when there is still endless dispute as to whether live steam feed-water heaters do or do not effect any real economy, and yet this apparatus has been on the market in full use for many years.

The only remedy that suggests itself is to have all the necessary information for running under test continuously recorded, so that at any instant a complete analysis of the working of the station may be seen. With the present methods of operation this is practically impossible, and the life of the charge engineer would be hardly worth living if it were seriously attempted; if, however, we had a means for *automatically* registering the necessary data for these test conditions, the information gained thereby would be a valuable index as to the result of all regulations and adjustments to the plant, and would show directly any errors that might occur. Further, the cost analysis of the station would be very much simplified—in fact, reduced almost to an automatic operation.

In consideration of the above, the writer has for some years been working upon a system for operating central station plant under continuous test conditions, with a view to producing a machine to print automatically on a daily log-sheet, hourly and summation readings of all the necessary data for continuous test operation. The individual records of coal and steam consumption do not present much difficulty, but the question of taking automatic summation readings from them is certainly more difficult. Thermal readings can easily be transmitted and recorded electrically, as may also flue draught and vacuum readings. When, however, it is attempted to print all these readings automatically on a daily log-sheet, serious complications arise. Another difficulty is that, were such a system put into operation, many details of the power station would have to be designed with a view to adopting the system, and the general lay-out, including coal handling, condenser discharge, feed-water piping, drain piping, &c., would have to be arranged to work in conjunction with it.

In conclusion, I would say that here at least is scope for new and original work to which we might profitably give careful attention. From the electric generator to the network we are able to analyse and isolate with great exactness the very slightest fault, but in the engine-room and boiler-house there is surely room for further improvement.

BUSINESS NOTES.

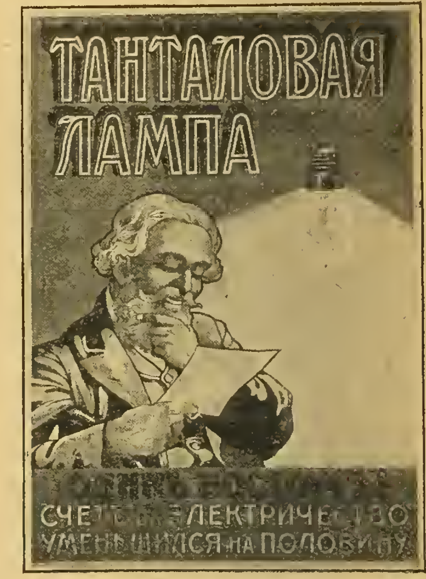
Annual Outing.—The annual outing of the employés of Messrs. Stegmann & Co., of Clapham Junction, took place last Saturday week, the party journeying to Brighton in the first instance, where they dined at the Queen's Restaurant; in the afternoon various members of the party enjoyed themselves in boating and visiting places of interest in the neighbourhood. In the evening, after returning to Clapham Junction, the party wound up at the Invitation Hotel, where several members entertained with musical selections.

Correction.—In our article describing the "Electric Lighting at Penrith" (Electrical Review, July 16th, page 114), we inadvertently described the producer plant as being of Crossley make. This part of the installation is, in fact, of the "Whitfield" type, supplied by Messrs. Salmon, Whitfield & Co., Victoria Works, Kettering, only the gas engines being supplied by Messrs. Crossley.

Consular Notes.—China.—The Belgian Legation in China reports that the imports into China of electrical materials and accessories during 1907 were valued at 1,168,436 Haikwan taels (about £200,000). At Shanghai in the same period the imports were valued at 406,950 Haikwan taels (about £65,000). The statistics do not give any details as to the nature and origin of these imports. In the provinces round Shanghai, and more particularly in the town itself, a great quantity of electrical apparatus is being used, since in the foreign concessions particularly private and public lighting is chiefly by electricity. In the international concession electricity is supplied by municipal works. During the last summer these works supplied electricity to 3,736 electric fans of various kinds and of about 170 H.P, and to 82 electric motors of a total of 530 H.P. Amongst these motors 40 are used for lifts, the others are used in connection with the cleaning of feathers, the manufacture of cement pipes, refrigerating apparatus, printing, fire pumps, &c. New installations are in course of construction which will utilise several hundred horse-power. The electrical works are in the habit of letting out motors on loan. The cost of electrical energy is 1s. 3d. per unit. The lamps chiefly used in Shanghai are of the metal-filament class of most recent manufacture. The works supply current to 17,194 lamps of 8 C P. In 1908 they sold 2,391,586 units for private lighting, 445,143 for public lighting, 3,805 for heating, 154,650 for motive power, 1,430,889 for traction, and 206,702 for use in the works, a total of 4,632,775 units. A piece of land situated along the Whargpoo has been purchased with the idea of erecting new electrical works in 1910. Up to the present, motors, apparatus, lamps, boilers, &c., have been chiefly supplied by English manufacturers. The municipal works also supply current for the electric tramways tramways installed by Bruce Peebles & Co. The telephone is greatly used in Shanghai, and a strong company with a capital of 1,000,000 Shanghai taels—the Mutual Shanghai Telephone Co.—serves the concessions and the Chinese town. The number of instruments in use in 1908 was 2 550, and this number is daily increasing. In the French concession the electrical works have been taken over by a company which at the same time exploits the tramways and the waterworks—the Cie. Française de Tramways et d'Eclairage Electriques de Shangbai. The apparatus and the boilers for these works were supplied by French firms. The firms in Shanghai chiefly employed in the sale of electrical apparatus are Jardine, Matheson & Co., 27, The Bund; Arnhold, Karherg & Co., 6, Kiukiang Road; F. Pinfold, Nanking Road; Shanghai Electric and Asbestos Co., 4, Peking Road; Porter & Co., 14, Canton Road. The information given above shows the kind of electrical apparatus chiefly used in Shanghai, but as regards prices it is impossible, under the circumstances, to give any definite information, since the houses engaged in the trade do not publish any catalogues stating the prices of the apparatus they sell. They use mostly the catalogues of American and European houses whose goods they sell, using the same prices and taking as profit the commissions and discounts granted to them by the manufacturers. Competition is already very keen in the market, and the best quality only must be supplied if it is hoped to secure trade.

As regards the North of China, the application of electricity is as yet very limited. The Chinese Engineering and Mining Co., of Tongshan and Linsi, have made installations at their mines; there are electric tramways at Tientsin and certain installations of electric light have been made at Peking, Tientsin and at the mines of Lincheng. At Peking the lighting of the Chinese town is carried out by a Chino-Japanese company using alternating current, with the exception of the Legation district which is lighted by a separate service with continuous current. At Tientsin the lighting of the Chinese town and the Austrian, Italian and Russian concessions, is carried out by the Compagnie des Tramways. In the French concession the exploitation of the lighting system is in the hands of the municipality. In the British and Japanese concessions private companies carry out the work, and the German concession is supplied by works in the hands of the Siemens-Schuckert Werke, of Berlin. At the mines of Lincheng the lighting system is of little importance. The lighting at Tientsin and at the Lincheng mines is by means of continuous current, whereas, at the Tongshan and Linsi mines the electrical installation is worked by alternating current with a tension of 2 200 volts. The imports of electrical materials and supplies into Tientsin in 1908 amounted in value to 176,000 Haikwan taels as compared with 110,000 Haikwan taels in 1907 and 98,000 Haikwan taels in 1906. The companies utilising electrical materials and apparatus in the North of China are:—The Chinese Engineering and Mining Co., Ltd., of Tongshan and Linsi; Peking Chinese Chartered Electric Light Co., Ltd., Peking; the Peking Electric Co., Ltd., Peking; the Cie. de Tramways et d'Eclairage de Tientsin, Tientsin; Usine Electrique de la Municipalité Francaise, Tientsin; Tientsin Gas and Electric Lighting Co., Tientsin; Siemens-Schuckert Elektricitäts Gesellschaft Werke, Tientsin; the Tokio Tatemono Kaisha (Japanese concession), Tientsin; Les Mines de Lincheng, Chemin de fer Peking-Hankow, Lincheng. At the present stage in the development of the use of electricity a considerable opening might be found in the North of China for electrical apparatus, chiefly for lighting purposes and spare parts for dynamos and motors. In order to gain a footing in this part of China, it would be necessary to have an agent on the spot. This is the method adopted by foreign firms.

"Tantalum" Lamps Posters.—We understand that the "Satisfied Consumer" design of posters and show cards used for advertising "Tantalum" lamps has not only appealed to the electrical trade in this country, but has found a ready acceptance on the Continent. It has been translated into Russian, German, Spanish and Portuguese, in order that the same idea may be brought before the public mind of these countries. It will be readily understood, however, that for different countries, an alteration in the design is necessary, to bring it into line with the prevailing types of the country represented. We reproduce here for the benefit of our readers the Russian version of the "Satisfied Consumer," and it will be noticed that the design is similar to the English one, but is made to appeal to the Russian idea of "Satisfaction."



Turin International Exhibition, 1911.—We have received printed pamphlets in English relating to the General Mechanics (IV) and Electricity (V) groups for the International Exhibition of Industry and Labour which is to be held at Turin from April to October, 1911, under the patronage of the King of Italy. The General Mechanics Section is to be sub-divided into two principal groups: (1) General motive machines, power conveying appliances, lifting and carrying machines and their accessories; (2) operating machines for working metals, timber, and any material employed in constructing machinery. The Electricity Section will have two main classes: (1) Mechanical generation and supply of electric power; (2) Mechanical utilisation of electric power; with the following other classes: Electric lighting, telegraphy and telephony, electro-chemistry, electric power measuring implements, apparatus for scientific and experimental researches. We understand that intending exhibitors are desired to apply to local or District Committee, or to the Executive in Turin for general regulations, programmes, and application forms. Count Emanuele Costa di Polonghera is secretary to the Executive Committee.

Trade Announcements.—Messrs. A. P. Lundberg and Sons ask us to announce that Mr. H. Jackson is no longer representing them.

The Midland Electric Manufacturing Co., Ltd., have appointed Messrs. Loxley & Co., Ltd., Cabinet Chambers, Basinghall Street, Leeds, as agents for Yorkshire.

The Acme Electrical Co. have commenced business as electric lighting, heating and power installation contractors at 248, Stanley Road, Bootle, Liverpool.

The Metallic Seamless Tube Co, Ltd, of Wiggin Street, Birmingham, announce that they are now in a position to supply from stock 25-C P. high-voltage metallic-filament lamps.

Messrs. Ship Carbons, Ltd, announce the appointment of new officers as follows: Mr. James Veit, secretary; Mr. F. B. Pell, sales manager.

Bankruptcy Proceedings.—Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds.—First meeting August 25th; public examination, September 14th, both at Leeds.

L. W. de Grave, electrical engineer, Derby.—September 1st is the last day for the receipt of proofs for intended dividend by the Receiver, Mr. F. Stone, 47, Full Street, Derby.

Catalogues and Lists.—The Davis Electrical Co., Ltd., 17, Moor Street, Charing Cross Road, W.C.—Illustrated and priced leaflet relating to a new high efficiency lamp for 200 to 260-volt d.c. circuits, which is adapted from the Nernst principle; also a priced leaflet regarding the "Delco" metal lamps.

The Electrical Co., Ltd., 121-5, Charing Cross Road, W.C.—18-page list giving general descriptive information, with tabulated data and prices, concerning their three, two and single-phase induction motors up to 6 h.p., and starters and switches; also a folding card giving prices of Aegma metal-filament lamps, for from 20 to 260 volts and from 5 to 400 c p.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.—New edition of their catalogue of crane motors and controllers. In the course of some 18 pages these manufactures are described and very fully illustrated photographically in the firm's usual admirable style, the motors and their parts being briefly particularised, together with a schedule of rating and net weights and dimensional details, while the metallic shield blow-out controllers for crane and hoist work are similarly dealt with.

American Electric Fuse Co., Muskegon, Mich., U.S.A.—Several lists describing respectively the Michigan spark coils, American black enamelled wire, the American igniter, and the Allen-Bradley rheostat and electric controlling apparatus.

Messrs. Louis Dernier & Co., 23, Newman Street, Oxford Street, London, W.—We have received from this firm a beautifully prepared catalogue of silk lamp shades suitable for all purposes. The illustrations are from actual photographs, and they have been executed in splendid style, showing the shades off most effectively. Among the special electric lines are shades for pendants, for Osram and tantalum lamps, for table standards, candle fittings, floral electric shades, and various other beautiful designs.

C. Schniewindt, Neuenrade, Westphalia.—Two new catalogues (one in English, the other in German), describing his asbestos-woven net resistances. Well arranged tabulated particulars of dimensions, weights, &c., of resistance wires, also prices, &c., of rheostat and motor starter and resistance nets, resistance bands, controller resistance nets, woven wire resistance bands and grids, and electric heating nets are included, with illustrations. In the German catalogue a number of heating and cooking utensils are shown.

Mr. G. Wuthrich, Oswaldestre House, Norfolk Street, W.C.—Two illustrated leaflets containing descriptions of his latest direct and alternating-current machines—d c. motors and generators for small outputs (starters and regulators), and single, two and three-phase asynchronous motors for small outputs.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 220 contains brief descriptive notes, with many illustrations and tabulated price information, relating to their "B.T-H." tungsten lamp fittings and accessories. The fittings, which are suited to shop, ship, hall or club room lighting, have been developed for the purpose of running these tungsten lamps in groups, so that a powerful light, equal to that of a small arc lamp, but softer, can be obtained without carboning and trimming troubles. They are made of copper or zinc with a standard of oxidised copper, and the globes which are supplied either plain or pocketed, are of flint glass, ground on the inner surface.

Private Meeting.—A. Keartland (trading as A. Keartland & Co.), electricians, 16, Birchills Street, Walsall.—A meeting of the creditors herein was held recently, when a statement of affairs was presented showing liabilities to trade creditors £280, cash creditors £50, and bank £65, making a total of £395. The assets totalled £224, and disclosed a deficiency of £171. The debtor, it appeared, started to trade in partnership with a Mr. Guest in 1905, but the partnership was dissolved in the July of the following year, the dissolution being gazetted, and Mr. Guest receiving as his share for going out, the sum of three guineas. Since that time the debtor has carried on business under the style of Keartland & Co. The debtor's brother has prepared balance-sheets, and these show that a loss of £145 was incurred in 1907, while in the following year the loss was £270. In 1907 the debtor's drawings from the business amounted to £178, but in the next year he only drew £65. During the present year the takings have only amounted to 24s. a week. The debtor put a sum of £1,000, which he received from his late father's estate, into the business, and this money has disappeared. In reply to questions, the debtor admitted that he had been losing money practically from the start. It was eventually resolved that a deed of assignment should be executed to Mr. Poppleton, of Messrs. Poppleton & Appleby, together with a Committee of Inspection, consisting of three of the principal creditors.

Japan-British Exhibition, London, 1910.—We have received from Mr. Charles I. Kiralfy, on behalf of the Committee of the Japan-British Exhibition, a copy of a letter signed by H.R.H. Prince Arthur of Connaught, as honorary president, and his Grace the Duke of Norfolk as president, in which it is mentioned that next year's Exhibition at the White City, Shepherd's Bush, is to be held under the auspices of the Imperial Government of Japan and with the cordial approval of the British Government. King Edward has recently expressed a hope that both the Japanese and British people will come forward to promote an undertaking which has for its object an increase in the commercial prosperity of both countries, and the uniting still closer of the bonds of fellowship which already exists between them. The Emperor of Japan has also telegraphed his congratulations on the inception of the Exhibition, and expressing his sincere wishes for the complete success of the undertaking.

His Excellency the Japanese Ambassador recently spoke of the intense interest taken in the Exhibition by the people of Japan, and of the large sum of money voted for it by the Imperial Diet. The Lord Mayor of London has pledged his official and personal support, and expressed the conviction that nowhere would more real interest be taken in the Exhibition than in the City of London. It is stated that the full support of the London Chamber of Commerce and of the Associated Chambers of Commerce of the United Kingdom is also assured. The hon. president and the president of the Exhibition request us to invite universal support for this specially important demonstration.

"The unique character of the Exhibition is sure to attract multitudes of people, not only from Japan and the United Kingdom and the Colonies and Dependencies, but from every European country and from America, and cannot fail to increase the commerce of the two nations and to create new commercial channels between them and the rest of the world. We therefore trust that the manufacturers and producers of this country, as well as those of the rest of the British Empire, will rise to the occasion by displaying the best of their respective productions in arts and industries, so as to make a representation worthy of this great opportunity."

Dundee.—The Corporation invites offers for the purchase of two tramway locomotives.

Book Notices.—We are asked to state that at the sale of effects in *re* C. H. W. Biggs in bankruptcy last week, Messrs. S. Rentell & Co., Ltd., of 36, Maiden Lane, Covent Garden, W.C., purchased the stock of the following books:—"Exercises in Electrical Engineering," by Magnus Maclean; "Novice's Guide to Electric Car-Driving," by E. W. Elsley; "The Electrification of Railways," by Prof. Gisbert Kapp.

"Steam Power Plant Piping Systems." By W. L. Morris. New York: McGraw-Hill Book Co. London: Hill Publishing Co., Ltd. 1909. Price 21s. net.

"Wireless Telephone Construction." By N. Harrison. London: E. and F. N. Spon, Ltd. 1909. Price 1s. 6d. net.

"Drawings for Medium Sized Repetition Work." By R. D. Spinney. London: E. and F. N. Spon, Ltd. Price 3s. 6d. net.

Dissolutions and Liquidations.—Thomas Parker, Ltd.—A meeting is to be held at Lich Gate, Wolverhampton, on Friday, September 17th, to hear an account of the winding up.

John Blaikie & Sons, brassfounders, electrical engineers, &c., Littlejohn and Union Streets, Aberdeen. Mrs. H. R. Blaikie, or Williamson, has retired from this business, which will be continued under the same name by Messrs. F. & D. B. Hislop.

LIGHTING and POWER NOTES.

Aberdeen.—At a meeting of the Aberdeen T.C. the convener of the Electricity Committee—Mr. Henry J. Gray—proposed that the engineer be authorised to purchase, for hiring out, a further stock of electrical heating and cooking apparatus for the department. It was mentioned that the experiment had met with more success than was anticipated, and that all the revenue possible would be necessary to make up for a serious deficiency that was expected in the matter of consumption of current in consequence of the new lamps. Objection was made to the proposal by Mr. Robertson, who thought that a further inroad was being made into the province of the private trader. On a division Mr. Gray's motion was adopted by 18 to 12.

Amble.—At a meeting of the U.D.C., on the 11th inst., the question of lighting the town with electricity was considered. A special committee submitted a report, including a provisional estimate of expenditure and revenue, which put down the initial cost at £5,000, which would include site, buildings and machinery. It was decided to send out a circular to ascertain the probable demand for the electric light, and upon the result of this vote will depend what course will be adopted. Amble is situated on the coast in North Northumberland, being seven miles S.E. of Alnwick. The population was 4,428. There are two collieries, and fish curing is one of the main industries.

Barnsley.—A L.G.B. inquiry was held on August 10th into the application of the T.C. for a loan of £3,000 for E.L. purposes. There was no opposition.

Cookstown (Co. Tyrone).—The scheme for the electric lighting of this town was discussed at the last meeting of the Urban Council, and was postponed till the September meeting.

Continental Notes.—Germany.—The Nistertalsperre Gesellschaft is about to put down a plant at Hachenburg (Hessische-Nassau) to utilise certain available water power in the generation of electrical energy for lighting and power purposes.

Italy.—A company has lately been formed in Milan with a capital of £8,000, and the title La Societa di Elettricita di Abbiategrasso e Limitrofi, to supply electrical energy for lighting and power purposes to the little towns of Abbiategrasso and Casorate Primo.

Dundee.—Work in connection with the submarine base is expected to be finished by the end of the month. The cables for the supply of electricity for power and lighting are now laid.

Glasgow.—The report of the Electricity Committee recently published, contains a good many matters of interest. The year's working resulted in a gross profit of £140,771, from which interest and sinking fund absorbed £91,056, leaving a balance of £49,715 on the year—some £2,000 less than in the preceding 12 months. The balance was applied to depreciation, which was written off capital account to the extent of £53,259, thus leaving a deficit of £3,544, which was made up from the reserve fund. The latter fund now stands at £19,281. While reduced charges, metal lamps and bad trade caused the revenue to fall some £8,000, as compared with 1907-8, this was more than counter-balanced by a saving on working expenses of £10,415. The deficit is accounted for by an extra £4,000 to sinking fund, and £3,108 for depreciation, as compared with the previous year. The taxation of the undertaking for the year amounted to £18,745. Some 32,736,058 units were sold, including 17,612,483 units for power purposes. In connection with the latter, 4 292 motors, with a total horse-power of 29,505 were connected, and of the power units sold, 4,716,263 were sold at 1½d. per unit, 980,996 at 1d., and 11,915,224 at ¾d. per unit. The bulk of the lighting units (8,192,411) were sold at 3½d. per unit. Some 837 arc lamps were in use for street lighting, and there were 18,158 consumers at May 31st, 1909.

Turning to the power plant, &c., the report states that the maximum load amounted to 21,585 KW., being a decrease of 2·7 per cent. on the previous year. Generation, distribution, and management costs amounted to ·56d. per unit; rent, rates, taxes, interest, and sinking fund brought the total statutory expenditure to 1·36d. per unit, against which the gross receipts amounted to 1·7d per unit.

During the year the Port Dundas station generated 29,595,529 units; Pollokshaws Road, 11,322,201 units; and Kelvinside, 575,303 units. At the Port Dundas station, marine water-tube boilers, &c., and coaling plant were brought into use, also a fifth turbine set of 5,500 H.P., making a total of 28,000 H.P. installed. At the Pollokshaws Road station, additional boilers were erected, and a third 5,500 H.P. turbine set, making 21,700 H.P. installed. No additional transforming plant was added to existing sub-stations, but a new sub-station at Haggs Road was brought into use, containing 1,000 KW. of plant. Six large consumers have some 3,000 H.P. of transforming plant on their own premises. Ten miles of feeders and six of distributors were laid on the north side of the river, and five miles of feeders and four of distributors on the south side, during the year.

At a recent meeting of the Electricity Committee, the engineer (Mr. Lackie) explained that the reduction of £495 13s. 6d. effected in the cost of attending to and repairing public lamps last year, was mainly due to improved switching apparatus invented and patented by two of his assistants (Mr. W. T. Calderwood and Mr. H. MacEwen) and himself, and the Sub-committee, after consideration, agreed, in respect that the Corporation is exempt from any royalty on the apparatus used by it, to recommend that an honorarium of 100 guineas be granted to meet expenses already incurred in patenting the apparatus, the sum to be divided between Mr. Calderwood and Mr. MacEwen.

The Territorial Force of the city has asked the Electricity Committee for a reduction in the price of the electricity supplied for lighting purposes, and the Committee has instructed the engineer to advice the Association with the view of reducing its account for current by improved methods of lighting. No reduction in price per unit has been made.

Gravesend.—The T.C. has received from the L.G.B. sanction to loans of £3,250 in respect of excess expenditure, £1,800 for mains, and £700 for services.

Greenock.—It is reported that the accounts of the T.C.'s electricity department for the past year show a surplus of £1,035. In accordance with the recommendation of the Scottish Office, it was decided to make this sum the nucleus for a reserve fund.

Haslingden.—The B. of G. has appointed Messrs. Peers, Copland & Cardin to prepare a scheme for electric wiring at the workhouse and new infirmary to utilise the supply by the Rawtenstall Corporation—their remuneration to be an inclusive fee of 50 guineas, such amount to include preparation of the scheme and supervision of the same, travelling expenses and plans, &c.

Ipswich.—The T.C. has arranged to supply current for seven years to the Admiralty telegraph station at Portman's Walk at 1¾d. per unit. The consumption will be about 40,000 units per annum, and the Admiralty will pay the entire cost of the surface cables, and £5 10s. per annum for maintenance.

Kearsley (Lancs.).—The B. of T. has approved of the transfer of the U.D. Co.'s electric lighting order to the Lancs. Electric Power Co.

Morecambe.—The T.C. has decided to ask Mr. W. R. Wright, electrical engineer, London, to report on the condition of the electricity works. The outlook is brightened by the application for a supply from the New Morecambe Tower and Gardens Co.

Northampton.—The Governors of the General Infirmary have decided to have the new laundry driven by electricity. This will save £750 on capital expenditure, and £90 per annum on the coal bill.

Partick.—The T.C. is to make extensions and additions to the plant at the electricity works, including the supply and erection of a 1,000-KW set, together with a condensing plant, cooling tower, and oil purifying plant, water-tube boiler, &c. The sum of £13,472 will be borrowed for electric lighting purposes.

Perth.—Councillor Macnab, Convener of the Electricity Committee, states that last year's revenue, exclusive of the tramways, was £7,990 or more than double the first year's revenue (1901-2). The estimated expenditure of £4 544 was £402 less than anticipated. As to the current year's estimates, he estimated the revenue at £8,110. Having regard to the annual increase in the use of electricity, he believed the estimate erred on the safe side, and would be more than realised. That there would be some increased expenditure there appeared not to be much doubt. The cost of the maintenance of the accumulators under a new contract had to be met for the first time.

The Corporation has fixed the price of electricity at 3¾d. per unit, the same as last year.

Rossall.—The governing body of the Rossall School (Lancs.) are carrying out extensive improvements involving a large expenditure, and including the installation of electricity for lighting and power purposes, and a very complete plant for heating, ventilating, and hot and cold baths.

South Africa.—It is stated that the Germiston T.C. has entered into a three years' contract with the Victoria Falls and Transvaal Power Co. for a supply of electricity for lighting and tramways purposes. The Council has engaged Prof. J. H. Dobson, manager of the Johannesburg lighting and tramways department, to report on suitable schemes.

Swinton and Pendlebury.—The U.D.C. has requested the Lancs. Electric Power Co. to continue the management of the E.L undertaking for a further three months, pending consideration of the appointment of a manager by the Council.

U.S.A.—Some interesting statistics relating to the Chicago Commonwealth Edison Co.'s distribution were recently given by Mr. D. W. Roper, from which it appears that in Chicago the output of 25-cycle energy has increased 17,000 KW. per year during the last five years, while the use of direct current only increased at the rate of 3,000 KW. a year. The average length of the direct-current feeders is 1,500 ft., and three-fourths of the copper used is in feeders and one-fourth in consumers' services. Last year the maximum load on the generating stations in 25-cycle energy was 107,000 KW. Of this, some 40,000 KW. in the centre of the city was furnished as direct current, 20,000 KW. being used in the business district—where the most congested part was a half-mile in States Street taking 5,000 KW. Overhead construction cost only ¼ or ⅕ of underground work in residential districts, though the maintenance was approximately the same for both. For each lb. of copper installed for all purposes during five years, 1 duct. ft. of conduit was laid; the conduit costing 15 to 60 cents per duct. ft. The company has some 300 miles of transmission lines, &c., and burn-outs average one a month.

Widnes.—Following upon the town clerk's interview with a representative of the B. of T. relative to the carrying out of the E.L. order, 1901, the T.C. has decided that the advice of a qualified electrical engineer be obtained upon the scheme suggested by Mr. Isaac Carr, C.E., for carrying out the order.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The revenue from passenger traffic on the Corporation cars last year was £70,735, a decrease of £429 over the previous year. The total working expenses amounted to £40,794. The cost of electricity for power, increased from £8,971 in the previous year, to £9,564.

Bolton.—The Tramways Committee, after lengthy deliberation, has decided not to issue contract tickets on the tramways.

Colwyn Bay.—Public pressure has compelled the U.D.C. to urge the tramway company, who work the electric tramway system connecting Colwyn Bay with Llandudno, to extend its line from the existing terminus at Station Road, Colwyn Bay, to the far end of Old Colwyn. The projected extension will add 1½ miles of track to the existing route, and open out a populous and promising area.

Doncaster.—The T.C. has decided to extend the tramways to the new colliery at Bentley. The colliery company will give the Council facilities for laying the lines, and will contribute £100 a year for two years towards the cost.

Germany.—The Rhenische-Westfalische Electricitatswerke is preparing plans in respect of a projected electric tramway between Opladen and Langenfeld.

Leeds.—The T.C. has a proposal in hand to install the trackless trolley system from the Oldfield Lane tram terminus through the district to Lawns Lane near the Farnley Ironworks. The distance is about a mile. In order to receive the consideration of Parliament next session, the Leeds Corporation must lodge its Bill not later than November. No suggestion has been made that the Leeds Bill should contain any request for powers to carry parcels.

(*Continued on page* 303.)

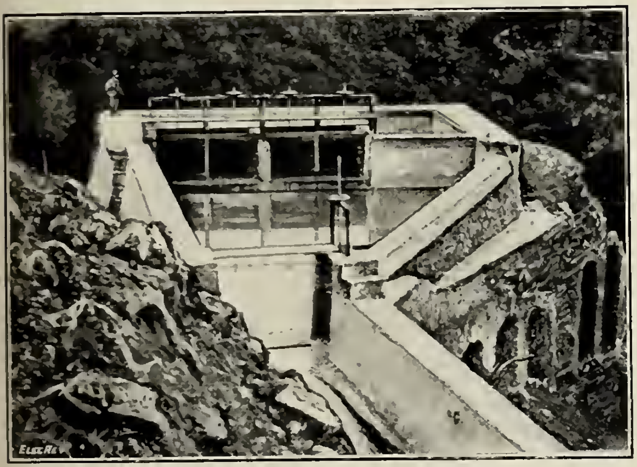
A SPANISH POWER-TRANSMISSION PLANT USING 50,000 VOLTS.

By Dr. ALFRED GRADENWITZ.

The power-transmission plant recently installed between Gaucin and Seville, in Spain, is specially interesting because of the pressure (52,000 volts) and the distance to which the electrical energy is transmitted (125 km.).

Power is derived from a waterfall on the river Guadiaro, situated between Gaucin and San Pablo, in the province of Malaga, the gross head being 137 metres and the net head 128·5 metres. The minimum amount permanently available is 1,500 litres per second, but there is available during eight months in the year 4,000 litres. The water is held up by an embankment 25 m. in length, from which a channel 5·7 km. in length (of which 1·1 km. is in tunnel) connects to a water compartment, designed for three penstocks, and 25 m. in length; the capacity of the water compartment is 360 cb. m., and the overflow embankment is 16 m. in length.

Two pressure conduits, each 1 m. in diameter and 500 m. in length, carry the water to the power house; 200 m. of their length is of armoured concrete (up to 50 m. pressure), while the remaining 300 m. is made up of pipes, 6 m. in length, of Siemens-Martins steel with Bessemer steel flanges tightened by means of caoutchouc.

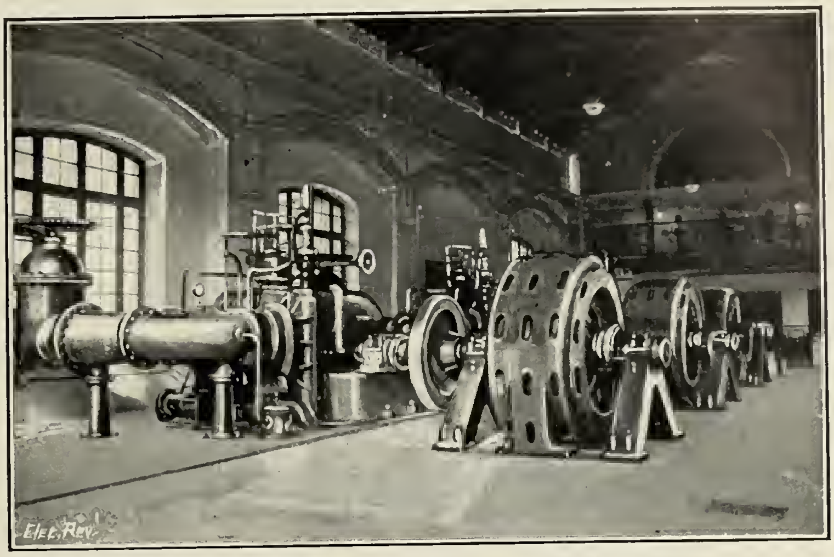


The Penstocks and Head Works.

Three Pelton wheels, of 1,500-H.P. capacity each, have been installed. These are of the horizontal-shaft type, with cast-steel vanes, and are arranged for automatic and hand regulation, and provided with oil governors. Each of them drives a 1,300-K.V.A. three-phase generator running at 410 R.P.M.; two similar units of 100 H.P. each have been provided to operate the continuous-current dynamos supplying the excitation and lighting current.

In addition to the power station, four sub-stations are provided, from which secondary lines for power transmission and lighting are branched off.

The three-phase current is generated at 40 cycles per second and 5,000 volts pressure, which latter is stepped up by transformers to 52,000 volts for the transmission of power to Seville.

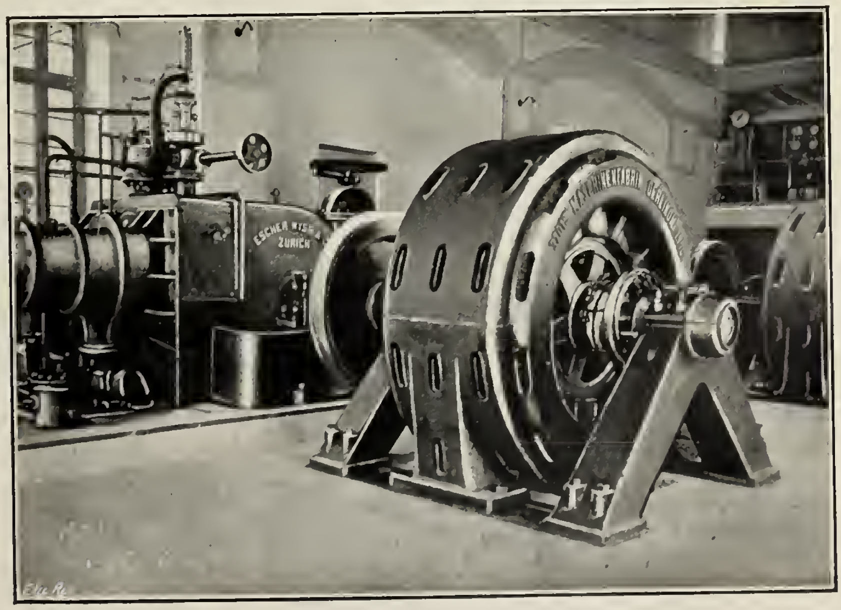


Interior of the "El Corchado" Power Station.

Although the power house is designed for 4 units of 1,500 H.P. each, only three have been so far installed. The generators are of the rotating-field type, and are controlled by oil switchgear with maximum-time relays and reverse-current relays.

Either of the two direct-current generators suffices for the excitation of the four main generators. The direct-current machines are each of 65 KW. output at 110 volts and 1,000 R.P.M.

Seven single-phase transformers are provided (of which one serves as stand-by), and these are constructed for oil and water-cooling and controlled by oil-break switches, provided with maximum-time relays in the low tension, and with maximum and reverse-current relays in the high-tension circuits, the two switches being coupled together electrically. The low-tension switches are provided with mechanical and the high-tension switches with electrical remote-control. Each transformer is of 600 K.V.A. capacity, with a step-up ratio of 5,000/50,000. The reserve transformer can be connected up to any phase desired.

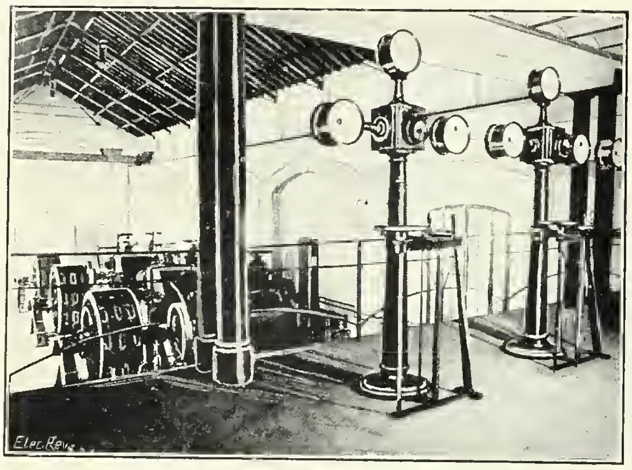


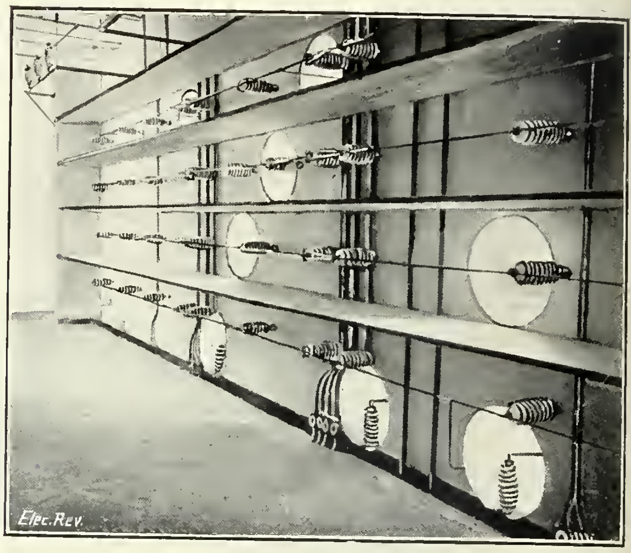
1,300-K.V.A. Pelton Wheel and Generator.

The two overhead lines, starting from the power house, for the transmission of energy, are provided with lightning arresters connected to the ground through water resistances.

At the switchboard the generators, as well as the primary and secondary transformer windings, are connected up in parallel to bus-bars, two self-contained sets being provided for the two power-transmission lines respectively, which can be worked independently or in parallel.

The power-transmission line is 125 km. in length, of which 18 km. are situated in the province of Malaga, 50 km. in the province of Cadiz and 57 km. in the province of Seville. The maximum altitude (770 m. above the level of the sea) is attained between the Atlantic and the Mediterranean in the environs of Mount Berrueco, and the minimum altitude (11 m.) near the river Guadaira at Seville. The majority of the 1,550 poles constituting the line are built of U-shaped irons with iron-bracket diagonals and wooden cross beams. The average distance between poles is 80 m., but spans of 100 to 120 m. are by no means infrequent, and at certain places even 200, 300 and 450 m. spans are reached.


Switch Pillars in the Power Station.


Armoured-Concrete Cells and H.T. Bus-bars in Power Station.

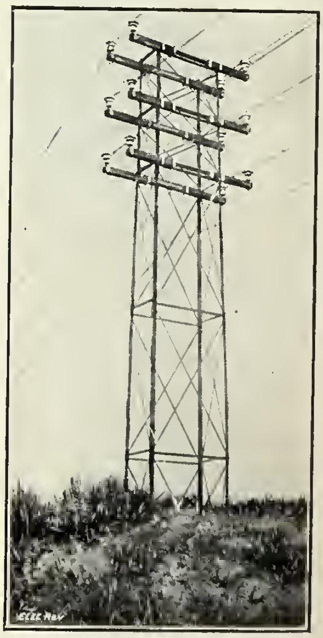
The power-transmission line consists of two sets of three wires, each of 5·5 mm. diameter. Double wires are adopted in the case of spans upwards of 90 m., and with spans exceeding 200 m. the wires are suspended from iron cables. The wires are spaced 1 m. apart.

The power-transmission line comprises 35 wire crossings.

Of the sub-stations, that at Villamartin, situated at 55 km. from the power house, has two incoming and two outgoing lines, connected together inside the station. Horn lightning arresters (with liquid grounding resistances) and 50,000-volt oil-switches, one being set apart for each line and the mutual connection of lines respectively, are provided, the apparatus being mounted in armoured-concrete cells.

The Utrera sub-station, situated 94 km. from the power house, is similar in arrangement to the foregoing. The lines are protected by horn lightning arresters with liquid resistances and water-jet resistances, permanently connected to the ground.

Transformers in the Seville Sub-station.


Typical Transmission Pole.

Six mechanically-controlled line oil-switches for 50,000 volts are installed; also four single-phase transformers, water-cooled, one being a reserve. The primary pressure is 47,000 volts, and the secondaries give 3,400, 3,500 and 3,600 volts respectively. The capacity of each transformer is 200 K.V.A.

The transformer circuits are controlled by oil-break switches, with time relays designed for mechanical remote control with electrical releasing.

A single conductor-system serves both for the light and power supply. Oil switches with time relays, as well as self-acting induction regulators, are provided in the outgoing lines, the apparatus being arranged in armoured-concrete cells.

The Dos Hermanas sub-station, situated at 112 km. from the power house, is arranged like that of Villamartin, but the oil switches are replaced by ordinary ones. It contains one three-phase water-cooled transformer, arranged for 47,000 volts primary, and 3,400, 3,500, 3,600 volts secondary pressures. Its capacity is 360 K.V.A.

Armoured concrete cellwork is also employed in this building.

The Seville sub-station, situated at the end of the line, that is, at 125 km. from the power house, is equipped for controlling the two three-phase incoming lines, and is provided with the same type of switchgear as in the power house, by which the lines can be worked independently or in parallel.

One of the seven single-phase transformers serves as a reserve.

Each of the transformers is controlled by oil switches, coupled electrically to time relays in the primary circuits and to reverse-current relays in the low-tension circuits. The low-tension switches are designed for mechanical, and the high-tension switches for electrical, remote control. The capacity of each transformer is 600 K.V.A., the primary pressure 47,000 volts, and the secondary 3,500 volts. The reserve transformer can be connected up to any phase desired.

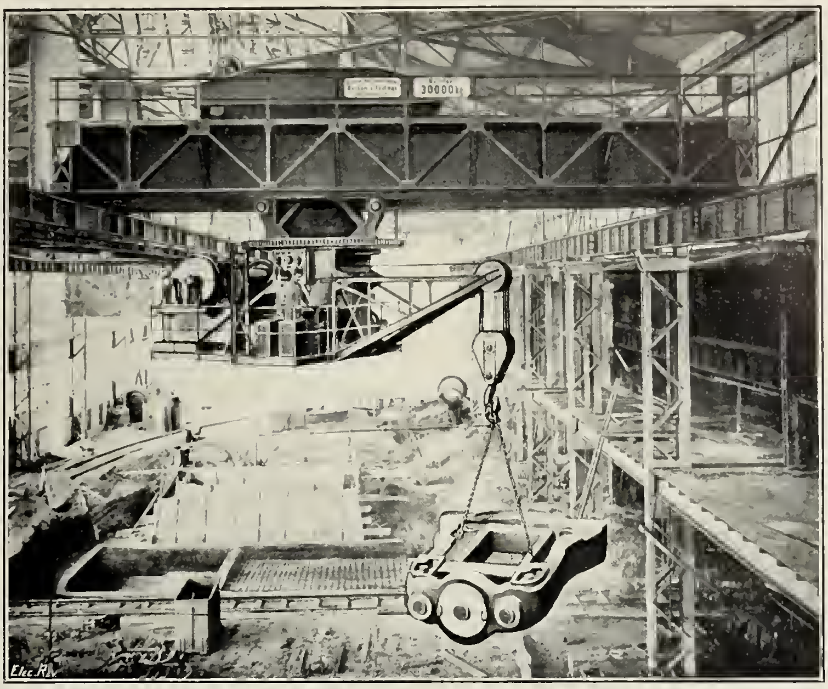
The switchgear is designed in duplicate, corresponding to the two lines; the apparatus is arranged in armoured-concrete cells. The switchboard contains ten panels for the secondary distribution lines, and one for the voltmeters, phase-lamps and meters. The measuring instruments and checking apparatus of the incoming lines and transformers are arranged on switching desks.

The secondary lines are branched off to loop bus-bars in two sets for the power and lighting, respectively, working either independently or in parallel.

The writer is indebted for the above particulars to the courtesy of the Oerlikon Machine Works, who constructed the whole of the plant.

TWO NOVEL ELECTRICAL CRANES.

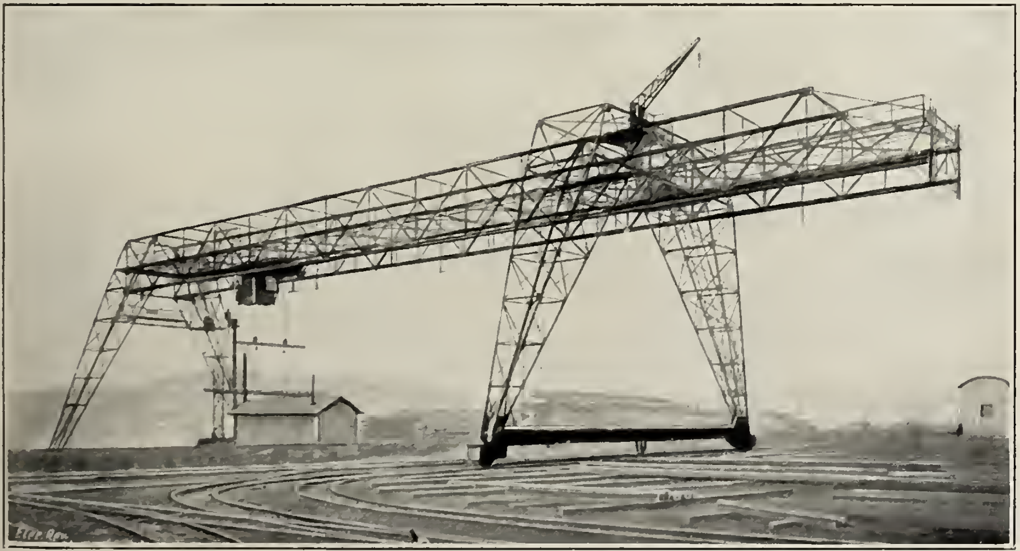
The accompanying views illustrate two interesting types of cranes which have lately been provided by Messrs. Bechem and Keetman (Duisburger Maschinenbau A.G.) at important German iron and steel works. The first view shows one of four overhead travelling cranes which have been provided at Messrs. Thyssen & Co.'s works at Muhlheim-on-the-Ruhr. Each of these cranes is fitted with a revolving jib attached to the trolley, and has a span of 13·2 m., and a lifting capacity of 30 tons. The outreach of the revolving jib is 4 m., so that each of these cranes covers a working range of 17 m. wide. The crane bridge is composed of box girders with parallel chords, stiffened by platforms, whilst the trolley with the revolvable jib runs on the crane girder. The driving gearing of the trolley consists of spur wheel reduction gear; the movable jib is arranged on a ball-collar-thrust bearing, and is suspended from the trolley by means of a forged steel centre pivot. The design is such that at one end of this revolvable jib is the load hook, whilst at the other end, the counterweight and the driver's cab are attached, space for the driver being provided in such a way that the operator constantly has the load in view. The tilting moment of the crane is taken up by an upper collar-bearing and a lower roller-bearing at the end of the guiding structure suspended from the trolley. The revolving movement of the jib is effected by the teeth of a forged pinion meshing with the pins of a pin wheel rim fixed to the jib. The lifting gearing is situated at the after portion of the jib, and serves at the same time as a counterweight. Spur wheel reduction gears are provided throughout and braking is effected by means of an electromagnetic brake. The following are the motor capacities and the working speeds:—



Electrical Traveller with Revolving Jib: Capacity 30 tons.

Lifting, 2·2 m. per minute	...	22 H.P.
Traversing, 18 m. per minute	...	14·5 H.P.
Revolving, 1 m. per minute	...	14·5 H.P.
Travelling, 45 m. per minute	...	33 H.P.

The lower view shows a gantry crane of 5,000-kg. lifting capacity, provided at the Rochlingische Iron and Steel Works, situated at Volklingen-on-the-Saar. As may be seen from the illustration, one leg of this crane is equipped with a revolvable jib, which is operated by hand. The iron structures consist of lattice-work, and the trolley runs on the lower chords of the main girders. The distance between the supporting legs is 43·3 m., and the outreach of the jib is 13·7 m. The crane travels on eight wheels, arranged in pairs, and the pressure on the wheels is therefore well distributed. The two crane travelling-motors are connected by transmissions with a view to securing an even travel. Two wheels of each of the crane-legs are set in motion by means of spur gearing, and the shafting is provided with bearings, access to which is easily obtained by runways and convenient ladders.

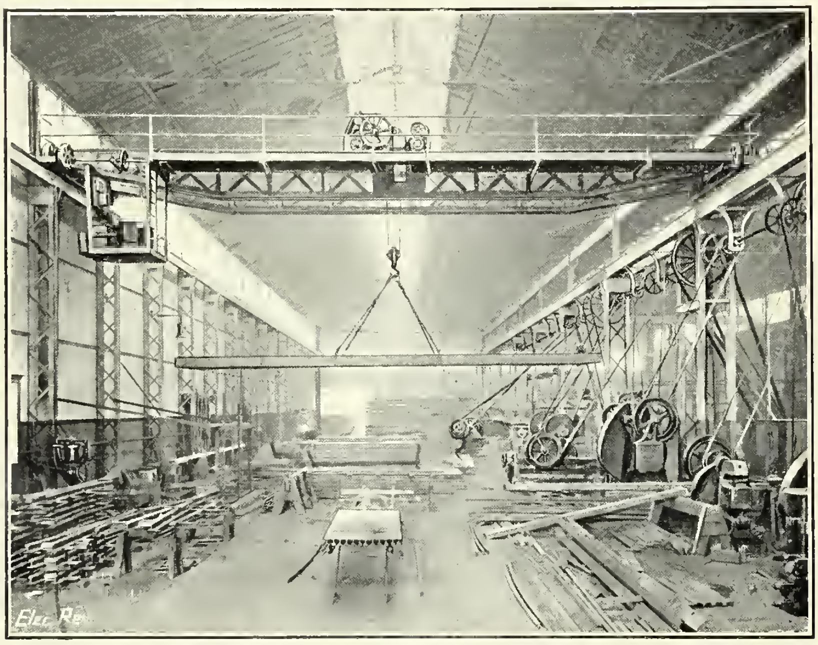


Yard Traveller at a German Steel Works.

Boston Lighting.—Messrs. Crompton & Co., Ltd., have informed the T.C. that they intend applying for a provisional order for electric lighting.

ELECTRICAL CRANES AT KERR, STUART AND CO.'S LOCOMOTIVE WORKS.

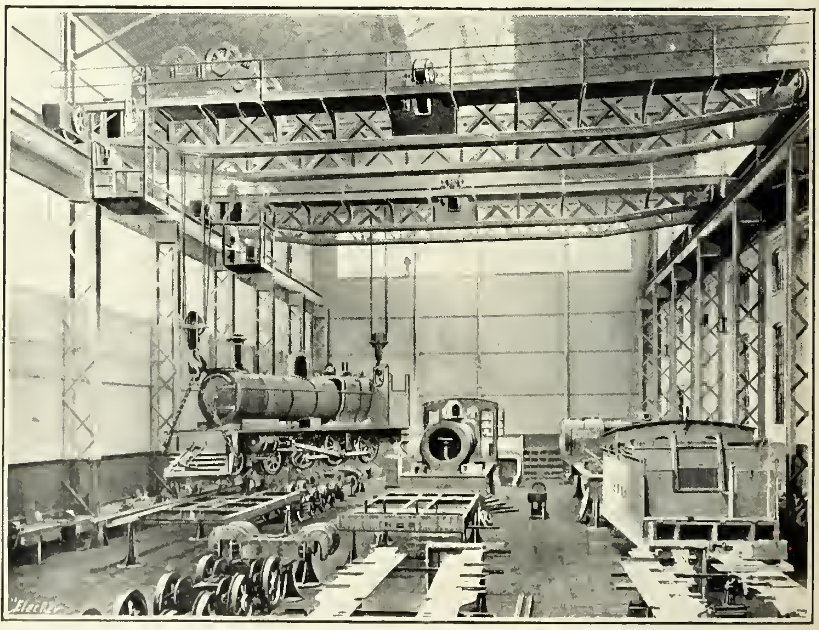
At their new workshops at Stoke-on-Trent, Messrs. Kerr, Stuart & Co., the well-known locomotive builders, have in service an installation of one 5-ton and two 30-ton electric overhead cranes, all three constructed by Messrs. Royce, of Trafford Park. The span of the 30-ton cranes is 53 ft. 5 in., and of the 5-ton crane, 47 ft. 6 in. All the cranes are of the three-motor type, a separate motor being used for each of the motions of hoisting, travelling and traversing; but in the case of the 30-ton cranes the hoisting motion is provided with a separate auxiliary barrel with rope and hook-block for dealing with loads up to 5 tons and lifting the same at a comparatively high speed. The two barrels are operated from one hoisting motor, and are brought into gear with it by means of clutches, fixed so that they can be operated by the driver from his cage when the crab is brought up to the cage end. When changing over from one barrel to another it is impossible for the hooks to run down, as small special brakes are provided to prevent this. The speeds for the 30-ton cranes are as follows:—



Royce 5-ton Electrical Travelling Crane; Kerr, Stuart & Co.'s Works.

Hoisting (main barrel) full load	5 ft. per minute.
Hoisting (main barrel) half full load ...	7½ ft. ,,
Hoisting (main barrel) light load	10 ft. ,,
Hoisting (light barrel) 5 tons	30 ft. ,,
Hoisting (light barrel) light load	60 ft. ,,

The travelling and traversing speeds are 150 ft. and 80 ft. per minute respectively. The various special features of the "Royce" cranes are provided, including riveted-up steel crab frame, machine-cut steel gearing, overwinding safeguard for the hoisting motion; automatic electrical solenoid brake for the hoisting motion, with hand-release device, which can be operated from the cage. Roller bearings are provided for the axles of the travelling and traversing motions; the travelling motion of each crane is also fitted with a powerful foot brake, as well as the "Royce" slipper-wheel device, which also can be used as a powerful brake for pulling the crane up quickly. The hoisting motion is fitted with the "Royce" standard dead-slow device, by which a constant dead-slow speed is obtainable for either lifting or lowering. This device is very simple, is entirely under the control of the driver, and for wheeling locomotives, or where loads have to be moved fractional and exact distances, it is of the highest importance. When in operation, the load is lifted or lowered with perfect steadiness, and without any tendency to vibration or jerkiness. One of the special advantages of the two 30-ton cranes is that an especially heavy load up to 60 tons can be dealt with if the cranes are brought together and the load slung between the two hooks. The 5-ton crane is also fitted with the "Royce" special features: the hoisting speed is the same as those for the 5-ton lift of the two 30-ton cranes; the travelling and traversing speeds are 250 ft. and 80 ft. per minute respectively. All parts of the cranes, both mechanical and electrical, are of Messrs. Royce's make throughout.



Two 30-ton Royce Travelling Cranes; Kerr, Stuart & Co.'s Works.

Electrolytic Hydrogen for Balloons.—A very interesting plant for the production of hydrogen gas for balloon purposes by an electrolytic process has been installed at Fort Omaha, Neb. A balloon house has been erected at this fort for the experiments of the U.S. Army Signal Corps. Alongside this house is a building containing the hydrogen generating plant. Electrical energy for the operation of this plant is obtained from the Omaha Electric Light and Power Co. A 200-kw. motor-generator set has been installed, which consists of an induction motor direct-connected to a direct current generator wound to give a pressure of from 66 to 110 volts. The hydrogen is generated by electrolysis in cast-iron cells containing caustic potash electrolyte. There are 30 of these cast-iron electrolytic cells, all connected in series. The voltage required varies according to the temperature of the cells, hence the wide range of voltage for which the generator is designed. The operating pressure when the cells are warmed up is 85 volts for the 30 cells, or 2·8 volts per cell. The cells are rated at 1,500 amperes. The output of hydrogen at 1,500 amperes is about 23 cb ft. of gas per hour, or 690 cb. ft. for the 30 cells. Both of the electrodes are of iron. The iron case of the cell forms the negative electrode from which the hydrogen is obtained. The positive electrode, which gives off oxygen, is in the shape of an iron cylinder in the cell. Hydrogen gas, which collects above the negative electrode, is piped to a 50,000 cb. ft. gas holder. The oxygen, which might easily be sold commercially to cover much of the cost of operating the plant, is allowed to escape into the air, because Congress has seen fit not to authorise the United States Army to sell this by-product.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 298.)

Glasgow.—The T.C. members and the public generally are expressing satisfaction at the decision of the House of Commons Select Committee on the Glasgow Bill, in regard to the placing of the surplus revenue from the tramways undertaking to the common good fund, the question of whether the tramways were part of the common good fund—which at times of extension helped with finance—was raised by the Scottish Office, where it was held that the tramways were not the common good property. The practice hitherto has been for the tramways department to hand over a fixed sum annually to the common good to wipe out its indebtedness. In 1895 a sum of £9,000 was given. This amount was gradually increased, and last year it rose to £50,000. The total sum handed over during 15 years, was £326,760. Now the whole surplus will go to the common good, and had this been in force last year, the sum transferred to that department would have been £66,275. The Scottish Office's principal contention was for a limitation of the annual amounts to be handed to the common good fund, and in his report on the question, the Secretary for Scotland (Lord Pentland), points out that having regard to the large amount of the profits, their disposal should not be left to the unfettered discretion of a Corporation.

Holywood.—Much pleasure is expressed locally at the Royal Assent having been given to the Holywood Tramways Bill, which has for its object the construction of a line between Holywood, Co. Down, and the city of Belfast. The line will help to bring the two places into contact, and improve the trade of both.

London.—According to the *Times*, the Central London Tube extension to Liverpool Street for which Parliamentary powers have recently been obtained, will be begun at once. The other improvements mentioned in the company's Bill are also to be carried out.

A considerable amount of discontent is said to exist among the L.C.C. tramways staff who are working the Streatham-Norbury extension, recently opened. The cause is said to be the transfer ticket system to the Croydon lines.

The Metropolitan Ambulances Bill came before the Grand Committee of the House of Commons on August 17th, when it was decided, by 28 votes to 1, that the L C.C., and not the Metropolitan Asylums Board, should be the body to carry out the service. Subsection 7 of Clause 1 ran as follows:—"To provide and maintain ambulances and other vehicles, and means of conveyance, to be drawn by electrical or other mechanical power, by horse or by hand." Upon the motion of Sir William Collins, the following words were added:—"Provided that any electrical power used for moving such vehicle, shall be entirely contained in, and carried along with such vehicle."

Mexico.—There has recently been considerable activity in the building of inter-urban lines in Mexico, and it has been announced that an American syndicate is planning a new line from the city of Guaymas to the suburban towns of Aurora, San Jose, De Guaymas, and Empalme. This road will be about 16 miles long. There is also a Canadian syndicate in the field, and it is planning a line between Mexico City and Puebla. The proposed line runs between the two volcanoes, Popocatepetl and Ixtaccihuatl, and parts of it will lie above the winter snow line. Power for its operation will be obtained from the electric plant of the Mexican Light and Power Co. at Necaxa.—*Electric Traction Weekly.*

Newcastle-on-Tyne.—The report of the city engineer (Mr. C. R. S. Kirkpatrick) to the Tramways Committee, states:—The expenditure on the general maintenance of the tramway track for the year ended March 31st, 1909, was £7,313. The down track of Westgate Road was renewed at a cost of £494, and a new loop, forming a junction between Elswick and Westgate Roads, was constructed at a cost of £341. The total cost for renewals was £1,403, included in which was £50 for the construction of an additional 20 yards of track in Heaton Road. All the tramway rails in stock, after treatment with bitumastic solution, have been stacked under a shed at St. Peter's. The expenditure for this item was £1,007, including the cost of shed. The laying of the track in Market Street extension and the junction at Pilgrim Street were completed, and the expenditure for the year was £3,097. A vehicle fitted with carborundum blocks had been engaged at night grinding the rails to remove corrugations, and with satisfactory results. The cost had varied from 6d. to 1s. per lineal yard. It was found that immediately the corrugations were removed the maintenance on that section of the track was automatically reduced.

Perth.—There is a deficiency of £1,500 on the tramways for the past year. The fares yielded £200 less than the estimate, and the expenditure has been £100 more than expected.

South Lancashire.—We learn that the South Lancashire Tramways Co. is negotiating with the Worsley and Little Hulton District Councils with a view to securing powers to construct additional tramways in those townships. The lines already in operation from Farnworth through Walkden to Swinton are proving remunerative.

Taunton.—The Rowbarton extension of the Taunton tramways was inspected by the B. of T. on August 13th; the work has been carried out by Wm. Griffiths & Co., London.

U.S.A.—The first 1,200-volt direct-current electric railway system in New England is to be constructed between Presque Isle and Washburne, Me., with an ultimate extension of 110 miles to the St. John River, according to an announcement recently made. The Aroostook Valley Railroad, affiliated with the Canadian Pacific Railway, is the promoter. The new road will be built for both passenger and freight traffic. Power will be bought, according to the plans, from the Maine and New Brunswick Power Co. at Aroostook Falls. On the south, the new road will connect with the Canadian Pacific.—*Electric Traction Weekly.*

TELEGRAPH and TELEPHONE NOTES.

American Railway Methods.—The use of modern methods of handling telegraph business of railway companies is illustrated by the equipment of the general offices of the Santa Fé's coast line at Los Angeles. All departments are connected directly by pneumatic tubes with the telegraph office, 31 tubes being used for this purpose, states the *Telegraph Age.* The system handles between 50-60,000 messages and reports monthly, and is very successful, doing away with the congested filing of business which occurred under the old system of messenger delivery and collection, and also expediting the handling of messages.

Canadian Wireless Stations.—The United Wireless Co. has made an offer to purchase the Canadian Government's wireless stations on the Pacific Coast. The offer, the *Standard* says, is not likely to be accepted. The Dominion Government maintains a number of these stations in connection with the coast protection service, but has not as yet opened them to commercial business.

Jamaica Telephones.—The *Jamaica Guardian* states that the licence held by the Jamaica Telephone Co. has been extended by the Governor in Privy Council to April 30th, 1910. The licence for the Vandeville and Montego Bay telephone service has also been extended to the same date.

South Africa.—It is reported that the Transvaal Government has extensive improvements in hand with the telegraph and telephone services all over the colony, which will make it one of the best equipped in the world. It is suggested to link up every town, and main trunk lines are to be carried to every point where the railway lines cross the border, with a view to their ultimate extension to the coast ports when the other colonies are ready. It is regarded as certain that the Union Government will find telephonic communication between Cape Town and Pretoria absolutely essential. The scheme contemplates connections with farmhouses as well as the establishment of call offices at convenient centres. It is estimated that the coast extensions will cost £250,000. A concentrator has already been installed in Johannesburg to enable messages between minor offices to pass direct to their destination, without any necessity for taking off and retransmission at central stations as heretofore.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	
Assab-Perim	July 8, 1909	
Trinidad-Demerara	Aug. 6, 1909	Aug. 13, 1909
Dakar-Conakry	Aug. 6, 1909	Aug. 14, 1909
Gibraltar-Tangier	Aug. 6, 1909	
Cuata-Tangier	Aug. 7, 1909	
Melilla-Chafarinas	Aug. 7, 1909	
Corfu-Trieste	Aug. 16, 1909	

The Eiffel Tower Wireless Station.—According to the *Daily Telegraph*, this station will be re-equipped by the end of next month, and will then be used for regular transmission to the United States and Canada. Wireless messages from New York are now received or intercepted almost daily, and occasionally Canadian messages are received.

The Madrid-Paris Telephone.—Negotiations for a through telephone communication between Madrid and Paris are well advanced, and telephone lines have been definitely arranged for between Madrid and Bordeaux.

The Telephonograph.—According to a daily paper, a Signor Pasquale, of the Italian Taranto Agricultural Bank, has invented a device bearing the above title, with the object of obtaining permanent records of telephone conversations, much in the same way as gramaphone messages are recorded. For business purposes such messages could be reproduced if desired.

Trinidad Telephones.—The *Trinidad Mirror* of the 21st ult. contains a leader on the subject of the telephone service in the island provided by the Trinidad Consolidated Telephones, Ltd., formerly the Trinidad Commercial Telephone Co., Ltd., which has issued a circular in which it states that the same rates will be charged as heretofore, although Trinidadians had hopes of their being reduced. The payment-in-advance system is strongly objected to because of the importance of obtaining service before paying for it. In conclusion, the *Mirror* hopes that wireless telephony will at some future date assist them in obtaining a reduction of rates.

Wireless Telegraphy in the West Indies.—The *Demerara Argosy* states that experiments at the West India and Panama Telegraph Co.'s station have been steadily proceeding towards the proper attunement of the apparatus for communication. Up to the present, however, though the stations at British Guiana and Trinidad have been in speaking touch all the time, and messages have been exchanged, the correct pitch has yet to be attained. Atmospheric influences, principally lightning, have unfortunately been hampering the work a good deal.

The Newfoundland Cable Dispute.—The full text of the letter addressed to the Newfoundland Government by the Commercial Cable Co. came to hand last week too late for detailed attention. The company states that it has invested over a million dollars on the faith of the contract of February 18th, 1909, which did not contain any provision requiring the approval of the Legislature. The contract required the company to pay the Government $4,000 annually as a tax on the cable, and an equal tax on the second cable which the company intended (and still intends, if the contract is observed) to lay. On the other hand, the Government is to pay $4,000 a year to the company as compensation to the latter for extending its cable from the landing place to the City of St. Johns, and maintaining a profitless office there, free of cost to the Government. The contract provided also that supplies should be free of import duties, a usual provision, but this clause was violated, the company being charged $4,322.60 duty on electrical apparatus.

The advantages to the Newfoundland Government were that the cable messages collected by the Government on its landline system could be handed to the company instead of traversing the whole length of the island and the Government's submarine cable to Nova Scotia, while the Government cost nothing in revenue, and the speed of transmission was increased. Lastly, considerable trade would have been brought to the island, especially if the company's cable steamer *Mackay-Bennett* was stationed at St. Johns, involving an expenditure of over $50,000 a year. The Government itself had asked the company to provide the direct cable connection, but now repudiated the contract, and thus, no doubt, pleased the Anglo-American Co., which was in competition with both the Government and the Commercial Co. The letter concludes with a protest against the repudiation of a solemn contract—an act hitherto unknown in the history of the British Government or its dependencies—and a denial of the Government's right to repudiate it.

The other side of the question is voiced by Sir Edward Morris, the Premier, who is now in London, and emphatically denies that there has been any breach of faith on the part of his Government, or that it fails to recognise the contract made with its predecessors or is hindering the laying of the company's cable. Sir Edward goes on to say in regard to his Government:—"It did, however, refuse, without ample consideration, to bring before the Legislature for ratification this contract of 1909, principally for the reason that it was unfair and prejudicial in many respects to the Anglo-American Telegraph Co., Ltd., which is a cable company, and would create in favour of the Commercial Cable Co. a monopoly for 25 years of the transmission of all cable messages passing over the Newfoundland Government landlines. The Commercial Cable Co., under its agreement made in 1905 with the Newfoundland Government, are now bringing in their cables. There is no objection to this, as the Government, only a few weeks ago, gave them the land they require, but the Government have not felt justified (not, however, without fully considering the matter) in granting by Act of Parliament the further concession attempted to be given in the agreement of 1909, namely, a monopoly for 25 years and freedom from taxation, whilst taxing the Anglo-American Co. doing business on the same street $20,000 per annum." . . . "The present Newfoundland Government, who were only in office a few days when this legislation was asked for, were fully justified in taking time to consider the matter before embarking on legislation." . . . .

In a letter to the Secretary of State for the Colonies, under date July 8th, Mr. F. A. Bevan, Chairman of the Anglo-American Telegraph Co., gave his company's views on the matter. This letter states that by the agreement of February 10th, 1909:—"Clause 2 extends the period of the Commercial Cable Co.'s 1905 agreement to 25 years from February 18th, 1909, and, together with Clause 3, confirms in specific terms the monopoly during that period to the Commercial Cable Co. (which is an American company) of all traffic from which the Government landlines, to the exclusion of my company (which is a British company), and whose landlines are also excluded from all business passing over the Commercial Co.'s cable. . . . ." The letter also shows that under Clause 4 the Government is to pay the Commercial Co. $4,000 per annum "in consideration of the advantages and facilities secured" by the cable extension to Newfoundland and New York; but, the letter points out, the Anglo-American Co. has already four cables to Europe and five to the U.S., which are available for the Government. Moreover, the effect of the above subsidy is to remit to the Commercial Co. the landing tax of $4,000 per annum, imposed by law, on each cable between the Colony and any place outside; the Anglo-American Co. pays taxes on five cables amounting to $20,000 per year.

United States Telegraph and Telephone Statistics.—The third set of statistics recently published deals with the year 1907. Among other things, attention is drawn to the enormous single-wire mileage of commercial telephone and telegraph systems, the large growth of the telephone, as compared with the telegraph mileage, and the difficulties in wireless development. Tabular statistics are given showing that there were 1,813 telegraph systems, of which 25 were commercial landline and ocean cable, six wireless, and 625 railroad telegraph systems. There was a grand total of 15,072,220 miles of single wire in use by the telegraphs and telephones: of this, the telephone systems controlled 12,999,369 miles, and the telegraph systems, exclusive of Government telegraph systems, used 2,072,851 miles. Operating the telegraph and telephone systems, but exclusive of railroads and wireless, there were 22,996 companies, 22,971 being telephone companies. The ocean cable amounted to 46,301 nautical miles, all controlled by the commercial telegraph systems. The capital stock and bonds outstanding, par value, was $1,034,909,579, of which $814,616,004 was credited to the telephone systems. The total income was $236,045,615, of which the telephone concerns earned $184,461,747, expending $140,802,305; and the telegraph systems earned $51,583,863, expending $41,879,613. Of the whole number of systems in operation, the telephone formed 99·9 per cent.

The difficulty in obtaining separate statistics regarding land and ocean telegraph systems is mentioned; the last census shows that these systems dealt with 103,794,076 messages, which included 5,869,317 cable messages, and 29,110 telegraph offices were in use. Of the 25 telegraph companies, 24 were incorporated; only 11 paid dividends on their capital stock, being the same as in 1902. There were six commercial wireless telegraph systems, having 122 tower stations (in 1907), and these dealt with 163,617 messages. The capital involved was $39,450,000; the year's income, $122,154; and expenses, $169,782.

The Federal Government had installed wireless plant on 73 naval vessels, and in 44 shore stations. The shore stations (which are open to the public) sent 26,933, and received 34,073 messages. The U.S. railroads operated 807,824 miles of telegraph, and 52,518 miles of telephone wire, requiring 33,441 telegraph offices, and 30,115 telephones. These transmitted 5,923,483 commercial messages, and 258,589,333 messages on railroad business. It is inferred that the telephone will come into greater use for railroad work on account of its speed and flexibility.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—2,550 common battery telephones and protectors for the P.M.G. See "Official Notices" to-day.

Ballinasloe. — September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Burnley.—The Guardians have decided to obtain tenders for the electrical work required for the new nurses' home, and alterations at the Infirmary.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

September 4th. Electric light installation at the new slaughter-houses, Gorgie, for the Corporation. Specification (one guinea deposit) from Mr. F. A. Newington, electricity supply works, Dewar Place.

Germany.—The municipal authorities of Wegscheid, Bavaria, are about to invite tenders for the establishment of a central electric lighting station in the town.

Glasgow. — Electric lifts for new Mitchell Library Wm. B. Whitil, architect, 219, St. Vincent Street.

Electric power plant for the Shieldhall works of the southern district sewage scheme. The Engineer on Sewage Scheme Construction, City Chambers.

Handsworth.—August 30th. Steam coal for the electric generating station of the U.D.C. F. A. Nixon, electrical engineer.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" August 13th.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" August 13th.

Leyton.—September 7th. Electric light wiring and fittings for the Public Offices; extension for the U.D.C. See 'Official Notices" to-day.

London.—Battersea.—August 21st. The Council wants tenders for motors and controllers, d.c. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" August 6th.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

September 1st.—Miscellaneous stores and electrical accessories for the Metropolitan Asylums Board. See "Official Notices" to-day.

Plymouth.—September 2nd. Steam turbo-dynamo for the Corporation. See "Official Notices" August 13th.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-kw. Diesel set and a 50-kw. steam dynamo. See "Official Notices" August 6th.

West Ham.—September 2nd. Electrical fittings for a year, for the B.G. Thomas Smith, clerk, Union Road, Leytonstone, N.E.

Wishaw.—August 30th. Three-wire D.C. switchboard for the Craigneuk sub-station for the Electricity Department. See "Official Notices" August 13th.

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Gravesend.—The T.C. has accepted the tender of Mr. W. R. Wills for an automatic stoker for the electricity works, at £215.

Hereford.—The T.C. has accepted the tender of the Blasberg Engineering Co., of Manchester, for a water-cooling tower, at £270.

Liverpool.—Repeat orders for vertical Curtis turbines have been given by the Corporation to the British Thomson-Houston Co.

Wallasey.—The following tenders for tramway stores has been accepted by the U D.C :—

British Griffin Co.—Chilled iron wheels.
J. Baker & Co.—Steel-tired wheels.
National Rail and Tramway Appliances Co.—Brake blocks.
Dick, Kerr, & Co.—Bearings, &c.
Cammell, Laird & Co.—Axles.

NOTES.

Condensing Water for Jet Condensers.—A correspondent writes as follows:—If the steam supplied to an engine be passed through a good separator it should enter the cylinder practically dry. The only heat lost by the steam in its passage through the engine is that lost by radiation and that converted into work. That converted into work can be very closely calculated from the value J = 778 ft. lb. Under these circumstances the chemical method described at page 235 appears somewhat supererogatory. The heat content of a pound of steam at initial pressure is known, and so is that of the exhaust steam at the final pressure. Then neglecting radiation, the initial heat less the heat equivalent of the horse-power should measure the final heat. There is no need to take into account cylinder condensation, for this is purely a local action in the cylinder, and does not imply any disappearance of heat.

Excepting for heat converted into work any steam which enters a cylinder must leave it as steam, for the total heat per pound of initial steam is greater than in a pound of final steam, and the final steam would be superheated were it not for the wetness due to performance of work. The wetness overcomes the superheat.

Between steam at 180 lb. absolute and exhaust steam at 3 lb. absolute there is a difference of 70 thermal units, or 1 in about 17, or say 6 per cent. The difference should fully counterbalance the radiation loss, and leave only the wetness due to work done. The final steam may thus be assumed to contain 1,100 units above an ordinary injection temperature, as per steam table, which shows 1,125·1 total heat above 32° for steam at 3 lb. absolute. If the injection is discharged at 100° F., and has gained, say, 40° F., the steam has lost 1,060 heat units. Then each pound of steam has heated up $\frac{1060}{40} = 26\frac{1}{2}$ lb. of water, and the ratio of steam to water is 10 : 265. This seems a method quite sufficiently accurate for all practical purposes. It is open to such slight correction as may be made by anyone who wishes to recognise the fact that 1° F. in a pound of water is only equivalent to the thermal unit at one temperature, but this correction is hardly necessary.

The method of Mr. Empson, as given in the ELECTRICAL REVIEW of August 6th, is correct, but it does not distinguish between the steam discharged from the engine and the water that has passed through as priming, and so does not appear to avoid the inaccuracy pointed out in Mr. Empson's first paragraph. If any water has got by the separator, it will dilute the air-pump discharge, and will appear as steam in the calculation. Is there any necessity for such extreme accuracy in any case? If the hot well is too hot, would not more water be used, irrespective of the calculation? "Sure," said the Irish nurse, "I don't need this (a thermometer). If the baby comes out red, the wather's too hot, and if he comes out blue, its too cold!"

The Norwegian Nitrogen Industry.—At the new works at Notodden, for the extraction of nitrogen from the air by means of the Birkeland-Eyde electrical process, which have been in full work for more than a year, nitrogen is now oxidised in 36 furnaces, requiring 1,000 E.H.P. each. The products obtained are nitric acid, which in concentrated form is brought into the market in iron casks; calcareous nitre with 13 per cent. of nitrogen; and sodium nitrite, of which there was sold to German dye manufacturers during the last year a quantity, amounting to the value of about 1 million kroner (£55,555), and corresponding to one-third of the world's requirements. Apart from the above products, it is intended to produce ammonium-nitrate in a factory, which is to be erected specially for this purpose. By co-operation with the Badische-Anilin and Soda Fabrikgesellschaft, the original company has succeeded in procuring the necessary capital for the purchase and harnessing of the Rjukan Waterfall and others.

Two separate companies have been formed, one under the name of the Norwegian Power Co., with a capital of 16 million kroner (£888,889), and the other with the style of the Norwegian Saltpetre Works, with a capital of 18 million kroner (£1,000,000); a third company has also been formed, dealing only with transport, and having a capital of 3 million kroner (£166,667). The total capital which up to the present time has been spent at the Notodden, Svälgfoss and Rjukan waterfalls already exceeds 22 million kroner (£1,222,222), which, according to the estimates, will have to be increased to 54 million kroner (£3,000,000), when all the projected arrangements have been completed in about 10 years' time. Nothwithstanding many difficulties and mishaps, which occurred during the first year, the value of the products amounted to 2 million kroner (£111,111), and the net profits to 25 per cent.

Institution Notes—MINING INSTITUTE OF SCOTLAND.—The members of this Institute, numbering 300, visited the collieries of the Lochgelly Iron and Coal Co., Ltd., on Saturday, to inspect the electrical power generation and distribution system there. The Lochgelly Co., who own pits covering a coalfield fully 16 square miles in extent, have one of the most modern electrical systems in the country, and a recent extension places it far ahead of any in the district. Until the end of last year the company provided power and lighting for their various pits by means of numerous isolated continuous-current plants of low and medium pressure, but, deciding some time ago to generate in bulk at high pressure at a convenient centre and distribute to the different pits from there, plant has been obtained sufficient meanwhile to supply five of the pits and the workshops on these lines, and the scheme is so designed that the remaining pits, seven in number, will ultimately be included. The power is transmitted from the central power house by overhead lines to the distant pits by high-pressure three-phase current. The power station contains four Babcock & Wilcox boilers in two batteries, each boiler having 2,531 sq. ft. of heating surface. There are two Belliss & Morcom self-lubricating three-crank triple-expansion engines, direct coupled to two Bruce Peebles three-phase 50-period alternators, having exciters on the same shaft. Each set is designed for a continuous output of 420 KW. on a 0·8 power factor (and for 25 per cent. overload for periods of 2 hours at clear intervals of 6 hours) at 3,000 to 3,300 volts when running at 375 R.P.M. The transformer stations are each designed to contain two 200 KW. transformers. To redeem the capital in 20 years the company hope to be able to deliver electrical energy to any pit in the coalfield for rather less than 0·3d. per Board of Trade unit, and with an increased load the cost may be even cheaper, owing to much of the capital expenditure already incurred belonging to possible, and, indeed, probable extensions. After the inspection the members were entertained to lunch, when Mr. George Mitchell, one of the directors of the company, expressed the pleasure that it had given him to welcome them on behalf of the Lochgelly Coal and Iron Co. He hoped that the day of jealousy amongst coal-owners was past, and that, in view of the competition which had to be faced at home and abroad, anything that was good for them in the way of cheapening production, was also good for them to learn and teach. Mr. McLaren, H.M. Inspector of Mines, in thanking the company for their courtesy and hospitality, stated that, in his opinion, neither money nor brains had been spared to make the Lochgelly pits the first in Fife. He hoped that if any of the members had any old installation at any of their mines they would get rid of it at once, and install something like that at Lochgelly. Messrs. Sayers & Caldwell, of Glasgow, were the engineers for the work.

Legal.—POSTMASTER-GENERAL *v.* RUSSELL.—In the City of London Court, before Judge Lumley Smith, K.C., on Tuesday last week, the Postmaster-General sued Mr. W. H. Russell, nurseryman, Haverstock Hill, to recover 15s. 7d. for the rent of an extension telephone line. The defendant had several other lines, about which there was no dispute. According to the report in the *Standard*, the defendant's manager said that the extension line was absolutely useless from beginning to end. They never could get connected, although he tried to do so over 50 times. At last they asked the Postmaster-General to take the machine away, and wrote and said that no sensible man would ask them to pay rent for the extension. Mr. W. Bregnall, for Sir Robert Hunter, the solicitor to the Post Office, said that the extension worked all right at first, but there was no responsibility on the Postmaster-General to maintain it, or to keep it efficient. If there was any error or fault on the part of the engineers, the Crown were not responsible, as they were not liable for the faults of any of their servants. Judge Lumley Smith said that the contract was a very tight one, and he had had similar complaints before. The defendant probably did not read the conditions under which he was bound. The fact that the extension was out of order was no answer to the present claim, and the contract precluded the defendant claiming damages. The defendant had trusted to the good feeling of the Postmaster-General that he would do his best to keep the extension in order. That was all. Judgment was given for the plaintiff, with costs.

Nalder Bros. & Thompson, Ltd., *v.* S. E. Smith.—At Lincoln County Court on Tuesday, plaintiffs sued Samuel E. Smith, electrician, Lincoln, for the return of two electrical instruments, or £5, their value and damages for detention. Mr. E. E. Payne, giving evidence for the plaintiff company, stated that the instruments were sent to A. C. Smith, Ltd., Lincoln, on loan for exhibition purposes in January, 1908. A great many were returned, but four, including the two electrical measuring instruments, were not. He saw the goods in defendant's premises on May 26th. Mr. J. G. Williams, who appeared for plaintiffs, said that they were only suing for two, because they could only prove that two were in defendant's possession. Sir G. S. Baker made an order for the instruments to be returned in a week, or, if not returned, a verdict for plaintiffs for £5. His Honour stated that he had a letter from the defendant asking that the case might be adjourned, as he had just received a telephonic message that his wife was seriously ill. On inquiry he was told that defendant had gone to Woodhall Spa.

Rossall School Installation.—The Governors of Rossall School have recently decided to make extensive alterations and improvements, including the installation of electricity. Messrs. Siemens are the main contractors, and are using their new Stannos wire throughout. A Belliss-Siemens steam dynamo is being provided, and the exhaust steam from this will be used in the calorifiers which are being installed to heat the school on the centralised hot-water system. A Westinghouse petrol set is also being put in. The whole installation is being designed and supervised by Messrs. Lacey, Sillar & Leigh, of Westminster and Manchester. The work will be completed before the boys return at the end of the summer holidays.

For Sale.—The Rhyl U.D.C. is offering for sale one 165-kw. d.c. steam dynamo. See our advertisement pages to-day for particulars.

We have received printed particulars of machinery, plant and tools, and other effects, of the Auto-Claw Co., Ltd., which are offered for sale by tender. They may be viewed on the premises, 148-150, Curtain Road, E.C., any day up to August 21st, between 10 a.m. and 1 p.m. Copies of the particulars can be obtained from Mr. James Todd, the receiver and manager, at 135, Wool Exchange, E.C.

Colliery Accidents.—It is reported that on Thursday, last week, two workmen, David Thomas (46) and Owen Davies (24), met their death at the Crihbwr Fawr Colliery, near Porthcawl. They were proceeding to their work, and when leaving the tram, they slipped, and, it is said, caught hold of an electric cable, from which they received a shock. One of them died instantaneously and the other a little later.

While working in Auchingiech Colliery, Chryston, on Sunday, James M'Mahon, a miner, met his death electrically. M'Mahon was engaged splicing a rope with the aid of a portable electric lamp. On taking the lamp from the hook, he received a slight shock, causing him to drop the lamp, which burst, and apparently thinking that the current was thus shut off, he stooped to lift the remains of the lamp, when he received the shock which killed him.

Up-to-date Bell-Ringing.—The offer of T. C. Keay, engineer, for the installation of electric power in connection with the ringing of the Old Steeple bell, has been accepted by the Dundee Town Council.

Appointments Vacant.—A salary of £104 yearly, with house, coals and light, is offered for an engineer to take charge of the installation at the large modern lunatic asylum at Bangour, near Edinburgh. Candidates must be experienced and fully qualified to take charge of the steam and electric plant.

Foreman of electric light service for Dominica, West Indies (£150). See our advertisement pages for particulars.

Mediterranean Push.—Messrs. Gent & Co., Ltd., send us the following letter, received by them from Malta, as the sequel to the amusing communication which was printed in our issue of July 16th, 1909, p. 102:—

"Mr. Gent and Co.,—

"It is not the first time we had business with many English firms under the conditions submitted to you or proposed by them, besides many others, as Germans, French and Italians, and always came to a conclusion.

"But, beg pardon, let us state that your well-known firm is one of those which we Maltese fellows since have been in the course of commerce never met across.

"Thanking you at last for the great trouble you had for publishing our letter in the Electrical Review.

"With many thanks, we remain,

"Mediterranean Push.

"N.B.—We beg this time to be kind again to publish our letter, and we will pay you for the expense."

Electrical Employers' Association of N.S.W.—According to an Australian newspaper, the above Association is to be formed in Sydney, with offices at 33, York Street. What led to its formation was the issuance in March last by the Electrical Trades Union of New South Wales of a log embracing conditions of labour, wages to be paid, &c., to the members of their union, and sending a copy to each of the firms employing electricians, suggesting that a conference be held between their representatives and representatives appointed by the employers, with a view of getting their special conditions accepted by the employers. It was quite impossible for the employers individually to deal with this matter, and a meeting was convened by Mr. A. J. Hanson in order that the employers might be brought together to consider the matter. At one of the meetings it was felt to be very desirable that an association of all electrical employers should be formed in order to deal with this particular subject, and with any other matters that might arise from time to time affecting the general welfare of employers in the electrical industry. On June 3rd it was decided that the Association should be formed, and the following officers were elected:—President, Mr. E. J. Erskine; vice-presidents, Messrs. W. A. Gosche and A. J. Hanson; general committee, Messrs. Forbes Mackay, J. E. Donoghue, Kendall, Waddell and Bell; treasurer, Mr. H. R. Sharp; trustees, Messrs. Handley and Warren; secretary, Mr. R. Burgin.

Copper.—The tendency of the market at present is rather obscured. We are informed (U.S. *Electrical World*, July 29th) that the managers of the Metal Exchange of New York have adopted the recommendations of a Committee which advises them to bring their system of selling copper into line with that in use in London. This involves quotations in tons of 2,240 lb., the grading of the copper under the term "standard," and the use of contracts worded as the London ones.

The same paper records a sale to the Western Electric Co. of about 12,000 tons, though it does not make direct mention of delivery. Presumably, however, this is a trading sale.

The trade "boom" appears to be setting in rapidly in the States, and would appear to have caused a reversal of policy in speculative circles. Indications hitherto have been all in favour of a "slump" in copper, to be followed by a sharp climb to high prices. In the face of a strong genuine demand in the States, however, it is difficult to see how this can come about.

Inquiries.—A correspondent wants a quantity of gas-heated thermopiles, and would like to meet with a maker of such.

A firm is inquiring for makers of electrical hammers for boiler riveting, or if not obtainable, for makers of hydraulic hammers for the same purpose.

Correction.—In the article on an "Electrically-Operated Fire Pump" on page 210 of our August 6th issue, reference is made to a "flexible cable of 60 sq. mm. section." This should read "16 sq. mm."; and two lines later for "3 × 60 sq. mm." read "3 × 16 sq. mm."

To Soothe a Savage Breast.—Although some of our electrical friends may now be tracking the wily grouse to his lair, there are many others left in empty (so-called) London, and to these we heartily commend a few evenings with the Moody-Manners Opera Company at the Lyric Theatre. This week these fine performers have given "Lohengrin," "Madame Butterfly," "Carmen," "The Mastersingers," &c., and music lovers who patronise only Italian and German opera, because it is the proper thing to do, will be pleasurably surprised and gratified with the superb singing and fine acting of the eminent vocalists Mr. Charles Manners has gathered into his fold. Principals, chorus and orchestra alike are first class; the chorus, indeed, is quite a feature, especially in the male-voice department, and the wonderful verve displayed, combined with a remarkable ability to retain the pitch, is a revelation in operatic chorus singing. On two consecutive evenings we have been gratified to note that the courage and enterprise of Mr. Manners have been rewarded with well-filled houses, and we hope that the recognition for which he has for years so manfully striven will no longer be denied him, for he deserves the hearty support of everybody to whom singing, acting, playing and scenic effects of the first order, appeal.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On the occasion of his marriage, Mr. H. Wilson, mains superintendent, has been presented by the Maidstone electricity works staff with a marble clock.

In celebration of the recent marriage of Mr. Harold Dickinson, the manager of the Leeds Corporation Electric Lighting Department, a social gathering of the officers and workpeople, together with their wives and lady friends, was held at the Grand Central Hotel, on Friday evening, 13th inst., when Mr. Dickinson was presented with a grandfather clock and a silver tea and coffee service, and other articles subscribed for by the entire staff, numbering 237 persons. During the evening musical selections were rendered.

Tramway Officials.—Mr. Thomas Medcalf, general manager of the Swindon Corporation Tramways, and formerly in the electrical department of the Burnley Corporation, was married on Thursday last week, at Burnley, to Miss Alice Isabella Grey, daughter of Alderman Grey, cotton manufacturer, and chairman of the Burnley Corporation Electricity Committee.

General.—The directors of the Suffolk Electricity Supply Co., Ltd., and the staffs at Stowmarket, Diss, and Felixstowe, have presented a marble clock and a cheque for 10 guineas to Mr. Frank Allen (accountant) on his marriage.

Miss E. F. Lewis, supervising telephonist of the Northampton Post Office staff, who is about to be married to Mr. Wilfrid Austin, of the staff of the Northampton Electric Light and Power

Co., has been presented by the staff with an old Staffordshire china tea set and a silver-plated teapot.

Mr. A. W. Blake is severing his connection with the firm of Mills, English & Co., Ltd., Swansea, with whom he has been associated for the last three years (previous to which he was borough electrical engineer at Monmouth), and has taken offices at 66, Wind Street, Swansea, where he intends to practise as a consulting engineer, devoting special attention to colliery and works equipment.

Recently at the Parish Church, Plumstead, near Cape Town, the wedding was solemnised of Mr. George Muirhead Clark, M.I.C.E., chief engineer in South Africa for Harper Bros. & Co., of London, and consulting engineer to the Rand Mine Power Supply Co., and Miss May Constance Edwards, eldest daughter of Major J. P. Edwards, V.D., M.I.E.E., of Branksea, Wynberg, formerly chief engineer of the postal telegraphs in Cape Colony.

It was announced in Wednesday's papers that Sir Matthew Nathan, G.C.M.G., will be appointed Secretary to the Post Office in succession to Sir H. Babington Smith, K.C.B., C.S.I. He will take up his new duties in January next on returning from Natal. The *Times* says that Lieut.-Col. Sir Matthew Nathan, R.E., G.C.M.G., was born in 1862, and has had a distinguished administrative career. He entered the Royal Engineers in 1880, and served in the Nile and Lushai expeditions in 1885 and 1889. In 1895 he was appointed secretary to the Colonial Defence Committee. In 1899 he was entrusted with the administration of Sierra Leone, and subsequently was made Governor of the Gold Coast, and later of Hong Kong. He was appointed Governor of Natal in 1907.

Mr. Frank Stuart Milne, who some time ago left the Newcastle-upon-Tyne Electric Supply Co., Ltd., to take up an important appointment in the Argentine in connection with the electrical department of the State Railways, has, in view of the rapid commercial expansion of the Republic, commenced business in Buenos Ayres as commercial engineer and agent for British railway, mechanical and electrical engineering firms. Associated with him as British engineer and secretary is Mr. J. A. Seager, A.M.I.C.E., A.I.E.E., and any firms desiring representation in Argentina should communicate with the latter gentleman at his office, Emerson Chambers, Newcastle-upon-Tyne.

Obituary.—Hugh Erat Harrison. — We announce with very deep regret that Mr. Hugh Erat Harrison, B.Sc. (London), A.M.Inst.C.E., M.I.E.E., F.C.S., the Principal of the Electrical Standardising, Testing and Training Institution, died on Thursday, August 12th. Mr. Harrison was born at Westminster in 1859, and was educated at University College School. He matriculated in 1876, and entered University College, where he gained a Cloth Workers' Exhibition in Chemistry and Physics in 1877. He studied for a short time in Paris, and subsequently took his degree in 1880 with Honours in Experimental Physics. In the following year he entered the service of the Anglo-American Brush Co., and subsequently became managing engineer of the Sheffield branch of the Hammond Electric Light and Power Co., Ltd. In 1882 Mr. Harrison organised and became Principal of this company's Electrical Engineering College in Red Lion Square, London, and when it was closed in 1885 he became a partner in the firm of Phillips, Harrison & Hart. On retiring from this firm he was appointed Clerk to the Research Committee of the Institution of Mechanical Engineers, but it was in 1889 that he carried out the work with which his memory will be associated, viz., the organisation and foundation of the Electrical Standardising, Testing and Training Institution, Faraday House, London, of which he was Principal at the time of his death. He drew up the scheme of studies himself, and to the close of last term lectured to the students on "Electrical Engineering." In addition he organised the Testing Department and superintended its work, and in connection with this he was appointed Board of Trade Electrical Inspector for Croydon, Tunbridge Wells, Ealing, Wimbledon, Chatham, Godalming and Clacton. From 1887-1901 he was Assistant Examiner in Magnetism and Electricity to the Board of Education, and he was one of the delegates sent by the Institution of Electrical Engineers to attend the International Electrical Congress held at St. Louis in 1904. He at one time contributed largely to the technical Press, and he has also written two small text-books for the pupils of Faraday House, one upon "Graphics," and another on "Armatures" (first part); he was engaged in the preparation of the second part of the latter at the time of his decease. He specialised very considerably in alternate current work, and in 1893 the Editor of *Industries* credited him with "perhaps the most important discovery in alternating current work during the last few years." He was unmarried. Mr. Harrison was a man of wide reading, with a well-balanced mind and singularly clear judgment. He was, however, reserved almost to shyness, and shrank instinctively from anything approaching publicity. Nervous to a degree and highly sensitive, he was nevertheless possessed of great tenacity of purpose and strength of will, and those with whom he happened to come into active opposition were often astonished at the force he disclosed. His favourite recreations were golf and yachting, and he was an excellent walker, and for years made it a rule to walk at least 50 miles a week. Latterly, however, due to weak health, he was less active. Extremely fond of music, he at one time sang very well, and a few years ago he installed an organ at Sussex Place and played on it almost daily. One of his chief delights was curio hunting, especially in glass, and a competent judge expressed the opinion that his was the finest private collection of glass in this country. For reasons which we have mentioned above, he was perhaps not as well known personally as his position and abilities might have led one to expect, but to those who were intimate with him, his premature death has come as a terrible blow. Of no one could it more truly be said that "those who knew him best loved him most." The Faraday House Institution which he organised, developed and guided for nearly 20 years, will feel his loss acutely; his name had become synonymous with it, and the Institution of Electrical Engineers, who twice elected him a member of their Council, will feel the loss of his thorough learning and shrewd judgment. The funeral took place at Golder's Green on Tuesday, among those present being the Earl of Crawford, Chairman of the Governors of Faraday House; Mr. W. M. Mordey, President of the Institution of Electrical Engineers; Messrs. Robert Hammond, C. P. Sparks, W. R. Cooper, J. E. Kingsbury, H. M. Hobart and Dr. Alexander Russell.

William Ford Stanley.—We regret to place on record the death, at the well advanced age of 81 years, of Mr. W. F. Stanley, whose name had for so long stood out very prominently among the scientific instrument makers of the United Kingdom, indeed of the world. It was some 55 years since he commenced business as a metal and ivory worker, and, according to the *Times*, two years later he brought out the first simple open stereoscope. For many years he had been engaged designing and manufacturing all classes of scientific instruments for Government and other purposes, and he also wrote a number of text-books on the subjects in which he had so successfully specialised. He shared his success with the people of the neighbourhood in which he resided, for upon South Norwood he poured out his wealth with exceptional munificence. A public hall and art gallery, costing £13,000, the Stanley Technical Trade Schools, erected and equipped and amply endowed, representing many thousands more, and other gifts, led to Mr. Stanley having the honorary freedom of Croydon conferred upon him a couple of years ago, and to the unveiling of a clock tower in South Norwood.

M. Wilson, Sen.—Those who have had dealings with the Electrical Standards Laboratory of the Board of Trade will learn with regret of the death, after only one day's illness, of Mr. M. Wilson, sen. He had served in the R.E. as sapper for over 21 years and held for seven or eight years the office of storekeeper whilst acting as laboratory assistant at the Chatham School of Military Engineering under Major P. Cardew. He has held the office of assistant electrician and mechanic to the Board of Trade Electrical Standards Laboratory since its inception in 1890, and the wide range of practical knowledge which he brought to bear on his duties made his services highly appreciated by all with whom he came into contact.

Sydney Holmes. — We regret to learn that Mr. Sydney Holmes, traffic superintendent of the Rhondda Tramways Co., was drowned on Saturday last. He was bathing in the Bristol Channel at Penarth, when he got beyond his depth and was carried away by the current.

NEW COMPANIES REGISTERED.

Dynamic Electrical Co., Ltd. (104,436).—This company was registered on August 6th, with a capital of £100,000 in £1 shares, to acquire all or any of the undertakings, businesses, properties and assets of the Dynamic Syndicate, Ltd., the Dynamic (French) Syndicate, Ltd., and the Mitcham Electric Fan Co., Ltd., to adopt agreements with the said companies and the liquidators thereof, and to carry on the business of electricians, engineers, makers and manufacturers of and dealers in electric and other motors, fans, dynamos, tools, induction coils and other machinery and electrical apparatus, &c. The subscribers (with one share each) are:—C. Simpson, 34, Down Street, W., stock jobber; T. H. Weguelin, 18, Clifford Street, W., stock jobber; B. H. Weguelin, Coombe End, Kingston Hill, stock jobber; J. Fairbairn, 6, Broad Street Place, E.C., manager; C. T. Treacher, 97, Ridgmount Gardens, Francis Street, W.C., estate agent; J. Berry, 6, Broad Street Place, E.C., secretary; A. Gocdlett, 6, Broad Street Place, E.C., chartered secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than nine; the first are C. Simpson, T. H. Weguelin, and B. H. Weguelin; qualification of first directors, one share; of other directors, £100; remuneration (except managing director) £200 each per annum, free of income-tax (chairman, £250).

General Accessories Co., Ltd. (104,464).—This company was registered on August 9th, with a capital of £3,000 in £1 shares (1,580 6 per cent. preference, 920 5 per cent. preference, and 500 ordinary), to carry on the business of manufacturers of and dealers in electrical goods of all kinds, general merchants, warehousemen, factors and agents, &c., and to adopt an agreement with E. C. Friend. The subscribers (with one share each) are: A. T. Richards, 20, Hanhury Road, Hornsey, N., clerk; Miss M. M. Marlow, 49, Dewhirst Road, Brook Green, W. Private company. The number of directors is not to be less than two or more than five; G. X. Markt is permanent director and manager with £391 10s. per annum. Registered office, 148-150, Curtain Road, E.C.

Laing Wharton, Ltd. (104,536).—This company was registered on August 12th, with a capital of £3,000 in 2,900 preference shares of £1 each and 2,000 ordinary shares of 1s. each, to carry on the business of electricians, mechanical engineers, makers of and dealers in electricity, suppliers of light, heat and power, &c. The subscribers (with one ordinary share) are:—W. R. Wildridge, 95, New City Road, Plaistow, clerk; J. W. G. White, 8, Harregate Road, South Hackney, N.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are H. P. Allison and H. J. de Courcy Moore; qualification, one share. Registered by H. J. Moore, 2, Gresham Buildings, Basinghall Street, E.C.

Geary, Adams & Co., Ltd. (104,463).—This company was registered on August 9th, with a capital of £3,000 in £1 shares, to adopted an agreement with F. C. Geary, and to carry on the business of electrical installation and general engineers and agents, &c. The subscribers (with one share each) are:—F. C. Geary, 20, Albany Road, Wolverhampton, engineer; G. W. M. Adams, Bolton Road, Wodnesfield, Staffs., secretary. Private company. The number of directors is not to be less than two or more than five; the first are F. C. Geary and G. W. M. Adams (all permanent; no qualification required); remuneration as fixed by the company. Registered by Alfred H, Atkins, Ltd., 27-8, Fetter Lane, E.C.

Midland Electric Wire Co., Ltd. (104,571).—This company was registered on August 14th, with a capital of £5,000 in £1 shares, to acquire the business carried on as the Midland Electric Wire Co., and to carry on the business of electric cable and insulated wire manufacturers and dealers. electricians, engineers, &c. The subscribers (with one share each) are:—W. J. Levi, 154, Fosse Road South, Leicester, electrical engineer; Miss E. E. Levi, 154, Fosse Road South, Leicester; G. A. Orme, 27, Ahney Street, Leicester, secretary; H. W. Griffin, 23, St. Albans Road, Leicester, managing clerk; G. Hall, Pendene, Stoneygate, Leicester, merchant. Private company. W. J. Levi is manager. Registered by Rawle, Johnstone & Co., 1, Bedford Row, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Walter's Electrical Manufacturing Co., Ltd. (94,300).—This company's annual return was filed on July 2nd, when 10,507 shares had been taken up out of a nominal capital of £13,000 in £1 shares. £1 per share has been called up on 507 shares, resulting in the receipt of £507. £10,000 is considered as paid. Mortgages and charges: £2,600.

Spanish Telephone Co., Ltd. (41,589).—This company's annual return was filed on July 19th, when 3,600 ordinary and 671 preference shares had been taken up out of a nominal capital of £61,000 in 3,600 ordinary shares of £10 each and 1,250 preference shares of £20 each. £20 per share has been called up on 671 preference, and £10 per share on 2,000 ordinary shares, resulting in the receipt of £33,420. £16,000 is considered as paid on 1,600 ordinary. Mortgages and charges: Nil.

J. G. White & Co., Ltd. (66,568).—This company's annual return was filed on July 19th, when the entire capital of £200,000, in 15,000 preference shares of £10 each and 50,000 ordinary shares of £1 each, had been taken up. £10 per share has been called up on the preference, resulting in the receipt of £150,000. £50,000 is considered as paid on the ordinary. Mortgages and charges: Nil.

Electrolytic Alkali Co., Ltd. (64,360).—Particulars of £50,000 first mortgage debentures, created July 12th, 1909, and secured by trust deed of even date (supplemental to a trust deed dated July 9th, 1904), filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £40,150. Above supplemental deed also registered. Property charged: Certain freehold land, buildings, plant and machinery at Middlewich, and the company's other property, present and future. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool.

Cryselco, Ltd. (58,218).—Particulars of £5,000 first and £5,000 second debentures created by resolutions of June 26th, and secured by trust deeds dated July 11th, 1905, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908. the amount of present issues being £500 of each series. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: A. Baker, Billiter House, Billiter Street, E.C.; and H. S. Deacon, Kempston, Bedford.

CITY NOTES.

Great Northern, Piccadilly and Brompton Railway Co.

The twenty-second half-yearly meeting of the above company was held on August 12th, at Hamilton House, under the chairmanship of Sir Geo. S. Gibb, who, in moving the adoption of the report (see Electrical Review, August 13th, page 267), said the issue of share capital to the contractors had now been completed. £75,000 of debenture stock was issued to the contractors during the past half-year, and there remained about £227,000, the bulk of which would remain unissued, representing the capitalised value of rent charges created. The number of passengers carried had been 19,155,883, an increase of 1,709,000, or 9·8 per cent. The increase in two years had amounted to the very handsome percentage of 60½. The local traffic was 68¾ per cent. of the total, and the increase in that branch had been about 2½ per cent. The through traffic was 31¼ per cent. of the total, and the increase in that branch had been 30½ per cent. The gross revenue was £157,993, an increase of £10,229, or 6·9 per cent. He had practically no comment to make on the working expenses, which showed a decrease of £1,578. They ran an increased number of trains, and a decreased number of cars. The service was working with the greatest regularity and success. They only wanted more revenue, and that was coming as fast as one could reasonably expect it. The net revenue balance was £84,588, out of which the directors had set aside £6,000 as reserve for contingencies and renewals. After providing for the preference dividend, the directors recommended the payment of a dividend of 1 per cent. on the ordinary shares and the carrying forward of £8,352. A great deal of new and useful experience was being gained in the working of the railway. No one could say beforehand what kind of movement would take place, and to what extent they would succeed in attracting short-distance passengers, and it was satisfactory to note the increase in the number of passengers who paid the larger fares. They carried 3½ millions of local passengers who paid 3d. during the half-year, and the increase in that branch of their traffic was 12 per cent. The increase in the number of passengers who travelled at 2d. fares was only 1·59 per cent., so that it would be seen they had a good increase in the number of those who paid the larger fares. They also found they got quite a considerable number of short-distance passengers. They had carried 2½ millions at 1d. and 1½d., which was nearly 24 per cent. of their local traffic, excluding workmen. No doubt these fares were too low, but if one could not get more, the traffic of these 1d. and 1½d. fares did at least add to the revenue. They had lately taken out a statement showing the average distances that their passengers travelled. It was a week's account of a week's traffic, and it went to show that those passengers who paid 1d. per fare travelled on the average ·85 of a mile. Passengers who paid 1½d. fares went 1·27 miles, so that the rate per mile paid by those passengers was 1·17 and 1·18 respectively. Taking the whole of the traffic, through and local together, the average distance travelled was 2·9 miles. The average recepts for through passengers, taking the whole length of the journey, was about 2·98d. Of course, some of this had to be divided between the various companies, so that their share had been about 1·66d. The average receipts for the whole of their traffic were 1·89d.

Lord George Hamilton seconded the motion, and the repor was adopted without discussion.

Mersey Railway Co.

The directors' report for the half-year ended June 30th, 1909, states that the train-mileage run during the half-year was 384,962 miles, as compared with 408,134 during the corresponding six months of 1908. The passengers conveyed were 5,818,759, as against 5,719,572, exclusive of season-ticket holders. The total receipts from all sources were £53,228, as compared with £51,784. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £30,810, equal to 57·88 per cent., as against £33,075, equal to 63·87 per cent. for the corresponding six months. These charges for pumping, ventilation, and hydraulic lifts, for the past half-year amounted to £3,660, equal to 6·88 per cent., as compared with £4,070, or at the rate of 7·86 per cent. for the corresponding period of 1908. The London office has now been closed, and the whole of the staff connected with the administration of the company has been concentrated at the general offices at the Central Station, Birkenhead. The period during which the payment of interest on the debenture stocks (other than the new first perpetual stock) is contingent on the revenue available in each separate year, and the holders of each of these stocks are entitled to appoint a director, will expire on December 31st, 1910, and the directors recommend that an application should be made to Parliament during the present session for a further extension of the period. In view of the progress which continues to be made in the development of the traffic and the reduction of the expenditure, the directors are unanimously of opinion that in the interest of all the classes of debenture stock holders and also of the holders of the preference and ordinary stock, it is desirable to continue the existing arrangement and maintain the credit of the undertaking. They hope at an early date to submit proposals for that purpose.

Liverpool Overhead Railway Co.

The half-yearly meeting was held at Liverpool on Tuesday, Sir Wm. Forwood presiding.

The Chairman, in moving the adoption of the report (Electrical Review, August 13th, page 267), said that there was a further shrinkage in revenue, amounting to £2,487, which was mainly, if not entirely, due to depression in trade. On the other hand, the reduction in the working expenses had saved £3,138. This had been accomplished mainly by a more frequent, but less rapid, and therefore less expensive train service. The directors had also effected other economies, small in themselves, but in the aggregate amounting to a considerable sum. They had not sacrificed efficiency for economy. The economies had mainly been effected in running expenses, and not in the cost of repairs and renewals. The railway and rolling stock had been well maintained, and had not been allowed to run down. He was not confident that they would ever be able to restore their fares to their former level. They were governed by the fares charged upon the Corporation tramways and the Lancashire and Yorkshire Railway. It was one of the evils of a municipal trading concern like the tramways, that they must be worked upon popular lines, rather than upon business principles. There had been a severe depression of trade, which had greatly affected the Liverpool Docks. A recovery, however, was already in progress. In America the rising tide in trade had set in vigorously, and it could not be long before it reached this country. He could see no reason why their traffic should not shortly be again as large as it was four years ago. Liverpool, after all, remained the greatest port in the Empire; it was to-day the only commercial port in the United Kingdom, which a modern Atlantic liner could enter, and was the nearest port to the great manufacturing centres. The outcome of their half-year was that they carried a balance to their net revenue account of £7,601. To this they added the balance brought in from last half-year of £4,210, and interest £214, making the total available £12,026. Deducting interest payable upon their mortgage debentures £4,171, and interest payable upon calls paid in advance, they had left a balance available for dividends of £7,696. They proposed to pay interest on the 1892 preference shares at the rate of 5 per cent., which would require £3,000, leaving £4,696 to be carried forward. They had carried £1,500, as usual, to the credit of the renewal fund, which now amounted to £38,082, and they had thought it wise to strengthen their contingent fund by crediting it with £200.

Mr. G. H. Robertson seconded, and the report was adopted.

It was resolved to pay a dividend of 5 per cent. on the preference shares.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1909, and payable on October 1st next.

Baker Street and Waterloo Railway Co.

Sir Geo. S. Gibb (chairman) presided on August 12th, at Hamilton House, over the twenty-second half-yearly general meeting of the above company.

In moving the adoption of the report (see Electrical Review, August 13th, page 267), he said the accounts showed a considerable improvement in all the main features to which one looked in studying railway accounts. Their receipts had gone up, their expenses had gone down, and they were able to double the small dividend which was declared in the first half of 1908. The capital account was not now of much interest. It showed capital expenditure of £71,880, but that merely represented the balances issued to contractors. They had carried 14,300,000 passengers, which was an increase of nearly 11 per cent. over the corresponding half of 1908. The increase had mainly occurred in through passengers. Through passengers in the June half of 1908 were 36⅓ per cent. of the total, and they were now 40¼ per cent. The through traffic did not yield quite so much money as the local, as they had to divide the receipts with the other companies concerned, but it was to the increase of through traffic, due to the co-operation of all the companies in their efforts to establish the habit of underground traffic, that they looked for considerable advantage in the future. The average payment by through passengers came to 2·8d., and the company's share of that was 1·3d. The average of their local traffic, including workmen, was 1·54d., and the average of the total traffic, both through and local, was 1·46d. Their principal exchange was with the Piccadilly Tube, with whom they exchanged about 1¾ million passengers. Next came the Central London Railway, with whom they exchanged 1¼ million; next the Metropolitan Railway, with just over 1 million; and then the City and South London, with just under 1 million. The gross revenue was £91,510, an increase of £7,981, or 9·56 per cent. The working expenses, notwithstanding the increase of car-mileage, showed a decrease of £3,228, of which £2,100 occurred under the head of train-working, and was largely due to the decreased price of electric current, which, again, was due to the decreased price of coal. They had that year put £4,000 to reserve, as the board thought the time had come when they should establish a fund for contingencies and renewals. After that reserve, there remained a balance of £18,304, out of which the directors recommended the payment of the 4 per cent. preference dividend; dividend of 1½ per cent. on the ordinary shares; and an additional dividend of 1½ per cent. on the shares held by shareholders other than the Underground Co.—that company having consented to waive the claim to their dividend. This left £1,305 to be carried forward to the next half-year. The total working expenses worked out at an average of ·71d. per passenger, which was an exceedingly low figure. It was interesting to consider that figure as showing that the large number of passengers they carried at 1d. and 1½d. fares did make some slight contribution to the company. They were aware that the company was authorised to extend the railway from Edgware Road to Paddington. Originally it was proposed to have a terminus in Bishop's Road and then the plans were altered to have the terminus in Praed Street. There was an idea with some people that the Bakerloo Railway should be debarred from extending the line beyond Paddington. He confessed when he looked into the matter it seemed unwise and unfair in the interests of both the company and the public that a permanent physical barrier should be placed in the way of further extensions beyond Paddington. He would not like to express at that time the desirability of such an extension, but the company ought to be perfectly free in a matter of that sort. He did not think the construction of a short length of line between Edgware Road and Paddington would be profitable, for the idea that a large trunk line yielded a large traffic to a line like theirs was quite a mistake. A much better gathering ground was a populous well built district. After careful consideration, therefore, the board had no hesitation in recommending the abandonment of the existing powers for the Paddington extension. The North-West London Railway Co. was authorised to make a tube railway from Victoria to Cricklewood, but had come to the conclusion that the line from Edgware Road to Victoria could not pay—a conclusion which he personally thought a wise one. The promoters approached them with the statement that they wished to abandon the piece of line from Edgware Road to Victoria and to construct a line from Edgware Road to Brondesbury if the Bakerloo Co. would work that piece of line as a continuous line with theirs. The details were very carefully worked out, and a working agreement was settled. The Bakerloo was to have nothing to do with the construction of the line, but was to give an annual contribution out of the through receipts, and the line was to be worked as an extension of the Bakerloo Railway. The financial result, they estimated, would have shown a payment to the Bakerloo line of something like £25,000 to £30,000 a year. That line would, he thought, have been a much more valuable feeder than the Paddington extension. The promoters' Bill was, however, rejected. He did not suppose this would be an end of the matter. He understood that the promoters were considering what they should do, and it was clear there was a very active desire on the part of the inhabitants of the district that the Bakerloo line should be extended to this district. If the scheme was again brought forward they would welcome it, and would be prepared to arrange a similar working agreement with the promoters. This might not occur next session, but he did not know. He saw that the L.C.C. were considering the promotion of trams down the Edgware Road, but whether they would pass Parliament no one knew. Some years ago a similar proposal met with great opposition on the part of the promoters, and was rejected. In any case, so far as that company was concerned, it was clearly their right policy to keep themselves quite clear for any development which might occur. As they knew, the Underground Co. guaranteed 3 per cent. on their shares during construction, and, of course, the abandonment of the Paddington extension would terminate the guarantee. It was clear, however, that the company must look to its permanent interests, and these would be best served by such abandonment of the extension.

Mr. A. Willis seconded the motion.

A Shareholder asked if the company got the advantage of any improvements in the cost of generating electric current by the Underground Co.

The Chairman said they did so.

The report was then adopted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

British Columbia Electric Railway Co., Ltd.—Further issue of £500,000 4½ per cent. perpetual consolidated debenture stock.

and to allow the following securities to be quoted in the Official List—

Bombay Electric Supply and Tramways Co., Ltd.—£150,000 5 per cent. second mortgage debentures, in lieu of the scrip now quoted.

Mexico Tramways Co.—£1,250,900 6 per cent. 50-year mortgage bonds, in lieu of the scrip now quoted.

Oriental Telephone and Electric Co., Ltd.—Further issue of £50,000 4 per cent. redeemable debenture stock.

Liverpool District Lighting Co., Ltd.—An interim dividend, at the rate of 4 per cent., has been declared for the past half-year.

Metropolitan District Railway Co.—Sir George Gibb, presiding at the half-yearly meeting held at Westminster Palace Hotel on August 11th, expressed satisfaction at the results shown in the report (see Electrical Review, August 13th, page 265), the passengers carried having increased by 11·22 per cent. as compared to the corresponding half of the previous year. That improvement occurred nearly all over the system. The passenger receipts at £254,000 exceeded by £10,900 the receipts of any previous half-year. Season ticket receipts were up by 34 per cent. The average receipt per passenger was 1·85d. The car-mileage had increased by 6½ per cent. An expenditure of £5,600 upon the alteration of the air-worked doors to doors having handles, had made it possible to dispense with an excessive number of staff on the trains; these men had been absorbed into the general staff. The new doors were satisfactory and economical, for on the present car-mileage, air-worked doors would have cost an additional £8,000 per annum. There was a net saving of £8,545 in the cost of current this half-year. The accumulated deficiency on the 4 per cent guaranteed stock was about 20 per cent. of the nominal value of the stock, and the board was now engaged considering a scheme, based on mutual concessions of the guaranteed and first preference stockholders, for capitalising the deficiency. A meeting will be called later to consider this scheme, with a view to promoting a Bill in Parliament.

Crossley Brothers, Ltd.—The *Financial News* says that the directors have declared an interim dividend of 2 per cent. (actual), against 2½ per cent. (actual) a year ago.

Chloride Electrical Storage Co., Ltd.—A financial daily says that the directors recommend a dividend for the past year of 10 per cent, placing £5,000 to reserve and carrying forward £14,200.

Northampton Electric Light and Power Co., Ltd.—The directors have declared an interim dividend of 4½ per cent. per annum (5⅖d. per share), less income-tax, on the "B" ordinary shares for half-year, payable 17th inst.

North Metropolitan Tramways Co., Ltd.—Mr. G. Richardson presided at Electrical Federation Building on 13th inst., over the annual meeting of the above company. He said that there was no alteration in the position since the last meeting. In the next report they might be able to recommend a small dividend. Mr. J. Devonshire seconded the adoption of the report.

Electric Supply Co. of Victoria, Ltd.—The report for the year ended March 31st shows, after payment of debenture and other interest, a credit balance of £7,760, and, with the amount brought forward, there is an available total of £16,342. Deducting the preference dividend to March 31st, 1908, and £3,962 for debenture stock redemption account, there remains (says the *Times*) a balance of £4,581. The dividend on the preference shares to March 31st, 1909, amounts to £8,250.

Switzerland.—The report of Messrs. Brown, Boveri and Co., of Baden, for the last financial year shows a net profit of £100,112 as contrasted with £94,058 in the preceding 12 months.

Lanarkshire Tramways Co.—The sixteenth ordinary general meeting of this company was held on Wednesday, at the London Offices, 83, Cannon Street, Mr. A. R. Monks, presiding. The Chairman formally moved the adoption of the report (see Electrical Review, August 13th) which was seconded by Mr. H. O. Levis and carried.

MARKET QUOTATIONS.

Wednesday, August 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon	„	£12	..
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£26 10	£1 inc.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	74/-	4s. inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	£10 inc.
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £136	inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c „ Tube (brazed)	„	8⅛d.	..
c „ „ (solid drawn)	„	7½d.	..
c „ Wire, basis	„	6¾d.	..
c Copper Tubes (brazed)	„	8¼d.	..
c „ „ (solid drawn	„	8¾d.	..
g „ Bars (best selected)	per ton	£72	£1 inc.
g „ Sheet	„	£72	£1 inc.
g „ Rod	„	£72	£1 inc.
e „ (Electrolytic) Bars	„	£61 10	£1 5 inc.
e „ „ Sheets	„	£78	£1 inc.
e „ „ Rod	„	£66	£1 inc.
e „ „ H.C. Wire	per lb.	8d.	¼d. inc.
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	8/3½	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	50/5	10d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£12 15 to £12 17 6	..
m Manganin Wire No. 28	per lb.	6/6	1/6 dec.
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1½	inc.
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	99/-	variable.
e Silicium Bronze Wire	per lb.	9¼d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£133 10 to £134 10	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Prospectuses.—*Membakut Rubber, Ltd.*—100,000 guaranteed shares of £1 each have been offered for subscription at par. The concession consists of 5,000 acres near Beaufort, in British North Borneo, whereon Para rubber is to be cultivated. The Government guarantees 5 per cent. dividend for the next six years, and will not charge any export duty on rubber grown on the estate for 50 years from 1905.

Sendayan (F.M.S.) Rubber Co., Ltd.—40,000 shares have been offered at par It is estimated that on the 820 acres already planted with Para rubber, there are 135,500 trees ranging from eight months to nearly three years old.

Charing Cross, Euston and Hampstead Railway.—The 26th ordinary half-yearly meeting of this company was held at the offices, Hamilton House, Victoria Embankment, on Thursday of last week. Sir George Gibb presided over the proceedings, which were purely formal, and the report was adopted.

STOCKS AND SHARES.

Tuesday Afternoon.

In some few departments of the Stock Exchange there is a fair amount of business going on. Easy money tends to divert capital into the investment markets. American Rails are having wild bursts of excitement—and Anglo-American Telegraph Deferred thereout draws no small advantage. Rubber shares are fairly animated, with prices moving irregularly. And the Canadian-Mexican group is good.

Of this week's new issues, the most interesting in at least one respect is the Membakut Rubber, Ltd. The company receives a guarantee from the Government of British North Borneo of a minimum 5 per cent. dividend for six years, after which the shareholders who desire to get out will have the right to sell the shares to the same Government at par, the purchase to be satisfied either by cash or the issue of certificates bearing 5 per cent. interest. The novel departure opens up all kinds of future vistas, and the speculative fancy wonders what shape of attraction will come next. The chairman of the Membakut Rubber, Ltd., is also managing director of the British North Borneo Company.

Following up a substantial rise last week, Mexican Light and Power common stock has gained a further 2 points, and the Preferred and 5 per cent. bonds are both 1 better. Mexico Tramways rose 3½, though the company's 5 per cent. bonds are ½ down. Rio Trams, at 93½, showed an advance of 3, and Sao Paulos put on 1 at 151½. Canadian General Preferred is 1½ higher at 119½, the Ordinary remaining at 123.

This change in the market within a fortnight is due as much to bear purchases as to investment support, although the latter, encouraged by the substantial fall that had taken place, was not wanting. The chief volume of business is in Rio Trams and Mexican Light and Power Common, the rest of the market obediently pursuing the paths of prices marked out by the two leaders.

The re-arrangement of the Anglo-Argentine Tramways capital is now practically complete, and a steady trade has developed in the First and Second Preference shares of the company. The respective prices are 4$\frac{13}{16}$ and 4⅝, while the 4 per cent. Debenture has risen 1¼ this week, standing now at 92½. The 4½ per cent. Redeemable Debenture stock is 95½ middle. United Electric Trams of Monte Video are quiet at 5½, and the 6 per cent. Cumulative Preference were done at the same price the other day. A seller of British Electric Traction 5 per cent. Perpetual Debenture got 86 for his stock. British Columbia Electric Tramways Deferred is a point harder, and Calcutta Trams are slightly better.

Sensational fluctuations in Anglo "A" are the outstanding feature of the Telegraph market. At one time the price was whirled up to 20⅝, to return below 20. That the prosperity of United States trade and the activity in the American Railroad market are jointly influencing good traffics over the cables there can be no doubt, but whether Anglo "A," on dividend merits, will be worth more than 20 for some time to come is open to question. The company's Ordinary and Preferred stocks are both a point higher. Other American cable companies' issues have not moved, and this is by some people construed as meaning that there may be more in the Anglo "A" rise than meets the casual eye.

Eastern Telegraph stock rose 3, upon a little steady buying by investors. On the other hand, Eastern Extension shares are ⅛ lower, which seems paradoxical, since the two generally, and appropriately, move in company. Alterations in the rest of the telegraph list are mainly confined to a few rises of about ½ each in some of the Debenture stocks, and telephone descriptions are also quiet. United River Plate Ordinary rose a small fraction, and National Telephone 4 per cent. Debenture went a trifle over par. American Telephone fell a point.

The Railway division is fairly firm, and there are a few rises, of no particular significance. City and South London has improved, and the quiet advance of Central London Ordinary stock continues, allowance being made for the dividend. The prospect of an Anglo-Japanese Exhibition at Shepherd's Bush next year, under direct patronage of royal and other powerful houses, encourages the hope that the summer of 1910 should be a very good one for the Central London and the Metropolitan Railways. Metropolitan Consolidated is steady at 40¼, but Districts yielded ¼ on the hottest day, when it was observed that London General Omnibus stock rose 2. Even now the price of the latter is only half a dozen points above the quotation for Districts, and the chances of a dividend on either look equally rosy. Metropolitan Pre-ordinary stocks are hardening in value, and to obtain the offer of any amount of stock becomes more and more difficult.

Electricity Supply shares suffer from the usual dog-days depression. Brompton Ordinary are 10s. down, of which 4s. 6d. is accounted for by the dividend. The deductions from Charing Cross shares have been accompanied by no change in the nominal prices, and Metropolitan Ordinary, *ex* 2s. 6d., are left at their previous level. Chelseas have risen 5s. Newcastle-on-Tyne shares were marked down to 4¼, but there is no real market in the shares.

Manufacturing varieties remain strong, and where movements occurred they were mostly rises. Callender's and Henley's are better. Castner-Kellner's recorded a small advance. The rest of the shares in this department are not altered nominally, but actually they are a little firmer on balance.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Business done week ended Aug. 17th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾ — 3¼	2¾ — 3¼	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146 —147	145 —146	..	..	—1	5 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	59 — 61	60 — 62	..	..	+1	5 4 8
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102 —103	103 —104	103⅞	102⅝	+1	5 15 5
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	3/-	19½ — 19¾	19⅝ — 19⅞	20 3/16	19⅝	+ ⅛	2 0 4
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103½ —105½	..	..	+ ½	4 14 9
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	92	91½	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼ — 9	8¼ — 9	8⅜	..	..	6 13 4
8,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11.
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	5 3 8
8,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	5 12 8
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	8 16 8
50,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	12⅞ — 13⅜	12⅞ — 13⅜	13¼	12 15/16	..	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	129 —132	130½	129	+3	5 6 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½ — 86½	84½ — 86½	85¼	84½	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	104½ —106½	..	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½ — 12	11⅜ — 11⅞	11¾	11 7/16	— ⅛	5 17 11
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ — 10¾	10¼ — 10¾	10⅝	10½	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 14	13½ — 14	13 9/16	13 7/16	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26½ — 27½	26½ — 27½	..	..	..	6 12 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	18 %	18 %	13 %	51½ — 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 78	..	..	— ½	5 2
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	.1	5 %	6 %	6 %	6 %	13/16 — 15/16	13/16 — 15/16	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — ⅞	¾ — ⅞	..	..	..	5 13 8
2,225,000	National Telephone, Pref. Stock	100	6 %	8 %	8 %	6 %	106 — 107½	106 —107½	106½	106	..	5 11 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123 —125	123 —125	124	123	..	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	8 %	6 %	6 %	10 — 10¾	10 — 10¾	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	8 %	5 %	6 %	6 %	10 — 10¾	10 — 10¾	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 7/16 — 5 11/16	5 7/16	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	99	98⅛	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99½ —101½	101	100	+ ½	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	33/1½	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 3 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86½	..	..	4 12 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99½ —101½	..	..	+ ½	3 18 10
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99½ —101½	100¾	..	+ ½	4 8 8
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6 15/16 — 7 3/16	7⅛	7 1/32	+ 1/16	5 11 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 10 8
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	22/6	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99½ —101½	..	..	+ ½	3 18 10
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½ — 14	13½ — 14	13⅞	13¾	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½ —104½	102½ —104½	..	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½ — ⅝	½ — ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 11/16 — 4 15/16	.. ..	96/10½	95/-	..	5 5 3
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 7/16 — 4 11/16	.. ..	90/-	..	..	4 6 0
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	90¾ — 91¾	92 — 93	92⅝	91⅝	+1½	4 16 2
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 9 11
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 5/16 — 4 7/16	4 5/16 — 4 7/16	..	..	..	4 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	8 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	48 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼ — ¾	¼ — ¾	..	..	..	18 13 4
50,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅜ — 1⅞	1⅜ — 1⅞	..	..	..	8 11 5
40,100	Do. do. "A" 6 % Cum. Pref.	5	8 %	6 %	6 %	6 %	3 — 3½	3 — 3½	..	..	..	5 14 3
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..	..	5 14 7
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	93 — 96	93 — 96	..	..	..	5 7 5
500,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	6 %	8 %	8 %	144 —148	145 —149	148½	148	+1	4 16 0
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	123	..	..	4 10 11
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	109½	..	..	4 6 7
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	Nil
133,801	British Electric Traction	10	8 %	Nil	Nil	Nil	½ — ⅞	½ — ⅞	..	..	..	6 0 0
161,437	Do. do. 8 % Cum. Pref.	10	8 %	6 %	8 %	1½%	2 — 2½	2 — 2½	..	..	..	5 16 3
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 — 88	85 — 88	86½	85	..	6 14 4
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 9 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ — 7¾	7⅜ — 7¾	7⅝	..	..	4 11 8
100,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	6 %	6 %	6⅛ — 6½	6⅛ — 6½	6 5/16	..	..	4 4 11
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 18 11
304,910l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	Nil
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	6/3	..	..	9 10 6
1,018,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	Nil
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/8	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	8 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	9 8 8
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	45½	..	..	14 10 2
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	4 12 2
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	4½%	4½ — 4⅞	4 9/16 — 4 15/16	97/4½	..	+ 1/16	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	..	..	..	4 10 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	99½	99	..	6 16 6
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10½ — 11	10⅝	10½	+ ½	4 13 1
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	6¼ — 6⅝	6¼ — 6⅝	6 5/16	..	..	4 4 6
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½ —106½	104½ —106½	104½	..	..	Nil
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	8 0
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	8 %	12 %	12½%	1⅞ — 2	1 15/16 — 2 1/16	40/6	40/-	+ 1/16	6
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	104 —107	105 —108	..	..	+1	3 14 1
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	62 — 64	61 — 63	61½	..	—1	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	81 — 83	..	..	—2	4 16 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44	..	..	5 11 1
1,[illegible]	City and South London Railway	Stock	1¾%	2⅛%	2¼%	1½%	31 — 32	31½ — 32½	32⅜	31½	+ ½	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 0 0
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Business done week ended Aug. 17th. 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	..	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	21/3	..	..	4 16 0
271,030	Do. dc. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1⅛%	⅛ — ⅜	⅛ — ⅜	..	..	..	20 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	81 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 5/16 — 1 7/16	1¼ — 1½	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12¼ — 13	12½ — 13¼	13	12⅝	+ ¼	5 13 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14½ — 15¼	14¾ — 15½	15 5/16	15	+ ¼	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
899,930	Do. do. , 60,008 to 100,000	10	8 %	8 %	3 %	Nil	1½ — 2½	1½ — 2¼	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2 — 2½	1⅞ — 2⅜	45/-	..	— ⅛	15 8 4
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	68 — 71	68 — 71	69⅛	68½	..	5 12 8
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	40 — 40½	40 — 40½	40⅜	40	..	1 4 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 — 67	65¾	64⅝	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	17½ — 17¾	17 — 17½	17⅝	17⅛	— ¼	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅝ — ¾	19/32 — 21/32	12/6	..	— 1/16	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32 — 27/32	11/16 — 13/16	15/6	..	— 1/32	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	..	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½—127½	128 —131	129⅞	127¼	+3½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	94½ — 96½	96 — 98	97	95	+1½	5 2 0
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34 — 35½	35¼	34¾	..	2 10 9
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —101½	100 —101½	..	..	..	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½ —103½	103½	102⅞	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	88 — 90	89	..	+1	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	35 — 37	37	36¼	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ — 3⅛	2⅝ — 3⅛	58/9	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Aug. 10th.	Closing Quotations Aug. 17th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	7½ — 8 xd	..	..	..	6 5 0
9, 51	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	7½ — 8 xd	7¾	..	..	4 7 6
336, 76	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 — 100	..	..	..	3 18 5
80, 00	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80, 00	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	91/10½	..	..	4 10 0
80, 00	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3⅞ — 4⅜	..	..	..	5 2 10
445, 36	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49, 36	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175, 00	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,5	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	10¾	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000*l*	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	..	..	..	5 9 1
400,000*l*	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	103 —106	103 —106	105½	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	84½ — 86½	84½ — 86½	87	85½	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	98 —101	..	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅜ — 7⅛	6⅜ — 6⅞	..	..	— ⅛	5 16 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	5 11 8
882,255	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4¾	4¼ — 4¾	87/6	..	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000*l*	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83 — 85	83½ — 84½	84½	..	..	5 17 8
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	70 — 74	72 — 76	75	72	+2	4 12 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	105 —10[illegible]	106 —110	106½	..	+1	6 7 8
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	85 — 87	86 — 88	87½	87	+1	5 18 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	91 — 97	94 — 97	..	..	..	4 12 9
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅜ — 5⅛	4 — 4½	..	..	— ⅝	2 15 7
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11 — 12	11 — 12	..	..	..	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 7 3
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 — 1 3/32	31/32 — 1 3/32	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	9	..	..	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000*l*	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100—104	..	..	..	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2	1½ — 2	20/-	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	76 — 80	77 — 81	..	..	+ 1	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	13/16 — 15/16	13/16 — 15/16	17/6	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8¾ — 9¼	8½ — 9	8 15/16	8 11/16	+ ¼	5 11 1
31,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞ — 5¼	4⅞ — 5¼	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st. 1909.

SOME LEGAL QUESTIONS RELATING TO ELECTRIC FITTINGS AND METERS.

[FROM OUR LEGAL CORRESPONDENT.]

It is proposed in the present article to discuss some of the questions which are often arising in relation to fittings. They may belong to the company or to the consumer, and nice legal problems occasionally arise as to the right of inspection and so forth.

Sec. 24 of the Electric Lighting Act, 1882, provides that any officer appointed by the undertakers, may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works, and apparatus, for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where the undertakers are authorised to take away or cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection, or removal. The powers conferred by this section must not, however, be arbitrarily exercised. Due notice of an intended visit should be given, for it was decided in Brompton, &c., Electricity Supply Co. *v.* Shadforth (Electrical Review, July 24th, 1903), that where a consumer refused to allow inspectors to come into her house unless she received previous notice of their visit, an injunction ought not to be granted to restrain her. Electric fittings are also protected from distress for rent. Thus, by Sec. 25 of the Electric Lighting Act, 1882, where any electric lines, meters, accumulators, fittings, works, or apparatus belonging to the undertakers (*i.e.*, the local authority or company supplying electricity) are placed upon any premises for the purpose of supplying electricity, they shall be subject to protection. In the ordinary way they might be seized by a landlord whose rent was in arrear; but this section provides that they shall not be subject to distress, or to the landlord's remedy for rent of the premises where the same may be, nor be taken in execution under any process of a Court of law or equity, or any proceedings in bankruptcy against the person in whose possession the same may be. This affords considerable protection to the undertakers. Very often when a tenant does a moonlight flit the only articles of *vertue* left on the premises are the electrical fittings, which the landlord would be glad to sell in order to satisfy some part of his claim for rent outstanding.

But what are fittings within the meaning of this section? Wires, and pipes through which wires are carried, naturally come under this heading, but there are other things not so easy to classify. It was decided under Sec. 14 of the Gasworks Clauses Act, 1871, which is similar to the above, that a gas stove let for hire is a "fitting for the gas" within the meaning of that section, and is therefore not subject to distress for rent (see Gas Light and Coke Co. *v.* Hardy, 1886, 17 Q.B.D., 619). It would seem to follow from this that electric stoves, kettles, motors, fans and electric irons, if hired out by the supply authority to the consumer, would not be subject to distress by the landlord.

A nice question may sometimes arise as to whether electric fittings let on hire by the supply authority vest in the trustee in bankruptcy of the consumer. The law of bankruptcy provides that goods which are in the order and disposition of the bankrupt, with the consent of the true owner at the date of his bankruptcy, shall vest in the trustee for the benefit of the creditors. And this is right; for credit is naturally given to a man upon the strength of the goods which he has on his premises. But where it is well known that certain classes of goods are customarily lent on hire, the presumption that they belong to the bankrupt does not arise. For instance, the custom of hotel keepers to hire furniture is so well known that such furniture does not vest in the trustees in bankruptcy of the hotel proprietor. It has long been the practice of the gas companies to hire out gas stoves to consumers; and questions arise from time to time as to the power of local authorities supplying electricity to deal in fittings. It is common to find in the Acts of local authorities a special clause enabling them to sell, hire, let, but not to manufacture lamps, meters, electric fittings, &c. The terms of such clauses vary somewhat. In the Nottingham Corporation Act, 1899, Sec. 4, the power conferred is to provide and let, &c., but not manufacture, "lamps, meters, electric lines, fittings, apparatus and things for lighting and motive purposes for which electric energy can or may be used, or otherwise necessary or proper for the supply, distribution, consumption or use of electrical energy." The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: "Electrical motors and apparatus for the use of electricity for motive power and other purposes." The Halifax Corporation Act, 1898, is even wider in its terms. It authorises the Corporation "to purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, burners, arc and other lamps, fittings, wires, plant, engines, conductors, machinery, apparatus and appliances for and in relation to the production, supply, distribution or utilisation of electricity, or required or used for or in connection with their electrical works and undertaking. . . ."

The case of the Attorney-General *v.* the Mayor, &c., of Barnstaple (Elec. Rev., Vol. 52, p. 766) showed clearly that it is not competent for an electrical company supplying electric light to supply electric fittings without an express provision to that effect in the Act under which they work. It appeared that in 1900 the defendant Corporation obtained from the Board of Trade a provisional order. In the summer of 1902 they circularised the ratepayers, and gave out that they were prepared to supply electric fittings, and fit them up in private houses. Two ratepayers moved the Attorney-General to bring an action, and as a result of the litigation, the Corporation consented to the following order: "The Corporation undertake not to do any further installations for customers, or to expend any further moneys on private installations except in pursuance of obligations already entered into."

The question whether a tenant for life has power to lay down and charge out of capital for electric plant put in by him has been considered in many cases. In *re* Lord Leconfield's Settled Estates, which was heard by Mr. Justice Kekewich some years ago, a summons was taken out under the Settled Lands Acts by the tenant for life in possession of the certain settled estates in England, asking that the trust might be directed to apply certain capital money in their hands in recouping the applicant the following sums expended by him out of his own moneys:—(1) £4,891 19s. 7d. for the construction of a new drainage system for the principal mansion house; (2) £3,299 9s. 10d. for the erection of an engine house for the engines which supplied the principal mansion house with electric light. The Settled Lands Act, 1882, Sec. 25, provides that improvements authorised by the Act to be made with capital trust moneys are works for (Sub-Sec. (1)) drainage, and (Sub-Sec. (2)) saw mills, scutch mills and other mills, water-wheels, engine houses and kilns, which will increase the value of the settled land for agricultural purposes, or as woodland or otherwise. It was held that, assuming that the engine house would increase the value of the settled land, taking settled land to include the principal mansion house, yet it would not increase its value "for agricultural purposes or as woodland or otherwise" within the meaning of Sub-Sec. 12, and that its expense could not therefore be allowed out of capital moneys; but it was held also that the cost of the new drainage system could be allowed, for it was not a case of mere addition but a completely new system and a permanent improvement. This decision appears to be somewhat incomprehensible to the non-legal mind. The tenant for life was allowed to spend a considerable sum of money on the drains for the house, but was not permitted to put down an electric lighting plant.

Yet, in the existing conditions of modern society, it is almost a *sine quâ non* that a country gentleman's house shall be properly lit. A glance at the date of the Settled Land Act is sufficient to explain this anomaly. That measure was passed in the same year as the first Public Electric Lighting Act. At that time, electricity was only in its infancy, and the fact that it has long since come to stay, and that, as a source of light, it is practically a common necessity, ought to afford sufficient justification for an amendment of the Settled Lands Act. A short section might easily be drafted, which would give the Court power to decree that a tenant for life may spend part of his capital on electric lighting.

The point was again raised in the case of in *re* Blagrave's Settled Estates (Electrical Review, Vol. 52, p. 383). Mr. Justice Joyce held (following Mr. Justice Buckley in *re* Clarke, 1902, 2 Ch., 327) that this was not an improvement which could be paid for out of capital within the meaning of the Settled Lands Act (Sec. 25). When the case came before the Court of Appeal, this decision was upheld, but Lord Justice Cozens-Hardy threw out the interesting suggestion that it would be desirable to extend the Acts so as to allow provision to be made for supplying gas or electric lighting to a mansion house. This, however, was a matter for the Legislature, not for the Court, to decide.

Under the heading Electric Fittings, the questions affecting the validity and effect of the free-wiring agreement appears to find a proper place. In the London Electric Supply Corporation, Ltd., *v.* Priddis (18 T.L.R. 64) an agreement made between the plaintiffs, the National Electric Free Wiring Co., Ltd., and the defendant on February 17th, 1898, contained (*inter alia*) the following clauses: "(2) The Wiring Co. will in a proper manner and in accordance with the regulations of the fire insurance companies, and free of cost to the consumer, furnish and fit up on the said premises the necessary wires and fittings for electric lighting, hereinafter called 'the installation.'" Clause 4 gave the defendant an option of purchase in a certain event. Clause 7 provided: "The consumer shall until purchase as aforesaid pay quarterly to the supply company for the use of the installation ¾d. per Board of Trade unit for every unit of electrical energy supplied to the said premises, and the *minimum* payment in any year shall be 1s. for each 8-c.p. lamp or its equivalent installed." Clause 8 contained a proviso for recovery in case of non-payment. The defendant used no electricity supplied by the plaintiffs from June to September, 1900. They sued in the County Court for the sum of £1 6s. 9d., being the *minimum* provided by Clause 7 *supra*. It was held, on appeal, that the installation had clearly been put in on the terms that the customer should have the right to purchase after five years, and that during those years he was liable to pay a *minimum* rent, whether he used the current or not. The case was sent back for a new trial.

Of all electric fittings to be found on the consumer's premises, the meter, which is usually hired out to him by the company, is likely to be productive of the greatest amount of trouble.

The register of a gas meter is *primâ facie* evidence of the quantity consumed, and two justices are empowered to settle differences between the company and the consumer. (See 34 and 35 Vict., C. 41, Sec. 23.) In the case of the Gas Light and Coke Co. *v.* Cree, 1897, 61 J.P. 699, it was laid down that where the only evidence of the amount is afforded by the meter, the Court will be unwilling to go behind it. There is no reported case in which a complainant has challenged the accuracy of a meter by appealing to an independent authority.

In the case of electricity supply, the meter register is still more conclusive. If any difference arises between any consumer and the undertakers as to whether any meter, whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers), is, or is not, in proper order for correctly registering the value, or as to whether the value has been correctly registered by the meter, that difference is to be determined upon the application of either party by an electric inspector, or, where the local authority are the consumers, by an inspector appointed by the Board of Trade. The inspector has jurisdiction over the costs of the inquiry, and his finding is conclusive and binding on the parties. Subject to the inquiry, the register of an electric meter is conclusive evidence of the value of the supply in the absence of fraud. (Electric Lighting (Clauses) Act, 1899, Sec. 57.)

As to the finality of the decision of a Government inspector, it is worthy of note that in the case of the Wandsworth and Putney Gas Co. *v.* Rye (31 Sol. J. 633) the accuracy of a gas meter, sworn to be perfectly accurate by a Government inspector, was successfully disputed, not by the production of any expert evidence, but merely by the sworn testimony of the plaintiff and his servants, who deposed that less gas had been used in the quarter immediately preceding that for which the company sought to charge. The authority of this decision, which comes from an inferior court, is doubtful.

Should the methods of supply and charge be altered, undertakers are bound to defray the expense of providing new meters to their consumers (Electric Lighting (Clauses) Act, 1899, Sec. 58.) It sometimes happens that a serious defect in a meter remains undiscovered over a long period of time. The consequence is that a consumer may be overcharged or—as more rarely happens—considerably undercharged for the amount of gas or other commodity consumed by him. In such circumstances there is authority for saying that, in so far as any claim is not barred by the Statute of Limitation (which prevents a debt being recovered after a lapse of six years) the injured party is entitled to redress. In the case of the South Metropolitan Gas Co. *v.* the Mayor, &c., of Bermondsey (the *Times*, May 18th, 1901), an action was brought to recover the sum of £884, the price of gas supplied to the Commissioners of Baths and Wash-houses in Rotherhithe (the predecessors of the defendants), from 1894 to 1900. Owing to the fact that the dial of the meter in use during that period was misleading, the amount of gas charged for was but one-tenth of the actual amount consumed. The mistake had existed since 1885, but the claim for arrears which had accrued prior to 1894, was barred by the Statute of Limitations. The defendants admitted the mistake, but sought to escape liability on the ground (*inter alia*) that they could not make or levy a retrospective rate for the purpose of discharging the debt, nor could they apply the moneys in their hands derived from current rates in payment thereof. This defence, however, did not prevail, and they were held liable for the arrears which were not barred by the statute.

A meter belonging to the undertakers which is placed upon any premises not being in the possession of the undertakers for the purpose of supplying electricity is not subject to distress for rent; that is to say, the consumer's landlord could not distrain upon it. The same rule applies to "electric lines, accumulators, and fittings" (Electric Lighting Act, 1882, Sec. 25). "Fittings," as applied to the property of a gas company, have been held to include a gas stove (Gas Light and Coke Co. *v.* Hardy, 17 Q.B.D. 619). An electric stove or an electric motor would probably come under the same heading, and would, therefore, be protected.

REVIEWS.

Heavy Electrical Engineering. By H. M. Hobart, M.Inst.C.E. M.I.E.E. London: Constable & Co. Price 16s. net.

This is probably the best book on electrical engineering considered in its broadest aspect that has been published. It is the work of a man of wide experience and reading, accustomed to minute observation and accuracy of statement.

Not only are the 300 odd pages full of valuable information, but the sequence of the facts and data is very well arranged. There are none of those irritating gaps in the general argument, met with in some text-books. Tables and curves run up to No. XCVIII and fig. 188 respectively, and they are not flung at the reader in pocket-book fashion, but are marshalled in correct order, giving just the information necessary to make each link in the chain of argument quite clear. The book treats of the more difficult problems of electrical engineering, and yet the mathematics used are quite simple; in only one instance, and that a quotation from Jona's graded cable paper, is there a reference to the calculus.

As with other books by the same author, the whole of the measurements and quantities, &c., are given in the metric system. Feet and inches, pounds avoirdupois, gallons, &c., are rigidly excluded.

A very useful feature is the way in which every calculation is resolved into the electrical engineer's unit of energy—namely, the kilowatt-hour or "kelvin." It seems odd at first to think of problems in connection with economisers, condensers, steam piping, boilers, &c., in kilowatt or kilowatt-hour units, but there can be no question of the convenience of the method.

The mechanical engineer whose work does not bring him into touch with electrical matters, will find in this book much up-to-date information on purely mechanical appliances. The reason is, that in laying out large power stations, such as those of Glasgow, the Central London, Brimsdown, Neasden, Greenwich, Chelsea, &c., the electrical engineers have had opportunities of working out some big mechanical engineering problems.

The first six chapters familiarise the reader with results that can be obtained from the pieces of apparatus that make up a power station, and Chapter VII explains how to combine them for efficient service.

Then follows a most interesting section on high-tension power transmission, and the last two chapters, covering nearly 100 pages, treat of electric traction calculations, traction motors and the electrification of railways.

The illustrations are exceptionally clear, the curves are fully described by their titles, and where necessary a series of curves are given on one sheet, instead of having one curve sheet with a number of lines jumbled together.

Mr. Hobart is an international engineer, his experience having been gained in the United States and Germany, as well as in this country. Therefore, when quoting statistics he takes data from all countries. Some of his percentages for power stations, &c., may be here quoted :—

Average Overall Efficiencies of Stations.

Between 1·0 and 5·1 millions of KW.-hours per year.	Great Britain	4·9 %
	Abroad	6·0 %
Between 18 and 56 millions of KW.-hours per year.	Great Britain	7·7 %
	Abroad	9·0 %

Average Transmission Losses.

	In 12 Continental stations.	In 5 Continental stations.
Loss in feeders	12 %	3 %
„ accumulators	7 %	3 %
„ transformers	—	17 %
„ distributors	6 %	8 %
	25 %	31 %

In 22 large towns of Great Britain, for every 1,000 inhabitants there are 800 8-C.P. lamps, or their equivalent, connected, and the average KW.-hours per lamp per year work out at 17 at the customers' meters.

The demand for electricity in 26 Continental power stations is 15 KW.-hours per inhabitant.

Averaging the tramway returns for 17 cities in England, gives 18·4 car-kilometres per inhabitant, and a consumption of 0·87 KW.-hour per car-kilometre.

When dealing with electric generating plant, Mr. Hobart forecasts the dimensions of a 20,000-KW., 20,000-volt, 25-cycle, 250 R.P.M., three-phase alternator, and as he is such a well-known and bold designer, particulars may be of interest. It will have 12 poles, a rotor diameter of 4 metres and length of 2 metres. The length over the stator windings will amount to some 3 metres, and the external diameter over stator windings to 5 metres. This alternator will require 15 tons of copper, 135 tons of electro-magnetically effective iron and 150 tons of materials for the mechanical parts. This aggregates 350 tons, or 17·5 kg. per kilowatt of rated output.

He writes vigorously regarding an inspector's duties, and referring to the importance of insulation testing, says, "The studied attempt on the part of large manufacturers and their subservient engineers to discredit the practice of subjecting machines to high-voltage insulation tests, and to substitute low factors of safety in specifications to which they tender, should not be permitted to succeed."

Some contractors are inclined to browbeat any inspecting engineer who acts right up to his client's interests, and they will go to any length to render untenable the position of a conscientious inspecting engineer. The writer can subscribe to this in regard to one firm in this country, and the explanation is partly found in Mr. Hobart's next sentence, "Thus the contractor may be an influential shareholder in the company for whom the client is acting, or the client in some other capacity may be dependent upon the contractor for a considerable proportion of the business turned over to him in this other capacity." Such relations are far from rare, and where they exist the business is a farce, so far as relates to specifications and tests.

The author's idea of a short-circuit test of an alternator is to adjust the field excitation to give normal voltage and then abruptly short-circuit the terminals of the three windings. For an instant a current several times (often six times the normal) will pass, but this will rapidly decrease to about three times, and remain constant at that. If the stator end connections have not moved after such a test, the machines can be relied on to sustain no mechanical injury as a result of short circuits on the line. It would also ensure against injury when thrown into circuit with other machines when its own phase differed from the other, as inevitably occurs at times.

Mr. Hobart favours a low periodicity, especially for low-speed gas engine sets. He points out that the slow-running gas engine requires great fly-wheel capacity to ensure parallel running, also there is a loss of several per cent., because amortisseurs have to be fixed on the alternator poles. He considers that the difficulty can be largely overcome by adopting a low periodicity. Whilst it possesses no special disadvantages, it leads to a better design of generator with fewer poles and higher efficiency, also to better conditions in the transmission line and at the sub-station. He says "the persistency in refraining from low periodicities when justified by circumstances such as the parallel operation of polyphase generators from gas engines, and even from large slow-speed steam engines, is really a remarkable phenomenon in modern electrical engineering, but there are at length signs of a more satisfactory attitude on this question."

Dealing with the question of sub-station machinery, Mr. Hobart makes a point in favour of motor-generators against rotary converters, by noting that the latter require more copper in the mains. Synchronous motor-generators will carry high overloads at much less than normal voltage. In the rotary converter, the commutator voltages cannot be maintained high when the drop in the transmission line is great, nor can freedom from "surging" or "hunting" then be ensured.

Mr. Hobart is refreshingly outspoken throughout the book, and is especially severe on those who, he says, have not the remotest approach to broad knowledge, or the energy to exercise their own reasoning faculties. "Such are hardly more than figure-heads desirous, on the one hand, of being on the side of the most fashionable engineering fads, so soon as there is no longer any doubt of its being fashionable, and on the other hand, hesitating to depart from the cut-and-dried practice of years' standing, which makes the preparation of plans a mere matter of copying."

Again, dealing with what he calls "forced ideas": the natural idea may be likened to a plant growing under favourable conditions and adapting itself to its environment; the "forced idea" may be likened to a plant raised in a hot-house with the exclusion of such conditions as might have a tendency to prevent its development. He cites the single-phase railway system and extra high-pressure continuous current transmissions as "forced ideas."

Mr. Hobart shows that for equal weight and equal speed the single-phase motor has only about half the power of a continuous-current or three-phase motor, and that of the three, the last-named gives the greatest power for a given weight. The accessory apparatus for single-phase also weighs much more, and together they necessitate heavier trucks and brake gear and greater maintenance charges, &c.

He makes references to the L.B. and S.C. Railway electrification which are not complimentary, and says that it is costing at least 50 per cent. more than would have been the case if the continuous-current system had been adopted. The operating costs will also much exceed what could have been attained with continuous current. He gives many figures to prove his contentions, and the *single-phase monstrosity*, as he calls it, in heavy leaded type, is smitten hip and thigh, through about 50 pages.

The author considers that for long-distance non-stop runs the steam locomotive will hold the field for a long time to come, but that there is a wide field for the electrification of urban, suburban and inter-urban sections. He says: "It is highly desirable that railway people should realise that a larger number of electrical engineers dissociate themselves, though rarely openly, from the claims put forward by the single-phase school. This is important, for the reason that there is a wide range of railway work when electric operation is of demonstratable advantage if undertaken on sound lines."

Regarding the three-phase system, he says: "It must also be kept in mind that the three-phase system can by no means be ignored as a determinant on the situation; in fact, for long-distance, non-stop runs it has points of superiority over any other system of electric traction as yet put forward. But at present it is with the object of obtaining better speed and shorter headway with frequent stops, and the more intense utilisation of termini, that resort will be made to electrical methods." E.K.S.

Radio-telegraphy. By C. C. F. Monckton. London: Archibald Constable & Co. Price 6s.

It is not to be expected in the present limited state of exact knowledge of radio-telegraphy in its various aspects that any text-book on the subject will fully elucidate such problems as are involved in ranges of communication between various types of stations, conditions of interference and non-interference, relative efficiencies of the various methods of transmitting and receiving or of the different types of antennæ and a host of other questions of much practical importance. Precise measurements bearing on these points are much wanted. Hence such information of real practical utility as can, at present, be recorded, merely serves to emphasise the dearth of real engineering data in many diverse directions. So much attention has been given to the development of new systems, new methods of transmitting and receiving and to the extension of distances of communication, that systematic measurement has, to a large extent, been neglected, or, at any rate, is yet unpublished. In the work under review there has been a serious attempt to bring out all that is available in the way of useful practical information. Hence the book is one of the most practical expositions on wireless telegraphy that has yet been produced, and will give to the engineer some at least of that practical guidance which is usually looked for in vain. The matter contained is, in the main, reliable and well ordered, though it is perhaps unavoidable that many of the statements made are open to difference of opinion, if not to criticism. The opening chapters deal with general principles; electrostatics, electromagnetism, and electric wave production. A good method of explanation has been attempted, but the rendering is somewhat involved, and likely to be difficult of appreciation by the student. Referring to wave propagation, the author makes a point of the tendency of waves to be tilted forward in the direction in which they are travelling by reason of the retardation of the lower portions associated with the surface of the ground. This is in contrast with generally accepted ideas in which the assumed tendency is rather a backward tilt due to the action partaking of the characteristics of an expanding hemisphere, and it will require stronger reasons than those given on pages 66 and 67 to make the author's view convincing. Dealing with the propagation of waves from the point of view of expanding fields of force, there appears to be a lack of finish in the method adopted on page 68. It would appear that the student is to picture a succession of magnetic fields of constant density passing a fixed point. The omission is that it is not brought home to him that the number of lines of force per wave (*i.e.*, the density of field) must diminish as the wave expands, otherwise the wave would gain energy as it progressed. The point is not a very important one, but it is one of those details which are always omitted in this method of picturing wave propagation and which tend to detract from the value of an otherwise correct and useful conception. On page 65 appears a repetition of the fallacy that rarefied air is a good electrical conductor. Rarefied gases do not conduct unless they are ionised or the electrical stress exceeds a certain critical value. On page 54 the author stumbles against a much misunderstood aspect of wave propagation—viz., the question of phase displacement of the electric and magnetic fields in the wave proper. It does not appear to have appealed to most writers on the subject that there is an essential difference between oscillations and waves, and that in a wave proper no phase difference is possible, otherwise the various points of disturbance would continue to oscillate after the passage of the wave.

On the whole, however, there is much to be commended, and little to criticise seriously in this work.

THE MEASUREMENT OF THE INSULATION RESISTANCE OF A LIVE THREE-WIRE SYSTEM.*

By Dr. GISBERT KAPP and Dr. DENNIS COALES.

The well-known Russell test gives the combined insulation resistance of the three wires, but not that of each wire separately. It, moreover, necessitates interrupting the earthing connection whilst the test is being made. This is not necessary in Froehlich's modification, but Froehlich's method, however, also does not allow of a separation of the joint conductivity of the three faults into its three components. In the present communication we propose to describe a method whereby this separation can be made, but before entering into this subject we shall describe two methods for finding the joint fault resistance, which do not require the earthing connection of the middle wire to be broken. The joint conductivity found by either method includes that of the earth connection, but as this is generally known, or can be ascertained at any moment by reading the earthing ammeter and the voltage to earth of the middle wire, the necessary correction to get the true fault resistance of the system can easily be made; but the accuracy of the determination is marred by the presence of a low earthing resistance, and this should, therefore, be temporarily increased to a limit determined by the permissible voltage between the neutral wire and earth.

1. *Method.*—Let in fig. 1 *a b* represent a potential slide, the resistance of which need not be known. The ends are permanently connected to the outer wires 1, 2, and the slider is connected through an ammeter A to earth. The middle wire is connected through a voltmeter V of resistance ρ to earth. R is the usual earthing connection with its ammeter A_0. To measure the total fault resistance push the slider into such a position that A reads zero, and note the reading of V, which we shall call *e*. Then push the slider into such a position that V reads zero, and note the reading on A, which we shall call *i*. The fault resistance is then—

$$f = \frac{e}{i - e/\rho}. \qquad (1)$$

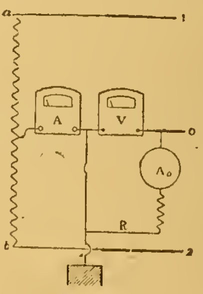


Fig. 1.

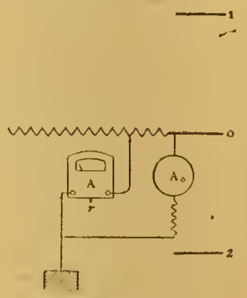


Fig. 2.

2. *Method.*—The middle wire has besides its usual earth connection, a connection with a graduated resistance with sliding contact, and the latter is connected to earth through a low-reading ammeter (fig. 2). To make a test, set the slider so that the pointer of the ammeter reads a little under half its total range, and note the corresponding resistance in circuit between the slider and middle wire. Let this be ρ and the current *i*. Then shift the slider so as to reduce the resistance to such a value ρ_1 that the current is exactly doubled. This will bring the pointer to near the end of the scale. Thus both currents can be read with great accuracy. If *r* is the resistance of the ammeter the combined fault resistance is—

$$f = \rho - 2\rho_1 - r. \qquad (2)$$

These methods have the advantages of being very simple and requiring no complicated calculation, that they do not interfere with the earthing connection, and that they can be applied at any point of the system—for instance, in the engineer's office instead of at the switchboard, as is necessary with the Russell test.

Since all the methods for finding the fault conductivity proposed up to the present give the sum of the conductivities, it is obviously hopeless to try separating them by the use of additional artificial faults. We must introduce a new element into the test, and this is a slight variation of the difference of voltage between the two sides of the system. This may be done, since the Board of Trade allows a variation of ± 4 per cent. in the pressure on the consumer's premises; and if the test be made at a time of minimum load, this means also 4 per cent. variation of bus-bar voltage at the station. Thus if normally the consumer's voltage is 250 on each half of the system, it will be permissible to adjust by means of the regulating cells or the balancing set the voltage to 240 on the positive and 260 on the negative side, and then change the difference so as to get 260 on the positive and 240 on the negative. We obtain thus a change of 20 volts in the value of E_1 and E_2, and some change in the value of e. By observing these changes we are able to determine the fault conductivities separately, as shall now be shown.

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* Abstract of original communication to the *Journal* of the Institution of Electrical Engineers.

Fig. 3 represents the apparatus we use for the purpose. The outer wires are connected to the terminals 1, 2, and the middle wire is connected to o. V is a voltmeter capable of reading the pressure between the two outer wires. It is provided with a switch so that it may also be used to measure the pressure between one outer (say the wire 1) and the middle wire. A is the low-reading ammeter used in connection with the test according to method 2 described above, and ρ is its series resistance. This is not altered during the test. The pressure between the two outer wires is also kept constant, but E_1 and E_2 are varied so that $E = E_1 + E_2 = E_1' + E_2'$; $E_1' - E_1 = E_2 - E_2'$ being the permissible variation of about 4 per cent. of the declared pressure. Let K be the combined conductivity of the three faults and the ammeter with its series resistance. Let E_1 and E_2 be the voltages to middle wire of the two outers and e that of the middle wire to earth. Let the fault resistances be f_1, f_2 and f_0 respectively, the latter including the earthing resistance. Let the conductivities be c_1, c_2 and c_0.

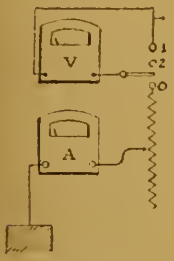

Fig. 3.

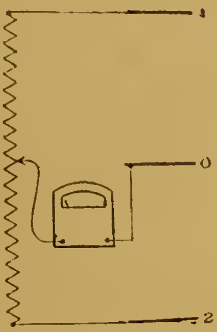

Fig. 4.

$$E_1 c_1 - E_2 c_2 + e K = 0 \quad . \; . \; . \; . \; . \; . \; . \; . \quad (3)$$

$$E_1' c_1 - E_2' c_2 + e' K = 0 \quad . \; . \; . \; . \; . \; . \; . \quad (4)$$

$$(E_1' - E_1) c_1 + (E_2 - E_2') c_2 + (e' - e) K = 0$$

$$(E_1' - E_1) c_1 + (E_1' - E_1) c_2 + (e' - e) K = 0 \quad . \; . \quad (5)$$

$$c_1 + c_2 = \frac{e - e'}{E_1' - E_1} K.$$

Since $c = c_1 + c_2 + c_0$ is known from the test made according to method (2), we find the conductivity of the fault on the middle wire from its conductivity—

$$c_0 = c - K \frac{e - e'}{E_1' - E_1} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (6)$$

To get the other two conductivities we proceed as follows:—

Determine c_2 from equation (5) and insert in (3); this gives—

$$c_1 = K \left(\frac{E_2}{E} \frac{e - e'}{E_1' - E_1} - \frac{e}{E} \right) \quad . \; . \; . \; . \; . \; . \quad (7)$$

Determine c_1 from equation (5) and insert in (3); this gives—

$$c_2 = K \left(\frac{E_1}{E} \frac{e - e'}{E_1' - E_1} + \frac{e}{E} \right) \quad . \; . \; . \; . \; . \; . \quad (8)$$

This test also need not be made at the switchboard, but can be made at any point on the system. The two instruments may be fitted up in the engineer's office, and all that is required is to give the switchman instructions to shift the voltage between middle wire and outers by a slight amount. It is not necessary that the difference should be exactly 4 per cent., anything between 3 and 4 per cent. is sufficient for an accurate test, but it is important that the voltage over the outer wires should be unaltered during the few minutes required for the test.

On consideration of the formulæ Nos. (7) and (8), it will be observed that the values of the fault conductivities of the outer mains depend for their accuracy upon the determination of the small differences between the large voltages E_1' and E_1. To render this measurement sensitive, two methods may be employed; (*a*) in which a voltmeter having an initial spring tension, and, say, of 10,000 ohms resistance, reading from 230 to 270 volts, is used; (*b*) in which a low-reading voltmeter is connected to a sliding contact (see fig. 4) on a slide wire connected to the outer mains, the other terminal of the voltmeter being connected to the middle wire.

Both these methods may be extended to the measurement of the voltage between the middle wire and earth upon the same instrument. When the insulation of the outer mains is high compared with that of the neutral main, and especially when the earthing resistance is low, the value of $(e - e')$ is very small compared with e. That is to say, a given change $(E_1' - E)$ in the mains voltages produces a small change on the voltmeter reading between the neutral and earth, and therefore for this reading also a voltmeter with initial spring tension is desirable.

By means of varying the series resistance of such a voltmeter, we can in the usual way change the value of its readings as we like, and so one voltmeter may be used to measure sensitively both $E_1' - E_1$ and $e - e'$.

If, for example, with total resistance of 10,000 ohms a voltmeter reads from 230 to 270 volts, then by altering this to 100 ohms it will read from 2·3 to 2·7 volts. Such an instrument should be provided with a rheostat having two sliders, two rows of contacts, and two keys, as in the diagram (fig. 5), each contact being marked with the volts per division on the voltmeter. The resistances between the contacts should be chosen so as to enable all voltages to be measured between, say, 90 and 120, 190 and 230, 240 and 260 on the upper row; and between 0·2 and 15 on the lower row. R V is a reversing switch, K_1 and K_2 are keys connecting the voltmeter to the outer wires and earth respectively.

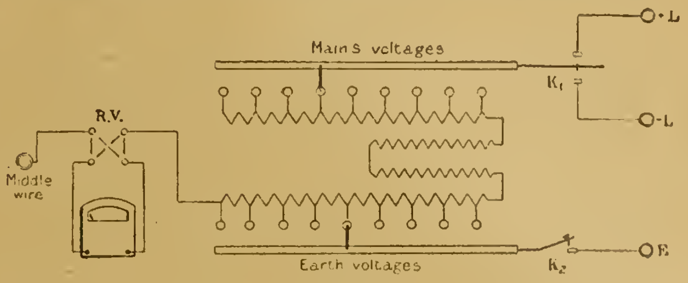

Fig. 5.

The instrument represented in fig. 5 may also be used to make the test of the combined fault by the methods given above, provided that the value of one scale division in amperes is known. We thus have an instrument which enables the fault resistances of each of the three live mains of a three-wire system to be determined.

TRADE STATISTICS OF MEXICO FOR 1907-8.

The following statement of the imports of electrical and other materials into Mexico during the year ended June 30th, 1908, is taken from the recently issued annual trade statistics; figures for 1906-7 have been added for purposes of comparison, and notes of any increases or decreases are given:—

Peso = 4s.

	1906-7. Pesos.	1907-8. Pesos.		Increase or decrease. Pesos.
Copper, brass, bronze, &c., wire, covered with various materials.—				
From Germany	124,800	186,700	+	61,900
„ Austria	7,100	8,200	+	1,100
„ United States ...	461,900	641,600	+	179,700
„ Great Britain ...	1,800	2,300	+	500
„ Other countries ...	1,100	1,900	+	800
Total ...	596,700	840,700	+	244,000
Bare copper, brass, bronze, &c., wire, up to 2 mm. diameter.—				
From Germany	9,400	12,100	+	2,700
„ United States ...	6,200	8,700	+	2,500
„ Great Britain ...	3,400	2,800	—	600
„ Other countries ...	1,000	2,500	+	1,500
Total ...	20,000	26,100	+	6,100
Bare bronze, copper, brass, &c., wire, more than 2 mm. diameter.—				
From Germany	27,100	169,900	+	142,800
„ United States ...	213,900	336,300	+	122,400
„ Great Britain ...	1,600	1,400	—	200
„ Other countries ...	400	300	—	100
Total ...	243,000	507,900	+	264,900
Cables, not armoured, of copper, brass, &c., covered with various materials, and bare cable.—				
From Germany	35,900	44,500	+	8,600
„ United States ...	752,400	450,400	—	302,000
„ Great Britain ...	34,900	86,900	+	52,000
„ Other countries ...	5,100	2,700	—	2,400
Total ...	828,300	584,500	—	243,800
Cables armoured, covered with various insulating substances.—				
From Germany	182,700	81,700	—	101,000
„ United States ...	53,400	125,900	+	72,500
„ Great Britain ...	58,000	62,600	+	4,600
„ Other countries ...	5,300	2,100	—	3,200
Total ...	299,400	272,300	—	27,100

	1906-7. Pesos.	1907-8. Pesos.		Increase or decrease. Pesos.
Lead tubing, sheets, &c.—				
From Germany	14,900	5,100	—	9,800
„ United States ...	63,900	45,700	—	18,200
„ France	1,500	12,200	+	10,700
„ Great Britain ...	2,900	7,700	+	4,800
„ Other countries ...	700	800	+	100
Total ...	83,900	71,500	—	12,400
Iron and steel wire more than 1 mm. dia.—				
From Germany	57,000	234,900	+	177,900
„ United States ...	358,900	387,500	+	28,600
„ Great Britain ...	8,500	15,900	+	7,400
„ Other countries ...	4,400	4,900	+	500
Total ...	428,800	643,200	+	214,400
Iron and steel wire 1 mm. dia. or less.—				
From Germany	17,500	23,900	+	6,400
„ United States ...	49,500	45,300	—	4,200
„ Great Britain ...	4,400	5,600	+	1,200
„ Other countries ...	500	2,400	+	1,900
Total ...	71,900	77,200	+	5,300
Posts, cross-pieces, &c., of iron or steel, for transmission of electricity.—				
From Germany	45,700	120,000	+	74,300
„ United States ...	254,900	307,100	+	52,200
„ Great Britain ...	39,800	53,100	+	13,300
„ Other countries ...	3,000	10,900	+	7,900
Total ...	343,400	491,100	+	147,700
Rails and parts thereof, for railways.—				
From Germany	822,200	884,300	+	62,100
„ Belgium	308,900	403,500	+	94,600
„ Spain	234,500	226,500	—	8,000
„ United States ...	2,988,900	3,810,300	+	821,400
„ Great Britain ...	291,900	926 100	+	634,200
„ Russia	—	722,800	+	722,800
„ Other countries ...	8,800	35,300	+	26,500
Total ...	4,655,200	7,008,800	+	2,353,600
Wire, of iron or steel, covered with cotton, linen, silk and paper.—				
From Germany	800	800		—
„ United States ...	1,500	1,600	+	100
„ France	1,400	2,400	+	1,000
„ Great Britain ...	100	100		—
„ Other countries ...	—	100	+	100
Total ...	3,800	5,000	+	1,200
Coal.—				
From Germany	63,500	87,300	+	23,800
„ Australia	65,000	323,600	+	258,600
„ Canada	46,000	148,800	+	102,800
„ United States ...	5,167,400	4,299,000	—	868,400
„ France	154,700	—	—	154,700
„ Great Britain ...	1,089,300	2,080,900	+	991,600
„ Japan...	82,600	13,000	—	69,600
„ Other countries ...	11,600	300	—	11,300
Total ...	6,680,100	6,952,900	+	272,800
Graphite.—				
From Germany	700	800	+	100
„ United States ...	12,300	14,300	+	2,000
„ Great Britain ...	1,100	1,300	+	200
„ Other countries ...	600	900	+	300
Total ...	14,700	17,300	+	2,600
Scientific instruments and apparatus.—				
From Germany	86,100	112,100	+	26,000
„ United States ...	190,900	169,800	—	21,100
„ France	76,500	84,500	+	8,000
„ Great Britain ...	8,000	13,000	+	5,000
„ Other countries ...	8,100	10,800	+	2,700
Total ...	369,600	390,200	+	20,600
Arc lamps.—				
From Germany	31,900	43,900	+	12,000
„ United States ...	47,900	69,000	+	21,100
„ France	3,300	1,300	—	2,000
„ Great Britain ...	100	400	+	300
„ Other countries ...	900	300	—	600
Total ...	84,100	114,900	—	30,800
Cars and carriages for railways.—				
From Germany	37,200	27,800	—	9,400
„ United States ...	4,412,500	3,255,100	—	1,157,400
„ Great Britain ...	17,300	197,100	+	179,800
„ Other countries ...	16,100	5,100	—	11,000
Total ...	4,483,100	3,485,100	—	998,000

	1906-7. Pesos.	1907-8. Pesos.		Increase or decrease. Pesos.
Machines of all kinds for agriculture, mining, industries, &c., not specially mentioned.—				
From Germany	2,248,800	2,903,700	+	654,900
„ Austria	1,000	35,300	+	34,300
„ Belgium	56,800	91,200	+	34,400
„ Canada	4,600	10,100	+	5,500
„ Spain	118,100	89,500	—	28,600
„ United States ...	20,140,600	19,147 500	—	993,100
„ France	484,300	558,800	+	74,500
„ Great Britain ...	2,884,100	3,669,800	+	785,700
„ Holland	500	7,100	+	6,600
„ Italy	49,800	10,500	—	39,300
„ Norway	20,400	6,700	—	13,700
„ Sweden	86,300	81,300	—	5,000
„ Switzerland	159,600	236,800	+	77,200
„ Other countries ...	5,700	1,700	—	4,000
Total ...	26,260,600	26,850,000	+	589,400
Detonators of all kinds.—				
From Germany	85,700	82,300	—	3,400
„ United States ...	94,600	47,200	—	47,400
„ Great Britain ...	2,400	200	—	2,200
„ Other countries ...	2,300	7,900	+	5,600
Total ...	185,000	137,600	—	47,400
Fuses for mines.—				
From Germany	47,100	40,600	—	6,500
„ United States ...	203,100	126,800	—	76,300
„ Great Britain ...	74,300	66,000	—	8,300
„ Other countries ...	12,700	100	—	12,600
Total ...	337,200	233,500	—	103,700
Mineral tar and asphalt.—				
From Germany	5,000	15,600	+	10,600
„ United States ...	133,600	89,600	—	44,000
„ Great Britain ...	10,300	5,600	—	4,700
„ Other countries ...	13,800	12,300	—	1,500
Total ...	162,700	123,100	—	39,600
Insulators of glass, porcelain, &c.—				
From Germany	31,600	49,700	+	18,100
„ United States ...	136,800	80,700	—	56,100
„ Great Britain ...	800	2,000	+	1,200
„ Other Countries ...	5,100	4,700	—	400
Total ...	174,300	137,100	—	37,200
Sulphuric acid.—				
From United States ...	63,900	77,000	+	13,100
„ Great Britain ...	100	8,700	+	8,600
„ Other countries ...	300	700	+	400
Total ...	64,300	86,400	+	22,100
Incandescent electric light bulbs, contacts, interruptors, commutators, &c.—				
From Germany	166,500	217,900	+	51,400
„ Austria	27,700	22,600	—	5,100
„ United States ...	353,500	496,600	+	143,100
„ France	7,500	12,200	+	4,700
„ Great Britain ...	13,500	9,700	—	3,800
„ Holland	1,100	2,600	+	1,500
„ Sweden	9,200	1,400	—	7,800
„ Other countries ...	400	500	+	100
Total ...	579,400	763,500	+	184,100

POWER CHARACTERISTICS OF THE TUNGSTEN FILAMENT.[*]

By CHARLES P. STEINMETZ.

As in the tungsten-filament incandescent lamp the resistance increases with the temperature, the power consumption varies at a rate which is less than proportional to the square of the impressed voltage. It, therefore, was interesting to investigate experimentally the manner in which the power consumption increases with increase of voltage.

In pursuit of an extended investigation on the radiation law of the tungsten filament, a series of tests had been made with special care on a number of modern tungsten lamps, extending over a wide range of candle-powers. Taking the readings very quickly, by experts especially trained in photometric work, it was possible to reach 10 times the rated candle-power of the lamps, without any appreciable impairment or change of the filament or blackening of the globes, as evidenced by the lamp showing its original candle-power and efficiency after the test. For these data the writer is indebted to Mr. F. C. Marshall, of the Harrison Lamp Works.

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[*] *Electrical World*, July 8th, 1909.

Analysing the relation between the power consumption and the impressed voltage, the interesting result was found that the power consumption varies proportional to the 1·6 power of the voltage—that is, follows a law analogous to that of the hysteresis loss in iron in an alternating magnetic field, and thus can be expressed by the equation:—

$$w = c\, e^{1\cdot6}.$$

The following table gives in the first four columns some of the observed values of candle-power L, impressed voltage e, and current i of one of these lamps, a 32-C.P. 40-watt lamp. The fifth column gives the watts w, derived by multiplying volts and amperes. The values of this column can be expressed by the equation:—

$$w = 0\,0235\, e^{1\cdot6}.$$

In the sixth column of the table are given the values calculated by this equation of the 1·6 power, and in the last two columns the differences between observed values of power w and values calculated by the 1·6 power law. As will be seen, the difference in no case reaches 1 per cent.

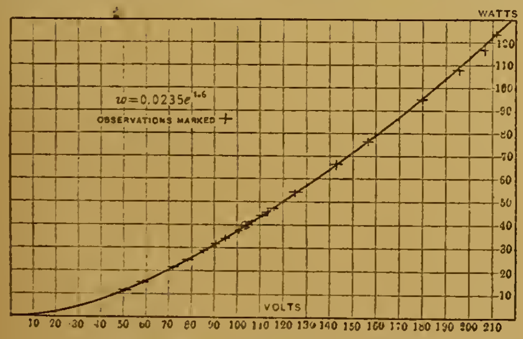
No. of test.		L C.P.	e Volts.	i Amps.	w Watts.	Watts calculated	Difference.	%
1	..	2	49·6	·247	12·25	12·14	— ·11	— ·9
2	..	4	59·6	·274	16·33	16·26	— ·07	— ·4
3	..	8	70 6	·302	21·35	21·43	+ ·05	+ ·2
5	..	16	85·3	·339	28 91	28 89	— ·02	— ·1
9	..	32	103·3	·380	39·26	39·25	— ·01	— ·0
15	..	64	126·6	·429	54·31	54·40	+ ·09	+ ·2
19	..	128	157	·489	76·77	76·68	— ·09	— ·1
23	..	256	196	·556	109 00	109·4	+ ·40	+ ·4
27	..	320	212	·580	122·9	124·0	+ 1·10	+ ·9
28	..	32	103·8	·380	39·45	—	—	+ ·9

In the accompanying illustration is shown the curve of 1·6 power with the observed values of power marked by crosses. As will be seen, the coincidence is so close as to give no noticeable deviation in the scale of the curve.

About 18 years ago the writer observed that the relation between the power loss in iron in an alternating magnetic field and the magnetic density can, with good approximation, be empirically expressed by a law of 1·6 power:—

$$w = \eta\, B^{1\cdot6}.$$

This law of hysteresis is still an empirical law, and all attempts to derive it rationally from theoretical considerations have thus far failed. It therefore is especially interesting to observe the same law of the 1·6 power, showing the relation between the consumption and voltage of tungsten lamps, especially as in the tungsten lamp the law of the 1·6 power is not only an empirical law, but can rationally be derived as a theoretical conclusion from the temperature law of metallic resistance,



EXPONENTIAL CURVE, 1·6 POWER.

$$r = a\, T,$$

and the normal radiation law,

$$B = b\, T^4,$$

where T = absolute temperature and B = total radiation power.

ELECTRICAL INSTALLATION AT SELFRIDGE'S.

THE problem of lighting a large store, such as Messrs. Selfridge's, is one requiring considerable technical skill and long experience. A much higher standard of illumination is demanded by the public than is considered sufficient for ordinary buildings, and the function of the engineer is to provide an adequate amount of light, without glare, and with due regard to cost. The consulting engineers for the Selfridge installation were Messrs. Wallis-Jones & Dent, of 50, Queen Anne's Gate, S.W., and the contractors were Messrs. Malcolm & Allan, of Glasgow. For the general lighting of the principal departments 286 Westinghouse enclosed type arc lamps are used; most of the lamps have special cases, of Corinthian pillar design, finished in Pompeian green, and large diffusing opalescent globes.

The lamps are hung from the ceiling by special chains, in which the electric conductors are concealed, and are at a sufficient height to give brilliant illumination, while being well above the ordinary line of vision. In addition to the arc lamps, there are about 6,000 incandescent lamps, mostly of the metallic-filament type. These are generally carried by ornate fixtures in various styles to suit the particular scheme of decoration adopted in different parts of the building.

Electric lamps are also extensively used for lighting the glass showcases in which goods are displayed. The lamps are fitted in special trough reflectors, which wholly conceal them from view and direct the light on to the merchandise.

One of the most important features of the installation is, of course, the method of illuminating the large shop windows.

In modern high-class establishments, the use of powerful unshielded arc and incandescent lamps for this purpose is rapidly becoming extinct, and merchants are gradually coming to realise that the function of artificial light is not to illuminate the pavement outside the shop or dazzle the eyes of the would-be customer, but to display the goods so that their colour, design and other qualities may be seen to the greatest advantage. In fact, shop window lighting should be so designed that the effect produced is that of a well-lighted theatre stage. The windows at Messrs. Selfridge's are, wherever possible, lit entirely by concealed incandescent electric lamps, fixed in special adjustable mirror reflectors along the top of the window, by which the articles on show are brilliantly illuminated, while the eyes of those who are inspecting them are shielded from all glare.

Provision has also been made for illuminating the exterior of the building on special occasions, connecting boxes being fitted at various points from which temporary wires may be carried in any direction.

The installation of the electric wires has been carried out in accordance with the latest practice. Solid-drawn, heavy-gauge, screwed steel tubes are everywhere used for protecting the conductors from mechanical injury, these being placed in position during the construction of the floors, and entirely buried in concrete; special precautions were taken to protect them from corrosion. The lights are controlled from switch and fuse distribution boards in iron cases, concealed from view but easily accessible, additional local switches being fixed where needed.

Current is obtained from the continuous-current mains of the St. Marylebone Borough Council, at a pressure of 480 volts, by means of four independent feeders and seven service cables, so that the risk of interruption of the lighting and power service is reduced to a minimum. The service mains are carried to a large main switchboard in the third basement, to which 36 lighting and 20 power circuits are connected. The lighting circuits are fed at a pressure of 240 volts, and also some of the small electric motors. Large motors are supplied at 480 volts.

The building is equipped with nine Otis electric passenger lifts, designed to travel at a speed of 175 ft. per minute, and capable of each carrying 15 persons. In addition, there are two goods lifts of 5,500 lb. capacity each, and running at 150 ft. per minute. Each lift is operated by a special controller inside the car, and provision is made to enable the lift to be run at the maximum or slower speed. Signals are fitted on each landing to indicate the approach of any lift in either direction.

There are also numerous electric motors installed for a variety of purposes, such as pumping, ventilating, air compressing, pattern cutting, ice breaking, knife cleaning, hair drying, &c.

In an establishment of this size it is of great importance to be able readily to ascertain the whereabouts of the principal members of the staff. This is accomplished by an ingenious system of signalling by four electric lamps of different colours, fixed in various parts of the building, each combination of lamps corresponding to a different person. In the telephone exchange four switches are fixed, by means of which the lamps can be lit simultaneously at every signalling point, in any desired combination. The departmental manager on seeing the lamps alight in a given combination then rings up the telephone exchange from the nearest point and is at once placed in direct communication with the inquirer.

The telephone exchange is equipped for 20 public service lines and 160 local stations, but provision is made for 60 public lines and 400 stations. Portable telephone instruments are provided in the restaurant, which may be connected to the telephone wires at 54 different points, and used at any table.

An installation of 60 electric tell-tales, to record the patrols of the night watchmen, is also provided, with portable telephones at two points for communication between an inside and outside watchman.

Electric clocks worked on the synchronome system are used throughout the building, the equipment consisting of one master clock operating 19 dials by means of half-minute impulses. The master clock is synchronised electrically with Greenwich mean time every hour. In conjunction with the clock system, a special signalling apparatus is used for ringing bells at fixed hours each day to indicate to the staff the times of beginning and leaving off work.

This brief description will afford some idea of the extent and variety of purposes for which electricity is brought into use in a modern business establishment.

Among the contractors who supplied materials for the electrical installation are the following:—Lifts, The Otis Elevator Co., Ltd.; arc lamps, British Westinghouse Co., Ltd.; fittings, Veritys, Ltd., Spital & Clark, General Electric Co., Ltd.; telephone installation, National Telephone Co., Ltd.; clocks, Synchronome Co.; main switchboard, Johnson & Phillips, Ltd.; switch and fuse boards, J. H. Tucker & Co., Ltd.; ventilation work, Ashwell and Nesbit; Grinnell sprinklers, Mather & Platt, Ltd.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE—NEW CALEDONIA.—The same duties are levied as on similar goods imported into France, with some exceptions, of which the following are a few:—

Cast-iron, rough	free
Iron in bars	free
Copper, pure or alloyed, in bars, pigs, plates, hammered or beaten	free
Boilers	free

In addition to the ordinary import duties, certain octroi duties are also levied on imported goods, as follows:—

Heavy oils and other mineral oils	1 fr. per kg.
Metals	5 % ad. val.
Manufactures of metals	5 % "
India-rubber and gutta-percha goods	5 % "

FRANCE—RÉUNION.—The duties are the same as those in France, with certain unimportant exceptions. The following octroi duties are also levied on imported goods:—

Earthenware pipes, tiles, &c.	8 fr. per 1,000
Faience, porcelain, pottery and glassware	6 % ad val.
Mineral oils	10 fr. per 100 kg.
Machines	1 % ad val.
Marble, worked	10 % "
Metals, and manufactures thereof:—	
Of steel, tinplate, copper or tin	6 fr. per 100 kg.
Of iron, sheet, lead or zinc	3 fr. "
Of cast iron	2 fr. "
Cast-iron pipes	1 % ad val.
Products not specially mentioned	4 % "

FRANCE—ST. PIERRE ET MIQUELON.—The duties are the same as on similar goods in France, with certain unimportant exceptions.

FRANCE-SOMALILAND.—No duties are levied on electrical and similar goods imported into Somaliland.

FRANCE—TAHITI and DEPENDENCIES.—The following duties are levied:—

Metals, raw: iron, steel, copper, zinc, lead, tin, and constructional iron	12 fr. per 100 kg.
Metals worked and ready for use	13 % ad val.
Galvanised sheets	" "
Lamps for hanging	15 % "
Agricultural or industrial machinery, machine tools and accessories	Free.
Motive machinery for navigation or locomotion	"
Pumps, suction	8 % ad val.
Bitumen, solid or liquid	" "
Cement	1·50 fr. per 100 kg.
Porcelain, faience and pottery	13 % ad val.
Glassware, crystal ware of all kinds	15 % "
Goods not specially mentioned	8 % "

The following are free of duty:—Articles imported on account of the Colonial Government or the municipalities; gasoline and petroleum for heating purpose, for machinery to be used in locomotion, navigation, agriculture or industry.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,888. "Improvements in electric-driving mechanism for clockwork." L. Webber, F. C. Webber and H. V. Webber (trading as Webber & Sons). August 3rd.

17,895. "Improvements in electric flashers." C. H. Jukes-Brown. August 3rd.

17,917. "Improvements in electrical terminals." S. K. Thompson. August 3rd.

17,926. "Improved means of balancing and starting electric rail cars." M. Churchill-Shann. August 3rd.

17,932. "Improved process and apparatus for wireless operation of switches and other apparatus at a distance by sound waves and other vibrations." G. M. Karolyi, E. Klupathy and C. Berger. (Date applied for under Sec. 91 of the Act, May 12th, 1909, being date of application in Hungary.) August 3rd. (Complete.)

17,960. "Improvements in or relating to metal-filament lamps." Felten and Guilleaume-Lahmeyer-Werke Akt.-Ges. (Date applied for under Sec. 91 of the Act, January 4th, 1909, being date of application in Germany.) August 3rd. (Complete.)

17,962. "Improvements in lamps, electric and acetylene, for cycles, motor-cycles, automobiles, carriages and the like." R. W. Onery. August 4th.

17,994. "Stop for the jack springs of telephone exchanges." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 4th. (Complete.)

17,998. "Safety indicator and control for electric lifts." P. T. Kenny. August 4th.

17,999. "Metal moulding for encasing electric wires." P. T. Kenny. August 4th.

18,003. "Electric control of clocks." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt.-Ges., Germany.) August 4th. (Complete.)

18,007. "Improvements in the manufacture of trolleys for use in electric railways, tramways and the like." A. Reiner. August 4th.

18,012. "Improvements in and relating to switches." C. Zee. August 4th. (Complete.)

18,036. "Improvements connected with circuit-breakers for electric welders and the like." S. Jevons and V. D. Green. August 5th.

18,098. "Improvements in and relating to secondary batteries." F. R. Lewis. August 5th.

18,118. "Improvements in electric furnaces for the continuous manufacture of glass." M. Sauvageon. August 5th. (Complete.)

18,221. "Improvements in and relating to electric switches and the like." M. B. Field and Ferranti, Ltd. August 6th.

18,228. "Safety electric connector plug." J. F. Conradi and E. S. Conradi. August 7th.

18,268. "Improvements in or relating to automatic electric switches, electricity meters, and similar apparatus where operating or controlling coils are in circuit whilst the apparatus is in use." F. C. Dannatt. August 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Winding Machines more especially applicable for Winding Coils of Wire for Electrical Purposes. E. A. Wilderspin and E. S. Hough. 15,053. July 15th.

Electric Motor-Generator Sets for supplying Arc Lamps for Searchlights and for other Apparatus. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 15,130. July 16th. (Application for Patent of Addition to No. 4,379/05.)

Electrical Contacts for use in Railway Signal Systems. C. P. Finnigan. 15,494. July 21st.

Electric Furnaces for the Treatment of Ores and the like. R. E. D. Kilburn. (E. Oesterle.) 15,645. July 23rd.

Magnetic Separators. R. E. D. Kilburn. (E. Oesterle.) 15,646. July 23rd.

Electrically-heated Hand Irons. H. J. Read. 15,674. July 23rd.

Electric Relay Systems and Relays therefor. E. Raymond-Barker and A. Orling. 15,853. July 25th.

Supports for Contact Plows or Electric-Current Collectors for Electric Railways. M. E. Curwen. (J. G. Brill Co.) 16,305. August 1st.

Arc-Control Mechanisms for Projectors, Searchlights and the like. British Thomson-Houston Co. (Gen. Elec. Co.) 16,722. August 8th.

Telephone Current-Transmitting, Retransmitting and Reinforcing Apparatus. J. E. Kingsbury. (Western Electric Co.) 17,048. August 13th.

Shade-Holders for Incandescent Electric and other Lights. W. A. G Hill. 17,706. August 24th.

Electric Circuit Breakers. British Thomson-Houston Co. (Gen. Elec. Co.) 19,589. September 17th.

Shade Carrier for Electric, Incandescent and other Lamps. J. Nelson and Drake & Gorham, Ltd. 19,705. September 19th.

Induction Coils and Transformers. H. F. Bigge and F. R. Butt. 19,886. September 22nd. (Postdated February 10th, 1909.)

Means of converting existing Petrol Omnibus Chassis into Electric or Petrol-Electric Vehicles. W. A. Stevens. 20,210. September 25th.

Overload Circuit Breakers. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 20,208. September 26th.

Electrodes for Accumulators. H. J. Haddan. (Nya Ackumulator Aktiebolaget Jungner.) 21,004. October 5th.

Telephone Instruments. W. Aitken. 21,405. October 10th.

Mercury and other Vapour Electric Lamps. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 21,834. October 16th.

Dry Rezincable Galvanic Cell. F. Weatherill. 23,622. November 5th.

Magneto-Ignition Devices for use in connection with Internal-Combustion Engines. Mulholland. 24,403. November 12th.

Means for Mounting or Supporting Telephonic Instruments. T. E. Winterbottom. 25,122. November 21st.

Secondary Batteries. Van Raden & Co. and M. Metz. 25,478. November 2[illegible]th.

Time Relay for Electric Currents. D. Timar and R. Ziegler. 26,967. December 12th.

1909.

Means for Mounting Electric Lamps. H. Girard. 425. January 7th. (Request under Sec. 19 not granted.)

Pendulum Electricity Meters. Fery. 687. January 11th.

Incandescent Electric Lamps. E. Bohm. 3,897. February 17th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges. 4,594. February 24th.

Electric Production of Iron and Steel and other Metals, and Furnaces for Carrying out the same. Aktiebolaget Elektrometall. 6,088. March 13th. (Date applied for under International Convention, August 1st, 1908.)

Working of Electric Arcs in Series. H. Pauling. 6,429. March 17th.

Overhead Conductor Frogs and Crossings for Electric Tramways. F. J. Venning. 7,795. April 1st. (Date applied for under International Convention, April 15th, 1908.)

Indicators Operated by Alternating Current. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 8,191. April 5th. (Date applied for under International Convention, July 11th, 1908.)

Time Relay for Electric Currents. D. Timar and R. Ziegler. 8,570. April 8th.

Telegraphic Receivers. A. Pictet. 10,450. May 3rd.

Safety and Anti-Inductive Appliances for Telephone, Telegraph or other Electric Conducting Wires. E. Hall. 12,869. June 1st. (Date applied for under International Convention, May 29th, 1908.)

Apparatus for Converting Alternating Potential Differences into High Continuous Potential Differences. R. Delon. 13,450. June 8th. (Date applied for under International Convention, June 13th, 1909.) (Application for Patent of Addition to No. 1,070 of 1909.)

THE

ELECTRICAL REVIEW.

Vol. LXV. AUGUST 27, 1909. No. 1,657.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Lndgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.

4, Ludgate Hill, London, E.C.

WEAR-AND-TEAR OF TRACK.

CARDIFF tramways have been very much in the public eye lately, chiefly because a certain section of the Committee thinks that it is more capable of managing the system than is the manager himself. A highly successful business for some years, these tramways have proved that they are not exempt from the common ills, and it has been evident for some time that meeting properly the depreciation and renewal charges will sop up the over-spill of profits which used to go to the relief of the rates.

The latest and the most grievous tribulation to afflict the Cardiff Tramway Department is disease of the track, and the reports of the manager, who is also the engineer, were so serious, and called for the expenditure of so much money in order to set things right, that a second opinion was demanded, and Mr. Howard Smith was instructed to examine and report. As one might suppose, his diagnosis and recommendations do not differ materially from those of Mr. Ellis, and it is only too clear that the track will be a heavy drag upon the progress of the tramways for some time to come.

None of the lines are 10 years old, and it may be said that the average age of the 30 miles is not more than 8 years, yet not only are the rails worn out, but a considerable portion of the "permanent"-way itself needs renewal. This is rather a blow—if any further killing were necessary—to the once-prevalent idea that the life of track under electric traction would be 15, 20, or even 25 years. The decrepitude of the earliest electric lines before the lowest of these figures was reached should have served as a check to the most sanguine promoter, especially when the comparatively light service on these pioneer lines was taken into account. Constructional methods have improved considerably since those days, but they seem to be only now on the point of overtaking the ever-increasing destructive effects of heavier service conditions.

It appears that the average density of car service over the Cardiff system is greater than that of any fairly comparable system in the kingdom, and corrugated rails have played a more than usually important part in the general decay of the track, while the boggy nature of the sub-soil in places, and the large number of sharp curves, have helped to produce the present state of affairs.

An article in the *Light Railway and Tramway Journal* of June 11th indicates a hopeful remedy for excessive rail wear, drawn from experience on the London underground railways. On the Circle sections the standard steam rail has worn in an astounding fashion under electric traction, a peculiar side wear being particularly noticeable. Rails in dry tunnels which under electric traction might have been expected to last five years have had to be removed in two years, and even in five months, while the life outside tunnels has dropped from an expectation of 12 years or more to a realisation of five years or less.

On the District Railway heavy side-cutting at curves has been experienced, and it was thought that this might be overcome by increasing the superelevation, but the results of experiments showed that the evil was intensified rather than diminished.

On both those lines rails with high silicon contents have raised the average life by 30 per cent. or more, and the use of a check rail much harder than the running rail has nearly eliminated side wear.

The specification of the rails, which are manufactured under the Sandberg patents and Bessemer process, is as follows :—

	District Railway.	Underground Railways of London.
	Per cent.	Per cent.
Silicon	·35 to ·45	·1 to ·2
Manganese (not to exceed) ...	·80	·8 to ·1
Phosphorus	·07	·07
Sulphur	·07	·075
Carbon	·45 to ·55	·5 to ·6

Mr. A. R. Cooper makes a most interesting addition to our knowledge of the causes of excessive wear on rails used under electric traction. This wear has been very marked on the Metropolitan and the District lines, which were converted from steam to electric traction without altering the characteristics of the permanent way; but the track of the tube lines was designed especially for electric service, and it is giving excellent results. We may remind our readers that the peculiar characteristic of Mr. Chapman's design lies in the sleepers being free to move vertically at the ends. Usually they are packed solid for their whole length, but on the underground electric railways the track really consists of a centre-bound road, the ends of the sleepers being supported by the initial packing only, and not beaten up, so that they depress some $\frac{3}{16}$ in. when trains pass over them. This spring in the track appears to counteract the punishment which the rails would otherwise receive.

On the Piccadilly Railway, which has a number of sharp curves, not a rail has been changed, or even turned, although in use for 2½ years, and there is none of that battering or corrugation on curves which has been such a nuisance on the District and other electrified railways.

In connection with the life of track it is germane to mention the scheme for determining the allowances to be granted for fair wear and tear on tramways, gas, water and electricity undertakings, which has been agreed upon, after long negotiation, between the Board of Inland Revenue and a special committee of the Tramways and Light Railways Association.

An abstract of this scheme appears in another part of this issue, and it is only necessary here to compliment the Association upon their work and its results.

The method of classifying permanent-way on the basis of average car-mileage per mile of track per annum, then saying that 16 years is the life of track used to the extent of under 50,000 car-miles per mile per annum, and so on, seems to be the best that could be adopted under the circumstances. Whether the life assumed in every class is not too long is a matter of opinion, and for the present we are inclined to think that it is.

In the case of overhead equipment on tramways, and of conduits on lighting systems, no allowance is to be made for depreciation, but the annual expenditure on repairs and renewals may be allowed as working expenses.

It is to be noted that this scheme has been drawn up for the sole purpose of income-tax assessment, for which it is necessary that allowance should be made for depreciation. Hitherto, we suppose, every undertaking has had to fight its own particular battle every year with Somerset House, but henceforth everyone knows where he is, and it is to be hoped that everyone is satisfied.

We do not gather that this agreement with the Inland Revenue will have any effect outside its direct purpose, but much use might be made of its provisions in making out the public balance-sheets of corporations and companies.

Rail Corrugation.

The *Official Circular* of the Tramways and Light Railways Association for July contains the translated discussion on Mr. A. Busse's paper bearing the above title.

It appears that every line of importance which contributes members to the Union Internationale and to the German Tramways Association has experienced corrugation, and the general opinion is that its appearance is connected closely with the introduction of electric traction. Many well-known Continental engineers joined in the discussion, but it will be sufficient to reproduce the concluding remarks of Herr M. Koehler (Berlin) :—

> This discussion has had a singular effect upon me. Barely an hour ago I was fully convinced that we had at last got the microbe of corrugation tightly by the throat, and I was going to propose to have it christened "Petersenius." But this hope is shattered, and I am forced to regretfully acknowledge that the question remains unsolved. Many are the reputed causes, and we are not even able to apportion to each its proportionate degree of importance. Nothing remains, therefore, but to undertake renewed investigations. I move that the discussion be closed for the present, and I propose that the question be brought up again at our next congress. I further propose that the present members of the committee who have been at such great pains to place before us all known facts bearing on this question be invited to continue their labours in the interests of all concerned, and I look forward to our next congress with the assurance that they will by that time have reached more definite conclusions. (This was carried unanimously.)

The St. Petersburg Tramway Scheme.

A short time ago reference was made in this journal to electric tramway proposals submitted by international firms in regard to the network in St. Petersburg. It now turns out that a scheme was presented to the municipal council a few months ago by the Allgemeine Elektricitäts Gesellschaft, the Siemens & Halske Co., and the British Westinghouse Co., offering to take over the tramways hitherto laid by the municipal council, the generating station and the rolling stock, &c., for the sum of 20,000,000 roubles (£2,000,000). The companies also proposed to assume the obligation to extend the network by the expenditure of a further amount of £3,000,000. The scheme is said to be financially supported by the Deutsche Bank, the Belgian Société Générale and the British Westinghouse Co., and an agreement exists between the manufacturing firms so as to exclude mutual competition. It was recently reported from St. Petersburg that the negotiations between the interested firms and the municipal council would be resumed during August in view of the expected presence in the Russian capital of the responsible representatives of the council, and that the realisation of the scheme was highly probable, having regard to the circumstance that the city authorities were under the necessity of devoting a large expenditure to the improvement of the system of supply of potable water. An inquiry made in competent quarters in Berlin a day or two after the publication of the report elicited, however, a statement to the effect that nothing was known of the proposed resumption of negotiations in August, which was declared to be an inappropriate month. It was added that the principles of the scheme have by no means been settled, but that it has now again become doubtful whether the companies will acquire the tramways from the city and work them. The possibility has to be reckoned with that the municipal council will retain the working in its own hands and also have the extensions carried out, in which case the companies in question would be taken into consideration. The main difficulty arises from the question as to the raising of the necessary capital, and it was this factor in the situation which formed the original motive for the suggested transfer of the undertaking to private enterprise.

An Italian Tragedy.

Last week that portion of the world which takes an interest in matters electrical was startled to hear of the terrible accident which occurred at the village of Oliginate, a township of 2,000 inhabitants on the left bank of the Adda River, a few miles south of Lecco, Lombardy. It appears, from the numerous newspaper reports, that during a furious thunderstorm some high-tension transmission wires broke, and, in falling, came into contact with low-pressure distributors, with the result, apparently, that in numerous instances the wiring and switches in the houses started to fuse and burn up. The wiring, evidently of the surface type, fell about the rooms, catching the inmates in its coils, with disastrous results, as from this and from attempts to use switches, a dozen people were killed outright and about 30 received severe shocks and burns.

It is significant that the casualties occurred almost exclusively in the houses of the lower classes, where the installations were evidently crude, and that in the better class villas no serious results occurred. The Orobia Electricity Co., of Lecco, whose circuits were concerned, supplies over a hundred villages round Como. In the absence of technical details, one can only conclude that the contempt bred of familiarity led to the neglect of what, in this country, would be regarded as elementary precautions; indeed, it is somewhat surprising and reassuring, if anything, when one considers the free-and-easy methods adopted in some parts of the Continent, that similar accidents have not occurred more frequently.

It is somewhat curious that not so many miles away—in Geneva, to be exact—a disastrous explosion occurred at the municipal gas works, on Monday afternoon, killing 13 men and injuring a great number of others, besides wrecking the property in the vicinity.

London's Electric Light Standards.

Our esteemed contemporary, the *Builder*, is much concerned as to the incongruities in design of the London electric light standards. Indeed, our friend has toured through certain main thoroughfares, note-book in hand, and emphasises its remarks by rough sketches of its pet aversions. Talking about arc lamp standards, our contemporary says "they are very much in want of a lift up out of the hands of the engineering ornamentalist"—but why "engineering ornamentalist"? Surely our contemporary is aware that many of these admittedly ugly standards are produced wholly and solely on the initiative of the municipal powers that be, the city architect, borough surveyor, civic council, &c.?

Moreover, we doubt whether the so-called engineering ornamentalist might not more accurately be classed as an architectural ornamentalist; certainly there is no engineering involved in designing a cast-iron lamp standard, and few engineers who have to pay for such things care for expensive and superfluous ornamentation, especially where this obstructs the light.

But even were the design of lamp standards in main streets left to qualified architects, with a view to their harmonising with their surroundings, what could the designer do in, say, Fleet Street, with its remarkable collection of architectural ugliness?

TARIFFS FOR DOMESTIC CONSUMERS.

By F. FERNIE.

Perhaps the object of any municipal electricity supply scheme is to give a supply of electricity to the greatest possible number of people at the cheapest possible rate. The "maximum demand" system of charging divides the total costs of the supply amongst the consumers more equitably than any other system. Such a system, however, does not necessarily mean that the greatest possible number of consumers will be obtained, for if there are a certain number of consumers who will be obtained whether they are charged cost price or over cost price, it is obvious that, by charging these people above cost price, the station can afford to supply a certain number of people below cost price. There are thus three classes of consumers to be considered:—

1. People who will (unconsciously) pay more than cost price.
2. People who will pay exactly cost price.
3. People who can only be obtained as consumers by charging them under cost price.

The greatest possible number of consumers will be obtained by making Class 1 pay more than cost price, for then a proportion of Class 3 will also be obtained. Any tariff, then, that aims at obtaining the maximum number of consumers, must so balance things that the sum of consumers in Classes 1 and 3 is a maximum. The majority of the consumers connected to any undertaking belong to Classes 1 and 2, and if they properly realised matters, it is probable that all municipal supply tariffs would be on the maximum demand principle.

The overcharging of a proportion of the consumers would appear to be sound, only so long as the new undercharged consumers attracted were such as tended to improve the station load factor. In this way the all-round cost per unit would be lowered, so that Class 1 might eventually be charged a lower rate per unit than the original cost of supplying them. On the other hand, if the overcharging of some consumers attracted only such consumers as tended to lower the station load factor (*e.g.*, early closing shops), then the policy would appear to be unsound. The price of any manufactured article depends on the ratio $\frac{\text{fixed charges}}{\text{No. of articles made}}$. If a large sale depends on a low price, then any trading concern must sell at a loss at first in order to reach the large sale. It is possible that the metallic lamp difficulty could be counteracted in some cases by reducing the charge for power (heating, &c.) instead of increasing the charge made for lighting.

The cost of an electricity supply business may be divided into four parts:—

1. The "fixed" charges, which depend on the maximum demand on the station.
2. The "running" costs, which depend on the number of units sold.
3. The "service" costs, which depend on the number of consumers.
4. The "preparation costs," which depend on the load-factor.

The service costs include the interest, &c., charges on, and the maintenance of, the service cables, cut-outs, meters, &c.; all those parts of the salaries and office expenses which are connected with the reading and testing of meters, the preparation and collection of consumers' accounts; part of the management charges and preliminary expenses.

It may also be argued that part of the interest and sinking fund and the maintenance of the mains depend on the number of consumers. For the greater part of the cost of the mains depends on their length, and the length of mains laid varies with the number of consumers supplied (not necessarily so, but true in practice).

The maintenance of the mains depends entirely on their length, and the number of units lost in distribution partly on their length. The section of copper used depends on the maximum load, as well as upon the length. The whole cost of the mains cannot in any case depend entirely on the maximum load, since the cost of the trench work, the protection of the copper conductors, and the reinstatement of roads, would be nearly the same whether the mains had to transmit 100 KW. or 1 KW.

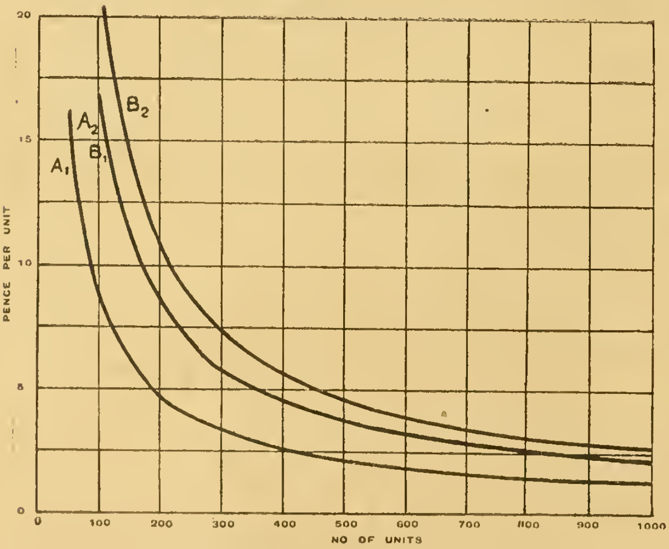
If it be admitted that half of the mains are true "service" costs, then the service cost per consumer will be quite a considerable amount. People who ought to be large consumers—those who live in comparatively big houses—involve a larger "service" cost than people living in smaller houses; for the length of mains necessary to supply a given number of consumers in a road depends on the frontage of the houses. Thus three houses, each with a frontage of 50 yards, require 150 yards of mains, whereas three small houses together, forming part of a row, might require only 30 yards of mains. The length of service leads would also be greater in many instances in the case of the larger houses. Against this must be set the ordinary commercial advantage of doing a large turnover with one customer instead of with a number.

On the "maximum demand" principle, consumers with similar load factors should pay at the same *rate* per unit, independently of the number of units actually used, but if the service cost per consumer be recognised as at all comparable in amount with the fixed charges per KW. of maximum demand, then the number of units used must be taken into account, and, of two consumers, the one who uses the largest number of units should be charged, on this account alone, at a lower rate per unit than the other.

Experience with the "maximum demand" system shows that nearly all domestic lighting consumers have very similar load factors; also, this system does not "slide" much when fairly reasonable load factors are reached, so that a flat rate per unit may fairly be applied to such a class. The unfairness of a flat rate occurs when it is applied both to this class *and* to very low load-factor consumers such as early closing shops and offices.

The effect of the diversity factor on the cost of supplying a consumer depends on what proportion the service charges bear to the total standing charges. The more standing charges that are put down as "service" charges the less will be the effect of the diversity factor.

The curve A_1 in the figure represents the cost per unit of supplying a consumer on the "maximum principle," with the following assumptions:—Maximum demand of consumer = ½ KW.; cost per KW. of maximum demand (including service charges) = £10 per KW.; running cost = ½d. per unit; diversity factor = 1·5. B_1 represents the cost of supplying a consumer with a maximum demand of 1 KW. under the same conditions. For a 10 per cent. load factor the cost per unit is just under 2½d. A_2 (which coincides with B_1) and B_2 represent the cost per unit for the same consumers, if the cost per KW. of maximum demand were £5 and the cost per service £5 (the service cost is purposely exaggerated). The cost of supplying A with a load 10 per cent. load factor is now just over 4d. per unit, and B just under 3d. per unit. If a flat rate of 3½d. were in force, the B people would pay too much and the A people too little, and this would be quite reasonable if the average service costs of large consumers were greater than the service costs of small consumers, and if it is desirable to make some consumers pay too much for the common good. Of course, in the particular (exaggerated) case taken, anyone using less than 300 units would be hopelessly undercharged.



Hypothetical Cost Curves.

The service costs, in many special cases, can be made very small indeed, for small premises. If the average load factor of the class considered was found to be 10 per cent., the flat rate might be based on a load factor of 8 per cent., say; then B should pay just under 3½d. and A 5d. per unit. To bring this right for a 10 per cent. load factor, B should be charged 687 units at 4·2d. and 193 units at 1d., A should be charged 343 units at 4·2d. and 97 units at 1d. This would give an average price of 3½d. for 10 per cent. load factors. The number of units that any consumer had to use before getting the reduced price, might be made to depend on the rental of his house. By this method a consumer who did not use the average number of units of his class would (correctly) pay a higher rate for them, although his load factor might be the same as the average. Although the load factors of domestic consumers are very similar, yet the number of units used by similar houses is sometimes very different. Consumers who used more than the average would have the benefit of a correspondingly lower rate. It would be unlikely for any house to use more than the average number of units and yet have a much lower load factor than similar houses.

The difficulty of two rates and two meters for power and lighting would be overcome, if the reduced rate for lighting was made equal to the power rate. Some such method as this would have much the same advantages as that in force at Norwich, but it would be less harsh on those consumers who wished to make only a limited use of electricity. A consumer who was undercharged for his lighting would be overcharged for his heating, if he had any. The special wiring involved by the use of two meters is a very real drawback to the more extended use of domestic power appliances. The year might be made to start at the September quarter so that the heaviest bill would correspond with heaviest quarter's consumption.

RECENT PROGRESS IN ARC LIGHTING.

In a lengthy article in the *E.T.Z.* for April 15th and 22nd, Dr. B. Monasch gives an interesting comparison, illustrated by recent tests, of the various types of arc lamps at present in use.

Up to about the year 1895, the only available arc lamp was the ordinary open one with vertically superposed pure carbons. The only advances made up to that time since 1879 were confined to improvements in mechanism and standardisation, leading to reduced cost. The price of a lamp in the eighties was about £17 10s., while the same type of lamp sells to-day at about £3. Series, shunt and differential lamps were in use, and the light obtained was white with a slightly blueish tinge. A 15-ampere lamp burning two in series on 110 volts, gave about 1,500 hemispheric Hefner C.P. without the globe, and used 18 or 20 mm. of carbon per hour, the specific consumption being about ·55 watt per hemispheric C.P. This type of lamp is still on the market, and even this year an order for 600 of them was given by a large Berlin establishment, chiefly because of the absence of injurious vapour and the whiteness of the light.

By careful design of the differential gear, it has now become possible to burn such lamps three in series on 110 volts without any starting or steadying resistance. The starting current may reach three times the normal value, but steady burning is attained in 30 seconds.

In 1895 the enclosed long-burning arcs introduced from America, came into competition with the open arc. The high cost of labour in America had led to the widespread use of the enclosed lamps, as they avoided the daily trimming required by the open arcs. The enclosed lamps burnt singly on 110 volts (70 or 80 volts on the lamp) for 150 hours, or, in extreme cases, for 350 hours with a single piece of carbon. The specific consumption, however, rose to about

1 watt per hemispherical candle-power with a clear glass inner globe and no outer globe. The greenish aureole present in the arc burning in air is absent in the enclosed arc, and the light is, therefore, blue or violet. The direction of maximum light emission is favourable to uniformity in street lighting, as it occurs only 10° or 20° below the horizon, instead of about 45° to the horizon, as in the open lamps. In America the 4 or 6-ampere enclosed arc is consequently still in general use for street work.

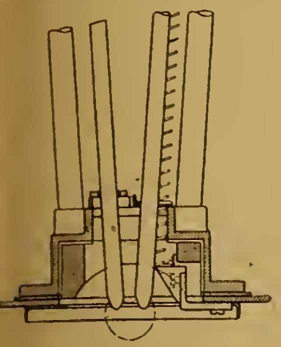


Fig. 1.

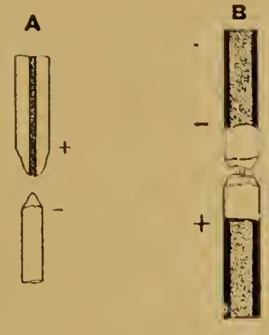
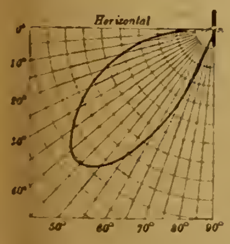


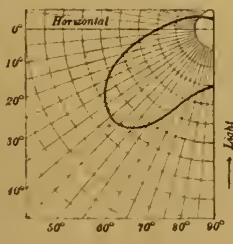
Fig. 2.

The dense coating of the inner globe after, say, 200 hours, together with the dusty appearance of the outside, has, however, led to the intermediate type of lamp which, although enclosed, is fitted with thin carbons, which burn for about 22 hours only, but gives more light than the older enclosed arcs. The 6-ampere lamp of this type with 7 mm. carbons gives 1,100 hemispherical Hefner c.p., and the 5-ampere one with 6 mm. carbons gives 725 c.p. with a single clear glass globe.

The light is not so blue owing to the white heat attained by the thin carbon ends, and these thin carbons also give a much steadier light.

In 1900 Bremer came into the market with a lamp which opened a new era in arc lighting. He mixed various luminous salts, chiefly calcium fluoride, with the core of his carbons, and attained a great increase in light emission. The heavy deposit given off by these chemical carbons, prevented the old vertical carbon arrangement being employed any longer, and Bremer went back to an old 1880 type lamp with inclined carbons. Much trouble was found with the early chemical carbon or flame arc lamp, but in the course of a few years, the mass of experience collected by the various makers eventually led to a satisfactory lamp having a specific consumption of about ·15 watt per hemispherical Hefner candle-power, without globe, and taking 45-47 volts. The recent 20-ampere lamp of this type installed in some of the principal Berlin streets gave 5,050 hemispherical c.p., with clear-glass globe and white light carbons. By suitably ventilating the globes, the harmful effect of the white deposit given off by the carbons is minimised, both as regards the mechanism, and as regards the obscuring of the globe.





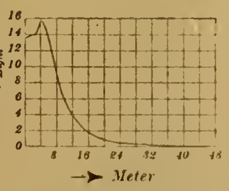


Fig. 3a.—Open Type Arc with Vertical Carbons, + 20 mm. and − 14 mm., without Globe. Hemispherical Hefner c.p. = 1,500. 15 Amps., 44 Volts.

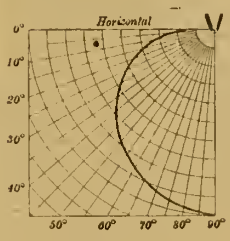
Fig. 3b.—Open Type Arc with Vertical Carbons, + 20 mm. and − 14 mm., with Opaline Globe (20% loss). Hemispherical c.p. = 1,200. Spherical c.p. = 762. 15 Amps., 44 Volts.

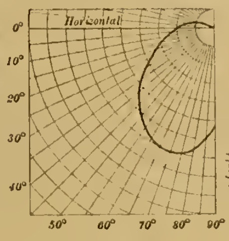
Fig. 3c.—Curve of Illumination 1 m. from the Ground, in Lux, from the above Lamp suspended 8 metres from the Ground.

The reduction in light from this cause, after burning for 18 hours, is under 5 per cent. Owing to the thin carbons which must be used for a steady light, exceptional lengths are required for these lamps, an 18-hour burning period requiring two carbons each 25 in. long.

Flame lamps using a special form of carbon, due to the Planiawerken, have recently been arranged for burning three in series on 110 volts or six on 220 volts, without starting or steadying resistance. The rush of current at starting reaches twice the normal value.

Most of the flame lamps in use employ a carefully designed and tested regulating gear, but in the earlier types so much trouble was caused in this mechanism by the white deposit given off, that Beck and others introduced simplified lamps without mechanism. Beck provides one of his carbons with a thin rib of carbon all along its length. This rib rests on a shoulder and gradually, owing to the heat of the arc near it, it consumes away and lets the carbon drop, and, since the two carbons are geared together, the feeding of the arc is thus effected.





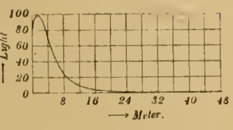
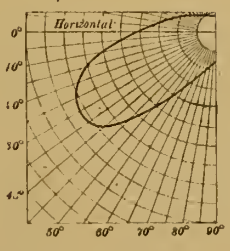


Fig. 4a.—Flame Arc with inclined Carbons, + 11 mm. and − 10 mm., without Globe. Hemispherical Hefner c.p = 4,100. 15 Amps., 47 Volts.

Fig. 4b.—Flame Arc with inclined Carbons + 11 mm. and − 10 mm., with Opaline Globe. Hemispherical c.p. = 3,380. Spherical c.p. = 1,915. 15 Amps., 47 Volts.

Fig. 4c.—Curve of Illumination 1 m. from Ground. Lamp 8 m. from Ground.

Janecek builds a lamp on the principle shown in fig. 1. An iron strip, out of which teeth have been stamped, is let into the anode carbon. The teeth rest in turn on the porcelain projection A, and as they become heated by the arc they bend back and allow the carbon to fall gradually until the next tooth, which is still stiff and straight, reaches A and the process repeats itself.



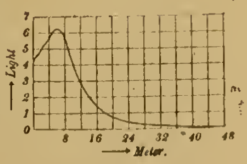


Fig. 5a.—Enclosed Arc Lamp with Clear Glass Inner Globe and Opaline Outer Globe (30% loss). Hours of Burning = 110. Carbons = 13 mm. for both + and −. Hemispherical c.p. = 800. Spherical c.p. = 511. 7½ Amps., 80 Volts.

Fig. 5b.—Curve of Illumination 1 m. from Ground. Lamp 8 m. from Ground.

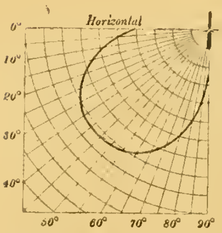
For working two lamps in series on 110 volts, a Nernst-type iron-wire resistance in hydrogen is employed as steadying resistance.

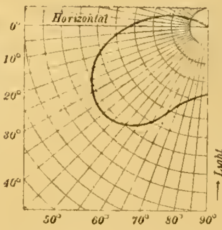
In general, however, these lamps without regulating mechanism must be considered as falling short in quality of those with the mechanism. They are too much dependent on the physical qualities of the carbon ribs, &c., to be selected in cases where reliability of action and constancy of light are of importance, even although they are naturally somewhat less expensive.

After flame lamps had come into widespread use, T. L. Carbone introduced pure carbon lamps with inclined carbons taking 75 to 80 volts. These stood between the ordinary pure carbon open arc and the enclosed arc. The hours of burning were only slightly in excess of those of flame arcs, so that no great demand for this lamp existed.

The next advance was made by Blondel who employs vertical carbons with special chemical treatment which gives the economy of the flame arc coupled with considerably increased hours of burning.

Blondel's carbons are distinguished from ordinary flame carbons by having a much greater proportion ($\frac{2}{3}$ in place $\frac{1}{5}$) of core diameter to outer diameter of carbon, as shown in fig. 2, where A shows the proportion of flame arc carbon and B shows Blondel's carbon. By this means the arc is always formed on the core substance instead of jumping to the pure carbon shell sometimes and so leading to an unsteady light.





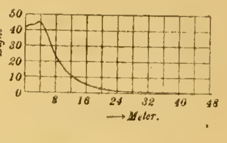


Fig. 6a.—Blondel Arc Lamp with "T. B." Carbons, + 20 mm. and — 18 mm. in Diameter, without Globe. Hemispherical c.p. = 4,100. 15 Amps, 40 Volts.

Fig. 6b.—Blondel Arc Lamp with "T. B." Carbons + 20 mm. and — 18 mm. in Diameter, with Opaline Globe. Hemispherical c.p. = 3,520. Spherical c.p. = 2,090.

Fig. 6c.—Curve of Illumination 1 m. from Ground. Lamp 8 m. from Ground.

The Blondel arcs are arranged for 30 to 40 volts and can be burnt 2 or 3 in series with a small steadying resistance on 110 volts. The vertical arrangement of the carbons allows greater diameters to be used than in inclined carbon lamps. The 15-ampere lamp with a 20-mm. upper and 18 mm. lower carbon burns for 22 to 24 hours with a length of each rod of 12½ in. For the sake of comparison, Dr. Monasch gives a series of candle-power and illumination curves for lamps of the various types, each including steadying resistance, consuming 825 watts, *i.e.*, the same consumption as the ordinary open type direct-current 15-ampere arc burning two in series on 110 volts.

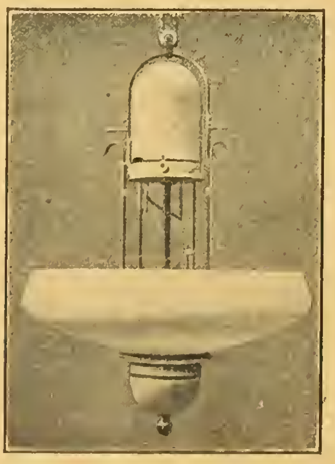


Fig. 8.—Inverted Lamp with Diffuser.

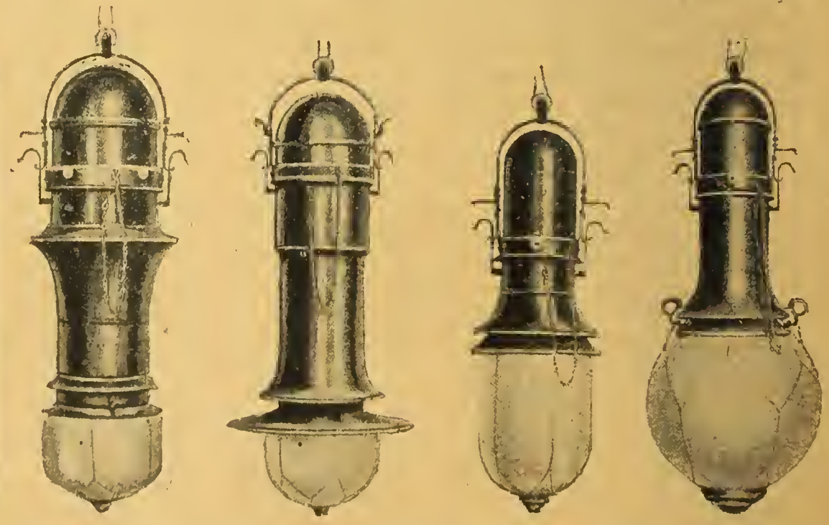


Fig. 9.—Four recent A.E.G. Arc Lamps.

In fig. 7 the curves of illumination 1 metre above the ground are shown for these various lamps (with opaline globes) on the assumption that they are suspended 8 m. from the ground and 60 metres apart.

Curve I is for the flame arc, the max. illumination is 98·9 lux, the minimum is ·8 lux, and the average[*] is 6·96 lux, so that the irregularity factor, $\frac{\text{max.-min.}}{\text{average}}$, is 14·1. The consumption for 1 lux average[*] illumination is 119 watts.

Curve II is for the Blondel arc with "T. B." carbons. The max., min. and average illuminations are 45·3, 1·6 and 6·8 lux. The irregularity factor is 6·4, and the energy consumption per average lux is 121 watts.

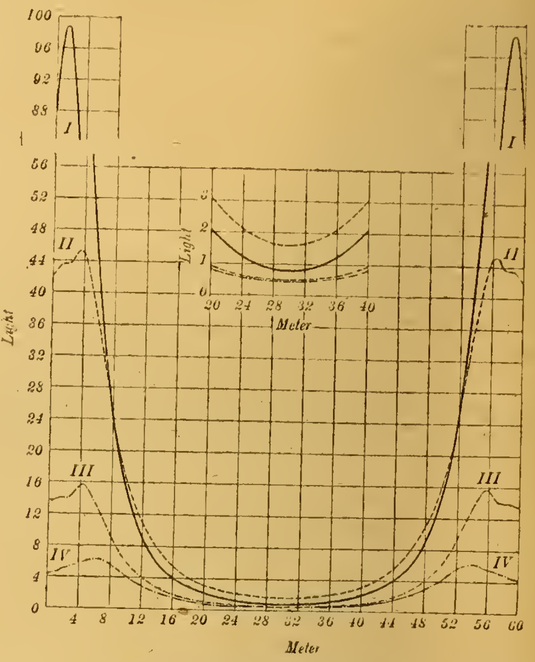


Fig. 7.—Illumination Curves for Lamps, 8 m. above Ground and 60 m. apart.

Curve III is for the ordinary open arc lamp with vertical carbons. The max., min. and average illuminations are 15·7, ·5 and 2·3 lux. The irregularity factor is 6·4, and the energy consumption is 353 watts per average lux.

Curve IV is for the enclosed arc. The max., min. and average illuminations are 6·3, ·45 and 1·5 lux. The irregularity factor is 3·9.

The energy consumption is 550 watts per average lux.

It will be seen that the Blondel arc gives the best all-round results for street lighting as regards uniformity and consumption, although the enclosed arc also gives good uniformity.

Turning next to the question of inside lighting, the author discusses the recent advances in indirect illumination by means of reflection from the ceiling or from special reflectors, with inverted lamps. In some cases good results are obtained with semi-indirect lighting, using inverted lamps, but letting some of the light fall through a strongly diffusing glass globe, whilst the rest is reflected from the ceiling (fig. 8).

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[*] In these curves the "average illumination" has been taken as the height of a cylinder whose developed surface is of the same area and same base length as the actual curve of illumination.

The following results have been obtained by the author and Dr. L. Bloch :—

Arrangement of lamps.	Average illumination in lux 1 metre above the ground.	Watts consumption per average lux and per 100 sq. metres of floor space.
Quite indirect lighting with the + carbon below ...	80 to 100	12 to 22
Quite indirect lighting with the carbons as usual (+ carbon above)	50 to 70	18 to 30
Semi-indirect lighting ...	30 to 60	15 to 35
Ordinary direct lighting ...	60 to 70	16 to 25
Nernst lamp lighting ...	56	44
Carbon - filament incandescent lamp lighting ...	40	80

The best results as regards energy consumption can thus be equalled by quite indirect lighting, but care must be taken to maintain the reflecting surfaces in a clean and efficient condition.

In conclusion, the author refers to the gradual suppression of the highly ornamented arc lamp by the more simple and serviceable modern designs. In fig. 9 are shown four recent simplified designs of the A.E.G.

CLAUDIUS MAXIMUS.

By A. K.

"From Claudius Maximus, in all things to endeavour to have power of myself, and in nothing to be carried about; to be cheerful and courageous in all sudden chances and accidents, as in sicknesses: to love mildness and moderation and gravity: and to do my business, whatsoever it be, thoroughly, and without querulousness. Whatsoever he said, all men believed him that as he spake, so he thought, and whatsoever he did, that he did it with a good intent. His manner was never to wonder at anything; never to be in haste, and yet never slow: nor to be perplexed, or dejected, or at any time unseemly, or excessively to laugh: nor to be angry, or suspicious, but ever ready to do good, and to forgive, and to speak truth; and all this, as one that seemed rather of himself to have been straight and right, than ever to have been rectified or redressed; neither was there any man that ever thought himself undervalued by him, or that could find in his heart, to think himself a better man than he. He would also be very pleasant and gracious."

Thus writes Marcus Aurelius, in recording "What, and of whom, whether Parents, Friends, or Masters; by their good examples, or good advice and counsel, he had learned."

I suppose Claudius Maximus was an ancient Roman. I know a modern Englishman, an electrical engineer, whom I regard as possessing the characteristics mentioned in the eulogium written by Marcus Aurelius, which I have quoted. He has gone to be a prince in his own right, and the place that knew him is filled by another.

The type and number of the applicants for his vacant chair is evidence that the supply of good men is still greater than the demand for them. I discussed this matter last October in this paper, and endeavoured to show that there is an alternation between good times and bad, which causes conditions such as those which obtain at present to recur periodically. Those of us who have been able to get into positions in which we can wait comfortably for opportunities, have much cause for thankfulness at our good fortune. Even if we sometimes feel a bit "groovy," rather sick of things, perhaps not least sick of ourselves, we may, I think, take comfort in this reflection that things have been getting worse and worse for so long, that there must be an improvement soon. The influx of new men from the colleges is less, and, as I said before, this in itself will cause in time a lessening in the number of men available. To point out that there is need for very great patience on the part of those deciding to enter the electrical profession is not to strike a severer note (to adopt the phraseology of your correspondent "Interested," who might, I sometimes think, sign himself "Interesting" instead) than is warranted by the facts of the case. Nobody who is familiar with these facts will deny that the profession is full of good men who find the utmost difficulty in moving. I have seen with satisfaction the transfer of the correspondence tuition advertisements to a position apart from the "Situations Vacant" in this paper. I foretell, further, a reduction in their number. Things which decrease the import of new goods, or new men, must eventually result in a raising of the prices of goods, or men, already in the market.

If I continue to write in this strain some will think I am a Protectionist. That would not be true. I merely desire to improve the quality of the dumped goods, and to prohibit entirely the importation of the useless and unfit. That the outlook is rather dull just now I admit, but that it is threatening to become worse, I deny completely. Those who think a sort of glorified trade unionism is necessary before improvement can result have mistaken the hour of the night; it is already morning.

One cause of bad conditions is to be found, I think, in the fact that so many electricity committees and similar bodies, who are the customers for the abilities and knowledge we have to sell, do not really possess the ability themselves to choose their goods. Those who go to make up the heterogeneous company composing these gatherings must know in their own hearts, if they will but give themselves two pennyworth of honesty, that they are not the right people to run an electricity undertaking. Knowing this, it is too frequently the case that they retire within the walls of their pride, and decline to adopt the well-reasoned advice offered them, in order to show their authority. In such circumstances very few men can afford to take the heroic course of resigning an appointment held under such very unsatisfactory conditions.

Raise the quality, then, and weed out the undesirables, and conditions will improve. Pay will become better, and the market will become brisk once more. Then the influx of men will begin again, but I hope that by that time we shall have some qualification test, without which no man will be able to call himself an electrical engineer, so that conditions could never again become as bad as they are now, and have been for some time past.

We must begin soon to rise on our curve, and try to decrease its amplitude. In the words of a poet who desires to remain anonymous:—

> No straight-line law thy varied moods obey
> Nor simple sinusoidal, so I find—
> The logarithmic decrement must play
> A leading part
> Within thy heart,
> Or soul, or mind.

He was addressing an English May, which had been uncommonly offensive at the beginning, but was improving, as June approached, to steadier weather conditions. *Mutatis mutandis* we may address the verse to the Presiding Genius of our profession, who directs electrical destinies.

Meanwhile, we must, like Claudius Maximus, "be cheerful and courageous," "never wonder at anything," and "be pleasant and gracious." That, in itself, will tend to improve each one of us, and in time the improvement we make in ourselves, will spread to others, raising the general quality in the manner which I have shown to be so desirable.

Copper.—Despite the predictions of the pessimist, visible supplies continue to increase and the hitherto absurd figure of 100,000 tons seems almost within sight. Messrs. Merton's mid-monthly return shows 80,852 tons, of which 67,455 tons are actually in the United Kingdom. Analysed figures give American supplies rather lower, Spain 1,373, or higher for mid-month, Australia about average, Chile lower; in general, as one might expect, there is a less brisk intake owing to the large stocks. So far, however, there are no re-shipments to the States.

The Selfridge Installation.—In connection with this matter, to which we referred last week, the Synchronome Co. inform us that their original installation of 19 clocks has now been extended to 34.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

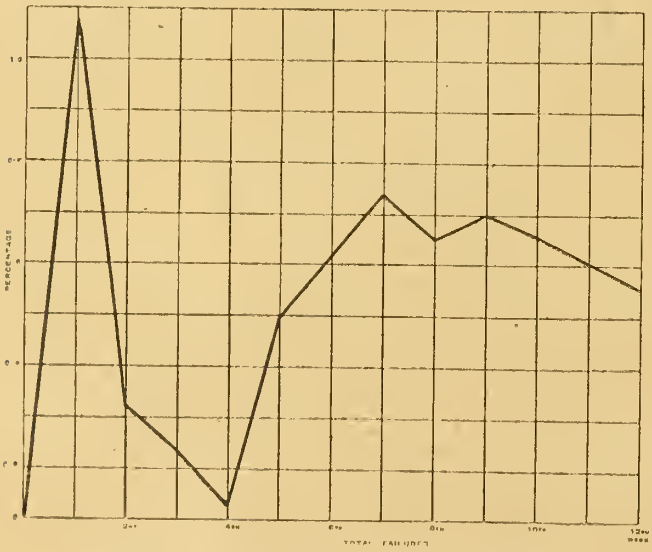
Electric Miners' Lamps.

Mr. F. Pritchard, of Messrs. Ellis & Ward, electrical engineers, Birmingham, recently brought to my notice an article on electrical miners' lamps, read by my late principal and tutor, Mr. S. F. Walker, before the Institution of Electrical Engineers in 1901.

It may appear not a little strange to rake up a subject dating so far back, but in view of the greater possibilities which the metallic-filament lamp has created, I am of opinion that one or two amendments to Mr. Walker's paper, and a few additional details of the working of the Sussmann lamp, would be of value to those interested in this branch of the electrical industry. Having been connected with the Sussmann Lamp Co., I took part in the working of a plant of 600 electric lamps at Merton Colliery, County Durham. I also installed a plant consisting of 300 lamps at another colliery, belonging, I believe, to the Durham Joicey group, situated at Fence Houses, in the same county, and later put down an experimental plant at Hyde Colliery, near Manchester.

At the outset, the results at Merton Colliery were very bad, the failures being nearer 30 per cent. than 4·25 per cent.; as given in Mr. Walker's paper. The failures were chiefly from battery troubles, due to defective positives, carelessly made and dirty connections. The next source of difficulty was the bulb item. The lamp used was eventually given up in favour of the French James lamp, which averaged 800 hours' life. In fact, the James lamp was so successful, that at Fence Houses no other make was tried.

What contributed largely to the ultimate success of the Sussmann lamp was the ability of the assistants to detect the appearance of the "star" on the filament when lighted. This put an end to lamps going out in the mine on account of filaments breaking. The "star" would invariably appear on the filament about 10 to 20 hours before the breaking point had been reached, when the bulb would be replaced by a new one, thus avoiding the chance of its breaking during working time.



Miners' Lamp Failures During 12 Weeks.

The intensity of light along the "unstarred" part of the filament was, of course, less than on the "starred" portion, which was caused by a particle of carbon having become disintegrated. Another item of importance was the adoption of acidulated water to replace loss in the cells from evaporation, bubbling over when on charge and other causes, instead of plain water, the trouble being, in the case of plain water. over dilution of the electrolyte. The cells, it must be borne in mind, were entirely enclosed save for vent holes, and being made of ebonite, the plates were out of view. After some six months, results were favourable, the percentage of failures from all causes having fallen to about 5 per cent., and later, in the light of further experience, results rapidly improved.

At this time I proceeded to install a plant of 300 lamps at Fence Houses, and these were highly successful. In fact, I was informed by the management that the question of installing electric miner's lamps throughout the whole of the collieries belonging to the group was under discussion. I enclose curve showing the results of 12 weeks' working, the curve indicating the percentage of failures from all causes. The adoption of metallic filaments would mean increased efficiency, and a lighter accumulator could be used.

The Sussmann lamp is by far the most useful pattern on the market. Suitable for the miner in many ways, it is equally adapted for rapid manipulation when being given out to the men, or when being received at the end of the shifts, when the battery has to be taken out, the case and lamp glass cleaned and placed in its position on a rack, and all the batteries charged, as fast as the miners come out of the mine. The locking arrangements, by means of lead rivets, leave little to be desired in practice. The miners will not have internal reflectors, and any lamp which does not illuminate all round will not be successful.

To protect the lights from the eyes of miners when walking in and out, or around about the mine, a tin shield is used. The Sussmann Company were compelled, under pressure from the miners' representatives, to remove the internal reflector from the lamp.

Under modern conditions, there should not be the slightest difficulty in making electrical miners' lamps a commercial success, with failures on an average not exceeding ½ per cent. The lamps could be run for less than 4½d. per lamp per week in installations of 300, while for installations of 600 lamps more favourable rates could be obtained.

Positives of the Planté type should be used, with Faure negatives; also with metallic filaments, lamps to run at 3·9 volts with detachable reflectors fitted on case. The Sussmann lamp could be made highly successful under these conditions, and would weigh less than when designed for carbon filaments.

With regard to gas-detecting apparatus, I am convinced this would be of little service, and as for primary battery electric miners' lamps, I feel bound to express the opinion that they would prove impracticable in working on a large scale.

Giraldus Jones.

Birmingham, *August* 18*th*, 1909.

X-Ray Tubes.

The query of your correspondent "Jacey" could be replied to more intelligently if there were some indication given as to the contents of his vacuum chamber, and the action taking place therein, when his apparatus is in operation.

His letter suggests that he is working at something in the nature of a Geissler tube, and in such apparatus he will find that it is practically impossible to maintain a constant degree of vacuum, probably owing to the ionising action associated with the discharge between the electrodes which, theoretically should, and does, tend to increase the degree of vacuum.

Does "Jacey" wish to use leading-in wires, and if so, what current must they be capable of carrying?

C. Orme Bastian.

August 18*th*, 1909.

Samples with Tender.

We also are glad to note that the very unreasonable requirements of the Swansea arc lamp specification are being aired in your "Correspondence" columns. We most certainly should not have applied for the specification and paid our deposit had we known beforehand that eight lamps had to be sent as samples *with the tender*, and looking at the matter from the point of view of the whole of the electrical trade, it is almost certain that the cost to th various manufacturers who tendered was more than the profit (if any) which will be made on the order. Each tenderer had to submit eight special lamps (and the "must" was emphasised in the specification), including carbons, cut-outs, &c. As detailed by "Another of the Tenderers," they had to bear the cost of carriage *both ways*, and in our case one of the lamps was returned in pieces, one or two globes were broken, and every lamp will have to be done up before being sent out again.

It seems to us that Mr. Prusmann makes out a very poor case indeed in his letter, it being a plaintive kind of epistle, saying "Please, sir, I did it for their good and now they rate at me." If Mr. Prusmann had specified that two or three of the lowest tenderers would have to send samples, and that these would have to be approved by him before the order was placed, we do not think any firm would have grumbled: but the electrical trade does not live on losses (what does it live on ?), and the Swansea arc lamp order has been a loss to the trade as a whole.

A Third Tenderer.

August 20th, 1909.

Testing Condensers for Leakage.

I have been much interested by the correspondence on this subject, partly, perhaps, because "Harbee's" method was substantially given in a paper on "Water-tube Boilers"—written by myself about two years ago—but chiefly because the problem stated by Mr. Middleton is one to which I was compelled to devote serious attention at that time, and which I think I may claim to have solved.

Like him, I have condensers under my charge which draw their circulating water from a salt supply. Up to two years ago I had experienced considerable trouble with leaky tubes which were apt to start leaking at any moment, and would quickly pass enough salt into the feed water to cause very serious priming. I had for some years used the silver nitrate test two or three times on every shift, but this involved considerable trouble and was besides insufficient, as I found that in bad cases enough salt could be passed into the system in half an hour to give rise to priming, which, among other things, necessitated washing out all the boilers on the line.

This being so, it was essential to devise an automatic method of instant detection of leakage, and I at length perfected an apparatus which will detect any such within two or three minutes of starting, and which can be adjusted to show any desired degree of leakage from 1 grain per gallon upwards. I have had it in continual operation for about 18 months, and it has never failed.

I may say this has been taken up and will shortly be put on the market by one of the best known firms of steam and fuel specialists.

R. Somerville Bayntun, A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E.

Birkenhead, *August 23rd*, 1909.

Naval Voltages.

A correspondent, writing under the initials "H. P. B.," in severely criticising an article entitled "Naval Voltages," has allowed his indignation at what he considers an insult to shipbuilding firms and Admiralty staffs alike, to carry him rather wide of the point.

As a matter of fact, the letter, which is a rough summary of the electrical equipment of one of our latest battleships, has very little bearing upon the article in question, which has for its subject matter the gradual growth of electricity in the Navy from the time when its principal use was to run the searchlight. Why the contributor's knowledge of modern ships and modern electrical matters should be so vigorously attacked is not quite clear, unless it be in order to provide an excuse for putting forward "H. P. B.'s" own knowledge of the electrical equipment of the very latest type of battleship. To imagine that the majority of ships in the Navy at the present time are built upon the lines of the latest type, is quite an erroneous view.

As a matter of fact, the letter describes the electrical equipment of the Navy as it may be expected to be in a few years' time, when the 80-volt ships have gone to the scrap-heap. The reader who wishes to see matters as they really are would scarcely be content to visit the latest "show" ship in the Fleet without also going on board other types which stand in the majority.

Here he would find that the standard of 80 volts predominated; that only in the latest types were twin searchlights fitted; that the searchlight equipment was what "H. P. B." seems to consider about 20 years stale; that the goodly number of arcs reduced itself down to two for general purposes and four temporarily rigged on such occasions as coaling ship at night. Batteries he would find largely in use for communication purposes. He would learn that wireless telegraphy had been in use in 80-volt ships long before the higher standard of voltage had appeared, and if he took the trouble to inquire in the dockyards, he would learn that the voltage still remained at 80 in the great majority of ships, but had taken a sudden leap in the later types, and had not risen by gradual stages at all. Doubtless the new standard was not fixed without due consideration of its advantages, and it can hardly be seriously imagined that it would be chosen in any haphazard manner.

Altogether, "H. P. B." seems to have gone out of his way to interpret the article into an attack upon Naval progress in electrical matters, and in order to strengthen his criticism, has found it necessary to employ personal invective, which in itself is not a logical form of argument.

The Writer of the Article.

Technical Classes Wanted in the Daytime.

Replying to your correspondent Mr. Brazier, I have for some years been attending evening classes, but, owing to being on "shift" work, have had extreme difficulty in keeping pace with other students, due to unavoidable absence every third week.

I know of many "shift" men who would welcome any arrangement whereby they could attend *regular* classes.

Esdaile Wyatt.

August 20th, 1909.

I am glad to see that such an influential journal as the Electrical Review is willing to take this matter up seriously. We hear of the educational authorities speaking of compulsory continuation classes, and the essentiality of technical education in all trades; we are told, and rightly so, too, that Germany's success and advancement is not due to her big army or her navy, but due to her advancement in technical education. This being so, I think that the governing bodies of the several colleges in London should come up to the scratch and show their earnestness to give every facility to those who are anxious to receive technical education, but who are handicapped owing to the nature of their work.

In my opinion, it is hardly probable that all obstacles which confront the "shift" worker can be entirely removed. For instance, there are three shifts—morning, evening and night shift; now, assume that these classes are held from, say, 9 a.m. till 12 noon, it is quite obvious that one of the "shifts" will be absent once every week, which means that a student could only attend two weeks out of three.

To make these classes anything like a success, the courses would have to be graduated similar to the present day and evening classes, as an elementary student would not benefit much by taking an advanced course, and likewise an advanced student could not be expected to take an elementary course. At first sight this may appear of necessity to incur a great additional expense on the governing bodies of the different colleges. But I suggest that these (shift) day students could attend the lectures given to the present day students, according to the particular course or class they proposed to take; this would eliminate the necessity of employing additional teachers. I feel sure, if the governing bodies carefully studied the courses (times of lectures, &c.) they offered, there would be a great number of men, who are at present handicapped, avail themselves of this opportunity.

J. W. Houghton.

August 23rd, 1909.

Increased Output of Boilers.

Referring to Mr. Embury McLean's letter, it is not clear how his method of fitting an automatic damper regulator to baffle the gases from boilers using forced draught can increase the output of boilers. On referring to my copy of the *Proceedings* of the American Society of Mechanical Engineers in December, 1906, I see that Mr. McLean gave several instances where boilers burning soft coal with natural draught showed increased duty and a money-saving when burning the cheaper fuel, rice or buckwheat anthracite, with forced draught; also that Prof. Kent then said:—

> I find here Mr. Embury McLean's discussion on balanced draught. I do not think it is a fair test to take an ordinary boiler and get a very low result, far below what one ought to get with that boiler in the usual conditions of everyday practice, and then publish that result in comparison with a fairly good result obtained from the same boiler when fitted with some patented appliance, claiming that the apparent saving in fuel is due to the use of that appliance.

Mr. McLean's last letter says nothing about changing from soft to hard coal; but in the instance he gives, of boilers formerly evaporating 3 to 4 lb. and now evaporating 7 to 8 lb. water per square foot of heating surface, it is noteworthy that the ratio of heating surface to grate surface is as low as 40 to 1.

It is obviously just as easy to get 8 lb. evaporation on the 40 to 1 ratio as to get 4 lb. evaporation on boilers with a ratio of 80 to 1, or to get 6 lb. with a ratio of 60 to 1; the identical fuel would be burnt in each case on the identical furnace.

No evidence is given of the claim of 15 to 16 per cent. of CO_2 in flue gases, but it is common knowledge that such a result is only possible with regular mechanical firing as well as correctly regulated draught and a good mixing method. Any attempt to cut down the air so near the theoretical minimum, with intermittent hand firing on grates, inevitably involves fuel being wastefully burnt to CO through deficiency of air when firing.

Balanced draught, using two fans, has been used for many years, and it is credibly claimed that air leakage with forced and induced draught combined is less than with induced draught alone.

But with forced draught, correctly applied, nothing can be gained by throttling the exit gases by an automatic damper regulator; there is no occasion for retarding the free outflow of gases (as Mr. McLean admits in the case of Lancashire boilers). It is doubtful if it is worth removing the ordinary baffles of a water-tube boiler, if this necessitates throttling the exit gases at the damper, with the risk of back-draughts if the automatic device gets out of order.

Regulation of draught alone, as advocated by Mr. McLean, is no substitute for correct regulation of fuel and air together, and the latter method is widely used both in Europe and America.

Scrutator.

Automatic Transformer Switch.

Your correspondents, "Engineer" and "Climax," seem agreed that the automatic transformer switch is designed to overcome the defects in bad transformers and inaccurate supply meters. If this be the case, surely it would be better to get at the root of the evil.

In the article it was not suggested that 4d. per unit was an average price for current. An examination of the "Electrical Review List of Supply Works" will show that it is impossible to get at the average price paid for current in the United Kingdom. Even did we know the figure it would be useless; for every proposed installation of an automatic switch must be judged on its own merits and circumstances.

"Engineer" apparently infers that a "glazed front" has been put in some switches, as their indifferent working is anticipated. It should be pointed out that an auto-switch must work perfectly.

Time alone will show whether manufacturers are able to produce an apparatus at a low price which will work with absolute reliability with so small a current; for unlike a clock, supply meter or similar apparatus, the switch has an appreciable amount of work to do.

If the switch is perfect, it is useful; if anything from perfect, it is useless. A single failure of a switch in the majority of cases would be sufficient to condemn it for all time.

The calculations of "Climax" are based on transformers of over 1 KW., whereas the view taken in the article, and to a certain degree upheld by "Engineer," is that there is little or no demand for an auto-switch for a transformer of more than 1 KW.; also, in an installation of the order of 3 KW., the lighting hours will probably be entirely different to the ordinary private house or small shop lighting hours.

As explained in the article, the mere fact of "Climax's" lamp having lighted does not prove that the transformer switch has "spoken." The effect of burglars, illness, or fire, also mentioned by "Climax," would certainly be very interesting, but it is extremely doubtful whether instant light would ameliorate matters.

The transformer, unfortunately, is a necessary evil. Will the addition of a delicate and somewhat complicated apparatus neutralise this? Two wrongs do not always make a right.

Student.

I have read with much interest "Student's" letter *re* the above, and the criticisms of "Engineer" and "Climax," and the figures they quote seem to prove conclusively that automatic switches have the advantage over "all-day" open-circuit losses, provided the former are reliable. My own experience does not prove in their favour, but I certainly think that the troubles which are usually met with in new electrical contrivances will soon be overcome.

I would like to point out, however, that the figures quoted for transformers are abnormally high. For instance, 500-watt coils are shown as having an open-circuit loss of 15 watts actual, the makers' figures being 10. Now these figures are ridiculous, and show that the writers are not conversant with the *present* market; 12 months ago the losses stated would have been about right.

Nowadays you can buy an auto-transformer for 500 watts for 27s., with a no-load loss of 5 to 6 watts, and this is guaranteed and never exceeded. I have assumed the ratio to be 4 to 1 up to 250 volts primary, periodicity 50. Of course, at 2 to 1 the output for same loss would be 750 watts. Also, you can buy 3,000-watt transformers for 50s. to 55s. with a 25-watt iron loss (2 to 1).

These figures (which I am prepared to stand by) will put a different complexion on the matter, and, I think, help the case for auto-transformers.

"Engineer" remarks that the ordinary house meter will often read 50 per cent. fast with a small amount of energy passing, but I know for a fact that a lot of meters now installed will not "start up" at all, although I would not like to give this as an argument in favour of

Iron Losses.

Inquirer "J. W. G." has not sent his name and address.

MAGNETIC TESTS OF COMMON AND SILICON STEEL.*

A circular issued under the date of June 1st by the Bureau of Standards, Washington, on the subject of magnetic testing, sets forth the scope of the Bureau in this line of work, and includes a description of the methods employed and a schedule of fees. Two tables are printed in the circular which give the results of the magnetic tests of ordinary steel and of silicon steel. It is pointed out that ordinary sheet steel in common use varies very widely in its magnetic qualities, and that the quality is not closely related to the cost. While the watt loss when tested with alternating current varies in the case of ordinary steel from 1·25 to 2·36 watts per pound for sheets of No. 29 gauge, at a frequency of 60 cycles and a magnetic induction of 10,000 gausses, silicon steel varies only from 0·66 to 1 watt per pound under the same conditions. In addition to this variarion, there is a great difference in the constancy of magnetic properties with time. Some metals show very decided ageing, which in one case amounted to as much as 67 per cent. in 500 hours; other specimens, including most silicon steels, show little or no variation with use.

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* N.Y. *Electrical World.*

As to the commercial significance of the tests, the design of a 5-KW. transformer is taken for an illustration. If, instead of material showing a core loss of 45 watts, another showing a core loss of 32·2 watts is taken, the saving in operation for 8 760 hours, or one year, amounts to 112-KW. hours. At a cost of 1 cent per KW.-hour, this amounts to $1·12, which at 10 per cent., allowing for depreciation as well as interest, represents a capital of $11·20; in other words, the buyer could, with advantage, pay any amount up to $11 more for the sake of getting better material in his core, and the manufacturer could pay 28 cents per pound more for the 40 lb. of material used. If the better silicon steel were to cost 2·8 cents more than the other (which is improbable), the difference in cost of the steel would be $1·12, and the user would each year save 100 per cent. of extra cost.

The comparison between the power silicon steel and the ordinary steel is even more marked. In a case cited the difference in core loss would be the equivalent of $2·45 per year, thus practically reducing the value of the transformer by $24·50; yet the difference in cost of the material is only $2·70 if the price of silicon steel delivered at the factory is taken at 7½ cents per pound, and that of ordinary steel at 3¼ cents per pound, assuming 40 lb. to be necessary.

INCOME-TAX ASSESSMENT.

Allowances for Depreciation.

The following is an abstract from the official arrangement made between the Tramways and Light Railways Association and the Board of Inland Revenue with respect to allowances for depreciation in electric tramway and lighting undertakings for the purpose of income-tax assessment. This scheme applies to municipalities as well as to companies:—

Tramways.

Permanent-Way.—Allowance for Maintenance to Cover Depreciation.

Life.

1. The life of the permanent-way is to be taken as 12, 14, or 16 years, according to the traffic thereon. The classification is to be based on the average car-mileage per mile of track per annum of the financial year preceding the year of assessment, viz.:—

(1) Not exceeding 50,000 car-mile per mile of track—16 years.
(2) Over 50,000 and not exceeding 75,000 car-miles per mile of track—14 years.
(3) Over 75,000 and not exceeding 125,000 car-miles per mile of track—12 years.
(4) Over 125,000 car-miles per mile of track—special consideration.

2. Where there are special circumstances, such as exceptional gradients, and the compulsory use of wood-paving, &c., tending to show that the car-mileage does not fairly represent the wear-and-tear of the track, each such case is entitled to special consideration.

Cost of Renewals.

3. The cost of renewals, including setts or other paving, but excluding concrete foundations, should be taken at £4,400 per mile of single track until the general renewal of the track takes place.

Basis of Computation of Depreciation Allowance.

4. No allowance should be made in computing the assessable profits in respect of any expenditure on repairs or maintenance of the permanent-way, but the allowance for depreciation should be computed at such a sum per annum as will in the aggregate, over the determined life of the permanent-way, be equal to the cost of renewal as above fixed, plus the estimated repairs for that period:—

Cost of renewal per mile as above	£4,400
Add, for example:	
Estimated cost of repairs at £100 per mile per annum, for an undertaking with a life of 16 years	1,600
	£6,000
Amount to be allowed per annum in lieu of depreciation, $\frac{1}{16}$th	375

5. The amount to be added in respect of ordinary repairs should be determined by taking the actual average expenditure as shown in the accounts of the undertaking for *the last three years*, or such period less than three years, as the undertaking has been in existence.

6. Repairs under this head should be understood to include renewals of special track-work at junctions and cross-overs, which occur at frequent intervals.

Periodical Adjustment.

7. Inasmuch as the expenditure on repairs is expected to increase as the track begins to wear, in which case the figure to be adopted under this head, which is to be based on past experience, will be unsatisfactory, the amount of such estimate should come up for revision at the end of every five years, and an adjustment should be made by increasing or diminishing the allowance as the circumstances require, having regard to the basis of calculation outlined above.

8. A strict account should be kept by the corporation and the surveyor of the annual allowances and of the actual expenditure on repairs and renewals; and at the end of 10 or 15 years (*i.e.*, the second or third revision), or at such time as the general renewal of the track shall have taken place, the amount to be annually allowed should be reconsidered and increased or diminished for succeeding years as the ascertained facts shall show to be necessary, provided that under no circumstances shall the allowances for previous years be re-opened.

9. All expenditure on extensions and improvements should be excluded from the working expenses for income-tax purposes; and the necessary additional allowance for depreciation on the lines suggested above (*i.e.*, mileage) should be at once allowed on such expenditure, and added to the sum already allowable.

10. The allowance of £4,400 for renewal of permanent-way mentioned above is intended to apply to the overhead trolley system. Special arrangements should be made, on the lines of the foregoing, in the case of the conduit, surface contact, or other system. The number of such cases is very small. As the circumstances vary very considerably in each case, the amount to be allowed for renewals should in the first instance be arrived at by arrangement with the Chief Inspector of Taxes.

Cables.

11. In addition to repairs, depreciation should be allowed at the rate of 3 per cent. per annum on the written-down value.

Overhead Equipment—i.e., Trolley Wires and Connections.

12. No depreciation should be allowed; all expenditure on maintenance and renewals should be charged as working expenses, as and when incurred.

Cars and other Rolling Stock.

13. Subject to the ensuing clause, expenditure on maintenance and renewals should be treated as working expenses, and allowed in lieu of depreciation.

14. Depreciation, however, should be allowed in lieu of renewals where the circumstances justify such an allowance, provided that a strict account is kept of all renewals, and that if such renewals are charged to revenue account they shall be shown separately in such account and added back in computing the assessable profits.

15. The allowance in such case should be 7 per cent. per annum on the written-down value.

16. In any case, the annual expenditure on repairs is to be allowed as a deduction in computing the assessable profits.

General Plant and Machinery.

17. All other plant and machinery, including standards, brackets, and workshop tools, but excluding loose implements, office furniture, and small articles which require frequent renewal, should be bulked together and depreciation allowed thereon at the rate of 5 per cent. per annum on the written-down value, in addition to the cost of repairs.

Electric Lighting Undertakings.

Cables.

21. In addition to repairs, allowance for depreciation may be granted at the rate of 3 per cent. per annum on the written-down value.

Plant and Machinery.

22. On all other plant, exclusive of loose tools, meters, and office furniture, depreciation may be allowed at the rate of 5 per cent. per annum on the written-down value, in addition to the cost of repairs.

Conduits.

23. No allowance should be made for depreciation, but annual expenditure on repairs and renewals may be allowed as working expenses, as and when incurred.

Meters, Loose Tools and Office Furniture.

24. No allowance should be made for depreciation; but annual expenditure on repairs and renewals may be allowed as working expenses, as and when incurred.

General.

25. In all cases where depreciation allowances are granted, a strict account should be kept of the annual expenditure on renewals (and repairs in the case of tramway tracks), including replacements due to obsolescence, and of the amounts allowed for depreciation and obsolescence, whether under this arrangement, or under any arrangement made prior hereto, and a readjustment should be made for the future, if necessary, at the end of every five years, as detailed under Tramways (Permanent Way), subject, however, to the special provisions applicable to Tramways (Permanent Way).

26. Where depreciation allowances other than those for the permanent way of tramways are granted, renewals should be carefully distinguished, and, if charged against revenue, they should be notified to the surveyor, in order that they may be added back in arriving at the income-tax liability.

27. "Written down value" means original prime cost, plus subsequent additions, less all allowances actually granted by the revenue in respect of wear and tear.

28. These proposals are to take effect for the year 1908-9, and for years preceding in cases where claims of depreciation are at the present time awaiting settlement.

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29. The computations necessary for any future adjustment should be duly made, agreed and recorded each year, whether the accounts for the particular year under review show any assessable income-tax liability or not.

30. Where, in any cases, allowances for depreciation have been made which are now to be discontinued, and they have not been exhausted by renewals already effected, the amount of such unexhausted allowances should be determined by agreement between the surveyor and the corporation or company, and deducted from the expenditure on future renewals as and when they are effected.

31. All cases of dispute should be referred to the Board through the chief inspector of taxes.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A New Arc Lamp Winch.

The North-Western Electrical Appliance Co., of Cathcart, Glasgow, who, as our readers are aware, are manufacturers of arc lamp gear and accessories, have recently placed on the market an arc lamp winch of considerable merit.

Our illustration shows all the parts of this winch, in which a coiled spring replaces the frequently numerous parts in the ingenious winches to which our readers may have noticed references in these columns during the past year or two. The winch is self-sustaining, and direct winding and unwinding; it gives a sensitive feel, thus preventing overstraining of ropes; it also allows rapid winding and unwinding, and freedom from sudden jars. Its simplicity is a great point in its favour; no adjustment being required for varying weights between 2 and 100 lb.

Our London readers will be able to examine this new winch as also the several other types which the North-Western Co. have placed on the market, at the headquarters of the Globe Electric Co., 11, Farringdon Avenue, E.C. The Globe Electric Co. have been appointed sole agents for the North-Western Co., for London and provinces South of the Midlands, as well as for export work.

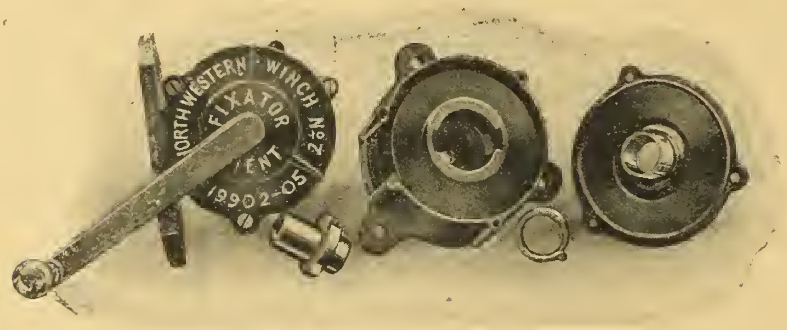


Fig. 1.—The "Fixator" Arc Lamp Winch.

"Whipall" Electric Tire Pump.

The rapid and continued increase in the number of motor vehicles has created an urgent demand for a reliable power-driven tire pump, as the hand pump is altogether inadequate in establishments where the expeditious turning out of cars is a necessity. The "Whipall" electric tire pump supplied by Mr. E. E. Coy, 77, St. John's Road, Bootle, has been specially designed and put on the market to meet this demand. As will be seen from fig. 2, the apparatus consists of an electromotor geared direct to a reciprocating air compressor, mounted on a substantial cast-iron base, and entirely enclosed in a strong iron case. Amongst the special features of this pump are the oil filter or arrester, which the makers inform us effectually prevents any trace of oil from passing into the tires (a point of vital importance) and which we understand is easily cleaned and adjusted; also to obviate the risk of tires being strained or damaged, an automatic adjustable safety valve is fitted, to act at any predetermined pressure, as shown on a gauge, visible on the outside of the containing case. Both the filter and gauge are readily accessible. The air tube is provided with a patent connector fitting any tire valve, the connection being made by simply pushing the connector over the valve nozzle, without the necessity of screwing, thus saving what is often very valuable time.

The set is supplied with an ample length of steel armoured flexible twin cable, fitted with bayonet or pin plug adapter, and switch.

The outfit is specially designed to stand rough usage and is practically fool-proof, quite portable, and supplied for all voltages. The motor is made to stand heavy overloads such as would be caused by choked tire valves, and is capable of fully inflating the standard motor cab tire in 90 seconds on an energy consumption of about 250 watts.

As a quick, reliable and ready means of tire inflating, the makers claim that their pump is unequalled by any other apparatus at present on the market, and the advantages of the electrical drive are obvious.

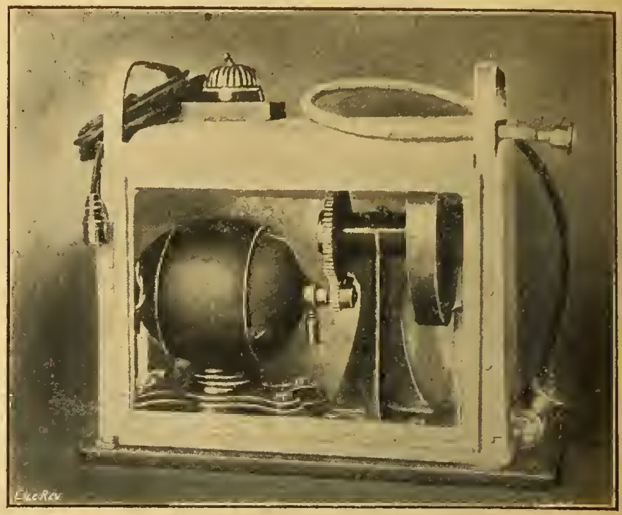


Fig. 2.—The "Whipall" Electric Tire Pump.

An Oil-Immersed Motor-Starter.

We illustrate a new type of motor-starter now being put on the market by Messrs. Reyrolle, of Hebburn-on-Tyne. It has been found that there is a considerable demand for small capacity starters, at a price, at which the firm cannot supply their patent resistance type, and this new design has been produced to meet the case.

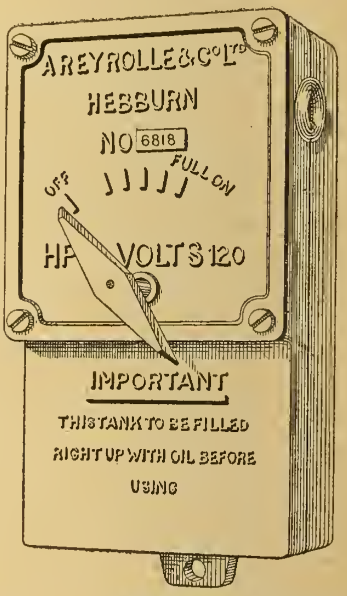


Fig. 3.—Small Oil Immersed Motor Starter.

These oil-immersed starters are made in two sizes only, namely, up to ½-h.p. and up to 2-h.p., and, as the ½-h.p. starter is only 9½ in. high, it is clear that the design is particularly compact.

The resistance consists of wire immersed in oil, and the starter can be operated 15 or 20 times an hour, without injury. An important feature is, that all the contacts are placed in a strong magnetic field, and owing to the entire absence of sparking, no trouble is experienced due to blackening and burning of the contacts.

The present design provides for no-voltage release only, as Messrs. Reyrolle have found that the demand for double automatic starters in these small sizes is decidedly limited. The design is simple as well as cheap, and capable of rapid production in quantities.

Simplex Porcelain Fuses.

Messrs. Simplex Conduits, Ltd., are energetically pushing the supply of distribution boards, fuses and fuse wires. In the latter direction special efforts are being made to meet the very large demand which exists. Our illustration, fig. 4, shows a large extruding press, weighing considerably over 10 tons, which has recently been installed at their Garrison Lane works for the purpose of the manufacture of fuse wire. The working pressure on the ram is 400 tons, and the press is fed by a vertical pump working at a pressure of 2 tons to the square inch. The press has been specially designed with a view to the peculiar requirements of the case. The fitting of special safety valves and facilities for rapid recharging with metal alloy, from which the fuse wire is made, contribute to make it one of the most up-to-date extruding presses yet designed. The molten metal is poured into a container, and maintained in liquid form by means of gas rings. The control is simple and effective, and the pump actuating the press is driven by an electric motor. With the latest and most up-to-date improvements, the firm claim to be able to supply fuse wire at strictly competitive prices, and to undertake large contracts for same.

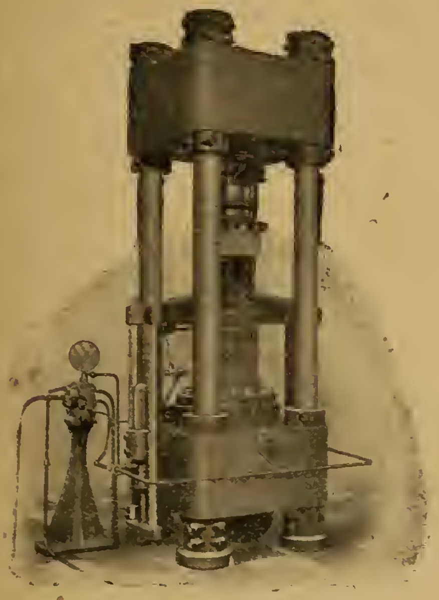


Fig. 4.—Special Press for Producing Simplex Fuse Wire.

A new form of fuse carrier, just introduced, departs only slightly from the standard design at present so popular. The fuse will fit any type of board of standard dimensions, and permits fuses being easily and safely renewed by unskilled persons. In our illustration of this fuse carrier the indicator, coloured red, is shown on the front at the hole on the front view when fuse is blown. The fuse wire is carried at the back, well out of the way, and the spring of the indicator is attached to the fuse wire by means of a hook provided. Two wing nuts bind down the fuse wire, and render replacements an easy matter.

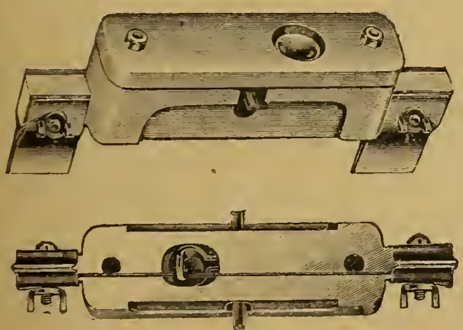
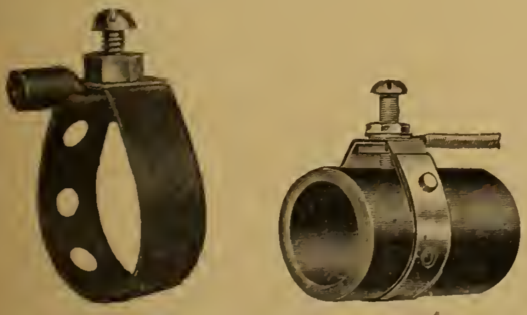


Fig. 5.—Indicating Porcelain Fuse Bridge.

An American Ground Clamp.

The improved Blackburn Ground Clamp is being introduced into this country by the Bureau of American Manufacturers, of 17-20, West Smithfield, E.C.; on the other side it is used for connecting ground wires to pipes.



Figs. 6 and 7.—Blackburn Ground Clamps.

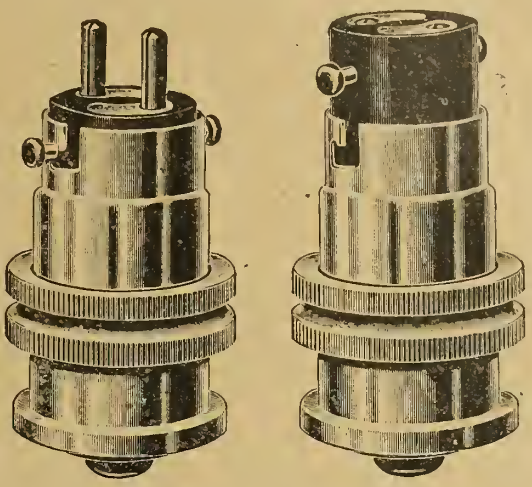
The illustrations show the arrangement, which consists of a flexible metal strap, which can be cut to any required length and looped round the pipe; the screw is then inserted through convenient holes and tightened up against the pipe, the ground wire being subsequently secured by the nut shown. It is claimed that the strap chafes the pipe when being tightened and thereby secures good electrical contact.

Special shoes are provided, if desired, for insertion between screw and pipe, to prevent injury to the latter.

Combined Wall and Lamp Plug.

Messrs. Jones & Meakin Ltd., of 28, Birkbeck Bank Chambers, Holborn, W.C., have recently placed on the market an ingenious combination wall and lamp plug, which we illustrate herewith in its double capacity.

The essential feature of the device is the central sliding ebonite block which carries the contacts and pins for the lamp socket (fig. 9), and which when pushed home (against two springs) and secured in exactly the same way as a lamp, causes two split pins to project for use with wall sockets &c. (fig. 8). The illustrations show clearly the nature of the fitting, which is solidly and carefully constructed, and, moreover, moderate in price.



Figs. 8 & 9.—The "Perfect" Combined Wall and Lamp Plug.

It is known as the "Perfect" combined wall and lamp plug and is being patented by the makers.

BRITISH ASSOCIATION MEETING AT WINNIPEG.

Address by Prof. Sir J. J. Thomson, M.A., LL.D., D.Sc., F.R.S., President.

(Delivered on Wednesday, August 25th.)

Twenty-five years ago a great change was made in the practice of the British Association. From the foundation of our Society until 1884 its meetings had always been held in the British Isles; in that year, however, the Association met in Montreal, and a step was taken which changed us from an insular into an Imperial Association.

This year, for the third time in a quarter of a century, we are meeting in Canada. As if to give us an object lesson in the growth of Empire, you in Winnipeg took the opportunity at our first meeting in Canada in 1884 to invite our members to visit Manitoba and see for themselves the development of the Province at that time. Those who were fortunate enough to be your guests then as well as now are confronted with a change which must seem to them unexampled and almost incredible. Great cities have sprung up, immense areas have been converted from prairies to prosperous farms, flourishing industries have been started, and the population has quadrupled. As the president of a scientific Association I hope I may be pardoned if I point out that even the enterprise and energy of your people and the richness of your country would have been powerless to effect this change without the resources placed at their disposal by the labours of men of science.

I have had the privilege of having as pupils students from your Universities as well as from those of New Zealand, Australia and the United States, and have thus had opportunities of comparing the effect on the best men of the educational system in force at your Universities with that which prevails in the older English Universities. As the result, I have come to the conclusion that there is a good deal in the latter system which you have been wise not to imitate. The chief evil from which we at Cambridge suffer, and which you have avoided, is, I am convinced, the excessive competition for scholarships which confronts our students at almost every stage of their education. The colleges in the University of Cambridge alone give more than £35,000 a year in scholarships to undergraduates, and I suppose the case is much the same at Oxford. The result of this is that preparation for these scholarships dominates the education of the great majority of the cleverer boys who come to these Universities. The preparation for the scholarship too often means that about two years before the examination the boy begins to specialise, and from the age of 16 does little else than the subject, be it mathematics, classics or natural science, for which he wishes to get a scholarship; then, on entering the University, he spends three or four years studying the same subject before he takes his degree, when his real life work ought to begin. How has his training fitted him for this work? Though he has acquired knowledge, the effect of studying one subject, and one subject only, for so long a time, is too often to dull his enthusiasm for it, and he begins research with much of his early interest and keenness evaporated. Now there is hardly any quality more essential to success in research than enthusiasm. Research is difficult, laborious, often disheartening.

I am convinced that no greater evil can be done to a young man than to dull his enthusiasm. In a very considerable experience of students of physics beginning research, I have met with more—many more—failures from lack of enthusiasm and determination than from any lack of knowledge or of what is usually known as cleverness.

The premature specialisation fostered by the preparation for these scholarships injures the student by depriving him of adequate literary culture, while when it extends, as it often does, to specialisation in one or two branches of science, it retards the progress of science by tending to isolate one science from another. The boundaries between the sciences are arbitrary, and tend to disappear as science progresses.

Again, the specialisation prevalent in schools often prevents students of science from acquiring sufficient knowledge of mathematics; it is true that most of those who study physics do some mathematics, but I hold that, in general, they do not do enough, and that they are not as efficient physicists as they would be if they had a wider knowledge of that subject. There seems at present a tendency in some quarters to discourage the use of mathematics in physics; indeed, one might infer, from the statements of some writers in quasi-scientific journals, that ignorance of mathematics is almost a virtue. If this is so, then surely of all the virtues this is the easiest and most prevalent.

Two points of view are better than one, and the physicist who is also a mathematician possesses a most powerful instrument for scientific research with which many of the greatest discoveries have been made; for example, electric waves were discovered by mathematics long before they were detected in the laboratory. He has also at his command a language clear, concise, and universal, and there is no better way of detecting ambiguities and discrepancies in his ideas than by trying to express them in this language. Again, it often happens that we are not able to appreciate the full significance of some physical discovery until we have subjected it to mathematical treatment, when we find that the effect we have discovered involves other effects which have not been detected, and we are able by this means to duplicate the discovery.

Pure mathematicians have been indebted to the study of concrete problems for the origination of some of their most valuable conceptions. Most of us need to tackle some definite difficulty before our minds develop whatever powers they possess, and I think the moral to be drawn is that we should aim at making the education in our schools as little bookish and as practical and concrete as possible.

It is possible to read books, to pass examinations, without the higher qualities of the mind being called into play. Indeed, I doubt if there is any process in which the mind is more quiescent than in reading without interest.

I think it was Helmholtz who said that often in the course of a research more thought and energy were spent in reducing a refractory piece of brass to order than in devising the method or planning the scheme of campaign. This constant need for thought and action gives to original research in any branch of experimental science great educational value even for those who will not become professional men of science. I have had considerable experience with students beginning research in experimental physics, and I have always been struck by the quite remarkable improvement in judgment, independence of thought and maturity produced by a year's research. Research develops qualities which are apt to atrophy when the student is preparing for examinations, and, quite apart from the addition of new knowledge to our store, is of the greatest importance as a means of education.

It is the practice in many universities to make special provision for the reception of students from other universities who wish to do original research or to study the more advanced parts of their subject, and considerable numbers of such students migrate from one university to another. I think it would be a good thing if this practice were to extend to students at an earlier stage in their career; especially should I like to see a considerable intercharge of students between the universities in the Mother Country and those in the Colonies.

The period which has elapsed since the Association last met in Canada has been one of almost unparalleled activity in many branches of physics, and many new and unsuspected properties of matter and electricity have been discovered. The history of this period affords a remarkable illustration of the effect which may be produced by a single discovery; for it is, I think, to the discovery of the Rontgen rays that we owe the rapidity of the progress which has recently been made in physics. A striking discovery like that of the Röntgen rays acts much like the discovery of gold in a sparsely populated country; it attracts workers who come in the first place for the gold, but who may find that the country has other products, other charms, perhaps even more valuable than the gold itself. The country in which the gold was discovered in the case of the Rontgen rays was the department of physics dealing with the discharge of electricity through gases, a subject which, almost from the beginning of electrical science, had attracted a few enthusiastic workers, who felt convinced that the key to unlock the secret of electricity was to be found in a vacuum tube. It is not to the power of probing dark places, important though this is, that the influence of Röntgen rays on the progress of science has mainly been due; it is rather because these rays make gases, and, indeed, solids and liquids, through which they pass conductors of electricity.

The study of gases exposed to Röntgen rays has revealed in such gases the presence of particles charged with electricity; some of these particles are charged with positive, others with negative electricity.

The properties of these particles have been investigated; we know the charge they carry, the speed with which they move under an electric force, the rate at which the oppositely charged ones recombine, and these investigations have thrown a new light, not only on electricity, but also on the structure of matter.

We know from these investigations that electricity, like matter, is molecular in structure, that just as a quantity of hydrogen is a collection of an immense number of small particles called molecules, so a charge of electricity is made up of a great number of small charges, each of a perfectly definite and known amount.

The great advantage of the electrical methods for the study of the properties of matter is due to fact that whenever a particle is electrified it is very easily identified, whereas an uncharged molecule is most elusive; and it is only when these are present in immense numbers that we are able to detect them.

We can by the electrical method detect the presence of three or four charged particles in a cubic centimetre. Rutherford has shown that we can detect the presence of a single α particle. Now the particle is a charged atom of helium; if this atom had been uncharged we should have required more than a million million of them, instead of one, before we should have been able to detect them.

We have already made considerable progress in the task of discovering what the structure of electricity is. We know that negative electricity is made up of units, all of which are of the same kind; that these units are exceedingly small compared with even the smallest atom, for the mass of the unit is only $\frac{1}{1700}$ part of the mass of an atom of hydrogen; that its radius is only 10^{-13} centimetre, and that these units, "corpuscles" as they have been called, can be obtained from all substances. The size of these corpuscles is on an altogether different scale from that of atoms; the volume of a corpuscle bears to that of the atom about the same relation as that of a speck of dust to the volume of this room. Under suitable conditions they move at enormous speeds which approach in some instances the velocity of light. The whole of the mass of the corpuscle arises from its charge.

We know a great deal about negative electricity; what do we know about positive electricity? In the first place, we find that the positive particles—"canalstrahlen"—discovered by Dr. Goldstein, which are found when an electric discharge passes through a highly rarefied gas, are, when the pressure is very low, the same, whatever may have been the gas in the vessel to begin with.

Some experiments made lately by Wellisch, in the Cavendish Laboratory, strongly support the view that there is a definite unit of positive electricity independent of the gas from which it is derived. These and similar results lead to the conclusion that the atoms of the different chemical elements contain definite units of positive as well as of negative electricity, and that the positive electricity, like the negative, is molecular in structure.

The investigations made on the unit of positive electricity show that it is of quite a different kind from the unit of negative. The mass of the negative unit is exceedingly small compared with any atom; the only positive units that up to the present have been detected are quite comparable in mass with the mass of an atom of hydrogen; in fact, they seem to equal it. This makes it more difficult to be certain that the unit of positive electricity has been isolated, for we have to be on our guard against its being a much smaller body attached to the hydrogen atoms which happen to be present in the vessel. If the positive units have a much greater mass than the negative ones, they ought not to be so easily deflected by magnetic forces when moving at equal speeds; and in general the insensibility of the positive particles to the influence of a magnet is very marked; though there are cases when the positive particles are much more readily deflected, and these have been interpreted as proving the existence of positive units comparable in mass with the negative ones. I have found, however, that in these cases the positive particles are moving very slowly, and that the ease which they are deflected is due to the smallness of the velocity and not to that of the mass. At present the smallest positive electrified particles of which we have direct experimental evidence have masses comparable with that of an atom of hydrogen.

A knowledge of the mass and size of the two units of electricity, the positive and the negative, would give us the material for constructing what may be called a molecular theory of electricity, and would be a starting-point for a theory of the structure of matter; for the most natural view to take, as a provisional hypothesis, is that matter is just a collection of positive and negative units of electricity, and that the forces which hold atoms and molecules together, the properties which differentiate one kind of matter from another, all have their origin in the electrical forces exerted by positive and negative units of electricity, grouped together in different ways in the atoms of the different elements.

As it would seem that the units of positive and negative electricity are of very different sizes, we must regard matter as a mixture containing systems of very different types, one type corresponding to the small corpuscle, the other to the large positive unit.

Since the energy associated with a given charge is greater the smaller the body on which the charge is concentrated, the energy stored up in the negative corpuscles will be far greater than that stored up by the positive. The amount of energy which is stored up in ordinary matter in the form of the electrostatic potential energy of its corpuscles is, I think, not generally realised. All substances give out corpuscles, so that we may assume that each atom of a substance contains at least one corpuscle. From the size and the charge on the corpuscle, both of which are known, we find that each corpuscle has 8×10^{-7} ergs of energy; this is on the supposition that the usual expressions for the energy of a charged body hold when, as in the case of a corpuscle, the charge is reduced to one unit. Now, in one gramme of hydrogen there are about 6×10^{23} atoms, so if there is only one corpuscle in each atom, the energy due to the corpuscles in a gramme of hydrogen would be 48×10^{16} ergs, or 11×10^{9} calories. This is more than seven times the heat developed by one gramme of radium, or by the burning of 5 tons of coal. Thus we see that even ordinary matter contains enormous stores of energy; this energy is, fortunately, kept fast bound by the corpuscles; if, at any time, an appreciable fraction were to get free, the earth would explode and become a gaseous nebula.

The matter of which I have been speaking so far is the material which builds up the earth, the sun, and the stars, the matter studied by the chemist, and which he can represent by a formula; this matter occupies, however, but an insignificant fraction of the universe, it forms but minute islands in the great ocean of the ether, the substance with which the whole universe is filled.

The ether is not a fantastic creation of the speculative philosopher; it is as essential to us as the air we breathe. For we must remember that we on this earth are not living on our own resources: we are dependent from minute to minute upon what we are getting from the sun, and the gifts of the sun are conveyed to us by the ether. To the sun we owe not merely night and day, springtime and harvest; it is the energy of the sun, stored up in coal, in waterfalls, in food, that practically does all the work of the world.

How great is the supply the sun lavishes upon us becomes clear when we consider that the heat received by the earth under a high sun and a clear sky is equivalent, according to the measurements of Langley, to about 7,000 H.P. per acre. Though our engineers have not yet discovered how to utilise this enormous supply of power, they will, I have not the slightest doubt, ultimately succeed in doing so; and when coal is exhausted and our water-power inadequate, it may be that this is the source from which we shall derive the energy necessary for the world's work. When that comes about, our centres of industrial activity may perhaps be transferred to the burning deserts of the Sahara, and the value of land may be determined by its suitability for the reception of traps to catch sunbeams.

This energy, in the interval between its departure from the sun and its arrival at the earth, must be in the space between them. Thus this space must contain something which, like ordinary matter, can store up energy, which can carry at an enormous pace the energy associated with light and heat, and which can, in addition, exert the enormous stresses necessary to keep the earth circling round the sun and the moon round the earth.

The study of this all-pervading substance is, perhaps, the most fascinating and important duty of the physicist.

On the electromagnetic theory of light, now universally accepted, the energy streaming to the earth travels through the ether in electric waves; thus practically the whole of the energy at our disposal has, at one time or another, been electrical energy. The ether must, then, be the seat of electrical and magnetic forces. We know, thanks to the genius of Clerk Maxwell, the founder and inspirer of modern electrical theory, the equations which express the relation between these forces; although, for some purposes, these are all we require, yet they do not tell us very much about the nature of the ether.

Is the ether dense or rare? Has it a structure? Is it at rest or in motion? are some of the questions which force themselves upon us.

Let us consider some of the facts known about the ether. When light falls on a body and is absorbed by it, the body is pushed forward in the direction in which the light is travelling, and if the body is free to move it is set in motion by the light. Now it is a fundamental principle of dynamics that when a body is set moving in a certain direction, or, to use the language of dynamics, acquires momentum in that direction, some other mass must lose the same amount of momentum; in other words, the amount of momentum in the universe is constant. Thus when the body is pushed forward by the light some other system must have lost the momentum the body acquires, and the only other system available is the wave of light falling on the body; hence we conclude that there must have been momentum in the wave in the direction in which it is travelling. Momentum, however, implies mass in motion. We conclude, then, that in the ether through which the wave is moving there is mass moving with the velocity of light. The experiments made on the pressure due to light enable us to calculate this mass, and we find that in a cubic kilometre of ether carrying light as intense as sunlight is at the surface of the earth, the mass moving is only about one-fifty-millionth of a milligramme. We must be careful not to confuse this with the mass of a cubic kilometre of ether; it is only the mass moved when the light passes through it; the vast majority of the ether is left undisturbed by the light. Now, on the electromagnetic theory of light, a wave of light may be regarded as made up of groups of lines of electric force moving with the velocity of light; and if we take this point of view we can prove that the mass of ether per cubic centimetre carried along is proportional to the energy possessed by these lines of electric force per cubic centimetre, divided by the square of the velocity of light. But though lines of electric force carry some of the ether along with them as they move, the amount so carried, even in the strongest electric fields we can produce, is but a minute fraction of the ether in their neighbourhood.

This is proved by an experiment made by Sir Oliver Lodge in which light was made to travel through an electric field in rapid motion. If the electric field had carried the whole of the ether with it, the velocity of the light would have been increased by the velocity of the electric field. As a matter of fact no increase whatever could be detected, though it would have been registered if it had amounted to one-thousandth part of that of the field.

The ether carried along by a wave of light must be an exceedingly small part of the volume through which the wave is spread. Part of this volume are in motion, but by far the greater part is at rest; thus in the wave front there cannot be uniformity, at some parts the ether is moving, at others it is at rest—in other words, the wave front must be more analogous to bright specks on a dark ground than to a uniformly illuminated surface.

The place where the density of the ether carried along by an electric field rises to its highest value is close to a corpuscle, for round the corpuscles are by far the strongest electric fields of which we have any knowledge. We know the mass of the corpuscle, we know from Kaufmann's experiments that this arises entirely from the electric charge, and is therefore due to the ether carried along with the corpuscle by the lines of force attached to it.

A simple calculation shows that one-half of this mass is contained in a volume seven times that of a corpuscle. Since we know the volume of the corpuscle as well as the mass, we can calculate the density of the ether attached to the corpuscle; doing so, we find it amounts to the prodigious value of about 5×10^{10}, or about 2,000 million times that of lead. Sir Oliver Lodge, by somewhat different considerations, has arrived at a value of the same order of magnitude.

Thus around the corpuscle ether must have an extravagant density; whether the density is as great as this in other places depends upon whether the ether is compressible or not. If it is compressible, then it may be condensed round the corpuscles, and there have an abnormally great density; if it is not compressible, then the density in free space cannot be less than the number I have just mentioned.

With respect to this point we must remember that the forces acting on the ether close to the corpuscle are prodigious. If the ether were, for example, an ideal gas whose density increased in proportion to the pressure, however great the pressure might be, then if, when exposed to the pressures which exist in some directions close to the corpuscle, it had the density stated above, its density under atmospheric pressure would only be about 8×10^{-16}, or a cubic kilometre would have a mass less than a gramme; so that instead of being almost incomparably denser than lead, it would be almost incomparably rarer than the lightest gas.

I do not know at present of any effect which would enable us to determine whether ether is compressible or not. And although at first sight the idea that we are immersed in a medium almost infinitely denser than lead might seem inconceivable, it is not so if we remember that in all probability matter is composed mainly of holes. We may, in fact, regard matter as possessing a bird-cage kind of structure in which the volume of the ether disturbed by the wires when the structure is moved is infinitesimal in comparison with the volume enclosed by them. If we do this, no difficulty arises from the great density of the ether; all we have to do is to increase the distance between the wires in proportion as we increase the density of the ether.

Let us now consider how much ether is carried along by ordinary matter, and what effects this might be expected to produce.

The simplest electrical system we know, an electrified sphere, has attached to it a mass of ether proportional to its potential energy, and such that if the mass were to move with the velocity of light its kinetic energy would equal the electrostatic potential energy of the particle. This result can be extended to any electrified system, and it can be shown that such a system binds a mass of the ether proportional to its potential energy. Thus a part of the mass of any system is proportional to the potential energy of the system.

The question now arises, Does this part of the mass add anything to the weight of the body? If the ether were not subject to gravitational attraction it certainly would not; and even if the ether were ponderable, we might expect that as the mass is swimming in a sea of ether it would not increase the weight of the body to which it is attached. But if it does not, then a body with a large amount of potential energy may have an appreciable amount of its mass in a form which does not increase its weight, and thus the weight of a given mass of it may be less than that of an equal mass of some substance with a smaller amount of potential energy. Thus the weights of equal masses of these substances would be different. Now, experiments with pendulums, as Newton pointed out, enable us to determine with great accuracy the weights of equal masses of different substances. Newton himself made experiments of this kind, and found that the weights of equal masses were the same for all the materials he tried. Bessel, in 1830, made some experiments on this subject which are still the most accurate we possess, and he showed that the weights of equal masses of lead, silver, iron, brass did not differ by as much as one part in 60,000.

The substances tried by Newton and Bessel did not, however, include any of those substances which possess the marvellous power of radio-activity; the discovery of these came much later, and is one of the most striking achievements of modern physics.

These radio-active substances are constantly giving out large quantities of heat, presumably at the expense of their potential energy; thus when these substances reach their final non-radio-active state their potential energy must be less than when they were radio-active. Prof. Rutherford's measurements show that the energy emitted by one gramme of radium in the course of its degradation to non-radio-active forms is equal to the kinetic energy of a mass of $\frac{1}{13}$th of a milligramme moving with the velocity of light.

This energy, according to the rule I have stated, corresponds to a mass of $\frac{1}{13}$th of a milligramme of the ether, and thus a gramme of radium in its radio-active state must have at least $\frac{1}{13}$th of a milligramme more of ether attached to it than when it has been degraded into the non-radio-active forms. Thus if this ether does not increase the weight of the radium, the ratio of mass to weight for radium would be greater by about one part in 13,000 than for its non-radio-active products.

I attempted several years ago to find the ratio of mass to weight for radium by swinging a little pendulum, the bob of which was made of radium. I had only a small quantity of radium, and was not, therefore, able to attain any great accuracy. I found that the difference, if any, in the ratio of the mass to weight between radium and other substances was not more than one part in 2,000. Lately we have been using at the Cavendish Laboratory a pendulum whose bob was filled with uranium oxide. We have got good reasons for supposing that uranium is a parent of radium, so that the great potential energy and large ethereal mass possessed by the radium will be also in the uranium; the experiments are not yet completed. It is, perhaps, expecting almost too much to hope that the radio-active substances may add to the great services they have already done to science by furnishing the first case in which there is some differentiation in the action of gravity.

As our knowledge of the properties of light has progressed we have been driven to recognise that the ether, when transmitting light, possesses properties which, before the introduction of the electromagnetic theory, would have been thought to be peculiar to an emission theory of light and to be fatal to the theory that light consists of undulations.

Take, for example, the pressure exerted by light. This would follow as matter of course if we supposed light to be small particles moving with great velocities, for these, if they struck against a body, would manifestly tend to push it forward, while on the undulatory theory there seemed no reason why any effect of this kind should take place.

Indeed, in 1792, this very point was regarded as a test between the theories, and Bennet made experiments to see whether or not he could find any traces of this pressure. We now know that the pressure is there, and if Bennet's instrument had been more sensitive he must have observed it. It is perhaps fortunate that Bennet had not at his command more delicate apparatus. Had he discovered the pressure of light, it would have shaken confidence in the undulatory theory and checked that magnificent work at the beginning of the last century which so greatly increased our knowledge of optics.

I now pass to a very brief consideration of one of the most important and interesting advances ever made in physics, and in which Canada, as the place of the labours of Profs. Rutherford and Soddy, has taken a conspicuous part. I mean the discovery and investigation of radio-activity. Radio-activity was brought to light by the Röntgen rays. One of the many remarkable properties of these rays is to excite phosphorescence in certain substances, including the salts of uranium, when they fall upon them. Since Röntgen rays produce phosphorescence, it occurred to Becquerel to try whether phosphorescence would produce Röntgen rays. He took some uranium salts which had been made to phosphoresce by exposure, not to Röntgen rays but to sunlight, tested them, and found that they gave out rays possessing properties similar to Röntgen rays. Further investigation showed, however, that to get these rays it was not necessary to make the uranium phosphoresce, that the salts were just as active if they had been kept in the dark. It thus appeared that the property was due to the metal and not to the phosphorescence, and that uranium and its compounds possessed the power of giving out rays which, like Röntgen rays, affect a photographic plate, make certain minerals phosphoresce, and make gases through which they pass conductors of electricity.

Shortly after Becquerel's discovery of uranium, Schmidt found that thorium possessed similar properties. Then Monsieur and Madame Curie, after a most difficult and laborious investigation, discovered two new substances, radium and polonium, possessing this property to an enormously greater extent than either thorium or uranium, and this was followed by the discovery of actinium by Debierne. Now the researches of Rutherford and others have led to the discovery of so many new radio-active substances that any attempts at christening seems to have been abandoned, and they are denoted, like policemen, by the letters of the alphabet.

Mr. Campbell has recently found that potassium, though far inferior in this respect to any of the substances I have named, emits an appreciable amount of radiation, the amount depending only on the quantity of potassium, and being the same whatever the source from which the potassium is obtained or whatever the elements with which it may be in combination.

The radiation emitted by these substances is of three types known as α β and γ, rays. The α rays have been shown by Rutherford to be positively electrified atoms of helium, moving with speeds which reach up to about one-tenth of the velocity of light. The β rays are negatively electrified corpuscles, moving in some cases with very nearly the velocity of light itself, while the γ rays are unelectrified, and are analogous to the Röntgen rays.

The radio-activity of uranium was shown by Crookes to arise from something mixed with the uranium, and which differed sufficiently in properties from the uranium itself to enable it to be separated by chemical analysis. He took some uranium, and by chemical treatment separated it into two portions, one of which was radio-active and the other not.

Next Becquerel found that if these two portions were kept for several months, the part which was not radio-active to begin with regained radio-activity, while the part which was radio-active to begin with had lost its radio-activity. These effects and many others receive a complete explanation by the theory of radio-active change which we owe to Rutherford and Soddy.

According to this theory, the radio-active elements are not permanent, but are gradually breaking up into elements of lower atomic weight; uranium, for example, is slowly breaking up, one of the products being radium, while radium breaks up into a radio-active gas called radium emanation, the emanation into another radio-active substance, and so on, and that the radiations are a kind of swan's song emitted by the atoms when they pass from one form to another; that, for example, it is when a radium atom breaks up and an atom of the emanation appears that the rays which constitute the radio-activity are produced.

Thus, on this view the atoms of the radio active elements are not immortal, they perish after a life whose average value ranges from thousands of millions of years in the case of uranium to a second or so in the case of the gaseous emanation from actinium.

When the atoms pass from one state to another they give out large stores of energy, thus their descendants do not inherit the whole of their wealth of stored-up energy, the estate becomes less and less wealthy with each generation; we find, in fact, that the politician, when he imposes death duties, is but imitating a process which has been going on for ages in the case of these radio-active substances.

Many points of interest arise when we consider the rate at which the atoms of radio-active substance disappear. Rutherford has shown that whatever be the age of these atoms, the percentage of atoms which disappear in one second is always the same; another way of putting it is that the expectation of life of an atom is independent of its age—that an atom of radium 1,000 years old is just as likely to live for another thousand years as one just sprung into existence.

Now this would be the case if the death of the atom were due to something from outside which struck old and young indiscriminately; in a battle, for example, the chance of being shot is the same for old and young; so that we are inclined at first to look to something coming from outside as the cause why an atom of radium, for example, suddenly changes into an atom of the emanation. But here we are met with the difficulty that no changes in the external conditions that we have as yet been able to produce have had any effect on the life of the atom; as far as we know at present the life of a radium atom is the same at the temperature of a furnace as at that of liquid air—it is not altered by surrounding the radium by thick screens of lead or other dense materials to ward off radiation from outside, and what to my mind is especially significant, it is the same when the radium is in the most concentrated form, when its atoms are exposed to the vigorous bombardment from the rays given off by the neighbouring atoms, as when it is in the most dilute solution, when the rays are absorbed by the water which separates one atom from another. This last result seems to me to make it somewhat improbable that we shall be able to split up the atoms of the non-radio active elements by exposing them to the radiation from radium; if this radiation is unable to affect the unstable radio-active atoms, it is somewhat unlikely that it will be able to affect the much more stable non-radio-active elements.

The evidence we have at present is against a disturbance coming from outside breaking up the radio-active atoms, and we must therefore look to some process of decay in the atom itself; but if this is the case, how are we to reconcile it with the fact that the expectation of life of an atom does not diminish as the atom gets older? We can do this if we suppose that the atoms when they are first produced have not all the same strength of constitution, that some are more robust than others, perhaps because they contain more intrinsic energy to begin with, and will therefore have a longer life. Now, if when the atoms are first produced there are some which will live for one year, some for ten, some for a thousand, and so on; and if lives of all durations, from nothing to infinity, are present in such proportion that the number of atoms which will live longer than a certain number of years decreases in a constant proportion for each additional year of life, we can easily prove that the expectation of life of an atom will be the same whatever its age may be. On this view the different atoms of a radio-active substance are not, in all respects, identical.

The energy developed by radio-active substances is exceedingly large, one gramme of radium developing nearly as much energy as would be produced by burning a ton of coal. This energy is mainly in the α particles, the positively charged helium atoms which are emitted when the change in the atom takes place; if this energy were produced by electrical forces it would indicate that the helium atom had moved through a potential difference of about two million volts on its way out of the atom of radium. The source of this energy is a problem of the deepest interest; if it arises from the repulsion of similarly electrified systems exerting forces varying inversely as the square of the distance, then to get the requisite amount of energy the systems, if their charges were comparable with the charge on the α particle, could not when they started be further apart than the radius of a corpuscle, 10^{-13} cm. If we suppose that the particles do not acquire this energy at the explosion, but that before they are shot out of the radium atom they move in circles inside this atom with the speed with which they emerge, the forces required to prevent particles moving with this velocity from flying off at a tangent are so great that finite charges of electricity could only produce them at distances comparable with the radius of a corpuscle.

One method by which the requisite amount of energy could be obtained is suggested by the view to which I have already alluded —that in the atom we have electrified systems of very differen types, one small the other large; the radius of one type is comparable with 10^{-13} cm., that of the other is about 100,000 times greater. The electrostatic potential energy in the smaller bodies is enormously greater than that in the larger ones; if one of these small bodies were to explode and expand to the size of the larger ones, we should have a liberation of energy large enough to endow an *a* particle with the energy it possesses. Is it possible that the positive units of electricity were, to begin with, quite as small as the negative, but while in the course of ages most of these have passed from the smaller stage to the larger, there are some small ones still lingering in radio-active substances, and it is the explosion of these which liberates the energy set free during radio-active transformation?

The physiological and medical properties of the rays emitted by radium form a field of research in which enough has already been done to justify the hope that it may lead to considerable alleviation of human suffering. It seems quite definitely established that, for some diseases, notably rodent ulcer, treatment with these rays has produced remarkable cures; it is imperative, lest we should be passing over a means of saving life and health, that the subject should be investigated in a much more systematic and extensive manner than there has yet been either time or material for. Radium is, however, so costly that few hospitals could afford to undertake pioneering work of this kind. Fortunately, however, through the generosity of Sir Ernest Cassel and Lord Iveagh, a Radium Institute, under the patronage of His Majesty the King, has been founded in London for the study of the medical properties of radium and for the treatment of patients suffering from diseases for which radium is beneficial.

The new discoveries made in physics in the last few years, and the ideas and potentialities suggested by them, have had an effect upon the workers in that subject akin to that produced in literature by the Renaissance. Enthusiasm has been quickened, and there is a hopeful, youthful, perhaps exuberant, spirit abroad which leads men to make with confidence experiments which would have been thought fantastic 20 years ago. It has quite dispelled the pessimistic feeling, not uncommon at that time, that all the interesting things had been discovered, and all that was left was to alter a decimal or two in some physical constant. There never was any justification for this feeling, there never were any signs of an approach to finality in science. The sum of knowledge is at present, at any rate, a diverging not a converging series. As we conquer peak after peak we see in front of us regions full of interest and beauty, but we do not see our goal, we do not see the horizon; in the distance tower still higher peaks, which will yield to those who ascend them still wider prospects, and deepen the feeling, whose truth is emphasised by every advance in science, that "Great are the Works of the Lord."

On Clark and Weston Standard Cells.

By H. L. Bronson, Ph.D., Assistant Professor of Physics, and A. N. Shaw, B.A., Demonstrator of Physics, McGill University, Montreal.

(*Abstract—Section A.—Winnipeg.*)

This paper deals mainly with the accuracy and reproducibility of Clark and Weston cells, and it is hoped that it may throw further light on the value of the cell as one of the two legal electrical standards.

The work has been very much facilitated by the courtesy of the Bureau of Standards at Washington, where one of the authors, at the suggestion of Dr. H. T. Barnes, spent some time in the summer vacation of 1908 in studying the construction of modern standard cells. At the invitation of Dr. F. A. Wolff, we have been glad to actively co-operate with the Bureau in the work it has been doing along these lines.

I. *The Reproducibility of the Cells when prepared according to the Specifications of Wolff and Waters.*

The mean of 15 Clark cells made in this way differed, a few weeks after their construction, from the mean of the reference cells of the Bureau of Standards by less than 14 microvolts. The average deviation of our cells from their own mean was not more than 13, while the maximum deviation was only 31 microvolts.

In the case of the Weston cells the figures were similar, but showed somewhat better agreement in every case; the difference between the mean of 13 cells and the mean of the reference cells at the Bureau of Standards being in this case 4 microvolts, the average deviation of the cells from their own mean being 8, and the maximum deviation being 22.

Some of the Clark and Weston cells were made in Washington by one of the writers, and subsequently transported to Montreal. A means of direct comparison with the values of the cells at the Bureau of Standards was thus obtained. This comparison has recently been checked by a second interchange of cells.

We have also had in our possession six Weston cells made at the National Physical Laboratory in London. One of these was damaged in transit; the mean of the other five differed from the mean of our other cells by only 5 microvolts.

II. *The effect of Introducing Slight Simplifications into the Preparation of Materials.*

About 25 cells were constructed in order to examine the effects of slight simplifications in their preparation. It was found that the ingredient of main importance is the mercurous sulphate, which must always be prepared with great care. When unpurified mercurous sulphate was used in a cell, the average electromotive force was found to be from 300 to 500 microvolts higher than that of the normal cell. The purification of the zinc and cadmium salts is not so important, and as the processes are somewhat tedious, especially in the case of cadmium sulphate, it is interesting to see what accuracy may be obtained with various samples of chemically pure commercial sulphates. It was found that no Clark cell made with this modification differed by more than 50 microvolts from the mean of our normal cells, while no Weston cell differed by more than 100 microvolts. Such cells are therefore sufficiently accurate for all practical work.

The presence of basic oxide, oil or small quantities of organic impurities was found to exert only a very small influence on the electromotive force.

III. *The Relative Value of Cells set up according to the Board of Trade Specifications and those set up according to the Specifications of Wolff and Waters.*

Ten Clark cells of the old "test-tube crystal" type were prepared from a number of different samples of chemically pure commercial materials, for the purpose of ascertaining how much they differed in voltage from those set up according to the modern specifications. The average electromotive force of these cells during the first 75 days, neglecting the first day, was 0·31 millivolts higher than the mean of our normal cells. The average deviation of these cells from their own mean was considerable, about 0·06 millivolt, which suggests that there might be a possible variation of three or four in the last figure of the mean for different batches of 10 cells set up with different materials. It is therefore in good agreement with the value (0·00030 volt) given by Wolff and Waters.

IV. *The Ratio of the Electromotive Force of the Weston Cell to that of the Clark.*

The determination of this ratio, which had also been obtained at the Bureau of Standards, was made with the object of furnishing a further check on the reliability of the comparison between our cells and those of the Bureau, and to give added assurance that no errors had been introduced by transportation.

Five Clark cells were connected in series and placed in opposition to seven Westons similarly connected. The difference between the two sets was then measured on a Kelvin-Varley slide by the usual potentiometer method.

The ratio obtained was 0·716,953, which differs from the ratio 0·716,958, determined by Wolff and Waters, by only seven parts in a million. This difference, small as it is, is entirely accounted for by the small differences, as ascertained by direct comparison between our cells and those made at the Bureau of Standards.

BUSINESS NOTES.

Manufacture of Telephones in Australia.—Mail advices from Melbourne received this week, state that the Postal Department is calling for tenders for the supply of 5,000 telephones of Australian manufacture. One of the conditions is that any design or pattern submitted will be considered by the Department, but preference will be given to instruments conforming to the sealed pattern. The latter is similar to the Ericsson type without any distinguishing name. On July 15th, Messrs. O. C. Beale and Co, Messrs. Straeker & Hipsley, of Sydney, and other electrical manufacturers, waited on the Postmaster-General. They contended that the adoption of the Ericsson type as the standard was not wise, as a manufacturer in Australia might lay down a plant for the manufacture of that class of instrument, which later improvements might render obsolete. There were already many improvements, they said, on the Ericsson instrument. If tenderers were allowed to submit the most up-to-date patterns they could manufacture, they said, the industry was more likely to be established on a firm basis in the Commonwealth. Sir John Quick promised to consult the officers of the Department as to whether the form of tender and specifications could be revised in the direction desired by the deputation.

Canadian Tariffs.—The Canadian Customs authorities have recently given a decision to the effect that "commutator bars of copper cut to form for electrical apparatus" are to be classified under No. 453 of the Tariff, the duty being 14 per cent. on British goods, and 27½ per cent. *ad valorem* on those of foreign manufacture.

Book Notices.—"*Journal* of the I.E.E." No. 196, Vol. 43.—This volume contains the following papers:—"Large Gas Engines for Generating Electric Power," by L. Andrews and R. Porter; "Dielectric Strength of Compressed Air," by E. A. Watson; "Kapp-Hopkinson Test on a Single D.C. Machine," by Dr. W. Lulofs; "Fly-wheel Load Equalisers," by J. S. Peck; and "Safety of Working Electrical Plants in Coal Mines," by S. A. Simon. London: E. and F. N. Spon, Ltd. 1909. Price 5s.

"Metallurgy of the Common Metals (Non-Ferrous). By A. H. Sexton and J. S. G. Primrose. Manchester: Scientific Publishing Co. 1909. Price 7s. 6d. net.

"Engineering Units of Measurement." By J. Ramsay. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 1909. Price 1s. net.

Theft of Platinum.—For stealing platinum to the value of £173 from the India-Rubber, Gutta-Percha and Telegraph Works Co., Silvertown, George Freakley, chief clerk in the instrument department, was sentenced to six months' hard labour.

Dissolutions and Liquidations. — Ozonisation Syndicate, Ltd.—The creditors and shareholders of the Ozonisation Syndicate, Ltd., of Cecil Chambers, Strand, and Craig's Court House, Craig's Court, Charing Cross, S.W., met on Friday, August 20th, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C., Mr. W. J. Warley, Official Receiver, presiding. The accounts filed under the liquidation showed an unsecured debt, £386; assets, £6, and a deficiency of £879, as regards shareholders. According to the observations of the Official Receiver, the company, which is stated to have been promoted by Mr. Maurice Salis-Schwabe, was registered on December 18th, 1907, with a nominal capital of £500 in £1 shares, and was formed to acquire patents for the manufacture, by a cheap process, of aluminium, armour plate, &c., and for the purification of liquid solutions. By the purchase contract which was entered into on December 27th, 1907, the company acquired from Messrs. Murphy, Schwabe, and Leslie Watney, all their rights and interests in certain patents stated to have been applied for and which included the English and foreign (excepting the Canadian and American) rights for an electric purification process for liquid solutions. The consideration for the sale was fixed at £492 in fully-paid shares of the company, of which 246 were to be allotted to Mr. Schwabe, and 123 each to Messrs. Murphy and Watney. The company further agreed to form a company with a capital of not less than £20,000, and to sell the English rights to such new company for £11,992, as to £4,000 in cash and the balance in fully paid shares of the new company. Of this consideration, Mr. Murphy was to receive £3,000 in cash, and £4,992 in fully-paid shares, and Messrs. Schwabe and L. Watney £500 in cash and £1,500 in fully-paid shares, each. It is understood that Mr. Murphy was the inventor of the patents, and that Mr. Schwabe was to receive his portion in consideration of his undertaking to promote the new company and raise the capital required to work the processes. Mr. L. Watney is stated to have been entitled to a portion of the purchase price as consideration for obtaining financial assistance from Mr. R. Watney. The purchase consideration of 492 shares was duly paid. The Ozone Purification Co., Ltd. (the intended new company) was registered on December 20th, 1907, with a nominal capital of £20,000 (its first directors being Messrs. Murphy and Schwabe, Mr. Nicholls afterwards joining the board), and an agreement was entered into between the two companies on December 27th, 1907, for the sale of the English rights in the patents to the Purification Co. in terms of the company's purchase contract of the same date. According to returns of allotments made to the Registrar of Joint Stock Companies 7,992 shares of the Purification Co. were allotted as fully paid to the original vendors. No part of the cash consideration of £4,000 payable by the Purification Co., however, appears to have been received. In consequence, it is stated, of Mr. Schwabe's failure to carry out his undertaking to raise funds, he, by an agreement with Mr. Murphy of February 10th, 1908, to which the two companies were also parties, agreed to retire, and in consideration of being released from all liability in regard to the syndicate transferred his holdings of shares in the two companies to Mr. Murphy. The two companies appear to have been financed by Mr. Reginald Watney, who states that he made advances to the extent of £500, part of which has been repaid to him. The failure of the company is attributed by Mr. Reginald Watney to its inability to make use of the secret processes owing to Mr. Murphy's absence from the country. Upon inquiry at the Patent Office, the Official Receiver was informed that only one patent—viz, that for an improved electrode, for use in purification of water and other liquids, had been granted, and that Mr. Murphy was the registered proprietor of the same, no assignment having been made to the company. In the absence of a quorum, the meeting of creditors was formally adjourned for a week, but the shareholders passed a resolution for the matter to remain in the hands of the Official Receiver, who will therefore act as a liquidator, without a committee of inspection.

Deep Leads Electric Transmission Co., Ltd.—A meeting is to be held at 20, Copthall Avenue, E.C., on September 22nd, to hear an account of the winding up from the liquidator, Mr. E. S. Rawson.

Ely Electrical and General Agency, 24, Hatton Garden, London.—Messrs. D. Santoni and K. Fiedler have dissolved partnership.

Empire Lubricating Co., Ltd.—This company is winding-up voluntarily, with Mr. W. H. Cochran, 51, North John Street, Liverpool, as liquidator.

Stolen Lamps.—On August 20th at the City Police Court, Manchester, G. H. Withers and R. J. Brocklebank, were charged with stealing a box of tantalum lamps, the property of Messrs. Drake & Gorham, Ltd., Manchester. According to the police evidence, the prisoners' own story was that their plan of action was for Withers to conceal himself on the premises until they were closed for the day, when he would get a signal from Brocklebank, indicating that it was safe to leave with the stolen property. The prisoners were remanded until yesterday in order to enable the police to complete their inquiries. The Manchester *Evening News* says that during the last 18 months, some 6 000 tantalum lamps, valued at from £500 to £600, have been stolen from the same firm's premises, the last occasion being between last Saturday and Monday week, when 100 lamps were taken.

Bankruptcy Proceedings.—Herbert Shuttleworth, Cross Court, Briggate, Leeds, electrical engineer.—The gross liabilities are put at £475, of which £465 are expected to rank. The assets are estimated at £84. The causes of failure are ascribed to bad trade and competition. The debtor, who is 27 years of age, was up to February, 1906, a journeyman electrician. At the time mentioned he commenced business as an electrical engineer and contractor on a loan of £20 from his father, who had since advanced money up to a total of £160, all of which was still owing. In addition, his father, in June, 1908, guaranteed a bank overdraft of £200, and the debtor is owing thereon £197. According to the debtor, the business had not paid at any time owing to irregular trade and competition. He states that he took stock roughly in January last, and the statement then made out, but not preserved, showed a small surplus taking stock at cost, but leaving out the amounts owing to his father and the bank. In July he was sued, when he executed a deed of assignment, and at a meeting held on the 16th of that month a statement was submitted showing liabilities £483, assets £100, deficiency £383. An offer of 5s. in the £ was refused, and the principal trade creditors filed a petition. Debtor, who is unmarried, lives with his parents. He has kept a full set of books, but they are not fully posted, and the cash-book is not balanced. The creditors include:—

Electric and General Stores Co., Leeds	£11
London, City and Midland Bank, Leeds	197
J. Shuttleworth, Wakefield	160
Siemens Bros. Dynamo Works, Ltd., Manchester	10
Scattergood & Johnson, Leeds	57

Cessio.—Messrs. Alexander Anderson & Co., electrical engineers, 18, Laird Street, Greenock, are to be examined in the Court House, County Buildings, Greenock, on September 8th, at 11.15 a.m.

Private Meeting. — J. D. Jones & Co., electrical engineers, 5, Midland Crescent, Finchley Road, N.W.—A meeting of the creditors of the above was held on 17th inst., when a statement of affairs was presented showing liabilities £424, and net assets £88. The estate, therefore, showed a deficiency on paper of £336. It was reported that the debtors, J. D. Jones and J. Beddington, started trading in 1906 with a small capital, continuing until last year, when the partnership was dissolved, the dissolution being duly gazetted. The consideration that Beddington had on leaving the concern, was to have been £52, but he only received £8 10s., thus leaving him to rank as a creditor against the estate for £43 10s. The matter was fully discussed at the meeting, the creditors being of the opinion that the debtor should make some offer of composition. The debtor's solicitor, however, thought it was not possible to get any offer, and suggested that the estate should be dealt with under a deed of assignment. The creditors did not approve of this, however, and resolved that if an offer of 4s. in the £ was not forthcoming within 14 days, the debtor should be requested to file his petition in bankruptcy. The following are creditors:—

Edison & Swan, Ltd.	£44	Electrical Fittings Co.	£10
Ellis, Simpson & Saunders ..	28	Cash creditors:—	
Ernest Roberts	26	"Bankers"	73
Falk, Stadelmann & Co.	23	Beddington, J.	43
Sloan Electrical Co...	15	Sundry creditors:—	
Thomas, F., & Co.	12	Rent	32
Farringdon Eng. Co.	10	Rates	10
Hands, A. C.	10	Fully-secured creditors	25
Galsworthy, Ltd.	10		

Trade Announcements. — The E.M.F. Manufacturing Co announce that they have amalgamated their interests with those of Mr. O. H. Bishop, for many years sales manager of the Edison & Swan United Electric Light Co., Ltd. Mr. Bishop, besides identifying himself financially, will devote his entire time and energies to the company as joint managing director, with Mr. Bein and Mr. Grose. The firm have also acquired the electrical manufactory and electrical business of Mr. T. H. Satchwell, Victoria Works, Walsall, near Birmingham, a manufacturer of special fittings for ship, street, mill and car lighting. The amalgamation will in future be known as the E.M.F., Ltd., under which name it has been registered. All accounts outstanding and owing will be taken over by the new firm, and will be settled in the ordinary way. The company will continue to make a leading feature of high-grade incandescent lamps, metal and carbon, and particular attention will also be devoted to mill, ship, car and street lighting fittings, high and low-tension switchboard work, switchgear and circuit breakers, lighting accessories, cables, and electric heating and cooking apparatus.

The Globe Electric Co, Ltd., 11, Farringdon Avenue, E.C., has been appointed sole agents for the North-Western Electrical Appliance Co., of Cathcart, Glasgow, for London and provinces south of the Midlands, also for export work.

An Australian exchange states that Messrs. Lawrence and Hanson, electrical contractors and manufacturers, have opened a branch office at Wellington, N.Z, in charge of Mr. H. F. Vickery.

The British Griffin Chilled Iron and Steel Co, Ltd., ask us to state that the fire which occurred at 139, Cannon Street, E.C., on Sunday last will in no way affect their business. On and after September 1st their London address will be 81, Cannon Street, E.C.

Works Visit.—Thirty members of the Dewsbury and District Association of Engineers, wishful to see for themselves the "Bennis" coking stoker, made a visit of inspection to the firm's works at Little Hulton, Bolton, on Saturday last. They were conducted through the various departments by Mr. A. W. Bennis, M.I.Mech.E, A.I.E.E, and members of the staff. Interest was evoked by the new patent shovel arm gear, an improvement which has been recently introduced to the sprinkling stoker. This new shovel arm is balanced, self-oiling and detachable. The additional arm gives extra strength, and ensures a dead-centre throw.

(*Continued on page* 344.)

ELECTRICAL COLLIERY INSTALLATION IN FIFESHIRE.

In June last Mr. John Paul read an interesting paper before the Mining Institute of Scotland on electrical matters connected with the Lochgelly Iron and Coal Co.'s pits in Fifeshire.

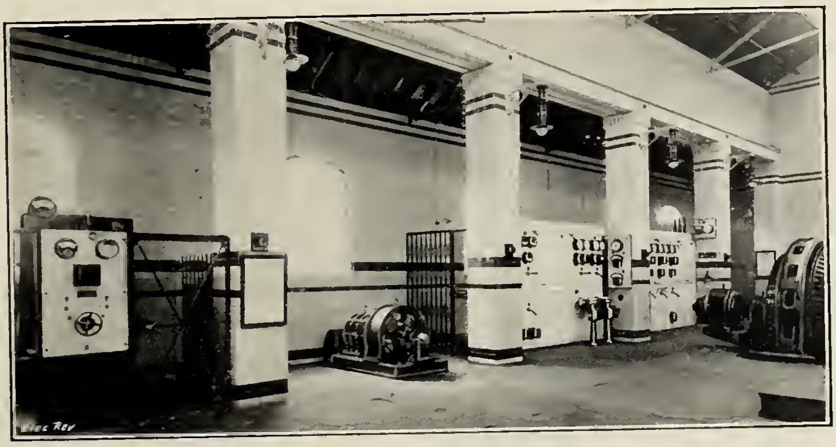
This company has 10 pits distributed over an area of 16 sq. miles, and raising about 1,250,000 tons of coal per annum.

Originally a number of isolated plants sufficed for what was principally lighting work at these pits, but in 1907 the increased possibilities in electric driving led the company to review the whole matter, and after consultation with Messrs. Sayers & Caldwell, of Glasgow, it decided to go in for central generating plant with high-pressure distribution to suitable points.

It was decided to deal with five pits and the workshops in the first instance, and a study of the working conditions showed that between 6 p.m. and 6 a.m. the estimated maximum load would be 613 B.H.P., and during the remainder of the 24 hours, 761 B.H.P.

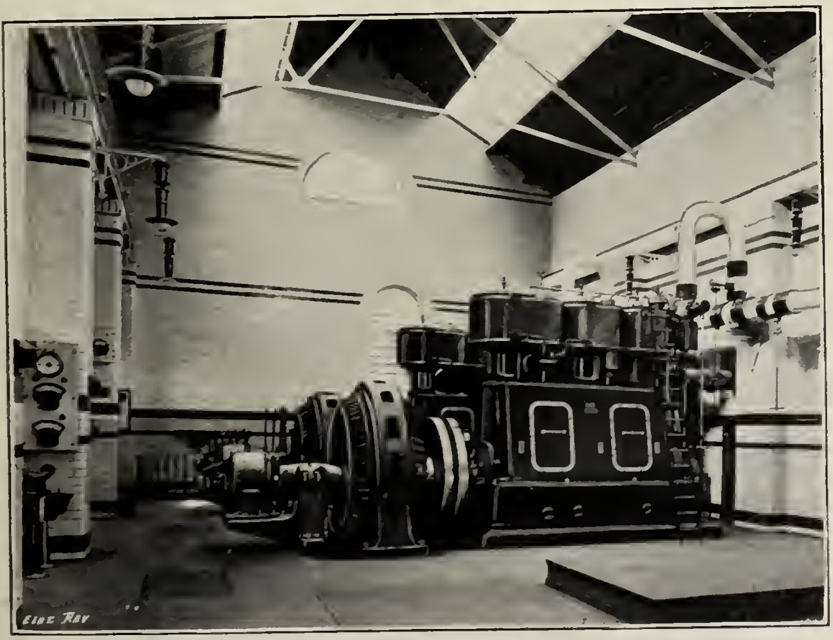
Water-tube Boilers for the Electrical Plant.

A site for the power house was decided on at the Nellie pit, and this provided for three 450-KW. sets and a 1,000-KW. exhaust or mixed-pressure turbo-generator. Condensing plant was included in the proposals, not with a view to economising fuel (which costs 2s. 9d. per ton handled), but to obtain good feed water and reduce capital expenditure. As regards the steam supply, superheating and high velocity of steam in the main were adopted, in view of the boilers being some 200 ft. distant from the generating plant.



Switchgear, Motor-Generator, and Local Sub-station in the Power Station.

Four Babcock boilers in pairs have been added to the existing Lancashire boilers at the Nellie pit, and these are constructed for 200 lb. pressure, although worked at 180 lb. Each boiler is fitted with a chain-grate stoker and internal superheater to give 100° F. superheat; the expected maximum evaporation with wet dross and gum is about 10,000 lb. per boiler.



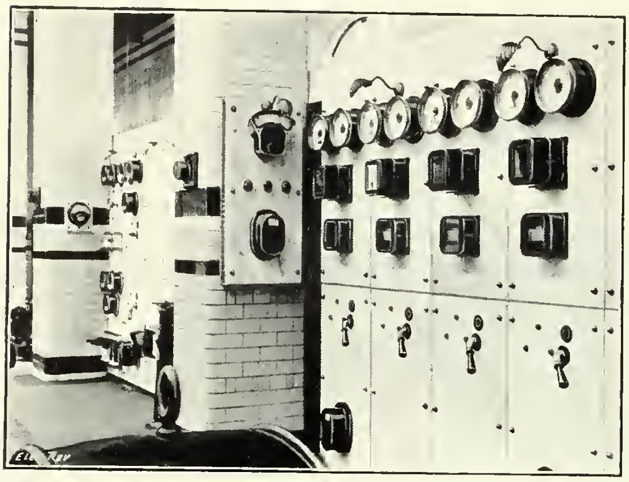
Belliss-Bruce Peebles Generating Plant in the Power Station.

For boiler feed purposes, three single direct-acting steam-driven pumps are installed, made by Andrews & Cameron, of Kirkintilloch.

At the present time, two Belliss and Morcom three-crank triple-expansion engines, direct-coupled to Bruce Peebles three-phase alternators, are provided in the power house. The alternators are 50-period machines, generating at 3,300 volts and giving 420 KW. on a ·8 power factor, and at 375 R.P.M.; they are provided with exciters mounted on the main shafts. These sets will carry 25 per cent. overloads for periods of two hours at six hours' intervals, either exhausting into the condenser with a 26-in. vacuum or to atmosphere.

The engines are supplied with steam at 160 to 180 lb. pressure and 470° to 500° F.; both sets on test gave a steam consumption of about 18·3 lb. per KW.-hour with a load of 422 KW., steam pressure 159 lb. and vacuum of 25 in.

The engines exhaust through atmospheric valves and Beckett oil separators into an 18-in. cast-iron collecting main, feeding a Ledward & Beckett evaporative condenser outside the engine house; the condenser consists of 336 corrugated pipes in 14 coils of 24 pipes each. A film of water is maintained over these pipes by a 3-H.P. motor-driven centrifugal pump, this requiring the circulation of 10,000 gallons of water per hour, of which 800 gallons is evaporated and made up afresh. The adoption of surface condensers would have involved four times as much circulating water, and, in addition, elaborate cooling arrangements.



H.T. Panels in Power Station.

Accessories to the condenser are a three-throw Edwards air pump, gear driven by a three-phase motor and a force pump for delivering the water passed by the air pump to the Harris-Anderson feed-water purifier, shown in one of our views.

As regards the power house switchgear, the H.T. portion consists of four generator panels and six feeder panels, only two of the former and four of the latter being at present fully equipped. The feeder panels in use supply (1) the transformer for the Nellie pit; (2) the transformer for the power house motors; (3) the overhead line supplying the Mary and Newton pits; and (4) the overhead line supplying the workshops, Jenny Grey pits, and the Dundonald colliery.

L.T. Panels in Transformer Sub-station.

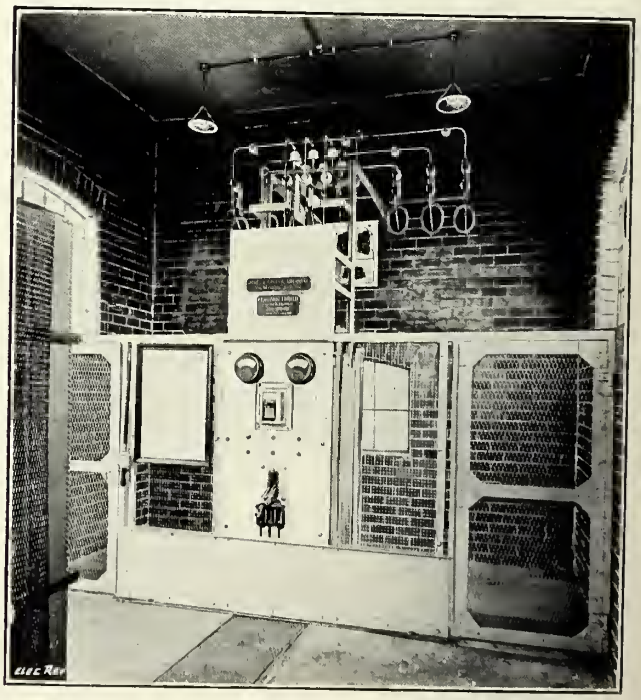
There are, in addition, two panels dealing with L.T. three-phase current from the power house transformer. One of these controls a 50-KW. motor-generator supplying continuous current at 200 volts for the lighting of the power house, Nellie pit-head, and the offices and shops; and the other the air pump, condenser, and centrifugal pump motors. There is also a continuous current panel controlling the 200-volt lighting supply from the motor-generator already mentioned.

All the switch apparatus except the measuring and indicating instruments and the handles of the oil switches are contained in screened cubicles.

Fixed to the sides of the brick piers, within which the main panels are accommodated, are the synchronising bus-bar voltmeter and earth-detecting panels.

Each generator panel contains a three-pole oil switch with automatic reverse power trip gear, indicating wattmeter, ammeter, &c., and the exciter pillar is arranged in front. The feeder panels each carry a similar oil switch with overload and out-of-balance trips, indicating wattmeter, ammeter, and integrating wattmeter.

The L.T. three-phase panels are also fitted with similar oil switches; there are no fuses on any of the three-phase panels. A 10-ton traveller runs the whole length of the power house. The H.T. distributing system consists of overhead lines from the power station to the Mary and Newton pits to the south-west, to the workshops and the Jenny Grey pits to the south-east, and sundry lengths of lead-covered and armoured-paper cables under the North British Railway track and from the power house to the adjacent terminal pole. The general plan (p. 341) gives an idea of the extent of this portion of the work, the heavy dotted line indicating the two lines now in operation, the dotted line from the Jenny Grey pit to the Dundonald colliery, the extension not yet at work, and the chain-dotted lines further extensions, which may or may not be realised. The point, however, of the interconnected network, completed as shown by these chain-dotted lines, is that in conjunction with the special arrangement of isolating switches in the several transformer stations, any section of line, excepting that from the Newton pit to the south, could be made dead (for repairs or other purposes) without interfering with the supply. The earthing guards have been arranged for operation with the supply from either direction, in view of this linking up.



H.T. Panel in Transformer Sub-station.

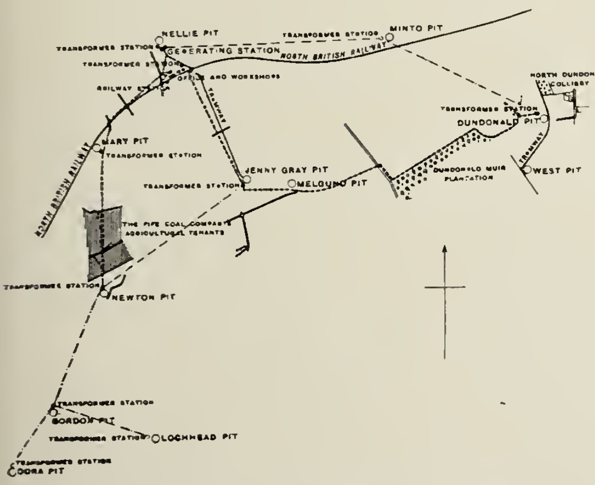
All cables and apparatus in connection with the overhead lines are protected from the effects of lightning, and excessive pressures from other causes, by spark gaps; and public roads and positions in the vicinity of the pits are guarded by adequate cradling.

A good idea of the line construction can be obtained from our views.

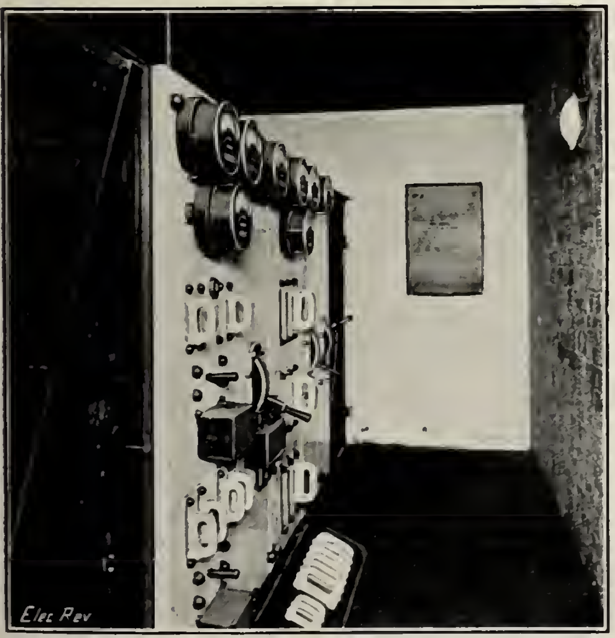
The transformer stations are each designed to contain two 200-KW. transformers (·8 power-factor), and the necessary switchgear, but contain only half their equipment at present. The transformers (by the British Electrical Transformer Co.) are oil-cooled and wound to transform from 3,000, 3,150 and 3,300 volts, to 525 volts, these ratios being arranged to compensate for the varying line losses at different points.

The transformer full-load efficiency is about 97 per cent. The switchgear in the transformer houses is of Ferranti type, comprising a high and low-tension panel for each transformer, with auto-oil switches, instruments, energy meter, &c.; the gear is designed to automatically cut out a faulty transformer, and on the high-tension side space has been left for a high-tension feeder panel in case it is desired to carry high-tension supply down the shafts. On the low-tension side, three 200-KW. circuits are provided.

The shaft and in-bye cables are three-core bitumen insulated and filled, and double armoured with galvanised-steel wires; they are supported in the shafts at intervals of 40 to 50 ft. by cleats of special design, and suspended in-bye by hempen slings. Electrical continuity of the armouring throughout each network is effected by substantial armour-clamping rings, and the whole is efficiently connected to the best earth obtainable on the several systems. These cables were supplied by Messrs. Johnson & Phillips, as also were the in-bye switchboards.



Plan of Area Supplied, showing Overhead Transmissions, &c.

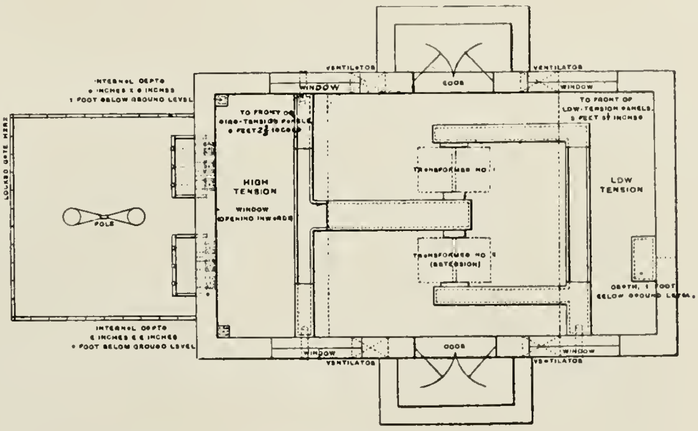


View of In-bye Switchboard.

The latter are of very substantial construction, and are designed for underground conditions. Arrangements are also provided on each board by means of auto-transformers for the supply of current to 50 lamps. One of our views shows one of these boards in position.

The sub-circuit fuseboards are of heavy mining type, with porcelain barrel fuses, and have all connections on the front of the slate panels; they are enclosed in cast-iron cases with armour anchor rings, and the lids of braced iron plate are hinged and secured by wing-nuts. They were supplied by Messrs. Harland, Bowden & Co.

Water-Purifying Plant at the Power Station.


LOCKED GATE HERE
POLE
INTERNAL DEPTH 6 INCHES X 6 INCHES 1 FOOT BELOW GROUND LEVEL
INTERNAL DEPTH 6 INCHES X 6 INCHES 1 FOOT BELOW GROUND LEVEL
VENTILATOR
WINDOW
DOOR
VENTILATOR
WINDOW
TO FRONT OF HIGH-TENSION PANELS 6 FEET 2½ INCHES
HIGH TENSION
WINDOW OPENING INWARDS
TRANSFORMER NO. 1
TRANSFORMER NO. 2 (EXTENSION)
TO FRONT OF LOW-TENSION PANELS 5 FEET 9½ INCHES
LOW TENSION
DEPTH, 1 FOOT BELOW GROUND LEVEL
WINDOW
VENTILATOR
DOOR
WINDOW
VENTILATOR

Plan Showing Arrangement of Typical Sub-station.

Motors have been supplied by the B.T.-H. Co., Mavor and Coulson, and the British Electric Plant Co. for haulage, pump, and fan drives, and include both the slip-ring and squirrel-case types, with control panels and starting switch gear suitable to the particular requirements of each drive.

Coal-cutters have been supplied by two Motherwell firms.

The pits at present outside the area of the three-phase supply are the Minto and the Raith group, the latter comprising the Dora, Gordon and Lochhead pits.

The Minto pit is provided for by two steam dynamos of 100 KW. capacity, and one of 250 KW., generating continuous current at 500 volts.

The Raith group is supplied by two combinations of 100 KW. capacity, which are exact duplicates of the first-named sets at the Minto pit. These are located at the Dora pit, and serve the Gordon and the Lochhead pits in addition by overhead transmission lines.

All these pits have small 200-volt generators for lighting purposes.

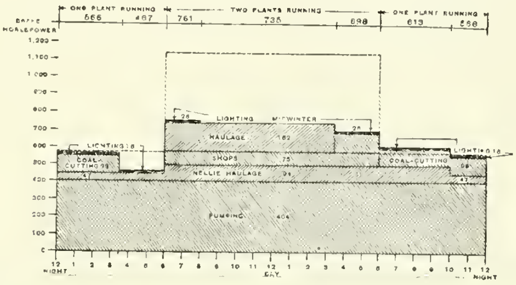
As to the outlay, it may be taken that the generating costs, based on the load diagram (p. 342), plus the capital charges—namely, interest on capital, and sinking fund to redeem the capital in 20 years, will enable the company by the equipment described to deliver electrical energy at any point in the coalfield for something less than 0·3d. per unit; and that with an increased load the cost per unit will be even cheaper, owing to the fact that much of the capital expenditure already incurred really belongs to possible extensions.

In conclusion, we are indebted to Messrs. Sayers and Caldwell for assistance in producing this article.

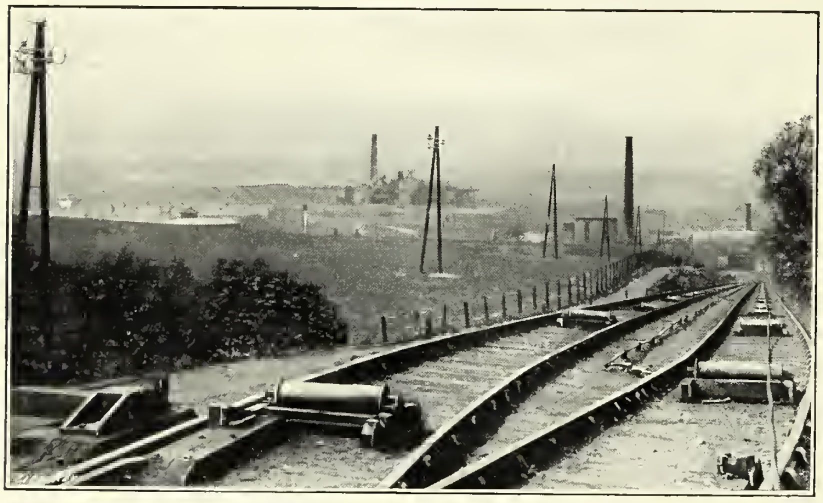
THE ELECTRIC AUTOMOBILE.

[Contributed.]

When the perfect accumulator happen into our existence, of course electric motor-cars will at once supersede petrol vehicles in the majority of cases; that is, they will prove superior in actual working and not merely in the columns of daily newspapers. Meantime, their field is very strictly limited to working in towns or near an economical source of electric supply, and, moreover, within a comparatively small radius in miles of such charging stations.



Estimated 24-hour Load, for Present Requirements; Lochgelly Co.'s Installation (p. 339).



An Overhead Transmission, Lochgelly Co.'s Installation.

What advantages do they offer to-day as compared with petrol vehicles?

First of all, apart from the battery, there is much less to go wrong or need frequent repair. Motors and reduction gear have been familiar objects for a long time now in tramway and other power developments, and we know from experience wherein lie their possible weaknesses, which can be, and are, accordingly guarded against by the designer and manufacturer.

A simple controller of the type required for motor-car work is not much more than a compound switch, and costs much less than the speed change-gear box. The differential can be avoided by the use of two small motors instead of one large one.

As for driving and looking after a car, the type of man considered necessary for a petrol vehicle is one who has had one or two years' special training, who is something of a mechanic by instinct as well as experience, and who asks and expects a wage of from 35s. weekly to anything the car owner cares to be persuaded is the man's value.

With electric automobiles—again apart from the battery—the driver can be of a much less skilled type; he has practically to steer the car and turn a handle—work that should be well paid at 25s. a-week, since he may be a younger man of far less experience.

The comparative ease and quietness of running in the ease of an electric car will naturally be less pronounced now, in these days of four and six-cylinder petrol cars of high power, than it was before the internal combustion engine made such strides; but, even to-day, it is the electric automobile that attracts attention for the silent way in which it rolls along, not perhaps so speedily as the petrol car, but with really more comfort to the passenger who does not need to be at the other side of nowhere in considerably less than no time.

What are these advantages going to cost a user as compared with the expense of running a petrol car? It is not much good emphasising the excellent features of electric cars if they only come within the reach of the wealthy and the few; they must show themselves adaptable for general employment if the business is to grow, and it is an open question whether this is at present possible.

Some figures have been shown to us in connection with this point that have considerable interest, as they deal with the application of the iron-nickel accumulators of the much-vaunted Edison type; but, taken as a whole, they do not, unfortunately, enable anyone to draw at once a very strong and overwhelming conclusion in favour of electric automobiles. The assumption is made of a heavy car to carry five passengers and the driver, and fitted with a double landaulette or limousine body. Its first cost is given as £775, including the battery and all complete ready for the road.

Allowing £185 for cost of the battery and tires, there remains £590 to represent cost of the chassis with motor, &c., also the body and fittings, and depreciation thereon is allowed at the rate of 15 per cent. per annum—amounting to, say, £88.

Battery depreciation is reckoned at only 50 per cent. per annum on a mileage of, say, 6,250; and 10 per cent. of the first cost is credited for the old cells when returned. This gives an annual depreciation for the battery of about £67, which is equal to about 2·5d. per mile. With such an allowance in a private car that has plenty of rest intervals, how is a rate of only 2d. per mile with lead batteries to be justified in the case of heavy motor-'bus work? Yet this is claimed to be sufficient by the Electrobus Co.

The iron-nickel accumulator being provided with an alkaline electrolyte, it is necessary to fill up the cells periodically with distilled water in order to prevent the intrusion of acids. The annual cost of this is estimated at about £2 10s.

Views of Overhead Line, Cradling and Sub-station, Lochgelly Co.'s Installation (p. 339).

Power or recharging current will, of course, entail a much varying expense. Assuming an average daily mileage of

22, or about 6,250 per annum, about 125 charges per annum would be required; and for a 64-cell battery about 30 KW.-hours per charge. Two estimates are given of the cost of current—one where the price per unit is about 1·92d., and the other, about ·6d. In the first, the annual cost of current is given as £30; in the second, £9 15s.

Renewals of tires account for at least £50 per annum; repairs of chassis, body, &c., estimated at, say, 3 per cent. of cost are £18; oil, grease, and cleaning may be put down as requiring, say, £5; and driver's wages are averaged at £80, which is on the high side.

The total costs amount to £340 per annum where the electric supply is taken at the higher figure; and £320, at the lower rate.

In these figures, it must be said that full allowance is very wisely made throughout, and they may be regarded as a maximum cost for the mileage given, and for reasonable care in working. They do not, however, give any extraordinary saving as compared with the average cost of a similar petrol car under like conditions, and although a small economy is possible, one would wish to see the difference so marked, that no doubt could exist in the mind of a prospective user.

Let us assume a first cost of, say, £800 for a petrol car; depreciation on this would be at least 20 per cent. per annum, or, say, £160.

Petrol for the same mileage would cost not less than £25; wages may be put at £102; tires the same, *i.e.*, £50, although their wear and tear is found to be considerably less with electric cars, owing to the more even torque; car repairs, oil, grease, and sundries, may be taken at £45, which makes a sum total of £382.

Comparative Costs—Electric and Petrol Cars.

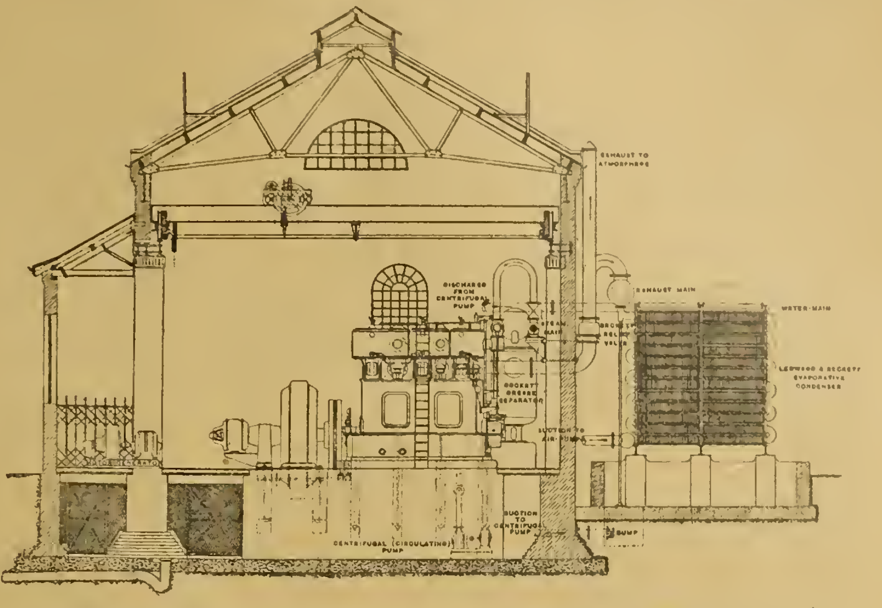
	Electric.	*Petrol.*
Depreciation of car	£88	£160
" " battery ...	67	—
Distilled water	2	—
Charging current or petrol ...	30	25
Tires	50	50
Repairs	18	40
Oil, grease, &c....	5	5
Driver's wages	80	102
	£340	£382

A saving of £40 or so is, of course, a consideration, but not nearly enough to cause a prospective user of one car only to decide upon electricity instead of petrol, in view of the extremely limited field of the one and the universal range of the other. For town work, however, the showing is good enough to warrant marked progress in this type of car, and we trust to see some rapid advances during the next few years, if all the reports one hears are well founded.

HOW TO CHARGE FOR ELECTRICITY.

"What's in a name?" said the great dramatist, and we reply, "A good deal more than some people think." Here is an instance, for example, in the "telephone" system of charging for electrical energy, which is in principle the same thing as the well-known maximum demand, but with a name designed for making the public more readily understand it, than has been possible under the technical explanations, which the "man in the street," who was not an electrical engineer, never could grasp.

The gas consumer, who has to be converted to the use of electricity, knows by experience that the number of feet of gas passing through his meter costs him so much per 1,000 all the year round, whether he takes little or much, and that he can, if he take the trouble, watch the consumption by reading the dials on the meter. He is not troubled with any scientific explanations as to the provision for standing charges, or cost of labour and material expended in production of the gas, and if you tried to explain that the establishment charges on a factory are represented by S on 10,000 articles per annum, and the cost per article by R and that the total cost is therefore $\frac{S}{10,000} + R$, the explanation would not be likely to forward your business. You might as well try to make a gas consumer understand how to measure a foot of something invisible.


Exhaust to atmosphere
Discharge from centrifugal pump
Steam main
Exhaust main
Water-main
Brockett relief valve
Ledward & Beckett evaporative condenser
Brockett grease separator
Suction to air-pump
Suction to centrifugal pump
Centrifugal (circulating) pump
Sump

Cross-Section through Lochgelly Co.'s Power Station, Fifeshire (p. 339).

There is simplicity in the telephone idea, because the public are familiar with the charge of a fixed price per annum and 1d. per call, so Mr. Seabrook says we will do the same: you shall pay so much a year, according to the extent of your requirements, and 1d. per unit. The difficulty will be in explaining how the fixed annual charge is arrived at, as it will differ according to the character of the installation.

Dealing with the small ordinary consumer, under the "telephone" system the proposed annual fixed charges may be based upon the candle-power of the lamps installed. Assume that a typical consumer has in his house 750 C.P. of metallic-filament lamps, or 250 C.P. of carbon-filament lamps, they would, in either case, require the provision of 1 KW. of power, and the telephone system of charge would be £14 per annum, and 1d. per unit for all units consumed. £14 means for one KW.-hour, a guaranteed maximum demand or fixed payment for 3,360 units per annum at 1d. per unit, besides the charge by meter of 1d. per unit for all current consumed.

In Mr. Seabrook's elaborate report to the Marylebone Electric Supply Committee he explains the proposed tariff by pointing out that 750 C.P. in metal-filament lamps is equal to 1 KW. of "maximum demand" or "power required," and consumes one unit per hour, and the same is required for 250 C.P. in carbon-filament lamps, one ordinary four-lamp radiator, two ordinary flame-arc lamps, four electric irons, or 16 small fans. He estimates that 750 C.P. would be approximately the "maximum demand" or "power required" of a 1,100 or 1,200 C.P. lighting installation.

Tariffs are specified for all classes of consumers, from 200 KW. "power required" down to $\frac{1}{10}$ KW., the minimum fixed annual charge ranging from £900 to £1 8s., with *pro rata* per KW. or part thereof per annum, and 1d. per unit for all units consumed.

The annual charge is payable in advance, and adjusted from year to year by the "power required" for the previous year, and necessary adjustments are provided for increase or decrease of installations after the annual payment is fixed. "For example, a consumer whose 'power required' for the past 12 months has been ½ KW. would have the option of paying £7 down, plus 1d. per unit for all units consumed. That 'annual charge' holds good for 12 months.

At the end of the 12 months the 'annual charge' is again fixed for the ensuing 12 months. If the 'power required' has gone up or down during the year, the 'annual charge' will be altered accordingly for the next year."

In the case of small consumers, a special tariff is fixed for heating, cooking and other uses of electricity, excluding lighting and motors, as follows :—

Power required.	Fixed annual charge. £	s.	d.
¼ KW.	0	5	0
½ „	0	10	0
¾ „	0	15	0
1 „	1	0	0
2 „	1	10	0
3 „	1	15	0
4 „	2	0	0
5 „ and upwards	2	2	0

and 1d. for all units consumed, payable weekly, monthly or quarterly, as the Council may require.

This scale for heating and other uses of electricity only applies where the lighting of the premises is exclusively by electricity from the Council's mains.

Among the advantages of the system is that only one meter is required ; risk of bad debts is reduced by the payment in advance ; one set of wiring only is necessary, even where lighting, heating and cooking are all mixed up.

Mr. Seabrook does not believe in the flat-rate system of charge unless various classes of supply can be grouped, and a different flat rate fixed according to load factor, which would not be practicable.

In dealing with power demands for factories, the "telephone" system of charge is common enough.

For large consumers the Marylebone tariff is as follows :—

Power required.	Minimum fixed annual charge. £	s.	d.
200 KW. at £4 10s. per KW.	900	0	0
175 „ £4 17s. 6d. „	853	2	6
150 „ £5 5s. „	787	10	0
125 „ £5 12s. 6d. „	703	2	6
100 „ £6 „	600	0	0
75 „ £6 10s. „	487	10	0
50 „ £7 „	350	0	0

Additional KW. *pro rata* per KW. or part thereof per annum, and 1d. per unit for all units consumed.

Terms.—Ten years' contract, and exclusive use of electricity for lighting and power (motors). The KW. charge payable annually in advance.

As an example of this tariff, a consumer of 200 KW. "power required" would pay £900 annually in advance, and £4 10s. per annum for every KW. above 200 KW., plus 1d. per unit for all units consumed.

BUSINESS NOTES.

(*Continued from page* 338.)

Catalogues and Lists.—Messrs. Previte & Co., 2, Crosby Square, London, E.C.—16-page pamphlet, entitled "Trinidad Lake Asphalt," in which a great deal of interesting information is set forth regarding the concession for working the Pitch Lake, for which the Government has just granted a renewal, also concerning the constituent parts of the asphalt, the solubility of the latter, and other points.

Mr. James Ferguson, 61, Pollok Street, Pollockshaws, Glasgow.—16-page illustrated catalogue, setting forth particulars of Ferguson automatic circuit-breakers, quick-break knife switches, replacement bridges and fuses, ironclad distribution boxes and other manufactures.

Mr. S. N. Brayshaw, 2, Mulberry Street, Hulme, Manchester.—In response to requests that have been received for copies of the (1) Decimal Equivalents, (2) Millimetre Equivalents, (3) Centigrade and Fahrenheit Comparisons, appearing in his various catalogues, Mr. Brayshaw has prepared a considerable quantity of these in serviceable form, mounted on cards, varnished and strung for hanging up. We have received a set with the firm's name printed on very simply and unobtrusively. A set of the three cards will be sent free to anyone who would find them useful either for shop, office or drawing office use.

Messrs. Donovan & Co., Barwick Street, Birmingham.—Price leaflet of 600-megohm grade non-Association cable ; also an illustrated price list of porcelain and brown-ware insulators and sundries.

Messrs. Perkin & Co., Ltd., Lord Street Engineering Works, Leeds.—Leaflet on the use of disk grinders, with prices of 16 and 18-in. machines, also 12 and 14-in. sizes for bench or stand.

The A.E.G. Electrical Co., of South Africa, Ltd, Caxton House, S.W.—Illustrated list (20 pp.), giving particulars, weights, prices, &c., of a variety of electric heating and cooking apparatus—water heaters, kettles, heating plates, workshop heating tables, hair-drying, soldering, and sealing apparatus, and cigar lighters.

Pumping Machinery for Alexandra Docks, Newport.—The contract has just been settled for an interesting pumping plant for the new Alexandra Docks of the Newport Docks Co. The pumping plant proper consists of two main pumps coupled direct to two triple-expansion steam engines, two separate 500-KW. generating sets being installed for lighting and power purposes. These pumps will be capable, when working simultaneously, of pumping 50,000,000 gallons of water from the River Usk into the dock extension in a period of five hours, the average quantity of water delivered during this period by one pump being 80,000 gallons per minute. Owing to the big quantities and comparatively low heads the pumps are dealing with, the average speed will be 90 R.P.M. The same pumps will be used for emptying the graving dock which will be built at a future date. In this case the pumps will work against a total head of 42 ft., and will each deliver an average quantity of 100,000 gallons per minute, running at speeds varying from 90 to 120. The maximum power required by each pump during this period will be between 1,100 and 1,200 B.H.P., placing them, it is claimed, amongst the biggest dock pumps built. Two schemes differing in principle have been carefully weighed with regard to this pumping plant. The question was whether the pumps should be driven direct by steam engines or whether electrically-driven pumps should be installed, and it was decided that the direct steam-driven pumps would give much greater economy under the existing conditions. This is due to the fact that steam engines are more adaptable to the different loads at the respective speeds which must be provided for in view of the varying heads against which the centrifugal pumps have to work. The main contractors for the whole of the scheme are Messrs. Cole, Marchant & Morley, of Bradford, while the pumps are being built to the designs of Messrs. Jens Orten-Boving & Co., of London, E.C., by Messrs. Willans & Robinson, of Rugby.

Germany.—A new company has recently been formed in Hamburg with a capital of £15,000 and the title Die "Telram" Gluhlampenwerke Gesellschaft, to manufacture a new metal-filament lamp known as the "Telram."

Fire.—An outbreak of fire occurred late on Saturday night at the works of the Brush Electrical Engineering Co., at Loughborough, in the core drying shed next to the moulders' department, and soon after the arrival of the brigade the roof of the building collapsed. There was, however, very little woodwork about the place, and the firemen kept the blaze within bounds, and were able to leave the place after two and a-half hours' work. They had the assistance of the Falcon Works brigade, under Mr. Porter, and plenty of water was available, but the men were hampered by the darkness and by the clouds of steam as the water reached the heated steel work. The outbreak, it is thought, was due to the overheating of the drying flues.

Annual Sports.—To-morrow, Saturday, the fourth annual sports of the Robertson and Osram Social and Athletic Club will be held at the Latymer Upper School Ground, Ducane Road, Wood Lane, Shepherd's Bush, commencing at 2.30 sharp.

LIGHTING and POWER NOTES.

Australia.—At a recent meeting of the Electrical Association of Victoria, Mr. H. R Harper gave some details of the Melbourne City Council's electricity supply, and general progress in Victoria. He said that 21 electric supply orders had been issued ; the total capital expended on generating and distributing plant, including tramways, approximated £1,600,000, and the capacity was about 16,000 KW. of which 11,000 KW. was in the Metropolitan area. The gross revenue was about £250,000. British towns were about 80 per cent. ahead of Melbourne as regards electrical connections per inhabitant and 45 per cent. ahead as regards amount sold. Many Melbourne suburbs had no supply, including Howthorn, Williamstown, Footscray, Port Melbourne and Brighton, which had orders. Melbourne, with a population of over half a million, had a supply available for 260,000. Excluding power stations there were 20,000 H.P. generated by steam, 4,000 H.P. by oil and gas, and 4,000 H.P. in electric motors, being utilised in Melbourne.

The Electricity Committee of Pyrmont, N.S.W., has adopted plans for erecting a new generating station, at an estimated cost of £30,000. The new building is to be similar to the existing one, but providing larger coal storage. A further proposal to accept tenders amounting to £44,547 for a 4,000-KW. turbo-generator plant was considered, but in view of other tenders for higher-speed plants having been submitted, at £32,354 (which, however, did not comply with the engineer's specification as to speed), it was eventually decided to refer the matter back for the city electrical engineer to report.

Acton.—The annual abstract of the accounts of the Council for the year ended March 31st, 1909, shows that, although 70,597 units were sold more than last year, the total income was less by £118. This is accounted for by the discontinuation of the electric street lighting early in the year, the charge for which was at the rate of 4d. per unit, and the increase in the number of power units sold. The average selling price per unit this year was 3·33d., as against 3·88d. last year. Another effect of discontinuing the electric street lighting was to increase the production costs per unit sold, as the maximum demand on which payment was made to the Metropolitan Electric Supply Co. for the full year included the street lighting demand, which was only continued during the first six weeks of the year. The total cost to the Council of each unit sold, exclusive of loan charges, was this year 3·51d. and last year 3·48d. The deficiency, after providing for the repayment of loans and interest, was £4,943, as compared with a deficiency of £2,934 in the previous year.

The Electricity Committee on Monday night decided that a two-rate system of charging for electricity supplied to shopkeepers should be adopted, the price to be 7d. per unit for a supply used during a certain two hours of the evening, and 3d. per unit at all other times.

Brazil.—The cotton mills of the Companhia Americana at Rio de Janeiro are now being operated by electricity; the necessary power—about 1,350 H.P.—being supplied from the central station of the Rio de Janeiro Tramway, Light and Power Co., Ltd. The same undertaking is also supplying 800 H.P., to the cotton mills of the Fabrica Carioca. This only represents about half of the company's requirements and arrangements are in hand for the electrical operation of the whole of the plant.

The *Diario Official* of July 21st contains a copy of a decree transferring to the Companhia Brazileira de Energia Electrica the concessions granted to Senores Guinle and Cia. for the installation of electrical works at Alberto Torres, and the appropriation for electrical purposes of the water of the Rio Itapanhau, in the State of Rio de Janeiro.—*Board of Trade Journal.*

Brumby and Frodingham.—The U.D.C. has referred to a Committee an electricity scheme whereby it is proposed to take energy in bulk from the Frodingham Iron and Steel Co. at 1½d. per unit. The cost of the installation is estimated at £2,500, and the suggested charge to consumers is 6d. per unit.

Canada.—In connection with the new hydro-electric power line which is being built by the Provincial Government of Ontario, the construction of the stations at Dundas and Niagara is already proceeding at a good rate, and it is anticipated that they will be completed by December. The towers and telephone lines on the route of the transmission line are being rapidly put up. Two construction gangs are now working on the erection of towers, and a third will be added this week, when it is expected that it will be possible to erect 15 towers per day.

The large power companies at Niagara Falls are showing the most bitter hostility towards the Ontario Government's power policy, making desperate efforts to have the Power Bill disallowed by the Federal Government. Only a short time ago a delegation from the power companies waited on Sir Wilfrid Laurier, impressing on him their arguments for disallowal. They assert that the Act is *ultra vires* insomuch as it conflicts with vested interests. They argue that millions of dollars have been expended at Niagara by private power companies on the assumption that there would be no Government competition. Capital was obtained, mostly in England, to build the great works at the Falls. They argue that it is not fair to the shareholders, who put up their money in good faith, not dreaming of competition from the Provincial Government. Now, they say, that the several works have been completed and placed in practical operation, the Government steps in to build a transmission line in order to supply the south-western half of Ontario with power at cost. Whatever there may be in the arguments of the power companies, the Federal Government will certainly not disallow the Act nor interfere in any way with the power policy of Ontario. The people of Ontario are hailing with joy the advent of the Government's power policy, and the disallowing of the Act by the Federal Government, and the consequent stopping of the provincial power scheme, would create a rebellion in Ontario.

Continental Notes. — ITALY. — The Ascoli-Piceno hydro-electric installation on the Tronto River had its origin in a small supply for mill work, which some years ago was utilised in a reaction turbine of 200 B.P., driving a three-phase alternator at 240 volts, the pressure being raised in transformers to 15,000 volts for transmission: more recently in 1906 a canal was constructed to ensure a larger supply of water at all times. The total length of the new canal is 4,500 metres, and the discharge takes place where there is a difference in level of 40 metres between the head and tail races. The down-take pressure pipes are built up of riveted sheet-steel; the total length of the down-take is 71 metres. Three turbines, each constructed to give 620 H.P. at 600 R.P.M., have now been installed. They are coupled with an elastic coupling to the alternators. The alternators are all identical, star wound for 3,000 volts and 50 periods, with exciters mounted on the same shafts. The cables are taken to the controlling apparatus which is fixed in a compartment near the machine. The energy is raised to 15,000 volts, at which pressure it is transmitted to Ascoli-Piceno. There are three transmission lines, two of 3·5 mm. and one of 4·5 mm., the line being suitably protected with lightning arresters, both the Gola type and the Siemens type being used. The poles are usually of chestnut wood, 10 metres in height and 35 metres apart. At the distant end of the line the pressure is reduced to 240 volts for distribution.

SPAIN.—The municipal authorities of Mansilla de las Mulas (Province of Leon) have recently granted a concession for the electric lighting of the town during a period of 20 years.

TURKEY.—It is announced that the Turkish Ministry of Public Works has appointed a Commission to draw up the terms for a concession for the establishment and working of a large central electricity generating station in Constantinople.

SWEDEN.—The Drags Aktiebolag has decided to put down a plant to utilise certain available water power on the River Motala in the generation of electrical energy for lighting and power purposes at its cloth manufacturing mills at Norrkoping.

Cowdenbeath.—The T.C. has decided to apply for a provisional order for the extension of the burgh, and to embrace also electric lighting. The Fife Electric Power Co. intimated to the Council some time ago its intention of applying for power to supply electricity within the burgh, and the Council now proposes to ask it to withdraw the name of Cowdenbeath from the order.

Dudley.—A L.G.B. inquiry was held on Friday last relative to the application of the T.C. for loans of £6,000 for buildings and plant and £5,693 for cables. There was no opposition.

Glasgow.—Many interesting comments were offered when the annual report and accounts of the electricity department came before the T.C. for approval. The convener, in explaining the decreased revenue and the deficiency (reported in last week's REVIEW), pointed out that while that was partly due to depression, they attributed a considerable amount of the shrinkage to the benefaction bestowed in the reduction of rates conceded to certain classes of consumers and, in the second place, to the introduction and very extensive use of metal lamps. They were glad to think that there was a prospect of securing from the B. of T. protection against undue competition. Mr. Cosh considered it a very great injustice that wealthy people who required electricity for power purposes should be supplied with that commodity at a price considerably less than cost, and that shopkeepers should have to pay 3½d. for what cost 1½d., while other people got it for less than 1d. Mr. P. S. Stewart contended that, were it not for the large user, or firms using power, electric light would be very much dearer for shopkeepers. Mr. W. F. Anderson thought it too bad that the average consumer was compelled to burn his light for 700 hours before he got the reduction to the ¾d. It was from that class they got the sum of £119,000.

Hay.—The U.D.C. has formed a Committee to consider and report upon the possibility of adopting a scheme of electric lighting.

Kettering.—A L.G.B. inquiry was held on August 18th into the application of the U.D.C. for a loan of £2,000 for electricity purposes, viz., mains extensions, meters, public lighting, and the provision of two mechanical stokers. There was no opposition.

Kirkcaldy.—The T.C. is asking the consent of Dysart, an adjoining burgh, to include in a provisional order powers to supply electricity for lighting purposes in Dysart.

Londonderry.—In consequence of applications for power and lighting, the electrical engineer has been authorised to report on necessary extensions and the estimated cost.

Loughborough.—The accounts of the electricity department for the year ended March 31st last showed a profit on revenue account of £547, but owing to the heavy charges for loans, a grant of £1,500 had to be made from the general district fund, and an adverse balance was carried forward of £2,346. The total amount borrowed on the undertaking is £30,900.

Mansfield.—The T.C. has applied to the L.G.B. for a loan of £300 for water softening plant, and £200 for economiser extension at the electricity works.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee the manager of the tramway system, Mr. Nance, recommended the abolition of the tramway centre poles in the interests of street traffic regulation. This was referred to the electrical engineer for report. A sub-committee was appointed to go into the question of the threatened litigation with Mr. Harrison over the Holywood tramway question and also to go into the proposed working of the Holywood line, the Bill for which has passed into law.

Canada.—A new electric railway will soon be commenced from Morrisburg to Ottawa. The company has been incorporated with a capital of £200,000. The power plants will be located at Morrisburg and Billings Bridge, Ottawa. Another line contemplated, called the Belt Line Electric Railway, covers practically the same route; but the Corporation of Metcalfe, in Carleton County, proposes to give the right of way to the company that begins work first.

Chile.—According to Reuter, the Government has decided on the electrification of 1,150 km. of railway, beginning as an experiment with 184 km.

China.—A scheme is on foot to construct an electric tramway from Swatow to the district city of Cheng-Hai, a distance of about 10 miles. According to the prospectus, the capital is to be $300,000, in $5 shares; the latter, however, are not being taken up readily. Two large river branches would require to be bridged, but otherwise the construction of the line would present no difficulties.—*Board of Trade Journal.*

Continental Notes.—Russia.—Three new lines of electric tramways have just been completed and put in operation in the town of Saratov. There are now 26 km. of electric tramways at work in the town; there are still two lines to be converted to electric traction, of which one is nearing completion.

It is stated that negotiations in regard to the tramway reorganisation in St. Petersburg are being actively pursued by an international syndicate consisting of the A.E.G., Siemens & Halske, and the British Westinghouse Co., backed by the Deutsche Bank. Later reports mention competition by a syndicate headed by the Société Parisienne Electrique. The matter is referred to elsewhere in our columns.

Germany. — The Rheinisch - Westfalische Electricitätswerke Gesellschaft, of Essen, has secured a concession from the Provincial Government authorities of Solingen for the construction and working, during a period of 60 years, of five lines of electric tramways in the district.

Italy.—A company has just been formed in Brussels, with a capital of £200,000 and the title La Société des Tramways de Palermo, to construct and work a system of electric tramways in the town of Palermo, Italy, as also a line connecting that place with Mondello, a distance of 10 km.

Glasgow.—The Postmaster-General has again communicated with the department a proposal to place small letter-boxes on cars. The Sub-Committee cannot see their way to recommend the T.C. to approve of the proposal.

Ilkeston.—According to a correspondent a strike of Corporation tramway employés is threatened, the men having applied for an increase in wages, which has been refused on the ground that the pay is equal to that given in other towns of equal size. Further, it is stated that the Ilkeston tramways are not a paying concern.

Kirkcaldy.—The agreement between Kirkcaldy and Dysart T.C. regarding the proposed extension of the Kirkcaldy tramway system to Dysart has been slightly altered, but it is believed it will now be acceptable to all parties.

Liverpool.—The tramways department of the Corporation carried out some smart work on Saturday night and Sunday in taking up and relaying the track with new double sets of rails, including junctions and points supplied by Hadfields, at the junctions of Dale Street, Castle Street and Water Street, where the main tramway traffic of the city converges. During Sunday the running of the trams at this spot was diverted, but the usual traffic was resumed on Monday morning.

London.—The evening of August 23rd saw the last of the Highgate Hill cable tramway—the first of its kind laid down in Europe—which is to give way to the electric car as soon as rebuilt by the L.C.C. The last few journeys were marked by a great demonstration on the part of the inhabitants living near, who crowded the cars, let off fireworks, and sang "Auld Lang Syne."

Following the example of the District Railway, the Charing Cross and Hampstead tube line is being provided with a morning and evening service of non-stop trains.

Morecambe.—The T.C. has decided to double the tramway track to afford greater facilities for the working of the system.

South Africa.—At a special meeting of the East London T.C. held on July 28th, it was resolved to re-lay the tramtramway track at an estimated cost of £8,500. Recent attacks on the electrical engineer, which led to his resignation being tendered, have caused much public feeling, and a petition is being largely signed asking the Council to retain his services till the reorganisation scheme is completed.

At the last meeting of the Johannesburg T.C., the question of the alteration in tramway fares came up for discussion. The Committee reported against the proposal of the introduction of 1½d. stages by a majority of one, so that the fares will remain as at present. The fact that last year the tramways showed a profit of £40,000, and that a larger profit was anticipated this year led to a demand by a great many for the reduction, but the fact of the heavy losses in previous years carried greater weight.

Wallasey.—The Bill providing for the construction of the extended tram route to Wallasey village from Seacombe having just received the necessary sanction, the U.D.C. will at the next Council meeting consider the question of the method of putting its powers into effect. In the Committee there is a controversy raging as to whether the Council should undertake the work or whether it should be let out to contract. The tramway system already in operation was constructed by the Council's own department.

TELEGRAPH and TELEPHONE NOTES.

Brazilian Wireless Stations.—The Government contemplates the erection of a high-power wireless station on Fernando de Noronha, as well as a small installation to communicate with Pernambuco. Another station will be erected on Babylonia Hill, Rio de Janeiro.

Cable Interruptions and Repairs:—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	
Tourane-Amoy	June 17, 1909	
Assab-Perim	July 8, 1909	
Gibraltar-Tangier	Aug. 7, 1909	
Melilla-Chafarinas	Aug. 7, 1909	
Cueta-Tangier	Aug. 7, 1909	
Corfu-Trieste	Aug. 16, 1909	Aug. 23, 1909
Dakar-Conakry	Aug. 20, 1909	

Fire at a Marconi Station.—According to the daily papers, a fire occurred at the Marconi wireless station at Glace Bay, on Saturday last; the repairs will occupy six weeks, and messages are being sent *via* Cape Cod in the meantime.

Indo-Burmah Telegraphs.—The work of improving the telegraph between India and Burmah, started two years ago, is nearly complete. The Chittagong line and that *via* Assam have been overhauled; the latter is now the main route. The Brahmaputra is crossed by an overhead suspension, and the only submerged cable is at the Ganges crossing. It is stated that the line will not be quite satisfactory until it is possible to run it along a railway.

Portsmouth Municipal Time.—The Telephone Committee has under consideration a proposal to take £300 from the reserve fund for the provision of a Magneta clock system in the borough. It has been decided to apply for the sanction of the L.G.B.

Rand Telephones.—The installation of telephones on the Witwatersrand Gold Mines is likely to become very general in application, and since the recent adoption of an underground telephone system in the shafts and various drives of the Roodepoort Central Deep Gold Mine, it is rumoured that a telephone installation will be generally carried out on the Randfontein estates. There is also a probability of the Langlaagte Gold Mine following suit, as well as various other mining properties.

South African Wireless Stations.—Reuter's Agency announces that active steps are being taken to erect wireless installations along the South African coast. The Government of Natal are in treaty with the Home Government with the idea of erecting such a station on the bluff at Durban, and the scheme will be extended to a system of stations between Cape Colony and Delagoa Bay.

Spanish Telegraphs and Telephones.—*Le Boletin Oficial del Cuerpo de Telegrafos* of Spain publishes a law according to which the Government of Spain has been authorised to spend 10,000,000 pesetas in the reorganisation and development of the telegraph and telephone services. Of this sum 1,895,670 pesetas will be expended on landlines, 2,116,000 on submarine cables, and 106,626 on telephone instruments. 4,618,607 pesetas will be allocated to the extension of telephones and telegraphs, and will include the cost of connecting 382 offices, where there are more than 4,000 inhabitants, with the telegraph system, and 846 offices, where there are less than 4,000 inhabitants, with the telephone system, as well as 1,235 localities where the inhabitants number less than 2,000. The remaining 1,263,096 pesetas will be devoted to the construction of telegraphs to places willing to furnish the necessary poles, and it is calculated that of these there are 1,235.—*Journal Télégraphique.*

Telegraphic Interference.—The Western Union, the Postal Telegraph and Cable Co., and the Lake Shore and Michigan Southern Railroad Co. have been proceeding against the Chicago, Lake Shore and South Bend Traction Co., claiming that the alternating current which is used to work the cars of the traction company seriously interferes with the working of the telegraph companies' wires, rendering them at times useless between Chicago and New York. The telegraph companies' suit was for an injunction, but the judge decided against them, and an appeal has now been lodged. The system of the traction company consists of a single-phase road 77½ miles long, with operating potential on the trolley wire of 6,600 volts. For some part of the way the lines of the various concerns run parallel.—*Telegraph Age.*

Wireless Communication with Balloons.—The *Zeitschrift fuer Schwachstromtechnik* refers to experiments made in in Belgium with wireless in communicating with balloons which recorded signals from the Eiffel Tower and the Palace of Justice at Brussels. This, the journal states, will be of great benefit to aerial navigators, who will not only be able to furnish observations to land without descending, but will also be able to receive directions for their journey or meteorological warnings, enabling them to seek safety before the approach of storms.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—2,550 common battery telephones and protectors for the P.M.G. See "Official Notices" August 20th.

Ballinasloe.—September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Belgium.—September 1st. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14 Rue de la Science) is inviting tenders for the contract for the supply and erection of the overhead equipment of the Trazegnies-Anderlues electric railway.

Brazil.—October 5th. Tenders are being invited by the municipal authorities of Corumba (Province of Matto-Grosso) for the establishment of a central electric lighting station in the town.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

Handsworth.—August 30th. Steam coal for the electric generating station of the U.D.C. F. A. Nixon, electrical engineer.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" August 13th.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" August 13th.

September 7th. Electric light wiring and fittings for the Public Offices; extension for the U.D.C. See "Official Notices" August 20th.

London.—L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G. G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

September 1st.—Miscellaneous stores and electrical accessories for the Metropolitan Asylums Board. See "Official Notices" August 20th.

L.C.C.—September 21st. Two 500-kw. and 150 kw. motor-generators, also high and low-tension switchgear, for sub-stations; steam and other piping, valves &c., for Greenwich generating station. See "Official Notices" to-day.

Plymouth.—September 2nd. Steam turbo-dynamo for the Corporation. See "Official Notices" August 13th.

Servia.—September 14th. The Servian State Railways authorities in Belgrade are inviting tenders for electrical plant required in connection with the new installation at the Segme mines. The plant required comprises a winding engine, centrifugal pumps, signals, and the necessary electrical conductors.

Spain.—September 2nd. The Artillery Authorities at Seville are inviting tenders for the supply of a 15-kw. continuous-current dynamo and an 18-h.p. electric motor.

Warrington.—September 10th. Electrical requisites for six months, for the B.G.; A. Bottomley, clerk, Bewsey Chambers, Warrington.

West Ham.—September 2nd. Electrical fittings for a year, for the B.G. Thomas Smith, clerk, Union Road, Leytonstone, N.E.

Wishaw.—August 30th. Three-wire d.c. switchboard for the Craigneuk sub-station, for the Electricity Department. See "Official Notices" August 13th.

CLOSED.

Dundee.—Messrs. Maxwell, Son & Co., Dundee, have secured the contract to install electric light in connection with the Submarine base. The contract comprises the illumination of the officers' quarters, outbuildings, and lavatories, and the providing of extra lights round the dry dock. The same firm are to carry out the installation in connection with the Corporation's new Central Reading Room.

Glasgow.—The Tramways Committee has recommended the following offers for acceptance:—

Steel traction poles.—Wilson's & Union Tube Co., Ltd.

Phono trolley wire.—Equipment & Engineering Co., Ltd.

H D. copper trolley wire. Standard Cable Manufacturing Co., Ltd.

Switch panel.—British Westinghouse Electric and Manufacturing Co., Ltd

When the recommendation of the Libraries Committee that the offer (£2,799) of Messrs. Allan, Arthur & Ure for the electric lighting of the new Mitchell Library came up for confirmation at the Town Council meeting, a discussion arose as to the method by which the tenders had been obtained. Mr. Battersby, the convener, explained that the Committee had been advised by their own electrical experts that the most satisfactory way was to take six or seven firms who did that class of work and provide them with specifications. That course was followed. Seven firms were invited to tender, six did so, and the lowest offer was that of Messrs. Allan, Arthur & Ure. Mr. M'Millan moved that the minute be taken back. He characterised the Committee's action as unfair, and held that public work should be put upon the public market. The minute was, however, subsequently approved.

India.—An Indian exchange says that the Bengal-Nagpur Railway Co. have ordered for trial purposes 100 cells from the Chloride Electric Storage Co., Ltd.

London.—The following tenders have been accepted for the Government Departments named:—

War Office.

Electric cable.—Callender's Cable and Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Johnson & Phillips Ltd.; Siemens Bros. & Co., Ltd.

Copper conductors.—W. F. Dennis & Co.

General Post Office.

House telephone apparatus.—Gent & Co., Ltd.

Cable (paper core).—Henley's Telegraph Works Co., Ltd.; British Insulated and Helsby Cables Ltd.

Cable, submarine.—Siemens Bros. & Co., Ltd.

Bell receivers.—General Electric Co., Ltd.

Portable telephones.—British L. M. Ericsson Manufacturing Co., Ltd.

Wire, copper, hard drawn, 800 lb.—British Insulated and Helsby Cables Ltd.; T. Bolton & Sons; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.

Electric lifts at Post Office telegraph stores, Cherrywood Road, Birmingham.—A. and P. Steven, Glasgow.

Telephone service and equipment, extension at Ealing Telephone Exchange.—Western Electric Co.

Manchester.—The Corporation Tramways Committee has placed a contract with Mr. William Stahway for a 40-45 h.p. Rynknield petrol motor-car for use as a tower wagon.

Middlewich.—The Electrolytic Alkali Co., Ltd., have placed an order with the Key Engineering Co., Ltd., for a 500-h.p. Ehrhardt & Sehmer gas engine for driving an electric generator at their works.

Rawtenstall.—The T.C. has accepted the tender of Mr. J. W. Kidd for the installation of the electric light at the Municipal Offices.

Sheffield.—The Education Committee on Monday accepted the tender of Messrs. Hall & Matthews, of Sheffield, for installing the E.L. at the new hostel, at £127. That of the Corporation Electricity Department, at £155, was recommended for acceptance. There were 13 tenders, the highest being £328, and the lowest £94!

NOTES.

Parliamentary.—The Electric Lighting Acts (Amendment) Bill.—The House of Commons again debated this Bill on 20th inst., and, after making further amendments, allowed it to be read a third time. The following addition was made to Clause 6:—"(4) Nothing in this section shall enable the Board of Trade, without the consent of the undertakers within whose area of supply the premises are situate, to give such permission as aforesaid to any undertakers where the last-mentioned undertakers are by any Act of Parliament specifically prohibited from supplying electricity within the area of the first-mentioned undertakers."

Clause 24, as we gather from the *Times* report, was struck out, and an amendment was made to Clause 26, stating that the expression "undertakers" meant any local authority, company or person authorised to supply electricity "to whom the E.L. Acts apply."

The London Electric Supply Bill.—In his "Slaughter of the Innocents" announcement last week, Mr. Asquith stated that the London Electric Supply Bill would have to be withdrawn.

Points in Favour of the Electromobile.—In a leaderette appearing in the New York *Electrical World* under the title "The Blessed Noiselessness of the Electric Vehicle," our contemporary interestingly and effectively sings the praises of the electromobile in the following words:—

"If the noise of machinery means waste, as engineers contend, the ordinary gasoline automobile must be a wasteful device indeed. In the campaign against the noise of city streets the gasoline car is often a conspicuous offender, and it contrasts most unfavourably with the latest types of electric vehicles, which are almost noiseless. Imagine a darkened upper room in a city house in which a father is anxiously regarding a sick child.

The curtains are drawn, but the windows must be left open to admit the summer air. The doctor says that the little sufferer must have rest and quiet, and the parents are doing their best to secure this condition without removing their little one from the comforts of home. There are flowers in the room, and the restful hum of an electric fan is heard. The child has fallen into a troubled sleep, and the father is regarding her anxiously. Suddenly, whir-r-r-r, chug, chug, chug—the distracting noise of a big gasoline automobile is heard outside. It sounds like an explosion and is continued for some time. The patient jumps up with a start; its dearly bought rest has vanished, and slow tears course down the cheeks of the child. The father has an impulse to tear that machine into a thousand fragments if he could get at it. This is no imaginary picture, but fact.

"No such charge as this can be brought against the electric machine. 'Joy riders' make no use of the electric vehicle. The speed mania does not seize hold of those who manage the safe and sane electric car. The latter does not drip gasoline on the street, neither is it characterised by an offensive odor. Quietly, steadily, but with strength and power, electricity does its work whether in propelling the carriage which a woman or even a child may operate, or driving the attractive delivery wagon or the heavy truck. The opprobrium which attaches to the reckless driving of automobiles is directed almost entirely against the gasoline cars, and rightly so, for very few accidents are to be attributed to the easily controlled machines of the electric type. In a few places in this country automobiles are forbidden the privileges of the street within municipal limits; but it will be well for the exasperated city authorities to make a distinction in favour of the electric vehicle, for it is not that type of car that has brought reproach on automobilism."

The virtues of the electric vehicle have been recognised by the powers that be in England by allowing electric carriages to be run in the parks at hours when cars using other forms of power are prohibited—much to the chagrin of those interested in the non-electric automobile trades. But with all this governmental patronage the electromobile does not make anything like the headway that it should do here. On the point of noiselessness, the annoying "whir-r-r-r, chug, chug, chug" of the doctor's own motor-car is not unknown to render his prescription of "perfect quiet" unavailing at times. The motor-car is undoubtedly a boon to the medical man—but it ought to be electric!

Appointment Vacant.—A manager is wanted for the Ilkeston tramways and electricity department (£200). See our advertisement pages to-day.

Electrical Fatalities.—A boy aged six took a short cut across the N.E. electric railway one day last week while returning from school, when he fell on the live rail where he lay until an electric train threw him off. "Accidental death whilst trespassing on the electric railway" was the verdict of the jury.

On the 19th inst. an inquest was held at Pyle, Glamorgan, into the death of Owen David and David Thomas, two colliers, who were killed recently at the Crihhwr Fawr colliery by touching the live armouring of a cable. According to the daily Press, Mr. Robert Nelson, Home Office expert, expressed the view that the accident was caused by inefficient earthing, and he suggested an improvement. Another witness, Joseph Llewellyn, said he saw David clasping the electric cable, and rushed forward. He caught hold of him by the waist and dragged him away. As he was doing so their faces came in contact, and witness received a shock which rendered him unconscious.

Engineering Day at the White City.—We have received particulars of arrangements that have been made for holding an Engineering Day at the Imperial International Exhibition at Shepherd's Bush on Saturday, September 4th. Mr. W. Worby Beaumont is the chairman of the Joint Organising Committee and Mr. W. Yorath Lewis is honorary secretary. The affair is being organised by the General Mechanical Engineering Committee, the Mining and Metallurgical Committee, the Building and Engineering Construction Committee, the Institute of Marine Engineers and the Cornwall Mining Committee. The Lord Mayor of London will preside over the proceedings. The programme includes a round of visits for inspecting the construction and operating mechanism of the Flip-Flap, the Wiggle-Waggle, the Witching Waves and whatever else you will in a long list, including such prosaic things as gas engine plants driving printing machinery and refrigerating plant, and the electrical sub-station; the exhibits in the Machinery Hall and other objects of engineering interest that have been brought together for the occasion will be on view. Between the hours of 2.45 p.m. and 7 p.m., no fewer than half a dozen papers and lectures will be delivered in the Congress Hall, as well as there being half-an-hour's interval for a reception at 5 p.m. by the Lord Mayor. In these discourses, Mr. A. Steiger will talk of "Water Power and Turbines"; Mr. J. McLaren will dilate upon "The Extended Uses of Electricity on Board Ship"; "The Treatment of Marine Boilers on Long Voyages," will be the theme of Mr. H. Ruck Keen; "Large Gas Engines" will be lectured about, with lantern slides, by Mr. Percy R. Allen, and the two remaining subjects relate to drawings by, and for, engineers and architects. The last paper is, "according to programme," to commence at 7 p.m., after which, at 7 45 p.m., there is to be a great "Engineering Day Banquet," for which tickets up to 500 are obtainable for 5s. each; anybody desiring to purchase tickets should apply to Mr. Lewis at the Exhibition; and as the printed programme says that a large number have already been applied for, you had better write soon.

From all the foregoing, we are told, it is hoped that "some good may result in thus starting a movement which might well be extended with the object of securing concerted action and more effective results by the numerous technical institutions." We are also told that "the idea of, in this way, endeavouring to bring together the members of the numerous societies relating to engineering seems to be heartily approved by several sections of the engineering community." This is an admirably guarded and qualified statement. The "architectural features of the remarkably beautiful buildings" are mentioned in the list of attractions for this day as appealing to architects and those interested in the building trades. "All interested in engineering work are cordially invited to attend, with their friends, including ladies," and so we suppose are all and sundry who care to pay for admission to the Exhibition. From what we have given above, it will be seen that those who desire to do so can spend a very busy Saturday half-holiday on September 4th, and if they have time, can think something about that question of more concerted action. We observe from the daily Press that the Institutions of Civil and Electrical Engineers and the M.E.A. are to be represented as institutions, but the programme does not say anything about these organisations, and we are not aware that the Institution of Electrical Engineers as a body is in any way identified with the event, whatever may be the part played by individual members.

Legal.—In *re* The Phosphor Bronze Co., Ltd.—Bruce *v.* The Company.—In the Vacation Court on Wednesday last this debenture-holder's action came before Mr. Justice Hamilton on a motion by the plaintiff for the appointment of a Receiver and manager of the defendant company. Counsel for the plaintiff stated that he had come to an arrangement with the defendant company, who were willing that his Lordship should at once pronounce the usual debenture decree. Under those circumstances, with his Lordship's sanction, it was proposed to take the usual order for accounts and inquiries and for the appointment of a Receiver and manager. He asked that the gentleman appointed should have liberty to act at once and to appoint a sub-manager. His Lordship made the order as asked.

Inquiries.—Names are asked for of manufacturers of Rheostene and Resista resistance materials.

Anglo-Japanese Hydro-Electric Power Scheme.—Our correspondent at Ottawa, Canada, writes:—

"The Canadian Trade Commissioner at Yokohama, Japan, advises the Department of Trade and Commerce here, that there will be established in London a company which will undertake the work of floating a loan in order to supply funds to the Anglo-Japanese Hydro-Electric Power Co. From the statement made by Mr. Sonoda, Mr. Masuda, and Baron Shihusawa and Marquis Katsura, it has, however, been ascertained that the aforesaid company will be established in Canada under the Canadian law. The Commissioner says that Marquis Katsura asked these financiers the reason why London business men had chosen Canada instead of London, and that Mr. Sonoda explained that in England the registration fee was excessive, whereas in Canada, which encourages industrial enterprises, the various taxes, including registration fee, were insignificant, and that, moreover, the Canadian law recognised the establishment of a company whose object it was to advance loans. These facts had induced the British capitalists to choose Canada for the establishment of the headquarters of the company.

"The views expressed by the promoters are that in accordance with the demands of the age a hydro-electric enterprise should be inaugurated by means of foreign capital, so that the Government is not likely to object to the scheme. Apparently the Government welcomes the enterprise. Sir Edward Strassay, accompanied by an expert, goes to Japan from London some time this month, when they will inspect several rivers capable of being utilised for the generation of electricity. The subscribers may be entitled to become shareholders of the Canadian Co. and of the Anglo-Japanese Hydro-Electric Co., which will be established in Japan at the same time."

Information Wanted re Life in Aden.—"Ignoramus" writes:—"Having regard to the bad state of things in this country, and seeing the large number of engineers who now seek situations abroad, I have under consideration the offer of a berth in Aden. May I trespass upon your valuable space in the hope that among your numerous readers there may be one who has had experience of this part of the world and who will be generous enough to give me some information as to (1) the cost of living; (2) the cost of clothes and other necessities; and (3) the sort of climate to be expected."

He Applied for a Reward.—We are indebted to an Australian correspondent for the following copy of an amusing letter received by him from one who, out of the fulness of his heart and the inner recesses of his fertile brain, desired to confer a boon upon his fellow countrymen in Australia—for a reward. All we are sorry about is that our correspondent did not send us a copy of his "sympathetic" reply! We believe that the extermination of rabbits electrically has been suggested and tried at least *once* already. That remark about the "stored electricity *promised* by Edison Co." is good, and seems to stamp the writer as not being such a child in electrical matters as some parts of his appeal might lead one to suppose:—

"Dear Sirs, I note from the "Bega" Budget a paragraph that your firm are "exponents" of all that can be done by electricity heating and iron to driving a motor or lighting a palace. Well, the idea came into my head that electricity might be utilised to kill rabbits, and I applied to the Premier for a reward for the scheme. Can you assist me in any way. My idea was to run two parallel lines of wire on insulating cups about ½ in. apart, under a fence about 4 in. from the ground, and that rabbits passing under would join the circuit and be killed.

"Some people say the plan was tried years ago and failed (if so, I never heard of it), others that the wires would be dangerous to human beings (but the wires need not be long, say, 200 yd., and could easily be guarded during three or four hours after dark). Others say the wires could not be charged sufficiently owing to excessive leakages (I am not aware if this is so).

"Can you tell me if it can be done, and if it would be very expensive. I note that a dynamo is not a very costly thing, but there may be other reasons I am not aware of, such as weight, 1 cwt. Doubtless there would arise a considerable demand for dynamos, and this might be worth the attention of your firm. My view was that each instrument should be handled by a Government expert, and moved from place to place to kill rabbits.

"Trusting you will give me a sympathetic reply, I remain, Sirs, yours faithfully, ——

"P.S. Would the stored electricity promised by Edison Co. be likely to be of assistance?"

Accident.—While fixing electric light wires at the new Council Secondary Schools at Croydon on 18th inst., the scaffolding collapsed, and two men (Edwards and Price), employed by Mr. Ernest Price, electrician, were thrown to the ground. They were both removed to the hospital with broken legs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On 19th inst. Mr. F. E. Newton, mains superintendent, was recently the recipient of a barometer, bearing a suitable inscription, given by the staff of the electricity department, Partick, Glasgow, on the occasion of his marriage. Mr. Sillery, burgh electrical engineer, made the presentation, and Mr. Newton replied.

Tramway Officials.—The Corporation tramway staff at Portsmouth has presented a set of silver fish knives and forks to Mr W. R. Spaven, general manager, and Mrs. Spaven, on their silver wedding.

In this column last week Mr. Medcalf was incorrectly described as general manager of the Swindon Corporation tramways. His title, we understand, is "tramways manager."

Mr. J. K. North, late tramway manager at Rawtenstall, has been presented by the employés with a framed photograph of themselves.

General.—As noted elsewhere in this issue, Mr. O. H. Bishop, for many years, and until recently, sales manager to the Edison & Swan Co., has now joined his interests with those of the E.M.F., Ltd., of Ironmonger Lane, E.C., of which company he has become a director. We are asked to state that he will welcome communications at the above address from old friends and supporters.

Mr. T. Tomlinson, 16, Beresford Place, Dublin, is now honorary secretary of the Dublin Section of the Institution of Electrical Engineers.

Mr. C. G. Trevett, sole partner in the firm of Green & Trevett, electrical engineers, Cape Town, having taken up a position on the engineering staff of the Rand Mines Power Supply Co., Johannesburg, the business of the firm has been taken over by Mr. E. A. Shaw, A.M.I.E.E., the manager of the late firm.

The *London Gazette* contains the following notices regarding appointments in the Territorial Force (Royal Engineers):—

"London District Telegraph Companies, Royal Engineers (Army Troops).—Lieut.-Col. A. Bain is granted the hon. rank of Colonel (March 31st, 1908).

Northern Cable Telegraph Company, Northern Command Telegraph Companies, Royal Engineers (Army Troops).—C. Wright to be Second Lieutenant (July 2nd).

Electric Lights Company, Cinque Ports (Fortress).—H. U. Hooper to be Second Lieutenant (to be supernumerary) (July 15th).

Cornwall (Fortress).—Major and Hon. Lieut.-Col. C. H. Paynter, Retired List, Militia (Major, retired pay), to be Major, with the hon. rank of Lieut.-Col. (June 23rd).

Electric Lights Companies, Hampshire (Fortress).—Second Lieut. R. Guest resigns his commission (July 7th)."

The *Australian Mining and Engineering Review* reports that Mr. A. Falkenbach, A.M.I.E.E., who has been for the last three and a-half years chief electrical engineer at the Deep Leads Electric Transmission Co., Ltd., Charlotte Plains, Victoria, has resigned to take up a similar position with the Ross Goldfields, Ltd., Hokitika, New Zealand, where a plant is being erected for the transmission of current from Kanieri Forks to the mine at Ross, a distance of 25 miles, the transmission pressure being 24,000 volts. Mr. Falkenbach left for New Zealand at the end of July.

The *Times* special correspondent at Teheran, in reporting the kidnapping of Mr. Alan Wright, of the Imperial Bank of Persia, by brigands while travelling between Kerman and Yezd, states that Mr. James, of the Indo-European Telegraph Department, who was working on the line, went to Mr. Wright's assistance, and effected his release on Saturday. "Both, however, are still in an awkward situation, as the road in either direction is infested with robbers." Later information reports that they are in a perilous position.

On the occasion of his retirement on a pension after 43 years' service, Mr Charles Pugh, chief telegraph department of the Newark G.P.O., has been presented by the inside and outdoor staff with a barometer.

Mr. Vincent S. Allpress, M.I.C.E., consulting electrical and mechanical engineer, asks that in future all letters and correspondence, &c., should be addressed to him either at 39, Victoria Street, Westminster, or to Southwick, Sussex.

Obituary.—The death of Thomas Livesey, late parcel clerk to the Blackburn Corporation tramways, by whom he has been employed for the past seven years, took place on Sunday, August 15th, after only a few days' illness, of pneumonia. Wreaths were contributed by the inspectors, drivers, and conductors, and the parcel and clerical staffs. The funeral took place on the following Thursday, when about 60 drivers, conductors, and parcel boys (in uniform) walked ahead of the hearse to the cemetery, as a mark of esteem for the deceased.

Mr. Holmes (William, not Sydney), whose death from drowning was alluded to in our last issue, was not traffic superintendent under the Rhondda Tramways Co., being a motorman in their service. Mr. Geo. E. Roddy is the company's traffic manager and superintendent. We are pleased to insert this correction.

The death is announced of Mr. John Wilson, of the Dundee Corporation electrical department. Death took place suddenly on 17th inst.

An evening paper says that Mr. Howard Thurston, who held a position in the service of the Eastern Telegraph Co, has been found shot on the western coast of Africa.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Imperial Lamp Works (Brimsdown), Ltd. (107,306).—Particulars of £40,000 debentures created August 4th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Dublin and Lucan Electric Railway Co., Ltd.—Mr. W. Mooney moved the adoption of the half-yearly report at the meeting held on August 19th. He said that the affairs of the company continued in a prosperous condition. The receipts were £3,351, or 8 per cent. (£242) better than for the corresponding period of 1908. The expenditure was less by £108. The line and rolling stock had been maintained in the highest state of efficiency, and the goods and passenger traffic had been carried on with the utmost regularity. There was a regular half-hourly service from both ends of the line, with occasional specials. Their goods and parcels traffic had developed largely, and he hoped would continue to grow. The preference dividend required £475, £250 had been placed in further reduction of electrical equipment debt, and £429 was being carried forward. They were applying for an Order in Council sanctioning the working of a portion of the proposed extension from Lucan to Leixlip. The report was adopted.

Claud Hamilton, Ltd.—At the general meeting, held in Glasgow, Mr. Alex. J. Fergusson, C.A., chairman, presided and moved the adoption of the report, which recommended a dividend of 6 per cent. on the ordinary capital of the company, after making provision for depreciation, carrying substantial amounts to the various reserve funds and paying the dividend on the 5 per cent. preference shares. Mr. Geo. M'Gregor seconded, and the proposal was adopted unanimously. Mr. Alex. J. Fergusson was re-elected a director.

Blackpool and Fleetwood Tramroad Co.—The half-yearly meeting was held on Thursday last week. The accounts showed receipts to be £11,794, on the revenue account the charges being £8,162. The sum of £4,657 had been spent in the purchase of materials for the renewal of six miles of single line. A dividend of 4 per cent. was announced, £1,250 being placed to the reserve fund.

Prospectus.—*Sungei Liang Rubber Co., Ltd.*—This company has been offering 35,000 shares of £1 each for subscription at par. The company acquires rubber estates in the State of Pahang, Malay States, whereon 32,000 trees are planted.

Ascot District Gas and Electricity Co.—The directors have declared an interim dividend of 5 per cent. per annum (5s. per share), less income-tax, for the past half-year.

Aberdeen Suburban Tramways Co., Ltd.—For the half-year ended July, 1909, the directors recommend a dividend of 2 per cent., carrying forward £527.

United Electric Car Co., Ltd.—A dividend of 2½ per cent. on the ordinary shares for the year is announced.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Aug. 18	3,626	+ 322	11	17,718	— 505	..	..
Ayr	,, 21	1,098	+ 6	14	5,813	— 226	8	..
Bath	,, 18	1,982	+ 153	33	25,488	+ 1,097	..	..
Belfast	,, 20	7,769	+ 571	19	78,951	+ 3,586	37	..
Birkenhead.. ..	,, 22	2,227	+ 73	20	22,326	— 442	13·63	..
Birmingham Corp.	,, 14	12,578	+ 88	20	129,207	+ 3,437	..	..
Blackburn	,, 18	2,535	+ 91	21	23,982	— 852	13·97	..
Blackpool-Fleetw'd	,, 21	4,168	+ 211	7	11,482	+ 130	..	..
Bolton	,, 22	4,884	+ 81	21	49,529	— 790	42	..
Bournemouth ..	,, 18	5,098	+ 314	20	85,938	+ 54	21·96	..
Bradford	,, 14	11,028	+ 612	19	97,470	+ 1,671	54·9	..
Brighton	,, 22	2,725	+ 188	21	21,913	+ 806	9·5	..
Bristol	,, 20	11,931	+1,884	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Aug. 13	447	+ 22	32	6,937	— 115	3·65	..
Barnsley	,, 13	354	— 32	,,	5,331	— 270	..	..
Barrow	,, 13	653	+ 8	,,	7,370	— 560	5·37	..
Cavehill	,, 13	294	— 28	,,	2,819	— 154	..	..
Devonport ..	,, 13	891	— 293	,,	11,830	— 2,847	8·85	..
Gateshead ..	,, 13	2,123	+ 5	,,	31,852	— 810	11·25	..
Gravesend ..	,, 13	569	— 14	,,	6,633	— 172	6·5	..
Greenock	,, 13	1,436	+ 174	,,	17,378	+ 397	7·25	..
Hartlepool ..	,, 13	696	+ 18	,,	7,446	— 204	6·72	..
Kidderminster ..	,, 13	456	+ 3	,,	3,475	— 238	..	..
Leamington ..	,, 13	554	+ 27	,,	5,558	+ 173	..	..
Merthyr	,, 13	545	+ 42	,,	6,875	+ 85	2·9	..
Metropolitan ..	,, 13	15,576	+ 995	,,	169,289	+15,014	22	..
Middleton ..	,, 13	839	— 49	,,	10,816	+ 881	8·5	..
Mid. Joint Com'tee	,, 13	13,164	— 207	,,	182,136	— 4,478	..	..
Oldham—Ashton	,, 13	1,231	— 50	,,	17,835	— 1,134	9·13	..
Peterborough ..	,, 13	328	— 31	,,	3,754	— 339	5·31	..
Potteries	,, 13	3.637	+ 24	,,	56,613	— 1,419	29	..
Rothesay	,, 13	1.282	+ 29	,,	6 860	— 201	2·75	..
Southport.. ..	,, 13	1,000	+ 5	,,	9,339	— 284	8·17	..
S. Metropolitan ..	,, 13	2,331	— 109	,,	25,291	— 589	..	..
Swansea	,, 13	2,477	+ 22	,,	30,642	+ 474	12·5	..
Tynemouth ..	,, 13	1,301	+ 257	,,	7,822	+ 413	3·75	..
Weston-s-Mare ..	,, 13	1,297	+ 151	,,	4,631	+ 216	3	..
‡Worcester ..	,, 13	869	— 51	,,	8,893	— 90	5·75	..
Wrexham ..	,, 13	250	+ 3	,,	3,110	— 143	..	..
Yorks. Wool. Dist.	,, 13	2,051	— 97	,,	28,862	— 468	17	..
Miscellaneous ..	,, 13	607	+ 26	,,	6,623	+ 28	..	..
Burnley	Aug. 21	2,725	+ 59	..	..	..	..	..
Burton-on-Trent ..	,, 22	579	+ 16	21	5,662	— 147	6·63	..
Bury..	,, 15	2.694	+ 169	$19\frac{4}{7}$	23,768	— 590	22·5	..
Cardiff	,, 14	6,076	+1,010	20	44,966	+ 812	..	..
Carlisle	,, 21	387	— 12	33	5,495	— 224	..	..
Chatham and Dist.	,, 19	2,145	+ 312	33	26,771	+ 1,483	14·98	..
Cork	,, 19	1,139	— 65	33	14,473	— 811	..	..
†Croydon	,, 6	2,050	+ 152	..	28,170	+ 122	11·25	4·75
†Darlington.. ..	,, 14	192	— 2	20	3,747	— 230	..	..
Darwen	,, 20	552	+ 5	20	5,167	— 220	4·36	..
†Dover	,, 14	326	+ 18	20	4,318	— 477	4·75	..
Dublin	,, 20	12,534	+1,087	..	43,957	+ 817	54·25	..
Dundee	,, 4	2,439	— 135	$11\frac{4}{7}$	13,852	— 613	15	..
East Ham	,, 21	2,071	+ 222	20½	21,153	+ 2,905	8·43	·68
†Exeter	July 30	340	— 30	18	6,212	+ 514	5·5	..
Glasgow	Aug. 21	34,694	+ 832	..	196,709	— 3,420	90·5	1·5
Hastings	,, 19	3,440	+ 23	..	..	..	..	..
Huddersfield ..	..	..	..	..	...	..	..	.
Hull	,, 21	5,314	+ 533	20	51,811	+ 1,219	14·5	1·5
Ilkeston	,, 19	307	+ 16	20	2,758	— 202	..	..
†Ipswich	,, 14	555	+ 65	20	8,268	+ 37	10·5	..
Kilmarnock ..	,, 21	284	+ 7	14	2,193	— 82	4·25	..
†Lan'kshire Trm.Co.	July 22	3,035	+ 113	29	36,202	— 1,697	17·62	1·18
Lancashire United	Aug. 18	3,223	+ 68	33	43,929	— 148	..	..
Leeds	,, 14	15,158	+1,349	20	135,513	+ 1,549	54	6
†Leicester	,, 21	4,497	+ 205	..	..	..	..	..
†Leith	,, 14	1,507	+ 331	13	8,595	+ 934	6	..
Liverpool	,, 14	23,139	+ 565	32	345,546	— 2,766	104	..
‡L.C.C.	,, 7	74,201	— 882	..	672,818	+21,641	121	4·25
London United ..	,, 21	15,410	— 891	..	202,901	—20,967	..	..
Lowestoft	,, 21	899	— 61	47	8,190	— 1,020	3·5	..
Manchester ..	,, 21	30,652	— 819	21	313,445	— 3,792	90·5	6
†Newcastle	,, 14	3,814	+ 147	..	76,996	+ 1,273	..	..
†Newport	July 31	672	— 41	18	11,874	— 382	14·5	..
Oldham	Aug. 22	3,787	— 299	21	40,838	— 2,948	23·75	..
†Pontypridd.. ..	,, 14	390	— 7	19½	8,353	+ 1,083	5·5	1·75
Portsmouth.. ..	..	..	..	..	..	..	..	..
Preston	,, 13	1,726	+ 108	..	..	..	..	..
Rotherham	,, 19	1,196	— 63	20	12,099	— 545	10	·66
Salford	,, 16	9,723	+ 131	$19\frac{5}{7}$	92,345	— 3,305	..	..
Sheffield	,, 94	10,896	— 185	$21\frac{3}{7}$	120,570	— 1,580	37	1·25
Southampton ..	,, 18	2,578	+ 143	20	22,222	— 540	..	..
Southend-on-Sea ..	,, 18	1,907	+ 220	20	11,987	+ 1,932	..	..
South Shields ..	,, 21	1,319	+ 94	..	12,065	+ 33	..	..
Swindon	,, 18	353	+ 15	.	..	..	..	..
Tyneside	,, 18	1,008	+ 103	7	8,391	+ 203	..	..
Wallasey	,, 14	2,356	+ 110	19½	19,081	+ 523	..	·22
Walthamstow ..	,, 21	1,574	+ 160	20	14,531	+ 152	9	..
West Ham	,, 12	5,154	+ 215	19	46,095	+ 2,636	15	·3
Wolverhampton ..	,, 18	1,674	— 46	20	16,582	— 876	12·5	..
Baker St.-Waterloo	,, 21	5 145	— 85	7	20 575	+ 865	4·25	..
Cen. London Rly...	,, 21	8,775	—4,284	7	31,955	—14,059	6·32	·55
Char. +, Eus. Hamp.	,, 21	6,660	+ 635	7	25,845	+ 3,335	7.75	..
City & S. Lon. Rly.	,, 22	6,042	+ 283	7	21,463	+ 1,259	7·3	..
Dublin-Lucan Rly.	,, 20	848	+ 13	7	1,214	+ 6	7	..
G.N. and City Rly.	,, 21	2,327	+ 5	7	7,562	— 32	3·5	..
G.N., P'y. & Brmtn.	,, 21	8,490	— 70	7	34,535	+ 755	9·25	..
L'pool Overh'd Rly.	,, 22	8 048	+ 72	7	11,985	+ 19	6·3	4·8
Llandudno-Col. Bay	,, 20	1,611	+ 136	38	10,001	+ 1,761	..	..
Mersey Railway ..	,, 21	3,638	+ 40	7	13,410	+ 509	4·5	..
Metropolitan Rly...	,, 22	29,705	+ 215	33	110,440	+ 1,917	24·5	..
Met. District Rly...	,, 21	16,692	+ 503	7	66,555	+ 5,260	24	..
Anglo-Argentine ..	,, 19	77,812	+7,621	32	1,294,697	+76,694	..	..
§Auckland	July 16	13,413	+1,503	28	96,514	+18,296	22·3	8·1
Bombay (B.E.T.) ..	,, 22	4,598	+ 157	28	72,776	+ 4,262	..	..
§Brisbane	,,	16,140	+2,114	..	..	..	..	..
§Brit. Columbia Rly.	June	41,365	+8,826	..	..	..	..	..
Calcutta ..	Aug. 21	6,625	+ 230	..	..	..	..	..
§Cape Electric T. Ld.	June	11,208	..	..	..	..	..	..
§Kalgoorlie, W.A...	July	3,609	..	30	26,133	..	20·5	..
Madras	Aug. 15	1,278	+ 103	32	18,940	+ 278	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	,, 20	2,646	+ 98	33	46,601	+ 22	28	2·4

* Compared with the corresponding period of 1908. † One week only, ‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

WITHIN the next two or three weeks the holiday season will be finished, and "the public" returned to town once more. Business is expected to show signs of awakening vitality in the middle of September, and here and there around the markets are already to be found indications of a little more general interest in stocks and shares than has been the case lately. That people are coming back from their holidays is patent, even in the Stock Exchange, where many of the principal features are sunburnt and tanned.

Home Railway stocks are amongst those to which barely a flicker of public attention is directed. The dealers sorrowfully admit that theirs does not deserve the dignity of being called a market—a word implying trade, activity and business. The man who has an order in a few thousand of stock is regarded as a curiosity, almost an anachronism, and the daily records of movements in Home Railway stocks are, on the whole, a pitiful exhibition of small shrinkages.

Metropolitan Consolidated has gone down with the rest of them, and shows a loss of 15s. Central London Preferred certainly has replaced its loss of 2, thanks to a retail buying order. Other alterations in electrical rails there are none. The Tube Debenture stocks have hardened, and Bakerloo Fours have attained, at last, the level of 100. Charing Cross Debenture improved to 93½, Great Northern and Piccadilly Debenture to 95½. That both will go ultimately to par there seems to be little room for doubt.

Electricity Supply shares are a good second to Home Railway stocks, and, indeed, it may be true to say that the latter themselves are less dormant than the former. Charing Cross Preference and Metropolitan Ordinary eased off a trifle, and Westminsters, of both kinds, are ⅛ higher. South Metropolitan 4½ per cent. First Debenture stock gained 2. There the story ends, and in this barren recital can be found no such cause for complaint as reached us the other day from a Stock Exchange reader. He declared that it was impossible to pick up the paper without finding a growl at market methods, such as the quotation of prices at unduly large margins, the retention of others at levels which did not fairly represent the market values, and so on. The touching upon such points, however, is surely part of an observer's duty, and if the market were to do more than to command that we should bless, Sempronius must deserve it. To descend:—

The Mexican power group has eased off again, and Mexico Tramways stock is 4 points down, while Mexican Light and Power lost 1. Business in Rio Trams has fallen off a good deal, and the price is lower at 92; the 5 per cent. bonds at 94½ have commanded more interest just lately. Sao Paulos went back a little to 149½. Canadian General Ordinary at 124½, shows a rise of 1½, the Preferred at 119½ being without change. Monterey Light, Heat and Power 5 per cent. Debenture kept at 89½, the disastrous fire in the town making no difference to the price.

Anglo-Argentine Trams retain their strength, and Calcuttas are steady. British Columbia Electric Railway Deferred continues to mount, and Cape Electric Trams created a mild surprise by moving up from 5s. to 7s. 6d. British Electric Traction Ordinary are, in Stock Exchange phraseology, a ha'penny harder, and there is no movement in London United Trams.

Advances have occurred in Amazon Telegraphs and Anglo-Americans, a few Debenture stocks also hardening. The quiet improvement in the fixed-interest stocks is all the more worth noticing, because the movement has been going on quietly for some time past. Marconi's shares have not been affected by the unfortunate accident to one of the company's stations. National Telephone issues are firm, with 5s. rises in the First and Second Preference shares.

Manufacturing shares continue very steady. The British Insulated and Helsby Cables Co. has declared an interim dividend at the rate of 8 per cent. on its Ordinary shares. Cromptons are better, and Armament shares show a tendency to improve. Rubbers are a good market.

American Telephone and Telegraph Co.—The *Financier* states that the earnings of this company for the first seven months of 1909 are as follows:—Gross, $19,315,000; net, after payment of interest, $13,463,000; net, after payment of dividends, $5,832,000. In 1909 all maintenance and depreciation is charged against expenses monthly, instead of being partly provided for by an extraordinary charge in December, as heretofore.

British Insulated and Helsby Cables, Ltd.—The directors announce an interim dividend at the rate of 8 per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Aug. 17th.	Closing Quotations Aug. 24th.	Business done week ended Aug. 24th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¾ — 3½	2⅞ — 3⅜	..	..	+ ⅛	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 — 146	144 — 146	145	..	— ½	5 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	60 — 62	60½ — 62½	60½	..	+ ½	5 3 0
3,230,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	103 — 104	103½ — 104½	104	103½	+ ½	5 14 10
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	3/-	19⅝ — 19⅞	20¾ — 21	20 3/16	19½	+ 1⅛	1 18 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103½ — 105½	103½ — 105½	..	..	..	4 14 9
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8 13/16	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	90½	..	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ — 9	8½ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	5 8 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 — 101	99 — 101	..	..	..	3 16 8
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	12⅞ — 13⅜	12⅞ — 13⅜	13⅛	12⅞	..	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 — 101	99½ — 101½	..	..	+ ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 — 132	129 — 131	131	130	..	5 6 1
3,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½ — 86½	84½ — 86½	..	..	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ — 106½	104½ — 106½	106	105	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅜ — 11⅞	11⅜ — 11⅞	11 11/16	11 7/16	..	5 17 11
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 — 104	102 — 104	..	..	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 — 102	100 — 102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ — 10¾	10½ — 10¾	10 9/16	10 5/16	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 14	13⅝ — 14⅛	14	13½	+ ⅛	4 4 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26½ — 27½	26 — 27	..	..	— ¼	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 — 101	99½ — 101½	..	..	+ ½	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	51½	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	74 — 79	..	..	..	5 2
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1 1/16 — 1 3/16	1 1/16 — 1 3/16	15/6	14/3	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16 — 15/16	13/16 — 15/16	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — ⅞	¾ — ⅞	..	..	..	5 13 8
3,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 — 107½	106 — 107½	107	106¾	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123 — 125	123 — 125	124	123	..	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10¾	10⅛ — 10⅞	..	..	+ ⅛	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10 — 10¾	10⅛ — 10⅞	..	..	+ ⅛	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 7/16 — 5 11/16	..	..	..	4 7 8
3,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 — 100	98 — 100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99½ — 101½	100 — 102	..	..	+ ½	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
60,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 87	85½ — 87½	86⅜	85⅞	+ ½	4 11 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99½ — 101½	99½ — 101½	..	..	..	3 18 10
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99½ — 101½	100 — 102	101¼	100¾	+ ½	4 8 3
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 — 132	130 — 133	131	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 15/16 — 7 3/16	6 15/16 — 7 3/16	7⅛	6 31/32	..	5 11 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	4 10 3
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99½ — 101½	99½ — 101½	..	..	..	3 18 10
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13½ — 14	13⅜ — 13⅞	13¾	13 17/32	— ⅛	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½ — 104½	102½ — 104½	103	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½ — ⅝	½ — ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	8 %	6 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 — 103	101 — 103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	.. ..	4 11/16 — 4 15/16	97/6	95/-	..	5 1 3
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	.. ..	4 7/16 — 4 11/16	..	..	..	5 6 8
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	92 — 93	92 — 93	92¾	92¼	..	4 6 0
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 — 104	102 — 105	..	..	+ ½	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	20 %	4 5/16 — 4 7/16	4 5/16 — 6 7/16	..	..	..	4 9 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼ — ¾	¼ — ¾	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅜ — 1⅞	1⅜ — 1⅞	33/9	..	..	18 13 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3½	3¼ — 3¾	66/10½	..	+ ¼	8 0 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	93 — 96	95 — 98	..	..	+2	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	145 — 149	146 — 150	..	..	+1	5 6 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 — 125	121 — 125	123	..	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 — 110	108 — 111	109	108¾	+1	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 — 104	102 — 104	102¾	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 — 104	101 — 104	..	..	..	4 6 7
183,801	British Electric Traction	10	8 %	Nil	Nil	Nil	½ — ⅞	9/16 — 15/16	..	..	+ 1/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 — 2½	2 — 2½	47/6	..	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 — 88	85 — 88	85¾	..	..	5 16 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ — 7¾	7⅜ — 7¾	7⅝	7½	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6½	6⅛ — 6½	6 5/32	..	..	4 11 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 — 106	103 — 106	104⅞	101	..	4 4 11
304,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	5/3	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	† Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4 11/16 — 4 15/16	4 9/16 — 4 15/16	98/9	..	..	4 12 2
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 — 100	97 — 100	98½	98¼	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10½ — 11	10½ — 11	10 5/16	..	..	6 16 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 18 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½ — 106½	104½ — 106½	..	..	..	4 4 6
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛ — ⅜	¼ — ½	..	..	+ ⅛	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1 15/16 — 2 1/16	1 15/16 — 2⅛	..	..	..	6 0 0
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 — 108	105 — 108	105½	..	..	3 14 1
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	61 — 63	61 — 63	62½	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	81 — 83	83 — 85	85	..	..	4 16 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,4[illegible]	City and South London Railway	Stock	1¾%	2⅜%	2⅛%	1½%	81½ — 82½	81½ — 82½	81¾	81½	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	½ — 1	⅝ — 1⅛	17/6	..	+ ⅛	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	9 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.   † A period of nine months.   From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 17th.	Closing Quotations Aug. 24th.	Business done week ended Aug. 24th. 1909.		Rise + or Fall –	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1 1/16 — 1¼	23/6	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 –103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1¼%	⅛— ⅜	⅛— ⅜	..	..	..	20 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	2½ %	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1¼— 1½	1¼— 1½	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½— 8	7¾— 8¼	..	..	+ ¼	6 1 3
200,000	Do. do 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13¼	12 — 13⅜	13	..	+ 1/16	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛— 5½	5 3/16	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ - 107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14¾— 15½	14¾— 15½	15 7/16	14¾	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞— 15/16	⅞— 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½ — 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1⅞ — 2⅜	1⅞ — 2⅜	..	..	..	15 8 4
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	68 — 71	68 — 71	68	..	..	5 12 8
5,732,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	40 — 40½	39¼ — 39¾	39⅞	39½	— ¾	1 5 3
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 –67	66½	65¼	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	17 — 17½	17 — 17½	17¼	17	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 3/32	1/32 — 3/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16 xd	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	..	..	..	4 12 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	128 —131	124 —127	128⅜	125¾	- 2	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	96 — 98	95½— 97½	97½	96¼	— ½	5 2 7
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	12/-	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34 — 35½	34½ — 36	35½	34¾	..	2 10 9
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —101½	100 —102	..	..	+ ¼	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	103 —104	103¾	103½	+ ½	4 16 2
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	88 — 90	..	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	36 — 38	38½	36⅜	+1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝— ⅞	⅝— ⅞	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝— 3⅛	2⅝— 3⅛	53/9	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Aug. 17th.	Closing Quotations Aug. 24th.	Highest	Lowest.	Rise + or Fall –	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4¼— 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,440	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7½— 8 xd	7½— 8	..	..	..	6 5 0
9,151	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½— 8 xd	7½— 8	..	..	..	4 7 6
336. 76	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 –100	97 —100	..	..	..	3 18 5
80 00	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80 00	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½— 5	4⅜— 4⅝	90/7½	..	— ⅛	4 12 4
80 00	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅜	3⅞— 4⅜	..	..	..	5 2 10
445. 36	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	97	..	..	3 19 3
49, 36	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 4⅛	3⅝— 4⅛	..	..	..	5 9 1
175, 00	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10⅜— 10⅞	10 21/32	10⅝	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾ – 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾— 3¼	2¾— 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½— 11	10½ – 11	10⅞	10¾	..	5 9 1
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	12/6	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$3,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84½— 86½	86 — 83	..	..	+ 1½	5 13 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	7⅛— 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	98 —101	98¾	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6⅜— 6⅞	6⅜— 6⅞	..	..	..	5 16 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞— 2¼	1⅞— 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	5 11 8
382,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4¼— 4¾	4⅛— 4⅝	85/7½	85/-	— ⅛	5 7 6
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83½— 84½	83½— 84½	84½	83¾	..	5 17 8
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	72 — 76	71 — 75	73¾	72½	—1	4 13 4
$?,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	106 —110	106 —110	108¼	108	..	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	86 — 88	87½	87	..	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 7
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11 — 12	11 — 12	..	..	..	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 7 3
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32— 1 1/32	31/32— 1 1/32	20/6	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16— 13/16	9/16— 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—101	102 —105	..	..	+ 1½	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½— 1	½— 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½— 2	1½— 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	77 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	13/16— 15/16	13/16— 15/16	..	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	11 %	12 %	10 %	10 %	8½— 9	8⅝— 9⅛	..	..	+ ⅛	5 9 9
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	6 %	4½%	4½%	4½%	4⅞— 5¼	5 — 5⅜	..	..	+ ⅛	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st. 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1909.

Although the returns for export business during July reached an extraordinarily high value, it will be seen that this was due entirely to the spasmodic rise in telegraphic exports, which attained to something like 10 times their normal value.

Actually the exports amounted in value to £501,749, as compared with £270,268 in June, but this half million total included £255,095 worth of telegraphic material—one item of £184,011 going to the States—and exclusive of this, £246,663 worth of general business remains (which is comparable with previous years' returns). This latter total is somewhat less than in the June return.

The imports have been steadily improving during the past three months, and the July total of £161,190, compares with £158,119 in the previous month. The re-exports, at £12,577, were approximately £500 better than in June.

Naturally the telegraphic section of the exports is the most bulky in the return; electrical machinery exports of all kinds were practically as good as in June, and the telephonic exports were some £12,000 better than in that month. Machinery and carbon imports show a large increase, but the value of telephonic and telegraphic material coming in was much less than in June; lamp imports remained steady. The United States, Japan, Brazil, Canada, and India were prominent purchasers, while among the increasing number of importers which find a place in the returns, Germany, as usual, heads the list with £92,708.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	153	79	78	...	54	4,063	80	...	...	28	349	4,884
Germany	93	154	63	...	222	1,022	...	13	...	20	550	2,137
Netherlands	348	1,094	7	15	31	526	...	11	...	5	41	2,078
Belgium	885	459	74	80	277	1,537	5	34	...	262	26	3,639
France and French West Africa and India ...	199	20	237	374	8	2,070	...	...	...	60	355	3,323
Portugal	99	...	24	...	13	71	4	4	...	...	47	262
Spain and Canary Isles...	171	...	22	104	...	296	20	12	27	15	479	1,146
Italy, Switzerland and Austria-Hungary ...	114	86	20	51	755	1,441	...	5	...	...	282	2,754
Greece and Turkey	57	...	22	...	8	431	...	54	...	11	134	717
Channel Isles, Gibraltar, Cyprus and Malta ...	69	81	6	51	21	623	...	12	...	...	14,456	15,319
U.S.A., Philippines and Cuba	323	...	80	118	30	18,717	...	...	18	...	184,011	203,297
Canada and Newfoundland	295	890	836	696	287	3,074	3	323	...	3,753	22,247	32,404
British West Indies and British Guiana ...	111	...	45	41	...	16	...	...	...	52	24	289
Mexico, Colombia, Panama, Venezuela and Ecuador	116	742	...	100	25	50	...	...	...	5	1,771	2,809
Peru and Uruguay	132	1,685	172	179	...	294	...	3	...	76	237	2,778
Chile	...	128	266	251	96	1,345	...	144	108	281	69	2,688
Brazil	249	5,157	330	367	352	9,904	865	371	10	1,997	23,147	42,749
Argentine	1,063	865	42	730	472	2,660	5,801	574	55	1,625	645	14,532
Egypt	91	59	1	117	...	145	2	126	...	348	246	1,135
British West Africa and St. Helena	8	633	...	106	2	3,075	...	...	...	332	10	4,166
Azores, Madeira, Port. East and West Africa	134	376	91	32	37	646	...	...	...	15	115	1,446
Cape of Good Hope	652	1,065	52	115	186	1,251	...	414	...	4	68	3,807
Natal	592	3,271	130	316	314	4,361	...	116	...	89	81	9,270
Zanzibar, Brit. East Africa, Mauritius and Aden	26	236	2	133	27	293	...	10	12	109	456	1,304
Rhodesia, Orange River Colony and Transvaal	1,039	1,094	33	468	18	1,036	...	93	229	1,589	53	5,652
China and Siam	261	2,160	114	84	40	1 417	682	172	...	9	3,059	7,998
Japan	488	11,950	1,025	...	355	14,495	9,469	...	...	11,304	686	49,772
Java and Dutch Borneo...	45	...	28	...	...	...	...	3	...	...	...	76
India	1,572	6,578	866	1,524	654	7,111	4,239	3,394	450	167	758	27,313
Ceylon	15	157	74	131	...	502	...	84	...	...	20	983
Straits Settlements and Fed. Malay States ...	217	1,286	281	143	186	829	110	108	...	115	111	3,386
Hong Kong	260	230	164	212	379	847	1,600	13	34	11	21	3,771
West Australia	1,641	585	41	59	200	671	40	572	...	200	18	4,027
South Australia	134	79	...	91	...	2,616	...	56	...	1,571	...	4,547
Victoria	727	3,256	175	256	145	3,590	...	251	..	5,464	125	13,989
New South Wales	976	238	532	1,355	375	2,124	2,574	766	...	1,189	32	10,161
Queensland	402	21	28	85	...	197	...	42	...	...	...	775
Tasmania	15	9	...	...	...	744	...	...	...	946	...	1,714
New Zealand	582	2,440	457	197	148	2,724	300	485	...	952	367	8,652
Total, £	14,354	47,163	6,418	8,581	5,717	96,814	25,794	8,265	943	32,604	255,096	501,749

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		£
Norway, Sweden and Denmark	...	...	...	97	...	394	34	358	42	2,233		3,158
Germany	615	9,490	1,368	30,388	2,767	28,615	286	597	6,482	12,100		92,708
Holland	...	40	...	2,610	...	198	2,636	...	91	29		5,604
Belgium	154	11,318	312	10	37	3,238	...	125	422	8,032		23,648
France	...	70	1,031	1,425	680	278	3	994	2,618	333		7,432
Switzerland	17	58	...	...	37	314	...	...	14	107		547
Austria-Hungary...	...	588	12	720	30	342	...	41	1,609	36		3,378
Italy	54	2,954	...	12	24	...	68	...	...	186		3,298
United States	1,150	10	1,017	1,213	145	8,798	8,250	438	80	132		21,238
Total, £	1,990	24,528	3,740	36,480	3,720	42,177	11,277	2,553	11,358	23,188		161,011

Additional imports: Spain, lamps, £100; carbons, £27. Portuguese East Africa, goods, £15. Victoria, electrical machinery, £37.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Country	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	2,039	230	...	2,688	...	3,183	...	298	663	3,476		...

Total Exports: £501,749. **Total Re-Exports: £12,577.** **Total Imports: £161,190.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

THE ELECTRICAL INSTALLATION AT THE NEW VICTORIA AND ALBERT MUSEUM.

In June of this year, just 50 years after the opening of the old museum, the new buildings of the South Kensington Museum, the largest collection of applied arts in the world, were declared open by their Majesties, the King and Queen, with due State ceremony.

The general scheme of the electrical installation at the Museum was designed by the Engineering Division of H.M. Office of Works, to meet the requirements of the architect and the Board of Education, as represented by the museum authorities some three or four years ago. The original scheme has been modified from time to time during the progress of the work, to meet the views of the Committee of Arrangement and the newly appointed Director of Art, including also such changes as were necessitated by structural alterations, and those required for the adoption of metallic-filament lamps when these became available.

The supply of current for the building is taken from the Kensington and Knightsbridge Electric Lighting Co., Ltd., on the three-wire continuous-current system, at 200 and 400 volts. The three cables are brought into the building at two separate meter rooms, some 180 yd. apart. In each of these rooms the supply is then divided to feed a power switchboard at 400 volts and two lighting switchboards at 200 volts, one in each room on the positive and one on the negative side of the three-wire system. The power boards have a main panel and three or four circuit panels respectively, the current being metered before arriving at the switchboard. The four lighting boards have each one main and six circuit panels, the latter being, for the sake of uniformity, all of 200 amperes capacity. In this case (to meet the wishes of the supply company who considered the large size meters, which would otherwise have been necessary, undesirable) the current has been metered at each circuit panel and not before reaching the main bus-bars. On entering the switch room the cables are divided, the neutrals being laid in a trench in the wood block floor and the live poles carried overhead on a shelf. Each circuit panel consists of two distinct slabs carrying D P. knife switches, tandem-coupled, and fuses of the hand-grip type. The panels are of white Sicilian marble 1$\frac{3}{4}$ in. thick, mounted on an angle-iron frame; they were made and erected by the Westminster Engineering Co., Ltd. The instruments, recording and other, are of Nalder Bros.' manufacture.

From the circuit panels of the lighting boards paper-insulated, lead-covered cables, made by W. T. Glover & Co., Ltd., of which there are in all some 3 miles, the largest size used being 91/13, run to main fuseboards at various points on the lower ground floor, such boards having usually four D.P. ways controlled by hand-grip fuses. These ways feed, through lead-covered rising mains, the distribution boards on each of the four floors in that section of the building, from which the lights themselves are switched on and off. The distribution boards have 10-ampere ways throughout with D.P. fuses, the stoneware holders of which have bridge threadings, and S.P. Diamond-type, quick-break switches mounted on white marble panels. All the circuits have the lights they control indicated on a white label fixed above the switch.

The sizes of mains and circuit wires have been calculated so that the fall of potential between the meter rooms and the most remote circuit (say, 700 ft. run) when full load is passing, does not exceed 1·5 per cent. The mains from the power boards run direct to the D.P. switches of the motors.

The power installation consists of four 45-H.P. motors, and four electric lifts, on the 400-volt supply. There are also 14 30-in. ventilating fans, and one small pump in the boiler house, which are driven from the 200-volt mains. The 45-H.P. motors, only two of which are in use at any one time, are for driving, by belt, the large fans of the Plenum ventilating and heating system. They were made by Messrs. Newtons, Ltd., of Taunton.

Of the lifts, two for 1,500 lb. are for the use of the general public; it is believed that this is the first time such a convenience has been provided in any public museum. These, with a smaller lift for office use, were installed by the General Electric Co. The fourth lift is also for office use, but is provided with push-button control, instead of requiring an attendant to operate it from the cage, as do the others. This lift has been made and erected by Messrs. R. Waygood and Co., Ltd. All the lifts have both electrical and mechanical locking gear on the doors. The total travel of each public passenger lift is 83 ft., at a speed of 180 ft. per minute.

The contractors for the general installation were Messrs. T. Clarke & Co., of 129, Sloane Street, under the supervision of H.M. Office of Works. The wiring throughout is 2,500-megohm grade, and is drawn into galvanised, heavy gauge, screwed conduit. It is interesting to note that the test of the whole of the wiring before the erection of fittings, both poles to earth, was 1·7 megohms in No. 1 switch room, and 1·6 megohms in No. 2 switch room. There are in all about 1,700 points.

The tubing throughout the public galleries is chased into the floors and walls, traps being arranged in the wood-block flooring, and, occasionally, in the fibrous plaster cornices, to give access to the draw-in boxes.

In addition to the general lighting of the galleries, a special pilot light circuit has been arranged, fed directly from the main bus-bars, for the use of the night police or in case of emergency. These lights are controlled by local switches instead of from the distribution boards. As there is usually only one such light for each gallery or flight of stairs, it will be readily understood that very long and expensive runs were entailed by this circuit. Those pilot lights which are adjacent to fire alarms are provided with ruby shades.

As a general rule it may be said that the architectural courts and the textile galleries are lighted by arc lamps and the wood-work, ceramic and engraving sections by metallic-filament incandescents.

The arc lamps are all of the enclosed type, burning two in series on the 200-volt circuit. There are approximately 140 8-ampere and 200 3-ampere lamps in use, the order for these being divided between the Westminster Engineering Co. and the Maxim Electrical Co. The majority of the 8-ampere lamps are provided with counterweights, of a simple pattern, for convenience in trimming, and the lamps which come near the bridges and balconies have oblique metal reflectors to shade the light from the eyes of the people on the first floor. The counterweights are suspended from the iron terminal-boxes by six-core insulated flexible cable: each core consists of nine strands of copper and three of steel wire wound on a centre of string, and the whole six are twisted round a seventh core of string. The insulation is cotton, pure rubber and braid. The flexibles pass round boxwood pulleys and are attached to a special cross-arm on the top of the lamp resistance. It should be said that in the case of both the large and the small lamps, the line resistance forms the top part of the lamp. The terminal boxes are filled in with paraffin wax to prevent moisture accumulating in them from the steel work of the roof.

Owing to the way in which the old and the new buildings are sandwiched together, the difference in lighting is very noticeable in many adjacent galleries; particularly so in passing from the Octagon Court, in which at present various loan collections are on exhibition, into Gallery 41, formerly the Science Library. The latter is still lighted by means of 10-ampere Siemens "Differential" open-type arcs, four in series on 200 volts, which have been in use since 1883. Much of the wiring in the old Museum is surface work on the "tree" system, the building having been a pioneer in electric lighting, as some of the galleries were so lighted as long ago as 1878. The re-wiring and better lighting of this part is now being taken in hand, but it will naturally occupy a considerable time.

A very objectionable feature presents itself in many galleries, and especially in the large textile courts, due to the reflection of the lights in the huge sheets of glass with which the exhibits are protected. The Holy carpet in the West Central Court presents a particularly flagrant example of this, either when viewed from a distance of a few feet or with the full 30 yards of the Court intervening. This unfortunate effect is, however, not confined to the hours of artificial light, for throughout the day the white columns and floors behind the spectator are equally troublesome.

The greater part of the incandescent lighting is as follows: a double row of six-light fittings in the 30-ft.

galleries, or a single row of one-light high C.P. pendants in the narrower rooms and passages.

The six-light fittings, of which there are upwards of 270, consist of a flat bronze ring suspended by chains from an inverted bowl containing the mechanical connections, the hook being screwed by means of a stirrup-piece on to the conduit, which, therefore, carries all the weight. The six lamps are each 28-watt, 100-volt, spherical, obscured, metallic-filament lamps under a 6-in. "saucer" opal shade. The lamps directly opposite to one another on the ring are wired in series. The rings hang at a height of 9 ft. from the floor, this having been found to be the best height for lighting the majority of the centre cases. The single-light flexible pendants are also screwed to the conduit, and have similar porcelain mechanical connectors covered by a bronze bowl. The lamps used in these pendants and also in most of the one-light brackets are 100-C.P. or 50-C.P. 200-volt Osrams, under 10 in. × 3 in. conical opal shades. The bronze fittings were supplied by the General Electric Co., Ltd., with the exception of the eight special ceiling fittings on the main staircases, fitted at present with 200-C.P. obscured Osram lamps, which were made by Messrs. G. Forrest & Son.

Only two of the galleries have as yet been fitted with the new gun-metal wall cases, but plug circuits with flush wall plugs about every 6 ft., and 8 ft. 6 in. from the floor, have been run for about 2,000 lineal feet of these. Each plug supplies two reflectors, wired in series, with 28-watt metal-filament lamps for supplying top lighting for the cases. Internal lighting of cases is avoided, as the cases may only be unlocked in the presence of one of the keepers of the particular department, which arrangement would render the lamps and wiring not readily accessible.

In one corridor on the first floor, in which textile exhibits in high cases are arranged down the centre, it has been found necessary to use two-light electroliers, having a spread of about 4 ft., so that the sides of the cases may not be thrown into shadow by the lights hanging immediately above them.

In the case of various large exhibits, as, for instance, the Santa Chiara Chapel in the Eastern Architectural Hall and the Sizergh and other panelled rooms in the Woodwork Section on the ground and lower ground floors, special lighting has been provided. This work, together with the erection of all the fittings and arc lamps, was also carried out by the wiring contractors, Messrs. T. Clarke & Co., under the direction of H.M. Office of Works.

There are, in addition, some 300 plain pendants and other fittings for the lighting of the boiler house, the new offices, stores, hot-air ducts, &c., bringing the total number of incandescent lamps in the new installation up to nearly 3,000 of sizes varying from 8 to 200 C.P.

A fire-alarm installation of 22 points has been installed, and, as the number of positions in the old museum was found to be inadequate, the extension of this is being undertaken at the same time, the number to be increased from six to over 30. Temporary instruments with "Pull" contacts and telephones have at present been fixed to ring simultaneously in the Fire-picket Room and the Police Room, from which a call for the Metropolitan Fire Brigade can be given if needful. This work, together with the extension of the night watchman's tell-tale clock installation, has been carried out by the Engineering Division of the Post Office. The bells required for the new offices have been fixed by Messrs. Comyn, Ching & Co.

NOTES ON TRADE ABROAD.

(*Continued from page* 288.)

How to deal with the French Northern Market.

An American Consul in France in calling attention to the excellent field offered by the French department of the North, hammers away at an old, but often disregarded, suggestion. American goods, he says, cannot be sold by catalogues and correspondence alone. "Neither catalogues nor correspondence should be sent to foreign business houses if not in the language of the country, as merchants are loath to buy goods the exact merits of which they do not know, and are often not able to make out when measurements, prices, &c., are given in the English language." The advice here given has been disregarded in the French market by Americans, and our own manufacturers have been told the story again and again from other parts of the world. We also know that French and German manufacturers are not at all over-anxious on the point, for we receive here, in the course of the year, a good many catalogues written from start to finish in a foreign language. If this American Consul be correct, we, as Englishmen, have some reason to plume our feathers as we contemplate our position in the North of France, for he tells his fellow-countrymen wherein we give them points :—

"In manufactured goods in general the market seems to be monopolised by England and Germany. This is wholly due to the systematic efforts of the manufacturers of those countries who have agents here who perfectly understand the language and the system in which the people are accustomed to do business; who carry samples of the goods they sell, and are prepared to give prompt information in regard to prices and terms of payment. Should the American manufacturer wish to have his share in the business, he must adopt the same measures as his foreign competitors."

Coming from the general to the particular, we find this Consul advising Americans to devote great attention to the coming electrical requirements in and around Roubaix, where large central stations have been installed, and are now supplying mills, industrial establishments, cafés, private houses and workshop installations. The sale of small electric fans for offices, cafés, and large stores would be greatly increased there if the price were not so high. Then after making an interesting circuit of many other lines of manufactures the reporter returns to his first point, and hammers home the warning that "circulars, printed matter and correspondence in English, will be time and labour lost. Have all printed matter in French, giving prices and stating the measurements in the metric system." He adds: "In sending circulars, &c., write to the firm in their language, explaining fully the article for sale, and quote, if possible, prices delivered in their city. Probably a trial order will result, and with this as a reference other firms should be written to or visited if possible." Tariff alterations notwithstanding, British electrical firms looking for an extension of business connections in Northern France should digest the foregoing advice, and see if they are among the careful ones whose example the American Consul holds up for emulation. If they are not—*verb. sap.*

f.o.b. or c.i.f. ?

Though indisposed generally to accept the charges hurled at the heads of British firms employing methods which were out of date compared with those of younger commercial competitors, the editor of the *Chamber of Commerce Journal* confesses in his June issue that instances are occasionally brought under his notice which would almost seem to justify the severe and sweeping criticisms referred to, unless it be remembered that it is unsafe to deduce general conclusions from what may be merely isolated instances :—

> For example, a correspondent abroad informs us that he recently asked a number of leading British firms in their particular trade for catalogues and prices of a certain article. In reply, one firm wrote that they could not quote a price f.o.b. the foreign port. Apparently the term "f.o.b. the foreign port" was a clerical error for "f.o.b. London." Anyhow, such clerical errors ought not to occur when corresponding with customers thousands of miles away. Again, what possible reason can there be to prevent a firm from quoting a c.i.f. price, if required? At all events, such a firm would be at a very serious disadvantage abroad compared with one which is ready to do so. Another firm was even less explicit, and merely quoted for "delivery at this address," which was a street in the outskirts of a large city. It is obvious that such a quotation is absolutely useless to a foreign customer who cannot have any idea of the cost of transport from factory to steamer. What possible chance can such a firm have in competition with a more up-to-date house which quotes c.i.f. terms, or f.o.b. the export steamer? Yet a third firm forwarded a catalogue of different goods altogether from those asked for. Further, all firms stated that the packing would be extra, but not one of them vouchsafed the least idea of what such charges would be. As we have said before, we hope and believe that methods, or lack of methods, such as those to which we have alluded are the exception rather than the rule amongst British firms. Still, it cannot be too strongly impressed upon firms seeking export trade that they should in all cases give a probable buyer, in the first instance, the fullest information to enable him to arrive at the exact price he will have to pay for the goods, in order to avoid

vexatious and unnecessary delays, which may even result in the loss of the business.

The importance of this point has lately been impressed upon us very strongly by an electrical friend from China now on a visit to this country. He says that when houses in China write home to England for quotations for machinery and electrical manufactures, it is absolutely useless for our firms to post or wire back prices that are not c.i.f. Obviously it is far more difficult for the man in China to ascertain the charges than for the home firms, who possess the necessary particulars of the goods, are accustomed to export shipping, and are in touch with the shipping company. An inclusive price for the whole of an inquiry enables the recipient of the tender to know exactly where he stands in regard to the matter—whether he be ready to order straightaway on the receipt of price, or whether he have to tender again to his own client. We know it is said that it is sometimes impossible for the Britisher to quote c.i.f., because of the inability or indisposition of shipping authorities to co-operate, and he has to give way to the American and German who manages to do so. All we can say is that wherever it is not absolutely impossible, the c.i.f. quotation should be given. The trouble will be well repaid. The same weakness was also alluded to in Mr. Grigg's celebrated Canadian report, referred to later in these notes. He showed how the scale had often been turned against British goods, and in favour of the German, in Canada by negligence of this matter. Strange that our manufacturers should occasion such a frequent source of irritation and annoyance as Mr. Grigg showed it to be.

Catalogue Preparation.

The manufacturer is often guilty of paying too little attention to the convenience of the purchaser when preparing his lists and catalogues. It is in all conscience short-sighted policy to spoil the ship for a ha'porth of tar. Many lists are beautifully got up and handsomely illustrated, but either through some oversight or short-sightedness or an unwillingness to take a little more trouble or spend just a few extra pounds, the entire efforts of an export or publicity department may be defeated. The technical man must learn to stoop from his high estate in his endeavours to meet the wants of a man who is "only commercial" and to a very large extent non-technical. In considering this point in relation to the Eastern Market, the *American Machinist* a couple of months ago wrote editorally as follows :—

> Suggestions have been made that trade lists or catalogues of many every-day mechanical appliances would be no worse if drawn up with more regard to the convenience of non-technical commercial men. Especially for the Eastern market, merchants have often to indent for workshop supplies, the details of which are, in the nature of things, unfamiliar. The Sheffield file list might be mentioned. Quite a number of different styles of files are similarly priced, the variations in cost being governed by their length; but, although prices are named for lengths from 1 in. to 24 in., no indication is given as to the most generally suitable length of, say, round, square or three-sided files in proportion to their diameter, or width across flats. The Sheffield file list and the standard tube lists have been so long and widely accepted that it is, perhaps, too much to hope that the basis prices should be written down so that they should much more nearly represent actual prices. Then rope for use in pulley blocks, scaffolding, &c., will sometimes be sized by girth, sometimes by diameter, and, whilst requisitions will naturally call for given lengths, the catalogues will name prices by the pound. To get at the approximate length per pound will entail a hunt through engineers' handbooks not always at the elbow of general merchants. Again, the wide discrepancies in the price of different types of self-sustaining lifting blocks are sufficient to puzzle a non-technical inquirer, but, if the mechanical efficiency of each type of block were given, the reason for the variation would be apparent. Illustrations of bevel or angular milling cutters are sometimes given, together with the information that they are supplied either right or left hand, but no definition of right or left hand is given, nor how the angle is measured. Ordinary self-interest would lead to the purchaser's task being made as easy as possible.

Australia.

Firms interested in the electrical requirements of Australasia will naturally desire to be placed in possession of information regarding work that has already been accomplished there. During the past few months we have published in the Electrical Review descriptions of a number of electricity works and the only electrical manufactory of any importance, from the pen of Mr. J. H. Davies. Other plants at Kalgoorlie, Perth, and in other parts of the Continent, have also been described in earlier issues. The last tables of Australian electrical works, with their engineers and voltages, compiled by the *Australasian Hardware and Machinery*, was reprinted in our issue of November 3rd, 1905. In addition, the usual brief particulars of systems of supply, voltages and so forth, are given in the *Universal Electrical Directory* in the Colonial and general classified section, under the heading "Electricity Works."

We have now before us the largest piece of purely electrical publication work that has ever appeared either in, or in regard to, Australia. It is entitled "Electrical Progress in Australia," and was issued as a special number of the *Australian Mining Standard and Electrical Record.* The object of the editor has been to post up all concerned in the progress of applied electricity in Australia, and on the merits of the Australasian market for electrical supply, and to enlist the close attention of engineering firms in the van of progress. As it is always very useful to know what men at the hub of things think of the position and prospects, let us quote the opening remarks of our contemporary's introductory review :—

"Electricity is in favour throughout Australasia for practically all the purposes to which it can be applied. That vast field for electrical enterprise is, therefore, open for exploitation in every direction. It is of vast proportions, and there is any amount of room for the development of all kinds of projects. Suggestions for its introduction are already listened to. In scores of cases where installations have been set up, year after year plants are increased and services augmented. Probably in no part of the world occupied by under 6,000,000 people, do better prospects present themselves for electrical enterprise. An ordinarily careful survey of what has been done, is being done, and will probably soon require to be done, with electricity in Australasia, convinces the critic that this is the case, whilst the strength of his conclusion is reinforced by remembering that the temperament of the Australasian peoples is to be up-to-date, at any reasonable outlay."

Our contemporary then proceeds to give illustrated articles on all kinds of electrical installations that are working in Australia, New Zealand and Tasmania for lighting, power, traction, coal, lead and silver mining work, also hydro-electric systems. Photographs also appear of a number of leading men—some of them old familiar friends—in the Electrical Association of New South Wales and the Electrical Association of Victoria.

Other literature that has lately reached our hands concerning this part of the world includes a "Handbook of South Australia; Progress and Resources," by David J. Gordon, issued by the Government of South Australia. The chief object in view in publishing the volume is to guide immigrants, tourists and settlers, and that being so it must necessarily contain also an account of the leading industries. These are particularised in this book with notes on their growth, information being also given of the resources of the State, with the idea of indicating the scope for industrial expansion. For the worker there are notes on the cost of living and the wages paid for skilled and unskilled labour. Manufactories exist there for various non-electrical purposes, and in this connection we observe it stated that "a winding engine for mining purposes, recently manufactured by a South Australian engineering firm for Broken Hill, is credited with having a world's record for hauling power." Under Legislation of the year 1907, boards were created in respect to certain trades for the regulation of wages, and the principle of the eight-hours system is in general operation throughout South Australia. For the past 40 years there has been in existence a South Australian Chamber of Manufactures, which circulates literature, holds meetings and exhibitions, and in other ways endeavours to promote the development of South Australian manufactures and products. A book of this description is of quite as much value to the English exporter as to the intending emigrant, for a general knowledge of the countries with which one does business is of interest and service, even to the electrical man. In the classified list of imports we find that among the goods imported in 1906 and 1907 there were the following :—

	1906.	1907.
India-rubber goods	£32,825	£38,194
Iron and steel	297,239	375,689
Machinery :—Agricultural	46,181	109,499
Other	261,631	324,316
Metals, manufactures of	306,685	438,010
Tools of trade	43,515	57,465

In the exports sections the principal item of concern here is copper, nearly all other lines being agricultural and such like produce. In 1906 the copper ingots exported were 2,829 tons valued at £236,526, the figures in 1907 increasing respectively to 3,739 tons, valued at £335,579. The copper in matte in 1906 was 1,135 tons, valued at £88,314, but in 1907 it was only 233 tons valued at £22,363. In regard to the employment of the people, 49,161, or 13·57 per cent., are engaged as "primary producers," 6,301 of these, or 1·74 per cent., being engaged in mining industry. The industrial occupations employ 24,924, or 6·87 per cent., in manufacturing; 8,834, or 2·44 per cent. in building and construction, and "indefinite" accounts for a further 7,473, or 2·06 per cent. It may be interesting to mention here as indicating how wages run, the following figures prepared in September, 1908, by the Government Labour Bureau :—

> Boiler makers, 10s. per day; brass finishers, 8s. 6d. to 10s. per day; coppersmiths, 9s. to 10s. per day; fitters and turners, 10s. per day; ironmoulders, 10s. per day; pattern-makers, 9s. to 10s. per day.

Reference should also be made to Mr. B. H. Morgan's report on "The Trade and Industry of Australia," (Eyre & Spottiswoode, London, 6s.), in which as a result of his tour in foreign parts as Commissioner on behalf of a home Manufacturers' Association, and of his conference with Government authorities, Chamber of Commerce representatives and others, he was enabled to bring together a large volume of information—much of it of general value for reference—on the state of, and openings for, trade, and the condition of local industries in Australia and New Zealand.

He writes that he found an "unmistakeable desire—indeed I might even say eagerness—to improve the trade relations with the Mother Country," and "leading importing and distributing houses" in the Commonwealth were "willing to give every possible information with a view to increasing British trade." Space precludes our entering upon the ground covered in any detail, but we observe that in his chapter on "British and Foreign Trading Methods," he describes the three charges of "want of enterprise," "want of adaptability," and "bad packing," levelled at the British manufacturer in British Consular reports, as being "more apparent than real," and as being "popular complaints" which have been "uttered with untiring monotony during the past decade," and which are unsupported by Consular details. Mr. Morgan "did" the Australian Commonwealth and the Dominion of Canada in a few months, leaving England in February and arriving back here again in July, 1908, and he says that he "did not find many instances of want of enterprise, want of adaptability, or bad packing" in travelling through Australia and New Zealand. May be on a flying visit he was otherwise occupied, but he does not omit to report in detail a number of "individual cases" that he came across. It may be possible to obtain a correct impression of a large part of the world in a few months, but we ourselves cannot ignore the remarks that are made to us by men hailing from countries in which they have spent years obtaining a specialised knowledge, and in this respect, whatever may be our opinion of Consular reports in general, we find that the men coming from the heart of things confirm the Consular charges of want of adaptability in meeting the general and electrical requirements of foreign markets, and want of enterprise on the part of some long-established buying houses abroad and manufacturers at home, while we have already said enough on the question of bad packing, as have also some of our contributors abroad. We would like to quote, however, the statement made to Mr. Morgan by one of the largest hardware distributing houses in Melbourne :—"American manufacturers are, as a rule, very much better packers than British." This does not look as though the utterances of "untiring monotony" were far wrong!

He quotes one testimonial to the improving packing methods of the British, and follows it with a number of cases to the opposite effect showing the superiority of American methods; one instance cited relates to a consignment of English lighting glassware, 50 per cent. of which was broken. This and other cases seem to us to provide the omission of details that the Trade Commissioner says is observed in the Consular reports. Mr. Morgan blames the shipping companies for breakages, the shipping companies retort—you must pack better.

He says "The British manufacturer is rather slow in his methods, and he will not make medium and low class goods. . . . . We undoubtedly make a mistake in sacrificing everything for quality." What is this, then, but lack of adaptability?—and lack of adaptability is more or less lack of enterprise. This, it is said, "will always tell against him in a new country where the foregoing characteristics are specially called for, as is the case in some branches of Australasian trade." Quite so, that is precisely what the Consuls have "uttered with untiring monotony." What Mr. Richard Grigg said in regard to Canada (see Electrical Review, March 13th, 1908, p. 457, and July 16th, 1909, p. 94) and what Blue Book Cd. 3867 said of New Zealand (see Electrical Review, June 18th, 1909, p. 990), is, we believe, worthy of close study.

The *Times* in its *Financial Supplement* recently commenced a series of articles on "British Oversea Trade." The second of these articles relates to the Australian markets, and is written by a Sydney correspondent. He says that in many lines the United Kingdom is losing ground in Australian trade, but in other lines she is maintaining or improving her position. The position of the United Kingdom is a predominant one, and the principal foreign competitors are the United States and Germany, "but even then the exports from other British possessions in 1907 to Australia, practically equalled in value those from the United States." He says, "Perhaps the best way for the foreign manufacturer to secure a footing is to introduce a novelty; he is sure to find England a slow copyist. Then, too, the Mother Country does not care for the cheap trades . . . . It is all very well to say that these cheap goods are rubbish and dearest in the end. If we want showy stuff we have to be humoured. The question of quality is our affair." The English exporter is shown to lead strongly in most metal and machinery lines, but he does not do so in, *inter alia*, lampware, electrical machinery, mining machinery. An English shopkeeper is instanced who made an effort to place business in England: "Some orders he gave were badly packed and badly executed. That, of course, is his version. But *he went to Germany and bought extensively*."

Many British lines have preferential treatment, but "how does the foreigner obtain a footing?" Answering his own question, the *Times* writer says: "There can be no question that the foreign heavily subsidised shipping lines to Australia are a material assistance if they carry the goods very cheaply. . . . Often the foreign agent will sell without profit, or even at a loss, to secure a footing, and he will sell small lines and take much trouble with them." This very interesting article is concluded in the following terms :—

> There is no doubt the Briton is often a slow competitor, and does not care to disturb his groove. He does not take a hand in the factory as he once did. But he is also handicapped by high railway freights in England, by shipping freights higher than the foreigner often pays, and by Government departments which have not the mercantile adaptability. Still, the manufacturer must learn and know for himself. In many lines the British manufacturer is quite up-to-date, and does well here. But where foreign competition succeeds there are good reasons, and they should be taken to heart. The British maker who is losing ground should come and see for himself.

These words were not written particularly concerning the electrical industry, but we earnestly urge British electrical manufacturers to indulge in a little self-examination and see whether the criticisms are in any degree deserved by them, and if they are, apply the remedy.

"Some Export Trade Humbugs."

This sub-title, to say the least of it, is expressive. It serves to warn the aspiring exporter that he must "watch out," and not be led into entrusting the interests of his firm to the first enthusiastic zealot who, with a profusion of big promises and self-advertisments, offers his services. The words formed the title of an instructive address delivered not a great while ago before the American Cotton Manufacturers' Association, by Mr. E. N. Vose, who warned his hearers against the "syndicate agent" as the commonest type of the class. We quote some extracts from Mr. Vose's address from the American *Electrical Record* for the edification and warning of British electrical exporters.

> It is by no means unusual for a group of manufacturers in closely related lines, or perhaps residing in the same city or belonging to the same club, to form a little syndicate or organisation for the purpose of sending a salesman abroad to represent them all jointly.

This plan is proper and entirely practicable. The humbug who seizes upon this idea reverses it. Instead of the manufacturers who form this "syndicate" working together and hiring the foreign salesman who seems to them most capable, the agent makes his own arrangements with each manufacturer separately. Instead of confining the syndicate to four or five closely related lines—such as clocks, watches, silverware, and jewellery—he calls upon anybody he thinks he can run across and cheerfully undertakes the representation of watches, steam engines, hair restorers and sulky plows, and as many other lines as he can run across. While usually asserting that he intends to have at most only 10 firms in his syndicate, the agent often secures that number in a single city and then goes on for more, telling each new victim that his firm is the last one needed to complete the enterprise. As the agent has no intention of so much as attempting to secure business for his clients, it is easy for him to make big promises. It is the folks who intend to keep their word who are hampered by having to keep within the prosaic limits of probability. The thing to do, when such syndicate agents come around is simply to put their statements to the test, insist on knowing the name of every firm composing the syndicate, investigate the agent's credentials and antecedents, and, in a word, treat the whole proposition just as you would if it related to domestic trade instead of foreign. There is no hocus-pocus about export trade that prevents the ordinary rules of business and of common sense from being applied to it.

An ingenious variation on the syndicate idea is that of the species of humbug who proposes to sell the manufacturer's goods strictly on a commission basis with a small salary to cover expenses. As the salary is to be deducted from the amount of the first order, and is not due if there are no orders forthcoming, the manufacturer considers himself quite safe in signing this contract, and cases have even been known where men who have been victimised by the syndicate game have been victimised a second time by this clever, and apparently innocent, scheme.

What happens, however, is this. The swindler disappears with his contract in his pocket, and for a year or so no more is heard of him, and he is well-nigh forgotten. Then an order is received from some distant point through his New York representative. The goods are shipped as directed, but instead of a remittance the manufacturer receives a neat little "statement" showing that his account with his forgotten "agent" stands somewhat as follows:—

To 12 months' salary at $50 per month, as per contract ..	$600
To commission on sale at 10 per cent	60
Total	$660
By merchandise, as per invoice	600
Balance still due	$60

While the cool request for another 60 dollars or so is usually ignored, the manufacturer really has no redress in a case like this. The goods are beyond recovery, and are, of course, sold before this "Statement" is ever rendered, while if the humbug were caught—which is also difficult—his "contract" would probably protect him against a criminal charge, and his utter lack of resources renders a civil suit useless. The only way to avoid such expensive experiences is to act toward such propositions as toward syndicate schemes—rigidly investigate everything, and reject absolutely those that show the slightest ground for suspicion.

The very latest wrinkle in the line of export agent humbuggery hails from Egypt, although a somewhat similar scheme has been tried elsewhere. A firm in Egypt made a contract with an American manufacturer whereby it was granted the exclusive agency of the manufacturer's goods for that country, the contract to run for two or three years unless formally terminated. As no orders were ever received, the American concern decided that its agent had gone out of business or was unable to effect any sales, and allowed some of its products to go to another Egyptian firm. The "exclusive agent" seems to have been waiting for this very thing to happen, for he immediately pounced upon the manufacturer with a suit for 50,000 fr. damages for breach of contract. The case went to the plaintiff by default, and he secured the full amount demanded and costs, together with a Court order authorising him to seize the defendant's goods or property in any part of Egypt. The result of this procedure was not so serious in point of actual loss, since the goods thus seized amounted to only a few hundred dollars in value, but this manufacturer now finds himself barred out of the Egyptian market indefinitely, while his competitors may be getting a firm foothold there. The same scheme in France or Mexico or any large buying market might result in very heavy loss both in confiscated goods and in trade. It is rarely worth while to contest such cases, since local Courts will almost invariably favour the plaintiff, and foreign lawyers are usually troublesome and expensive. It is extremely difficult to prevent a few packages of one's goods from getting into a country tied up by such an exclusive contract, even when the utmost care is taken to do so, since merchandise often travels by roundabout channels.

(*To be continued.*)

French Railways.—The eventuality of the conversion of French railways to electric traction has induced the Compagnie Thomson-Houston, of Paris, with the co-operation of the A.E.G., of Berlin, and various banks, to decide upon the formation of a company with a capital of £200,000 as a kind of trust in connection with any schemes which may be brought forward. In this way the German company hopes to secure appropriate and adequate representation when any proposals are in contemplation.

REVIEWS.

Radio-Activity and Geology. By J. J. Joly, Sc.D., F.R.S. London: Constable & Co. Price 7s. 6d. net.

This most interesting work, of some 300 pages, is an extension of Dr. Joly's presidential address to Section C of the British Association in 1908. It contains chapters dealing with radio-active measurements, together with some nine other chapters dealing with the influence of radio-activity on terrestrial history.

The "Age of the Earth" and the state of its interior is a fascinating subject for speculation. So far as the writer is aware, no one except Lord Kelvin has succeeded in giving an estimate of the earth's age, free from very grave uncertainties. The methods adopted have been (*a*) geological, based on rate of denudation of rocks, or quantity of sodium in the sea; (*b*) physical, Kelvin's method, based on the fact that the present temperature gradients are regarded as due to escaping heat from the earth's interior, the earth originally being supposed to have been in a highly heated condition.

Now, however, owing to advances in radio-active research, we have a school of scientists who ask us to believe that the earth is not necessarily a cooling body, but that its losses of heat may be made good, and even its original store of heat accounted for by the presence of radio-active substances in its constituents.

Before accepting such a doctrine it is well to look into the facts a little closely.

Uranium, the supposed parent of radium, has never been experimented upon in the laboratory. Radium has been experimented on, and it is found that its changes are independent of pressure and temperature, within the limits at our disposal. It is therefore assumed by those scientists that uranium when buried under immense depths, and at great temperatures, still behaves in the same way as it is *supposed* to behave — viz., still remains the parent of radium, and undergoes radio-active change. The radio-active changes being wholly atomic, these changes are supposed independent of external conditions of every description.

Next, the rocks containing uranium are of great density, and at first sight one would suppose that we might expect to find them concentrated at or near the centre of the earth. Observations, however, of temperature gradients reveal the fact that the radium in the earth's interior is much more sparsely distributed than on its surface, and the conclusion is arrived at that there is a layer of "radium-rich" material in the earth's surface extending to a depth of 30 miles or so. Beneath this the radium deposits are much less rich.

Further, we have in this volume an attempt to account for the observed underground temperatures in the Simplon and St. Gothard tunnels, and perhaps this is the chapter which will strike the general reader as the most unsatisfactory of the lot. In this case certain temperatures at different points in the tunnel are observed which do not at all agree with the radio-active content of the rocks (see page 86).

Of the various chapters, those on "Radio-Activity and the Interior of the Earth," and "Uranium and the Age of the Earth," seem the most interesting.

The chapter on the "Radio-Activity of the Atmosphere," discusses the presence of helium in it. As is well known, the amount of helium seems relatively enormous, and could not have accumulated in this geological epoch. It is hinted that this helium may be the accumulations of pre-geologic times, and here it seems we are in quite as bad a state as the geologist with his bank of time.

Entrancing as it may appear to account for the earth's age, &c., most of the hypotheses piled one upon the other being quite unprovable, it will, of course, be noticed that such calculations cannot possibly be regarded in the same way as, say, Lord Kelvin's estimate of the earth's age.

Nevertheless, Dr. Joly has written a delightful book, which will be welcomed by everyone interested in this latest phase of scientific progress, and the general reader, or the geologist, unacquainted with radio-active measurements, will find some explanatory chapters. There are also Mathematical Appendices at the end of the book in which the method of calculating underground temperatures due to radio-activity is simply explained.

On page 100 we notice a printers' error, "potentional" instead of "potential," otherwise the book seems quite flawless in this respect.

We cordially recommend a perusal of this work to all those interested in these "up-to-date" speculations.

Electric Railway Engineering. By H. F. Parshall, M.Inst.C.E. and H. M. Hobart, M.I.E.E. London: Archibald Constable & Co. Price 42s. net.

A large quarto-sized book of 450 pages, treating, in a most exhaustive manner the various problems connected with the application of electric power to heavy railway work, as distinct from tramways. It is a fine example of the printer's art, and the illustrations, curves, tabular data, &c., are presented in such a way as to make the book a most valuable one for ready reference as well as a book to read steadily through.

The subject matter is divided into three parts. The first treats of The Mechanics of Electric Traction; Tractive Resistance and Force: Acceleration; and Studies of Characteristics of Motors and Load Curves. The second part describes Generating Plant, Details of High-Tension Transmissions, Sub-Stations and the Third Rail and Overhead Wire Methods of Conveying Current to the rolling Stock. The third is concerned with rolling stock, Locomotives, Trucks, and includes a Comparison of a Single-Phase and Continuous-Current System.

The authors take a series of established facts and connect them together with subject matter written in a clear style. They have very definite opinions on a number of debateable points, and they state them in unmistakable language, where perhaps others would have written ambiguously.

Regarding the scope for railway electrification, they are of opinion that the field, at present, is on urban and suburban lines. They admit straight away that, except in the case of exceedingly dense and steady traffic, the cost of working by electricity will, apparently for a long time to come, be greater than that of working by steam.

Many electrical engineers, and especially those few who, like the writer, have served their engineering apprenticeship in a locomotive-manufacturing works, will be able to subscribe to the authors' reference to the excellencies of the steam locomotive. They say, "In the application of electricity to long-distance lines, it is to be steadily borne in mind that the steam locomotive has demonstrated itself to be the most efficient self-contained machine, considering its varying functions, that the engineer has yet devised. To compete with this machine, every appliance entering into the electric traction installation must compare from every point of view as regards efficiency with this most highly-developed and perfect mechanism."

Standardisation has been one of the great elements of success in steam railway working, and the future growth of electric traction will be slow until the standardisation phase has been reached. At the present time there exists a wide difference of opinion among engineers regarding the commercial advantages of alternating and continuous-current motors for traction. The authors make it quite clear that they do not favour the single-phase system, and they say "we are satisfied that a careful comparison of the two types at the present time is decidedly to the advantage of the high-tension continuous-current motor."

Acceleration is very exhaustively dealt with, the separate sets of curves in this chapter alone numbering over 200. One set of curves shows the limits of attainable *average* and *schedule* speeds. Thus, for a 1-mile run between stops, an average speed of 45 miles an hour is practically unattainable. Such an average speed with one stop per mile, and a duration of 20 seconds per stop, involves a total of

$$\frac{45 \times 20}{60} = 15 \text{ minutes}$$

out of every hour during which the train is at rest. The corresponding schedule speed is therefore—

$$\frac{60 - 15}{60} \times 45 = 33{\cdot}8 \text{ miles per hour.}$$

In practice a schedule speed of 30 miles an hour represents the upper commercial limit.

The accelerating gradients of the Central London Railway contribute as much as one-fourth of the energy supplied to the train, and similar retarding gradients assist the brakes when stopping.

Table XII is important, because it gives the recoverable energy per ton-mile in percentage of total energy expended at axles per two-mile run from start to stop, and with an average speed of 30 miles an hour. If the maximum speed at completion of acceleration is 60 miles, the recoverable energy is 70 per cent., whereas with maximum speeds of 35 and 31 miles it is 50 per cent. and 48 per cent. respectively.

From their own tests the authors say that for relatively low schedule speeds and infrequent stops the advantage of employing regenerative control is very slight. On the other hand, a high schedule speed with frequent stops permits of much greater advantages than is generally realised. They give a practical case where it works out at 25 per cent. of the energy input to the train.

The largest chapter in the book deals with characteristics of electric railway motors, and if there is anything more to say on the subject than the authors have stated, then it must surely deal with the colour and thickness of the paint. There are over 100 curves in this chapter and 22 tables. Table XX gives some excellent information regarding five alternate methods of motor control. Parallel control gives an efficiency, during the period of acceleration, of 42 per cent., and series-parallel control, with an infinite number of steps, can only attain to 65 per cent.

Discussing the question of steam prime movers, the authors thus sum up the matter. For a large installation with large units a slow-speed engine or steam turbine would be more suitable than a high-speed reciprocating engine. The former should be used if the facilities for condensing are limited, and the turbine if there is abundance of condensing water at a convenient level not involving much extra power in lifting. In the case of a small installation, where the size of the units is under, say, 500 kw., the high-speed reciprocating set would be found more suitable than a slow-speed set; and if the condensing facilities are limited a steam turbine is out of the question as against a high-speed set.

A noteworthy feature of this chapter on generating plant is the tabular data of overall thermal efficiency of power plant. Table XLI shows the possible commercial efficiency of a steam plant, varying with size of unit and load-factor, and the values given are such as the station engineer should obtain, provided he has all the advantages of superheat, ample condensing water, pressure, &c. If any specific advantage is absent, such, for instance, as superheat, or if the station is placed so that the amount of condensing water is limited, or if it has to be lifted to a considerable height, then the value of such deficiency can be readily calculated, and the necessary corrective can be applied to the figures in the table.

The chapter on the distributing system contains an amount of practical information, the preparation of which must have involved considerable research and experiment. Table LXXVI, for example, gives the dip and span of suspension cables for different ranges of temperature. Also, on page 270, there is valuable data on the resistance of steel rails, according to the amount of carbon, manganese, silicon, phosphorus and sulphur present. Table LXXXII gives the resistance, reactance and impedance of bull-head steel rails, and a very important table, LXXXVII, gives the total impedance per mile of circuit, consisting of overhead conductor and rail return. Leakage from track rails is also exhaustively dealt with, and it is a matter likely to assume some importance if single-phase traction comes to be adopted.

Needless to say, all the leading electric railways in the world are described, or reference made to their principal features. The authors have most to say about continuous-current railways, but that is natural, as the majority of railways are worked on that system. The advocates of single and three-phase railways have, however, nothing to complain of in the way such railways are dealt with. Whatever be the merits of the various systems, this book places on record in a handy form, the details of much fine original engineering work carried out by electrical engineers during the last 10 years. It is a record the profession, throughout the world, has every reason to be proud of.

E. K. S.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE—FRENCH WEST AFRICA.—In the French possessions in West Africa situated outside the zone dealt with in the Treaty of 1898 with the United Kingdom—that is to say, in Senegal, French Guinea, Upper Senegal, Niger and Mauretaine—a duty of 12 per cent. *ad valorem* is levied on electrical and similar goods. In the other French possessions in West Africa—viz., the Ivory Coast and Dahomey—the duty is 10 per cent. *ad valorem*. The value on which duty is calculated is the value of the goods at the place of importation, as fixed by the official at the port of importation, or the value as shown by the invoice and increased by 25 per cent.

GAMBIA.—The following goods are admitted free of duty:—Machines for industrial purposes; mills for grinding, sawing, raising water, or any such as are set in motion by electricity, steam, horse, wind or water power, and all parts of the said mills; pipes; scientific instruments and apparatus; steam engines or any part of a steam engine; articles of every description imported for the use of the Colonial Government; all *bona fide* telegraph materials landed for the use of the African Direct Telegraph Co.

Electrical and similar goods not specially mentioned are dutiable in general at the rate of 5 per cent. *ad valorem*.

The value of goods liable to *ad valorem* duty is to be taken as the invoice value, less trade discount, freight, insurance, and value of packages.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,310. "Improvements in electric advertising signs." H. H. Clements. August 9th.

18,326. "Improvements in switch plugs for telephone exchanges." Siemens Bros. & Co., Ltd. (Application for patent of addition to No. 9,592, 1909. August 9th.) (Complete).

18,328. "Improvements in flame arc electric lamps." Siemens Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, August 11th, 1908, being date of application in Germany.) August 9th. (Complete.)

18,366. "Improvements in or relating to what is known as photo-telegraphy." T. T. Baker. August 9th.

18,402. "Improvements in telephonic transmitters or microphones." G. A. Nussbaum. August 10th.

18,405. "Improvements in electric clocks." F. Hope-Jones. August 10th.

18,409. "Improvements in and relating to electric insoles for shoes, boots and the like." O. Rampelbergh. August 10th. (Complete.)

18,420. "Improvements relating to magnetic separators." A. P. Hutchinson. August 10th.

18,433. "Improvements in the electro-chemical production of phosphatic fertilisers." G. Levi. August 10th.

18,436. "Improvements in or relating to wireless telegraphy." V. Colin and M. Jeance. (Date applied for under Sec. 91 of the Act, April 17th, 1909, being date of application in France.) August 10th. (Complete.)

18,449. "Improvements relating to the parallel driving of electric generators and prime movers." D. Roberts, A. R. Bellamy and C. James. August 10th.

18,456. "Improvements in telephone exchanges." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, October 2nd, 1908, being date of application in Germany.) August 10th. (Complete.)

18,457. "Improvements in ignition devices for internal combustion engines." R. Bosch. (Application for patent of addition to No. 26,435/07. Date applied for under Sec. 91 of the Act, September 17th, 1908, being date of application in Germany.) August 10th. (Complete.)

18,469. "Improvements in and or connected with electrodes for arc lamps." F. M. Lewis. August 10th.

18,471. "Improvements in electrical switches." J. H. Tucker. August 11th.

18,484. "Improvements in balancers, auto-transformers and boosters on direct current system." A. M. Taylor. August 11th.

18,499. "Improvements in electric traction." E. G. Pink. August 11th.

18,500. "Electric circuit closer for use with railway switch points, point locks, signals, train stops, gates and the like." A. H. Johnson. (Date applied for under Rule 13, December 18th, 1908. An invention comprised in application No. 27,554, dated December 18th, 1908.) August 11th.

18,511. "Electric burner for heating water to produce superheated and ordinary steam for motor cars of all descriptions and motor boats." G. E. A. Holdsworth. August 11th.

18,522. "Improvements in or relating to systems for telegraphy and telephony." J. Perry and S. G. Brown. August 11th.

18,524. "Improvements in transmitting apparatus for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co.

18,534. "Multiple distribution for ignition apparatus." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, July 20th, 1909, being date of application in Germany.) August 11th. (Complete.)

18,583. "Improvements in and relating to electric mechanism for writing and colour changing signs." R. F. Venner and R. C. Griesbach. August 12th.

18,590. "Means for preserving or protecting the lead supports of the positive electrodes of secondary or storage batteries from peroxidation." P. Marino. August 12th. (Complete.)

18,594. "Improvements in or relating to communicators for dynamo-electric machines." P. A. Lange. August 12th.

18,624. "Improvements relating to electrical devices for controlling movements from a distance." P. Viey. (Date applied for under Sec. 91 of the Act, August 14th, 1908, being date of application in France.) August 12th. (Complete.)

18,636. "Improvements in arrangements for charging and discharging accumulators or secondary batteries." A. M. Taylor. August 13th.

18,665. "Improvements in switch mechanism for small electric lighting installations." C. A. Vandervell and A. H. Midgley. August 13th. Complete.)

18,675. "Improved automatic switch gear for the remote control of electric motors." M. T. Medway and M. D. Scott. August 13th.

18,687. "Improved switch for controlling electrical circuits." T. J. Rorke and E. Rorke. August 13th. (Complete.)

18,690. "Improvements in and relating to insulators for telegraph, telephone and like wires." A. M. Bourke. August 13th. (Complete.)

18,691. "Improvements in and relating to counting trains for electricity meters and the like." W. Hamilton and Ferranti, Ltd. August 13th.

18,755. "Improvements in electrical timing mechanism for clocks and the like." F. H. M. Thomas. August 14th.

18,756. "Improvements in or relating to electric lamps and galvanic batteries." F. J. Turquand and W. A. Turquand. August 14th.

18,758. "Improvements in means for regulating the sensitiveness of the tripping devices employed in connection with the automatic operation of electrical switches." P. Hero. August 14th.

18,771. "Improvements in or relating to electrical or electrically-operated fire alarms." W. Leake and A. V. Rushworth. August 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electricity Meters and other Measuring Instruments. G. Hookham. 15,802. July 25th. (Cognate application No. 219/09.)

Soundproof Box for Telephones and other Purposes. W. H. Colwill and H. Horswell. 16,755. August 10th.

Telephone Exchange Systems and Apparatus Therefor. J. E. Kingsbury. (Western Electric Co.) 17,209. August 15th.

Packing Incandescent Electric Lamps. M. I. Cooper. 17,978. August 27th.

Regulation of the Speed of Electric Motors. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 18,017. August 27th.

Three-Wire Telephone Systems. F. J. Dommerque. 18,038. August 27th.

Electric Starting Switches using Liquid Resistance. Sandycroft Foundry Co. and T. M. Dutton. 18,623. September 4th.

Electrical Ignition Devices. E. Denieport. 18,811. September 8th.

Electrical Driving Gear. G. F. O. Pollet. 22,377. October 21st.

Means for Holding Globes or Shades in the Galleries of Electric Light, Gas and other Fittings. Falk. 22,964. October 28th.

Manufacture of Electric Conductors. P. McGahan. 23,007. October 29th. (Date applied for under International Convention, November 8th, 1907.)

Brush Gear for Dynamo-Electric Machinery. P. L. R. Fraser and Tudor Accumulator Co.) 23,709. November 5th.

Intercommunication Telephone Systems. G. Burney and J. Brinkmann. 25,446. November 25th. (Application for Patent of Addition to No. 21,995/04.)

Shade Devices for Incandescent Electric Lamps. C. W. Frauenlor. 27,523. December 18th.

1909.

Instruments for Measuring the Decrement of Electromagnetic Oscillations. Marconi's Wireless Telegraph Co. and H. J. Round. 185. January 4th.

Alternating-Current Magnets for Resonance Apparatus. G. G. M. Hardingham. (Hartmann & Braun Akt.-Ges.) 2,016. January 27th.

Ignition Indicator for a Multi-Cylinder Internal-Combustion Engine, Particularly for Motor-Cars. H. H. Mattonet. 3,403. February 11th.

Switchboard Equipments for Telephone Exchanges. F. F. V. Johannsen. 3,539. February 12th.

Directed Wireless Telegraphy. E. Bellini and A. Tosi. 4,301. February 26th. (Date applied for under International Convention, March 7th, 1908.)

Wireless Telegraphy. S. Eisenstein. 5,578. March 8th. (Application for Patent of Addition to No. 10,019/08.)

Friction Couplings Adapted for Use with Electromotors for Driving Machine Tools and the like. P. M. Justice. (Soc. Anon. Electricité Electromecanique.) 6,850. March 22nd.

Electric Induction Furnaces. Gröndal Kjellin Co. and J. Härden. 8,194. April 5th.

Polarised Morse Sounders and Ink Writers. C. C. Vyle. 8,533. April 8th.

Electrically-Operated Cranes, Lifts and the like. Allgemeine Elektricitäts Ges. 8,456. April 7th. (Date applied for under International Convention, April 8th, 1908.) (Application for Patent of Addition to No. 17,622/08.)

Wireless Telegraphy in China.—A Shanghai correspondent of a German newspaper reports that a wireless telegraph installation was recently erected on the new building of the English Palace Hotel in that city, for the purpose of establishing communication with incoming and outgoing ships *via* Wasung. Immediately on the apparatus being brought into use, on the opening of the new hotel in July, the Chinese Government lodged a protest against it on the ground that wireless telegraphy was a State monopoly which could not be granted to private individuals. The owners of the hotel, and the British authorities on their behalf, sought to maintain the British claim, but they finally had to give way after the Government expressed readiness to buy and remove the installation. The objections of the Chinese are explained, the correspondent states, by the experiments which the Government recently made with systems of wireless telegraphy, and by the value which would be attached to an extension of such a network throughout that enormous empire. Owing to the great distances the existing overland telegraphs are worked at great cost, especially as they are almost exclusively carried along the river valleys and are subject to constant floods and breakages, whilst the wires in various districts have to be guarded by military in consequence of the attitude of the population. In the circumstances, the introduction of a State system of wireless telegraphy would be of extraordinary value to China, and this belief led to the experiments already mentioned. It is said that a German system has proved to be the best, and has the most prospect of being introduced in China.

THE
ELECTRICAL REVIEW.

Vol. LXV. SEPTEMBER 3, 1909. No. 1,658.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

ELECTRICITY AND THE "MAURETANIA."

A PLEA FOR RECOGNITION.

THE remarkable regularity with which the *Mauretania* has recently made and remade record voyages to and from America has astonished the lay mind and surprised the engineer. The former, with its characteristic docility in accepting without question what it is given, believes that the change of propellers when the boat was overhauled at the end of last year was the cause of the sudden access of speed, but the engineer would fain have some better reason. A boat of this size which has scarcely exceeded 23 knots since it left the builders' hands does not acquire a normal speed of 26 knots by a slight modification of the construction of the propellers, which were originally the outcome of the ingenuity of the foremost designers and could not well be materially improved upon. The simple fact is that the ship has all along been capable of this great speed, as proved by the official trials, when an average of 26·5 knots was obtained on a 48 hours' trial, and the reason that it had not since been reached was either that the engineers had not become fully conversant with the efficient working of the machinery or else that they had received orders not to put it to the test.

Without in any way reflecting upon the abilities of the engineers, it must be admitted that they did not seem to have grasped the great possibilities of the various auxiliaries on the ship; and it is attention to these auxiliaries which determines the ultimate fulfilment of the designers' ideas.

As is now well known, practically all the auxiliary machinery on the *Mauretania* is electrically driven (see ELECTRICAL REVIEW, April 3rd, 10th and 17th, 1908), and it is equally well known, especially among electrical engineers connected with shipwork, that marine engineers have a stubborn and conservative objection to anything other than the steam-driven plant with which they have been brought up. When, therefore, an electrical installation of more than 2,000 H.P. was thrust upon them with practically no qualified electricians on board to enlighten them as to its proper usage, they naturally felt some trepidation, and had little desire to attempt any record speeds.

Perhaps it is not quite evident why the speed of the ship should entirely depend on the auxiliary plant, and in explanation it must be said that practically all fast boats require a relatively enormous quantity of steam at high pressure, which can only be obtained from the boilers when high-power forced-draught fans are employed to supply air to the furnaces, and a slight diminution in their output has an immediate effect on the steam pressure of the boilers, and consequently on the speed of the engines and propellers. In the case of the *Mauretania* the forced-draught fans are electrically driven, the number of motors being 16, each of

50 H.P. when running at a speed of 450 R.P.M. In order that the boat may steam at 26 knots, which is obtained with a propeller speed of 185 to 190 R.P.M., a boiler pressure of 180 lb. per square inch is necessary, requiring the full power of the forced-draught fans. It is evident, then, that the working voltage for which they have been designed should be maintained at the terminals of the fan motors, which means that the speed of the electric generating engines must be kept up, and it was the failure to recognise the essential importance of this point that led for so long to the disappointing performance of the *Mauretania.*

The dynamos are of 500 H.P. each, and are turbine-driven, the steam being obtained either as a branch supply from the main steam-pipe for the propelling turbines or direct from the boilers, as may be desired. The exhaust steam is taken to the direct-contact feed heater, where it is used for raising the temperature of the boiler feed water, and the turbines, therefore, work against a back pressure. There are now two causes which may reduce the speed of the turbo-generators, lower the voltage, and hence indirectly diminish the speed of the ship by the consequent slowing down of the forced-draught fans: (1) the steam pressure (at the turbine stop-valve) may be low, or (2) the exhaust pressure may be high.

It might be imagined, with some reason, that a decrease in steam pressure would have its effect primarily upon the main turbines, but, curiously enough, this is by no means the case, and it was here that the first mistake was made. All the steam from the boilers was led into one main pipe, which supplied the main turbines, and from this a branch was taken to the turbo-generators, which therefore received an amount inversely dependent on the demand of the former. If, then, the main stop-valve was opened slightly, a larger quantity of steam passed through, and less was available for the turbo-generators, whose speed consequently fell, producing, as explained above, a reduction in the speed of the propellers.

The next trouble which arose was in the management of the feed water to the boilers. If its temperature fell, steam could not be raised rapidly enough and the pressure fell, and the main turbines slowed down. The engineers then used to adopt the apparently obvious expedient of closing the exit valve controlling the amount of exhaust steam entering the feed-heater from the turbo, which undoubtedly caused more steam to condense and the temperature of the feed water to rise. Unfortunately, however, it also put a back pressure of perhaps 10 to 15 lb. per square inch on the turbo-generators, which, in the already low state of steam pressure, brought about a reduction of speed, with the same disastrous results as before.

These points have now been realised by those in charge of the ship's machinery; the entire dependence of the boat's speed on the electric generating plant is thoroughly understood, and one of the first considerations is to keep the voltage up to its normal value at all costs. Never before has it mattered seriously if it dropped 10 or 15 per cent.—the only result was a dim light and the slowing down of a few unimportant motors—but on the *Mauretania* it is vital.

The steam to the turbo-generators is now an independent supply, which does not diminish just when it is required to be augmented, *i.e.*, when the main turbines are opened out. The back pressure is no longer increased immediately the feed water falls in temperature, which is but a jump from the frying pan into the fire. The turbo-generators were designed to run at 1,200 revs. per minute with a steam pressure of 150 lb. per square inch and a back pressure of 10 lb. per square inch, and they are now given a chance of working under these conditions. If the steam pressure drops, the back pressure is lessened, not increased, with the apparent paradox that the boiler pressure rises. The manipulation of the machinery is seemingly so simple, and actually so complex, that the most satisfactory results cannot be obtained by following any set rules; it is really a matter of trial and error, and success has at last been obtained by careful observation.

It is strange, on the face of it, that such apparently small details should be the means of converting a 23-knot boat into one of 26 knots; but it is no exaggeration to say that the records of the *Mauretania* are entirely due to a better understanding of the electrical conditions.

Electric Lighting Acts (Amendment) Bill.

The *Municipal Journal* is angry with the Incorporated Municipal Electrical Association. In the issue of August 27th in an editorial notice we read—"We are as unable to understand the weakness of the Board of Trade as to appreciate the subtleties of the Incorporated Electrical Association's diplomacy." "One would almost imagine that the Incorporated Municipal Electrical Association was in league with the lawyers."

Our readers will scarcely need to be reminded that in the original Bill, Clause 16 gave power to local authorities, as undertakers, to provide lamps, meters, electric lines, fuses, switches, fittings, lampholders, motors, and other fittings for lighting and motive power. It was considered, and in our opinion rightly considered, that such a clause would give an unfair advantage to municipalities and permit them to place themselves in competition with electrical contractors, who might have to provide their share of the rates to cover any loss that might be sustained in this branch of municipal trading. Owing largely to the vigorous action of the Electrical Contractors' Association, this clause was amended during its passage through the House of Lords, so that it would be necessary for municipalities to employ an electrical contractor to carry out work which is generally understood to come within the sphere of electrical contracting. In view of the fact that many municipalities were opposed to municipal electrical contracting, it was assumed at the time that the Bill as amended would go through, but, owing chiefly to the action of the Incorporated Municipal Electrical Association, this has not been the case. Individually, the members of the Municipal Electrical Association do not, we think, agree with the principle of municipal trading, and in opposing the Avebury amendments, they did so professedly, not because they wished their departments to carry out contracting, but merely because they desired to have the power to do so, so as to prevent scamped or shoddy work by incompetent contractors. We take leave to congratulate them upon their good intentions. The effect of their opposition, however, has been that Clause 16 has been dropped altogether, so that the position of municipal electrical trading remains as it was before. There is, however, no doubt that the agitation against municipal trading has had, and is having, its effect, and it is significant that recent Bills relating to municipal electrical undertakings have only been passed either after the deletion of the clauses which give municipalities power to supply fittings, or after a contractors' clause has been inserted.

"Engineering Day" at the White City.

The Committee of the Engineering Section of the White City, and Mr. W. Yorath Lewis, who has acted as the honorary secretary of the Organising Committee in connection with the above event, are hoping for a successful day to-morrow, Saturday. Much organising skill and energy has been put into the arrangements, and it is desired that for engineers, electrical or otherwise, in London or outside, all roads and railways shall lead to Shepherd's Bush, for the purpose of hearing the papers and inspecting the objects of engineering interest alluded to by us last week, or for doing a little bit of both, and winding up with the great fraternising banquet, where every course shall be flavoured with a desire for securing concerted action between, and more effective results by, the numerous technical institutions. We understand that applications for dinner tickets have been received from all parts of the country. Prodigious efforts have been made to popularise the event, some 20,000 programmes having been issued to members of about 30 technical societies. We are asked to remind intending visitors to be sure and take 1s. with them, as they cannot get into the Exhibition without it. The only other thing that has to be paid for is the banquet—the programme and its accompanying advertisements are all given away free gratis for nothing. Levity apart, however, there is much good in the idea that engineers would be better men if they fraternised more, and this event may afford engineers an opportunity of meeting old friends in the great engineering brotherhood, and making new acquaintances. Who knows but we may find the humblest member of the Charge Engineers' Association hobnobbing with the President of the Civil or Mechanical Engineers!

What is Electricity?

The Presidential address of Prof. Sir J. J. Thomson to the British Association, of which an abstract was published in our last issue, and the address of Prof. E. Rutherford, which is similarly dealt with elsewhere in this issue, may be taken together as a masterly summary of the present state of knowledge regarding the nature of electricity, on the one hand, and the ultimate constitution of matter on the other—questions which, it is hinted, may eventually prove to be essentially identical, though we are still far from anything like certainty on this point.

Nothing in connection with these addresses can be more striking than the immense range of physical magnitudes involved. For example, we are told that the radius of the unit of negative electricity is 10^{-13} cm., and its mass is $\frac{1}{1700}$ part of the mass of an atom of hydrogen, while the number of molecules of hydrogen contained in 1 cubic centimetre under normal conditions is no less than $2{\cdot}77 \times 10^{19}$. These figures are easy to write and read; but what impression do they convey to the mind? It is, perhaps, possible to form a conception of the comparative magnitude of numbers up to the order of hundreds of millions—we are accustomed to such figures in connection with statistics of population, annual revenue in pounds sterling, output of coal in tons, and so on; but when we are confronted with magnitudes exceeding one thousand millions, it is questionable whether any definite impression other than that of vague immensity is left upon our minds. What, then, are we to think of the number of molecules in 1 cm.^{3} of any gas—viz., 27,700,000,000,000,000,000? The mass of each of these molecules, in the case of hydrogen, is 3,400 times that of the negative unit of electricity.

Again, in 1 gramme of hydrogen there may be, on the basis of one corpuscle per atom, a store of energy equal to that developed by the burning of 5 tons of coal; if an appreciable fraction of the energy stored in matter were to get free, "the earth would explode and become a gaseous nebula!"

The density of the ether attached to a corpuscle is calculated to be 2,000,000,000 times that of lead; and if ether is incompressible, it must possess this density throughout the whole of space. What physical conception can possibly be formed of such a condition? We are not much helped by Sir J. J. Thomson's cheerful suggestion that matter is composed mainly of holes; that it possesses a "bird-cage kind of structure," and that we may increase the distance between the wires as we increase the density of the ether!

In making these comments, we do not wish to be understood to throw doubt upon the credibility of the remarkable statements and statistics put before us by these great leaders in physical science. Their conclusions are based, not upon isolated or random observations, but upon a logical series of investigations conducted by different scientists—of whom, we are proud to say, our British representatives have ever been found in the front rank—upon experiments which can be repeated as often as desired, and confirmed to demonstration. Upon such substantial foundations has the modern theory been upraised, that it is impossible to dispute the definite conclusions arrived at without first disposing of the experimental observations; "seeing is believing"—and when, for example, it is possible to detect the presence of a single α particle, and to count one by one the number of particles expelled, by different and absolutely independent methods; when investigations of entirely different characters, conducted by different observers in different countries, all lead up to the same conclusions, it is impossible to doubt the validity of the results, however difficult it may be to form any idea of their physical significance. There are, however, serious difficulties in connection with the popular reception of these modern discoveries, and these were emphasised by leading articles in the *Times* and the *Daily Mail* last week, in both of which more or less open ridicule was poured upon some of the statements made at Winnipeg.

Sir Oliver Lodge, replying to these in the *Times* of August 31st, protested against the tendency on the part of the lay Press to stigmatise the latest results of physical science as "mere speculation," and pointed out that the election of a man to the post of president of a great scientific organisation, implying that he possessed the confidence and approval of his co-workers, ought to ensure that his deliberate statements should be received as presumably the best and safest exposition of the state of knowledge in his particular subject, and therefore worthy of respectful consideration. The rejection by the ignorant of what they do not understand is inevitable, except in cases where habit exerts an influence; even the most dense person, for example, must admit the existence of gravitation, though not even the cleverest scientist has yet found the explanation of that phenomenon. But influential journals ought frankly to accept the utterances of our greatest investigators as seriously put forward on solid grounds, and as embodying their considered judgment and belief; let them refute the arguments or attack the evidence if they will, but merely to scoff at statements because they have not digested the evidence, and therefore cannot appreciate their weight, is an unwise and unworthy course to follow.

There is a curious hiatus in the chain of facts brought forward at the B.A. meeting—while the corpuscle or electron has been identified with the indivisible unit or atom of negative electricity, and its dimensions have been ascertained, far less is known regarding the unit of positive electricity. Indeed, there was a set discussion on the question whether a positive unit exists, the report of which will be awaited with interest. It appears that the positive electron, if it exist, possesses mass about equal to that of an atom of hydrogen, and is 100,000 times larger than the negative electron; Sir J. J. Thomson suggests the possibility that the positive units were originally as small as the negative, but that most of them have "exploded" and expanded to the larger size, while there are still some small ones lingering in radio-active substances, and liberating by their explosions the energy set free in radio-active transformations. We are here, however, admittedly in "speculative" regions. There is obviously a vast field of work open to research, and we may confidently look forward to future discoveries of immense interest and importance in this fairyland of the ultra-infinitesimal.

METALLIC-FILAMENT LAMP TRANSFORMERS.

Considerations Regarding their Technology and Economics.

By L. CROUCH.

The manufacture of the small transformer of from ¼ to 5-kw. capacity has developed into a large industry during the past few years, mainly owing to the increasing use of this apparatus with the metallic-filament lamps, though the transformers are also considerably used for arc lamps and general testing purposes. The application to metallic-filament lamp circuits is, however, by far the largest in extent, and it is with this service that the present article exclusively deals.

As is well known, the early electricity supply undertakings delivered energy to the consumer at 50 or 100 volts in most cases. With the demand for increased illumination and the development of the carbon-filament lamp came insistent requests for a higher supply voltage. Though this was favourable to many stations by greatly increasing the distributing capacity of their cables, the capital cost of the conversion to higher pressures bore very heavily on most undertakings. The alteration was, however, practically complete several years ago, when, not long after its accomplishment, metallic-filament lamps began to achieve that popularity which is now so widespread. These lamps were the original pioneers of electric lighting in the form of platinum-filament lamps, and had been discarded for many years by inventors in favour of carbon lamps.

It being almost impossible to make 200-volt metallic-filament lamps of less than 30 c.p. from the materials at present available, it is now customary to either run two or more low candle-power low-voltage lamps in series or supply them from an auto-transformer, the latter method being preferable, but of course only applicable to alternating current supply. The old low-voltage supplies, so condemned in the days of the carbon-filamant lamp, can probably never be re-established, if only owing to the capital cost and the increased section of distributing cable that would be required, but the consumers in the few districts where low-voltage generation still persists are, indeed, fortunately placed. New undertakings, whether private or public, should certainly be arranged for a pressure not exceeding 50 volts unless A.C. be employed, in which case 200—250 volts enables economical distribution, and the main pressure can easily and efficiently be reduced by house auto-transformers. If a high percentage of the load on the new station be "power," then, even with D.C., where auto-transformers are impossible, low voltage cannot be used.

As most systems now generate at 200—260 volts for lighting purposes, the ratio of lighting transformers for metallic-filament lamps is usually 2 : 1, 4 : 1 or 8 : 1, corresponding to secondary pressures of 100, 50 or 25 volts respectively. For ordinary household purposes, 25-volt lamps are preferable on account of their robust filaments and the possibility of obtaining 10 or 16-c.p. lamps at prices little above those of the best carbon lamps. The householder can then obtain the same light as he obtained by his previously existing carbon lamp installation, but at from one-third to one-quarter the energy cost. The economy of metallic-filament lamps is then much greater and more readily appreciated than when high candle-power lamps have to be installed, which, despite their high efficiency, consume nearly as much, if not more, energy than the carbon lamps replaced, on account of their far higher candle-power (as stated, a high-voltage metallic-filament lamp must have from two to three times the candle-power of a high voltage. carbon lamp). The much higher candle-power of high-voltage metallic-filament lamps is frequently trying to the eyes in room lighting, and besides detracting considerably from the possible saving were only the requisite candle-power obtained, discourages the average householder from using the new lamps, for, in most cases, he is a short-sighted and rather obstinate person in matters concerning the mysteries of electric lighting. The intangibility of electricity awaken in his breast the deepest distrust of everything connected with that commodity.

Types and Requirements of Transformers.—The transformers used in lighting circuits are almost invariably of the auto-transformer type—*i.e.*, the voltages required are tapped off from a single inductance shunted across the mains : no double winding—primary and secondary, in the ordinary sense—is employed. The importance of high efficiency in such service as the present one cannot be over estimated. The no-load losses must be as low as possible or the magnetising current will total such an amount of energy as will remove much of the economy of the higher efficiency lamps. The lamps being in use only a few hours daily, the question of the "no-load" current of the transformers supplying them assumes great importance. In some cases it is possible to switch off the lighting circuit during the day thus avoiding this source of loss, but in most cases it is inconvenient to totally cut off the lighting ; an intermediate course is to run a separate circuit, supplied by a smaller transformer, to those parts where light is required during the day (basements, &c.) or if the day lighting needed in these places is only intermittent and only a few lamps are concerned, carbon lamps run direct from the mains might well be employed.

It is equally important that the efficiency of the transformer on load should be high, and it is usually advisable to secure maximum efficiency at about ¾ full load, the efficiency at half and full load being less by about ½ per cent. (see also efficiency data later).

The construction of the transformers must be mechanically very strong and rigid, the latter quality being essential for silent running, though it is to be noted that the mechanical strains set up by rigid bolting are apt to cause ageing. Only the best iron and copper should be used in the construction of the core and coils, parsimony in the design of such apparatus being very ill advised.

Ample material should be employed in all parts, and, since the whole must be entirely enclosed so as to be damp-proof, special care must be taken to provide ample cooling surface. A frequent procedure in the best designs is to use fire-proof heat-conducting material between the windings ; this considerably increases the maximum safe loading by aiding the cooling of the whole. The temperature limit in the cores of auto-transformers is about 80° C. ; above this temperature, rapid ageing is liable to occur. The temperature actually attained should be rather lower than this limit in most cases owing to deterioration of the insulation which otherwise occurs. This restriction is not rigid since some insulating materials can be run up to 150° C.

The iron section should be liberally proportioned and disposed as symmetrically as possible, while the metal itself must be thoroughly aged before use (good modern transformer iron has comparatively slight tendency to age). The use of special transformer iron reduces the no-load losses by some 40 per cent., but increases the cost of the apparatus by about one-third, and since the light losses are in any case small, it is only in large installations—such as shop-lighting, where the transformers are not switched off during the day—that the use of very special materials is really justified.

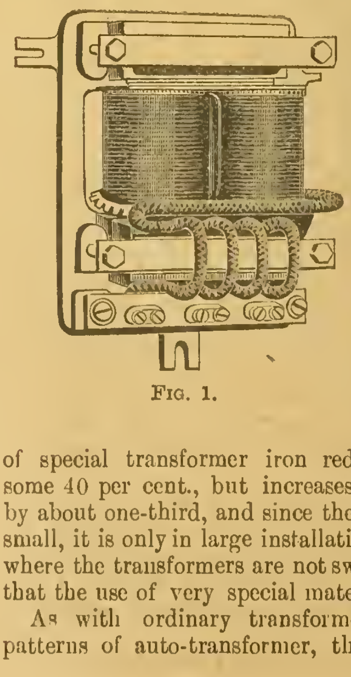


Fig. 1.

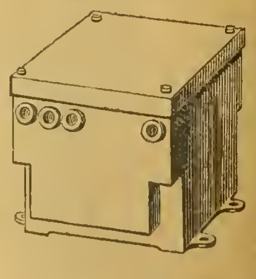


Fig. 2.

As with ordinary transformers, there are two main patterns of auto-transformer, the core and shell types. A very representative design for a core pattern of transformer is shown in fig. 1, light sheet metal enclosure being adopted for the smallest units: for larger sizes the more substantial construction of fig. 2 is adopted. Another form of winding is indicated in fig. 3, while the method of enclosure shown in fig. 4 is very neat. Cast-iron cases are standard construction, and may assist the normal magnetic circuit, though they must not be depended on in the least to do so. Easy inspection and repair access should be provided, cylindrical coils are preferable to rectangular shapes in general owing to the greater copper and space economy and consequent shorter iron paths. By the auto-transformer construction, one of the greatest difficulties in the design of small transformers of the ordinary type, viz., high magnetic leakage, is avoided.

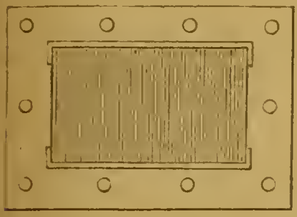


Fig. 3.

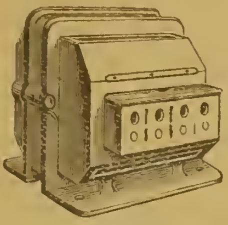


Fig. 4.

Whatever the type of core and coil, there are two vitally different arrangements of the secondary circuit, the difference referred to is apparently slight (see figs. 5 and 6), consisting as it does in the omission of a second L.T. circuit across the points A B in fig. 5. This difference, however, has a great effect on the rating of the transformer, since the utilisation of the second L.T. circuit increases the total load, that can be safely dealt with by the set, at least six-fold. The transformer is said to be of the "balanced" type if connected as in fig. 6, and of the "simple" type if connected as in fig. 5. In fig. 6 the transformer feeds what is practically an A.C. three-wire system, the transformer exactly replacing the balancing motor-generator of a D.C. three-wire supply in so far as it deals only with the out-of-balance current. Thus by running a third wire round the existing lighting installation (in most cases the existing leads are large enough for the new conditions, and the third lead may be of the same section), and installing a "balanced" auto-transformer, the full benefit of metallic-filament lamps can be reaped. In addition, a considerably smaller and cheaper transformer can be employed than is otherwise necessary. The lamps in fig. 6 are essentially connected in series across the mains, but without that difficulty of "pairing," and curtailed life consequent on unequal "pairing," which is so marked if simple series connections be adopted. The load on each "leg" of the transformer may safely rise to three times the maximum current that may flow through its winding, *provided that the out-of-balance current between the legs does not exceed the normal full-load current of the transformer.* In many cases a much higher loading is allowed, and so long as due care is taken to balance the two sides of the circuit sufficiently closely (a rather awkward problem in some house installations), the increase of rating is quite legitimate.

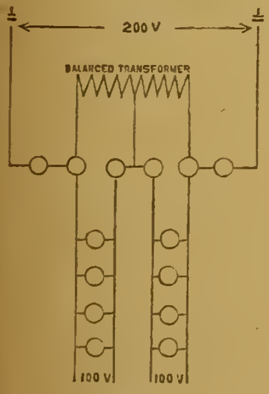


Fig. 5.

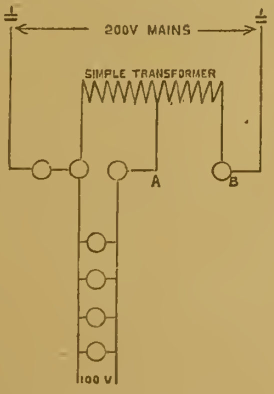


Fig. 6.

The usual rating of "balanced" transformers is six times that of the same apparatus used as a "simple" transformer, always providing the higher loading be divided equally between the two circuits supplied.

For high efficiency and low cost of installation the "balanced" is obviously far superior to the "simple" auto-transformer, since the maximum losses are only those due to the full load of the transformer when the total load supplied is six or seven times the latter. The cost of installation is also only that of a transformer capable of dealing with the out-of-balance current. The efficiency of a "balanced" auto-transformer may be kept well above 99 per cent., whereas that of a "simple" set rarely exceeds 98 per cent. To supply a total load of 35 amperes a balanced auto-transformer with a maximum current capacity of 5 amperes may be safely used if the load be connected up properly. Whereas the cost of the 5-ampere apparatus is £1 13s., that of the 35-ampere "simple" auto-transformer is £3 5s. (assuming a 200-volt/25-volt ratio and 40 ~ per second); the economy, apart from higher efficiency, is obvious. The rating of an auto-transformer, whether of the balanced or simple type, may be increased 25 per cent. above the normal value, as estimated above, for short periods. It is, therefore, on account of the increased magnetising current, unwise to install an unduly large transformer.

Efficiency Considerations.—The practice of regarding small auto-transformers as toys is rapidly disappearing, and the greatest attention is being paid to securing a high efficiency and reliable construction for this apparatus. The difficulty of obtaining high efficiency in small transformers is well known, and is graphically shown in fig. 7, which illustrates the rising efficiency with increasing capacity of apparatus. Thus the efficiency of a 200-watt 8/1 transformer is 93 to 94 per cent., and of a 3,000-watt 8/1 set, 96 to 97 per cent. As already explained, ¾ full load is chosen as the point of maximum efficiency by some makers, ½ per cent. decrease being allowed at half and full loads. The curves of fig. 7 also show the fall in efficiency as the ratio of transformation increases, the latter point being further illustrated by the following figures, which also show the agreement between the products of two standard makers A and B, using quite different mechanical arrangements of their transformers:—

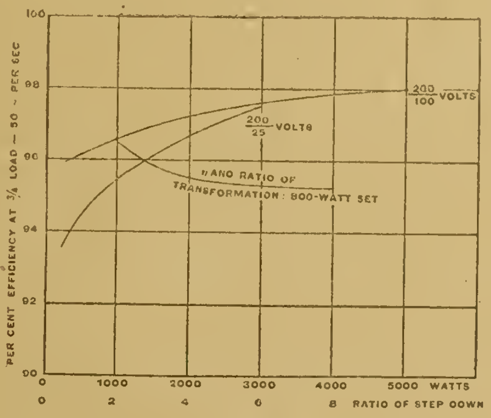


Fig. 7.

200 volts reduced to	Efficiency at full load. Maker A.	Efficiency at full load. Maker B.	Efficiency at half load. Maker A.	Efficiency at half load. Maker B.	Efficiency at three-quarter load. Maker A.
100 volts ...	96 00	97 50	96·00	96·50	96·50
50 " ...	95 00	95·00	95·00	94·50	95·50
25 " ...	94 75	94·00	94 75	93·00	95·25

Note that A aims for highest efficiency at three-quarter load, while B obtains highest efficiency at full load; probably A's is the wisest principle, but there is little to choose between the makers in result since, though B has a 1 per cent. higher efficiency in the 200/100-volt sets, A is 1·25 per cent. better in the 200/25-volt units, which are the most useful in ordinary lighting service.

Fig. 7 covers the whole range of capacities made by a certain firm, and from this it will be seen that the higher the ratio of transformation the smaller the smallest unit made;

thus with an 8/1 ratio the smallest transformer has a capacity one-half that of the smallest 2/1 transformer. The efficiencies referred to above are those of "simple" auto-transformers, from which the net efficiency of a "balanced" transformer circuit on a given load can readily be calculated, and will be found to exceed 99 per cent. in most cases.

The voltage regulation from no load to full load should not exceed one volt in lighting transformers, and this figure is a reasonable one for specifications.

(*To be continued.*)

POLE TESTING.

By S. M. POWELL.

The deflection of a simple cantilever, loaded either by a uniformly distributed or by one or more concentrated loads, theoretically varies in direct proportion to the total load, the equations applicable to the two cases being respectively

$$\delta = \tfrac{1}{8}\,\frac{W\,l^3}{E\,I} \text{ and } \delta = \tfrac{1}{3}\cdot\frac{W\,l^3}{E\,I},$$

where δ = deflection, W = total load, l = length of cantilever or "arm" of load in the two cases, E = Young's modulus, I = moment of inertia of section of cantilever. The formulæ are very closely satisfied by ordinary single telegraph or telephone poles; the former being used in making calculations relevant to wind pressure, and the latter when estimating the effect of wind pressure on the lines, this being transmitted to the pole as a concentrated load by the cross-arms. Where A poles are used, the deflection for a given load applied transversely to the length of the line is naturally much less than in the case of single poles (the ratio varying from $\frac{1}{30}$ to $\frac{1}{60}$, and being usually about $\frac{1}{50}$). Moreover, the deflection no longer varies directly with the load, but, roughly, in accordance with a law, $\delta = K\,L^n$: where δ = deflection, K = constant, L = load, and n = a numerical index constant for each particular case, and usually lying between 1 and 2. From curves obtained during experiments on poles, the writer found that the index n and constant K had the values given in the table, the poles tested being 36 ft. A poles, loaded 2 ft. from the apex, with loads varying from 500 to 6,000 lb. The relation between deflection in inches and load in pounds is given by—

$$\delta = K\,L^n, \quad . \quad . \quad . \qquad (1)$$

where for a "spread" of—

2 ft. at the pole base $n = 1{\cdot}282$ and $K = 389 \times 10^{-6}$,
3 ,, ,, ,, $n = 1{\cdot}172$,, $K = 646 \times 10^{-6}$,
4 ,, ,, ,, $n = 1\ 650$,, $K = 8\ 1 \times 10^{-6}$,
6 ,, ,, ,, $n = 1{\cdot}612$,, $K = 7\ 8 \times 10^{-6}$.

The details of construction of an A pole have a very important influence on its strength as a whole, hence the following notes may be useful. The tops of the poles are "scarfed" to about two-thirds their original diameter for a length of 1 ft. 6 in. to 2 ft. 6 in.; the amount and inclination of the scarfing determines the "spread" of the poles at their base (standard spreads are 2 ft. to 6 ft., 4 ft. being normal). Two tie bolts hold the tops of the poles together, these being 1 ft. and 3 ft. from the top respectively. The cross-arms very considerably strengthen the joint, since they are bolted to both poles. Angle strips, as in fig. 1, also strengthen the construction very considerably. An oak block B, fig. 1, is necessary to prevent slipping of the top joint on the application of a side force to the pole. A distance tube and bolt, or diagonal tie straps, placed about 10 ft. above the ground, and a sleeper block 6 to 9 ft. long and 8 in. × 4 in. to 10 in. × 5 in. section bolted to the poles 3 ft. from their butts complete the construction.

In spite of the above precaution against slipping at the top joint, a certain amount of give is unavoidable, but must be very limited for satisfactory behaviour in practice. The curves in fig. 2 show the results of tests conducted on a 36-ft. A pole, loaded 2 ft. from its tip. The inches of slip at the top joint on the application of a given load to poles similarly constructed except as to "spread" (*i.e.*, angle included by the axes of the component poles) are plotted for loads of 1,000, 2,000, 3,000, 4,000 and 5,000 lb. successively. A certain amount of inconsistency between points is naturally obtained in such tests, since successive points are observed from different poles inevitably differing slightly in their inherent mechanical properties, but by conducting a number of tests and averaging the results the information of fig. 2 is obtained. These curves show that as the angle between the poles increased, the liability to slip at the top joint rapidly becomes negligible.

The stresses on the poles at the ground level, and 5 ft. above the latter (these being standard points of reference in pole calculations), due to a wind pressure of 30 lb. per sq. ft. (this being taken as the maximum force of the severest gale likely to be encountered on ordinary systems), are shown in fig. 3. These results allow for the taper of the poles (about 1 in 120), and assume a cylindrical surface to have a coefficient of resistance = half that of an equal plane surface. The curves refer to a considerable range of lengths and assume a uniform ground diameter of, say, 10 in. for poles up to 40 ft. long, and, say, 20 in. for poles 40-85 ft. long (these lengths being the projection above the ground: from 5 to 9 ft. have to be buried according to the size of the pole). Actually the pole diameters vary gradually as the length increases, and not in steps as here assumed, but the assumptions made are necessary for the present purpose, and enable ready approximation to actual conditions. Three types of pole are assumed, including the extreme types possible, and one with a taper = mean of the extremes (see key to fig. 3). The dotted horizontal straight lines in fig. 3, show the maximum working stresses permissible for timbers having the various ultimate compressive strengths shown, and allowing a factor of safety of 8. In telegraph and telephone practice a factor

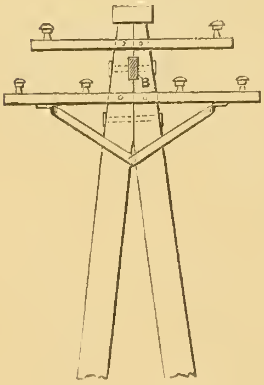


Fig. 1.

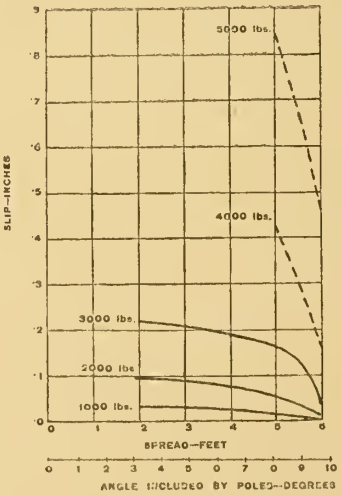
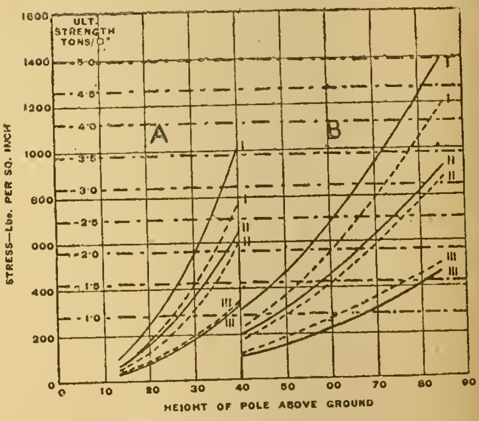


Fig. 2.



A = 10-in. poles. B = 20-in. poles.
Full lines = stress due to B.M. at ground.
Dotted lines = stress due to B.M. 5 ft. above ground.
Case I = Parallel poles. Case II = Top dia. only half ground dia. Case III = Tapered to point.

Fig. 3.

of safety of 8 and maximum wind pressure of 17 lb. per sq. ft. are the common basis of calculation, while for large poles, and always for power transmission poles, a wind pressure of 30 lb. per sq. ft. and a factor of safety of 10 must be allowed for.

Much more might be written on this important subject did space permit, but the reader may be referred for more specific details to the G.P.O. tests and requirements issued to contractors, and to Mr. C. Wade's Institution of Electrical Engineers' paper of May, 1907—the present article being intended to give currency to a few novel methods of regarding the laws governing the subject.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Storekeeping for an Electricity Works.

May I offer a few remarks on "Interested's" system of storekeeping.

1. Is his goods requisition book necessary? I find a carbon copybook simpler, and just as effective.

2. The same with his stores order delivery book. A copy of the official order written in a ruled foolscap book, using the double page, will give one all the information needed; and by simply booking the date opposite each item as received, a glance will show at once all orders sent off, received and outstanding. A tick over the order number will show invoices received and outstanding.

3. The stores received and issued card should not be kept by the storekeeper, for obvious reasons. The card, if allowed, is not so simple as it might be, and it would be a great disadvantage to use a card for each item as received. Surely the storekeeper would have a thorough knowledge of electrical materials?

4. Are the rate and priced invoiced spaces in the stores received book of any value to the storekeeper, and should this not be part of the office work? I should think all goods received and passed by the storekeeper would be official, and he should also be responsible for all goods passed by him.

5. The £ s. d. column in the stores issued book is of no value to the storekeeper, for the same reason as No. 4. I am afraid "Interested" would find it rather difficult with the number of books he mentions to keep accurate account of all stores received and issued by him.

E. W. R.

August 28th, 1909.

Electric Lighting Acts (Amendment) Bill.

The above Bill has apparently passed through the House of Commons (with amendment), but as to the exact nature and scope of the amendments, any person interested may well be left in a somewhat perplexed condition.

Might I point out that the electrical journals in their last issues apparently have very mixed ideas as to what actually took place in the House of Commons, and as to the additions and deletions that were effected.

One paper informs us that the Bill "has passed third reading in the House of Commons, and now only awaits the Royal Assent." This infers the passing of the Bill *in toto* as it came from the House of Commons Committee. It, perhaps, suggests reform in procedure also.

Another prominent journal mentions amendments to Clauses 6 and 26, and the deletion of Clause 24, but says nothing as to Clause 16 (the wiring clause); so that this clause apparently still exists.

Still a third journal mentions alterations to Clause 6, and excision of Clause 24, and, in addition, an amendment in favour of water companies to Clause 25, which has not been mentioned by the two previous journals. It also suggests possible action of the House of Lords with reference to the (apparently yet existing) wiring clause.

In another paper we are informed that the Bill has passed its third reading, and the same paper suggests disaster to the wiring clause in the House of Lords.

So in four papers we are led to infer, at any rate, that the Bill, with Clause 16 still in, has passed the House of Commons.

Unfortunately, another prominent journal says definitely that the wiring clause was deleted. It gives us a new clause as to unfair competition, and amendments to Clauses 6 and 25, also the deletion of Clause 24. One other journal takes substantially the same view.

Perhaps the editor would be willing to enlighten us all as to the real facts of the case. At present I am not clear as to whether Clause 16 has, or has not, passed the House of Commons, but having in mind the views of the majority of the papers, I take it that the clause is going forward to the House of Lords. Anyway, information as to what took place in the House of Commons in reference to this unfortunate Bill seems somewhat mixed, and one can only think that the germ of sleeping sickness, or the pyjama microbe, so active of late in the House of Commons, has spread, and infected our usually reliable journals.

Norman Stanilland.

Hornsey Electricity Works.

August 30th, 1909.

[Clause 16 was struck out in order to avoid endangering the passage of the remainder of the Bill. We refer to the matter in a leaderette to-day.—Eds. E.R.]

Electric Miners' Lamps.

Mr. Giraldus Jones's letter in your current issue is, I think, of general interest to all engineers following the rapid application of electricity to many branches of colliery practice.

It so happens that I have special knowledge of the installations of electric miners' lamps which he refers to, as I was myself in charge of those and similar organisations; and I think Mr. Jones's resuscitation of the matter is very opportune.

There are, however, one or two points in which I can, I think, correct Mr. Jones:—

1. The colliery he refers to near Fence Houses, Durham, belongs to the Lambton, and not the Joicey group.

2. With regard to the lamp bulbs, those ultimately found the most reliable were of Ediswan British manufacture, and not the French lamp.

3. Respecting the demand for gas-detecting apparatus, I am constantly informed by colliery managers and others that in electric lamps the lack of gas-detecting capacity stands in the way of their general adoption. To overcome this difficulty the writer has protected an important improvement to a well-known type of gas indicator; thereby the main objection hitherto experienced is effectually removed.

Mr. Jones's statistics respecting bulb failures are most instructive, and the results were afterwards improved upon to the added reputation of the whole scheme.

The remainder of Mr. Jones's remarks are also corroborated by further experience with the Sussmann lamp.

With regard, however, to the adoption of metal-filament lamps, it must be borne in mind that oil lamps have themselves improved since 1901, and as the colliery manager expects a considerable increase of light over older lamps, only a portion of the margin created by the higher efficiency of the metal-filament lamp is available for the reduction of the battery weight.

A lamp of my own design gives increased light and decreased weight, and is made at a much lower cost than the lamp referred to in Mr. Jones's letter. Furthermore, necessity for absorbent of the acid is removed in my lamp, and the full efficiency of a wet battery is secured, while all connections are insulated and enclosed, and the lamp used safely in any gaseous mixture or non-corrosive liquid.

The wear and tear is reduced very considerably, and the labour required for maintenance is much less, and an effective indicator for any of the gases found in coal mines can be fitted to the lamp or operated independently, as desired. This problem was attacked owing to loss of business in one instance through the intermittent occurrence of CO_2 at the working face.

A well-known illuminating journal has just accepted an article written by myself epitomising the relative advantages of all forms of colliery illuminations.

Electricity is proved to be both the safest and most economical in general, and some form of self-contained hand lamp the most convenient.

It is estimated that with a suitably designed electric hand lamp, the cost of running 2,000 lamps, including interest on capital, labour and renewals, would be between 1·0d. and 1·2d. per lamp per week of 48 hours.

It should be remembered that in calculating comparative data, the oil and acetylene people ignore the tremendous loss of life and money that too frequently results from faulty construction or working of oxygen-consuming illuminating apparatus.

The arguments for filament lamps against non-electric flame lamps are, of course, too familiar to require repetition, but in view of the rapid and wide-spread adoption of electric power in collieries, I think any device which assists colliery managements and facilitates the further introduction of electrical methods is worth discussing in your valuable columns.

I shall welcome any information respecting reliable means of indicating percentage of deleterious gases in colliery atmosphere, and at the same time informing the owner or engineer of the denomination and locality of such gases.

Fred. J. Turquand.

Albion House, London, W.C.

Samples with Tender.

With reference to Mr. Prusmann's letter in your issue of the 20th inst., we note he states it is his opinion that in deciding tenders the only fair plan is to be in a position to examine and test the actual article quoted for.

Does Mr. Prusmann seriously consider that he can satisfy himself by a few days' test that an arc lamp is going to be satisfactory in practice, when it takes most arc lamp manufacturers a year's much more thorough and critical testing to enable them to put an arc lamp on the market with any degree of confidence?

We should therefore suggest that Mr. Prusmann, instead of putting the whole industry to such an expense as referred to by "Another of the Tenderers," should ask those firms to tender who have previously manufactured similar lamps to burn under similar conditions, who will guarantee their satisfactory burning, and state where such lamps are installed. He would then be sure of getting lamps which are satisfactory in *practice*. Instead of this the manufacturer, in sending these sample lamps, is in the dark as to whether his lamps have not been rejected on account of the merest detail which could be altered to suit an engineer's preference, and this in spite of the sample lamps burning satisfactorily.

Another Tenderer.

August 24th, 1909.

Automatic Transformer Switch.

In reference to the letter of "Engineer" relative to the above, and published in your issue of August 20th, it would undoubtedly pay to install an automatic transformer switch when dealing with a transformer of about 500 watts, especially with current at the average price of 5d. per unit. The transformer iron losses will certainly not decrease as time goes on, but rather the reverse, owing to the ageing effect. This effect is still further increased by the frequent fast reading of the meter. As "Engineer" points out, the present high price of the switches prevents them from being adopted in small installations, where the cost is out of all proportion to the size of the installation. The reliable switch at the figure mentioned (32s. 6d.) by "Engineer" would pay for itself in a very short time. I should be very glad, however, to hear more about the design and method of working the switch referred to, as I have failed to find any reference to it in any of the technical journals.

Enquirer.

Technical Classes Wanted in the Daytime.

Under the above heading in the current number of the Electrical Review, two correspondents have drawn attention to the need for combined evening and day classes to meet the special requirements of shift engineers.

Many of us who are engaged in technical training have for some years past felt a keen desire to assist such a useful body of men who labour under exceptional disadvantages.

May I be allowed to state that the governing body of the East London College has for some time past endeavoured to meet this need in the subject of electrical engineering. As head of the department devoted to this subject for the past three years, I have had shift engineers studying in the evening and attending every third lecture in the morning at the same time, and in the same classes as the day students. This has been done both in the elementary and advanced grades. By this means the difficulty mentioned by your correspondent, Mr. Houghton, is overcome, and a connected course obtained.

I may say that these arrangements have been appreciated by those shift engineers who have taken advantage of them. They will be continued during the ensuing session.

J. T. Morris.

East London College, *August 30th*, 1909.

With reference to the correspondence running in your valued organ, might I suggest some arrangement whereby a Technical Institute would let "shift" men take lectures with the evening students, and the 3 p.m. to 11 p.m. shift men do laboratory work with the day students. Any slightly increased cost of such classes would, I feel sure, be met by the large number of "shift" men who would take up the classes once the scheme became known.

I cannot but feel, like Mr. Brazier and those who have replied to his letter, that it is time something was done for the large and increasing number of "shift" men.

A. E. Tridgell.

London, *August 30th*, 1909.

[We have received a considerable number of communications on this subject, all emphasising the need for some such provision as that mentioned by Prof. Morris, and we shall now bring the matter to the notice of the various authorities, in the hope that they may be able to make the desired arrangements.—Eds. E.R.]

BRITISH ASSOCIATION MEETING AT WINNIPEG.

Abstract of Address to the Mathematical and Physical Section by Prof. E. Rutherford, M.A., D.Sc., F.R.S., President of the Section.

The rapid advance of physics during the last decade has not only given us a much clearer conception of the relation between electricity and matter and of the constitution of the atom, but has provided us with experimental methods of attack undreamt of a few years ago. At a time when, in the vision of the physicist, the atmosphere is dim with flying fragments of atoms, it may not be out of place to see how it has fared with the atoms themselves, and to look carefully at the atomic foundations on which the great superstructure of modern science has been raised. Every physicist and chemist cannot but be aware of the great part the atomic hypothesis plays in science to-day. The idea that matter consists of a great number of small discrete particles forms practically the basis of the explanation of all properties of matter. From the point of view of modern science, the atomic theory dates from the work of Dalton about 1805, who put it forward as an explanation of the combination of elements in definite proportions. By the labour of the chemists matter was shown to be composed of a number of elementary substances which could not be further decomposed by laboratory agencies, and the relative weights of the atoms of the elements were determined. On the physical side it was shown that the properties of gases could be satisfactorily explained on the assumption that a gas consisted of a great assemblage of minute particles or molecules in continuous agitation, colliding with each other and with the walls of the containing vessel.

It has been generally considered that a decisive proof of the atomic structure of matter was in the nature of things impossible, and that the atomic theory must of necessity remain an hypothesis unverifiable by direct methods. Recent investigations have, however, disclosed such new and powerful methods of attack that we may well ask the question whether we do not now possess more decisive evidence of its truth.

Since molecules are invisible, it might appear, for example, an impossible hope that an experiment could be devised to show that the molecules of a fluid are in that state of continuous agitation which the kinetic theory leads us to suppose. In 1827 the English botanist Brown observed by means of a microscope that minute particles like spores of plants introduced into a fluid were always in a state of continuous irregular agitation, dancing to and fro in all directions at considerable speeds.

The character of the Brownian movement irresistibly impresses the observer with the idea that the particles are hurled hither and thither by the action of forces resident in the solution, and that these can only arise from the continuous and ceaseless movement of the invisible molecules of which the fluid is composed. Strong additional confirmation of this view has been supplied by the very recent experiments of Perrin, who found that, within the limit of experimental error, each small particle had the same average kinetic energy of movement as the molecules of the solutions in which they were suspended; in fact, the particles in suspension behaved in all respects like molecules of very high molecular weight. Whatever may prove to be the exact explanation of this phenomenon, there can be little doubt that it results from the movement of the molecules of the solution, and is thus a striking if somewhat indirect proof of the general correctness of the kinetic theory of matter.

From recent work in radioactivity we may take a second illustration which is novel and far more direct. It is well known that the α rays of radium are deflected by both magnetic and electric fields. It may be concluded from this evidence that the radiation is corpuscular in character, consisting of a stream of positively charged particles projected from the radium at a very high velocity. From the measurements of the deflection of the rays in passing through magnetic and electric fields the ratio e/m of the charge carried by the particle to its mass has been determined, and the magnitude of this quantity indicates that the particle is of atomic dimensions.

Rutherford and Geiger have recently developed a direct method of showing that this radiation is, as the other evidence indicated, discontinuous, and that it is possible to detect, by a special electric method, the passage of a single α particle into a suitable detecting vessel. The entrance of an α particle through a small opening was marked by a sudden movement of the needle of the electrometer which was used as a measuring instrument. In this way, by counting the number of separate impulses communicated to the electrometer needle, it was possible to determine by direct counting the number of α particles expelled per second from one gramme of radium. But we can go further and confirm the result by counting the number of α particles by an entirely distinct method. Sir William Crookes has shown that when the α rays are allowed to fall upon a screen of phosphorescent zinc sulphide, a number of brilliant scintillations are observed. It appears as if the impact of each α particle produced a visible flash of light where it struck the screen. Using suitable screens, the number of scintillations per second on a given area can be counted by means of a microscope. It has been shown that the number of scintillations determined in this way is equal to the number of impinging α particles when counted by the electric method. This shows that the impact of each α particle on the zinc sulphide produces a visible scintillation. There are thus two distinct methods—one electrical, the other optical—for detecting the emission of a single α particle from radium. The next question to consider is the nature of the α particle itself. The general evidence indicates that the α particle is a charged atom of helium, and this conclusion was decisively verified by Rutherford and Royds by showing that helium appeared in an exhausted space into which the α particles were fired. The helium which is produced by radium is due to the accumulated α particles, which are so continuously expelled from it. If the rate of production of helium from radium is measured, we thus have a means of determining directly how many α particles are required to form a given volume of helium gas. This rate of production has recently been measured accurately by Sir James Dewar.

Knowing the density of helium, it at once follows that each atom of helium has a mass of $6{\cdot}8 \times 10^{-24}$ grammes, and that the average distance apart of the molecules in the gaseous state at standard pressure and temperature is $3{\cdot}4 \times 10^{-7}$ centimetres.

The above result can be confirmed in a different way. It is known that the value of e/m for the α particle is 5,070 electromagnetic units. The positive charge carried by each α particle has been deduced by measuring the total charge carried by a counted number of α particles. Its value is $9{\cdot}3 \times 10^{-10}$ electrostatic units, or $3{\cdot}1 \times 10^{-20}$ electromagnetic units. Substituting this number in the value of e/m, it is seen that m, the mass of the α particle is equal to $6{\cdot}1 \times 10^{-24}$ grammes—a value in fair agreement with the number previously given.

The experiments, taken as a whole, appear to me to give an almost direct and convincing proof of the atomic hypothesis of matter. By direct counting, the number of identical entities required to form a known volume of gas has been measured. May we not conclude that the gas is discrete in structure, and that this number represents the actual number of atoms in the gas?

We have seen that, under special conditions, it is possible to detect easily by an electrical method the emission of a single α particle—*i.e.*, of a single charged atom of matter. This has been rendered possible by the great velocity and energy of the expelled α particle, which confers on it the power of dissociating or ionising the gas through which it passes. It is obviously only possible to detect the presence of a single atom of matter when it is endowed with some special property or properties which distinguishes it from the molecules of the gas with which it is surrounded. There is a very important and striking method, for example, of visibly differentiating between the ordinary molecules of a gas and the ions produced in the gas by various agencies. C. T. R. Wilson showed in 1897 that, under certain conditions, each charged ion became a centre of condensation of water vapour, so that the presence of each ion was rendered visible to the eye. Sir Joseph Thomson, H. A. Wilson and others have employed this method to count the number of ions present and to determine the magnitude of the electric charge carried by each.

The development of the kinetic theory of gases on a mathematical basis at once suggested methods of estimating the number of molecules in a cubic centimetre of any gas at normal pressure and temperature. This number will be denoted by the symbol N.

A very interesting method of determining the value of N was given by Lord Rayleigh in 1899 as a deduction from his theory of the blue colour in the cloudless sky. Lord Kelvin in 1902 recalculated the value of N on the theory by using more recent and more accurate data, and found it to be $2{\cdot}47 \times 10^{19}$. The newer methods allow us to fix the value of N with much more certainty than was possible a few years ago. The value N $= 2{\cdot}56 \times 10^{19}$ has been obtained by the direct method of counting the particles and determining the corresponding volume of helium produced. Another very simple method of determining N from radio-active data is based on the rate of transformation of radium. Boltwood has shown by direct experiment that radium is half transformed in 2,000 years. From this it follows that initially in a gramme of radium ·346 milligramme breaks up per year. Now it is known from the counting method that $3{\cdot}4 \times 10^{10}$ α particles are expelled per second from 1 gramme of radium, and the evidence indicates that one α particle accompanies the disintegration of each atom. Consequently the number of α particles expelled per year is a measure of the number of atoms of radium present in ·346 milligramme. From this it follows that there are $3{\cdot}1 \times 10^{21}$ atoms in 1 gramme of radium, and taking the atomic weight of radium as 226, it is simply deduced that the value of N is $3{\cdot}1 \times 10^{19}$.

The study of the properties of ionised gases in recent years has led to the development of a number of important methods of determining the charge carried by the ions produced in gases by α rays or the rays from radio-active substances. On modern views, electricity, like matter, is supposed to be discrete in structure, and the charge carried by the hydrogen atom set free by the electrolysis of water is taken as the fundamental unit of quantity of electricity. On this view, which is supported by strong evidence, the charge carried by the hydrogen atom is the smallest unit of electricity that can be obtained, and every quantity of electricity consists of an integral multiple of this unit. The experiments of Townsend have shown that the charge carried by a gaseous ion is, in the majority of cases, the same as and equal in magnitude to the charge carried by a hydrogen atom in the electrolysis of water. From measurement of the quantity of electricity required to set free 1 gramme of hydrogen in electrolysis, it can be deduced that N $e = 1{\cdot}29 \times 10^{10}$ electrostatic units where N, as before, is the number of molecules of hydrogen in 1 cubic centimetre of gas, and e the charge carried by each ion. If e be determined experimentally, the value of N can at once be deduced from this relation.

The first direct measurement of the charge carried by the ion was made by Townsend in 1897. When a solution of sulphuric acid is electrolysed, the liberated oxygen is found in a moist atmosphere to give rise to a dense cloud composed of minute globules of water. Each of these minute drops carries a negative charge of electricity. The size of the globules, and consequently the weight, was deduced with the aid of Stokes's formula by observing the rate of fall of the cloud under gravity. The weight of the cloud was measured, and, knowing the weight of each globule, the total number of drops present was determined. Since the total charge carried by the cloud was measured, the charge e carried by each drop was deduced. The value of e, the charge carried by each drop, was found by this method to be about $3{\cdot}0 \times 10^{-10}$ electrostatic units. The corresponding value of N is about $4{\cdot}3 \times 10^{19}$.

We have already referred to the method discovered by C. T. R. Wilson of rendering each ion visible by the condensation of water upon it by a sudden expansion of the gas. The property was utilised by Sir Joseph Thomson to measure the charge e carried by each ion. When the expansion of the gas exceeds a certain value, the water condenses on both the negative and positive ions, and a dense cloud of small water drops is seen. J. J. Thomson found $e = 3{\cdot}4 \times 10^{-10}$, H. A. Wilson $e = 3{\cdot}1 \times 10^{-10}$, and Millikan and Begeman $4{\cdot}06 \times 10^{-10}$. The corresponding values of N are 3·8, 4·2, and $3{\cdot}2 \times 10^{19}$ respectively. This method is of great interest and importance, as it provides a method of directly counting the number of ions produced in the gas. An exact determination of e by this method is, however, unfortunately beset with great experimental difficulties.

Moreau has recently measured the charge carried by the negative ions produced in flames. The values deduced for e and N were respectively $4{\cdot}3 \times 10^{-10}$ and $3{\cdot}0 \times 10^{19}$.

Ehrenhaft studying the Brownian movement in air shown by ultra-microscopic dust of silver, in a recent paper (1909) has shown that each of these particles carries a positive or negative charge. The size of each particle was measured by the ultra-microscope, and also by the rate of fall under gravity. The charge carried by each particle was deduced from the measured mass of the particle, and its rate of movement in an electric field. The mean value of e was found to be $4{\cdot}6 \times 10^{-10}$, and thus N becomes $2{\cdot}74 \times 10^{19}$.

A third important method of determination of N from radioactive data was given by Rutherford and Geiger in 1908. The charge carried by each α particle expelled from radium was measured by directly determining the total charge carried by a counted number of α particles. The value of the charge on each α particle was found to be $9{\cdot}3 \times 10^{-10}$. From consideration of the general evidence, it was concluded that each α particle carries two unit positive charges, so that the value of e becomes $4{\cdot}65 \times 10^{-10}$, and of N $2{\cdot}77 \times 10^{19}$. This method is deserving of considerable confidence, as the measurements involved are direct and capable of accuracy.

From the theory of the distribution of energy in the spectrum of a hot body, Planck found that $e = 4{\cdot}69 \times 10^{-10}$, and $N = 2{\cdot}80 \times 10^{-19}$. This theoretical deduction must be given great weight.

When we consider the great diversity of the theories and methods which have been utilised to determine the values of the atomic constants e and N, and the probable experimental errors, the agreement among the numbers is remarkably close. This is especially the case in considering the more recent measurements by very different methods, which are far more reliable than the older estimates. I place some reliance on the radioactive method previously discussed, which depends on the charge carried by the α particle. The value obtained in this way is not only in close agreement with the theoretical estimate of Planck, but is in fair agreement with the recent determinations by several other distinct methods. We may consequently conclude that the number of molecules in a cubic centimetre of any gas at standard pressure and temperature is about $2{\cdot}77 \times 10^{19}$, and that the value of the fundamental unit of quantity of electricity is about $4{\cdot}65 \times 10^{-10}$ electrostatic units. From these data it is a simple matter to deduce the mass of any atom whose atomic weight is known, and to determine the values of a number of related atomic and molecular magnitudes.

There is now no reason to view the values of these fundamental constants with scepticism, but they may be employed with confidence in calculations to advance still further our knowledge of the constitution of atoms and molecules. There is every reason to believe that the values are already known with reasonable certainty, and with a degree of accuracy far greater than it was possible to attain a few years ago. The remarkable agreement in the values of e and N, based on so many different theories, of itself affords exceedingly strong evidence of the correctness of the atomic theory of matter and of electricity, for it is difficult to believe that such concordance would show itself if the atoms and their charges had no real existence.

There has been a tendency in some quarters to suppose that the development of physics in recent years has cast doubt on the validity of the atomic theory of matter. This view is quite erroneous, for it will be clear from the evidence already discussed that the recent discoveries have not only greatly strengthened the evidence in support of the theory, but have given an almost direct and convincing proof of its correctness. The chemical atom as a definite unit in the sub-division of matter is now fixed in an impregnable position in science. Leaving out of account considerations of etymology, the atom in chemistry has long been considered to refer only to the smallest unit of matter that enters into ordinary chemical combination. There is no assumption made that the atom itself is indestructible and eternal, or that methods may not ultimately be found for its sub-division into still more elementary units. The advent of the electron has shown that the atom is not the unit of smallest mass of which we have cognisance, while the study of radioactive bodies has shown that the atoms of a few elements of high atomic weight are not permanently stable, but break up spontaneously with the appearance of new types of matter. These advances in knowledge do not in any way invalidate the position of the chemical atom, but rather indicate its great importance as a sub-division of matter whose properties should be exhaustively studied.

The proof of the existence of corpuscles or electrons, with an apparent mass very small compared with that of the hydrogen atom, marks an important stage in the extension of our ideas of atomic constitution. This discovery, which has exercised a profound influence on the development of modern physics, we owe mainly to the genius of the President of this Association. The existence of the electron as a distinct entity is established by similar methods and with almost the same certainty as the existence of individual α particles. While it has not yet been found possible to detect a single electron by its electrical or optical effect, and thus to count the number directly as in the case of the α particles, there seems to be no reason why this should not be accomplished by the electric method.

Experiment has shown that the apparent mass of the electron varies with its speed, and, by comparison of theory with experiment, it has been concluded that the mass of the electron is entirely electrical in origin, and that there is no necessity to assume a material nucleus on which the electrical charge is distributed. While there can be no doubt that electrons can be released from the atom or molecule by a variety of agencies, and, when in rapid motion, can retain an independent existence, there is still much room for discussion as to the actual constitution of electrons, if such a term may be employed, and of the part they play in atomic structure. There can be little doubt that the atom is a complex system, consisting of a number of positively and negatively-charged masses which are held in equilibrium mainly by electrical forces; but it is difficult to assign the relative importance of the *rôle* played by the carriers of positive and negative electricity. While negative electricity can exist as a separate entity in the electron, there is yet no decisive proof of the existence of a corresponding positive electron. It is not known how much of the mass of an atom is due to electrons or other moving charges, or whether a type of mass quite distinct from electrical mass exists. Advance in this direction must be delayed until a clearer knowledge is gained of the character and nature of positive electricity and of its relation to the negative electron.

The general experimental evidence indicates that electrons play two distinct *rôles* in the structure of the atom, one as lightly attached and easily removable satellites or outliers of the atomic system, and the other as integral constituents of the interior structure of the atom. The former, which can be easily detached or set in vibration, probably play an important part in the combination of atoms to form molecules, and in the spectra of the elements; the latter, which are held in place by much stronger forces, can only be released as a result of an atomic explosion involving the disintegration of the atom. For example, the release of an electron with slow velocity by ordinary laboratory agencies does not appear to endanger the stability of the atom, but the expulsion of a high-speed electron from a radioactive substance accompanies the transformation of the atom.

The transformation of the atom of a radioactive substance appears to result from an atomic explosion of great intensity in which a part of the atom is expelled with great speed. In the majority of cases, an α particle or atom of helium is ejected, in some cases a high-speed electron, while a few substances are transformed without the appearance of a detectable radiation. The fact that the α particles from a simple substance are all ejected with an identical and very high velocity suggests the probability that the charged helium atom before its expulsion is in rapid orbital movement in the atom. There is at present no definite evidence of the causes operative in these atomic transformations.

Since in a large number of cases the transformations of the atoms are accompanied by the expulsion of one or more charged atoms of helium, it is difficult to avoid the conclusion that the atoms of the radioactive elements are built up, in part at least, of helium atoms. It is certainly very remarkable and may prove of great significance, that helium, which is regarded from the ordinary chemical standpoint as an inert element, plays such an important part in the constitution of the atoms of uranium, thorium and radium.

Quite apart from the importance of studying radioactive changes, the radiations from active bodies provide very valuable information as to the effects produced by high-velocity particles in traversing matter. The three types of radiation, the α, β and γ rays, emitted from active bodies, differ widely in character and their power of penetration of matter. The α particles, for example, are completely stopped by a sheet of notepaper, while the γ rays from radium can be easily detected after traversing 20 centimetres of lead. The differences in the character of the absorption of the radiations are no doubt partly due to the difference in type of the radiation and partly due to the differences of velocity.

The character of the effects produced by the α and β particles is most simply studied in gases. The α particle has such great energy of motion that it plunges through the molecules of the gas in its path, and leaves in its train more than 100,000 ionised or dissociated molecules. After traversing a certain distance, the α particle suddenly loses its characteristic properties and vanishes from the ken of our observational methods. It no doubt quickly loses its high velocity, and after its charge has been neutralised becomes a wandering atom of helium. The ionisation produced by the α particle appears to consist of the liberation of one or more slow velocity electrons from the molecule, but in the case of complex gases there is no doubt that the act of ionisation is accompanied by a chemical dissociation of the molecule itself, although it is difficult to decide whether this dissociation is a primary or secondary effect. The chemical dissociation produced by α particles opens up a wide field of investigation, on which, so far, only a beginning has been made.

The β particle differs from the α particle in its much greater power of penetration of matter, and the very small number of molecules it ionises compared with the α particle traversing the same path in the gas. It is very easily deflected from its path by encounters with the gas molecules, and there is strong evidence that, unlike the α particle, the β particle can be stopped or entrapped by a molecule when travelling at a very high speed.

When the great energy of motion of the α particle and the small amount of energy absorbed in ionising a single molecule are taken into consideration, there appears to be no doubt that the α particle, as Bragg pointed out, actually passes through the atom, or rather the sphere of action of the atom which lies in its path.

There would appear to be little doubt that a careful study of the effects produced by the α or β particle in passing through matter will ultimately throw much further light on the constitution of the atom itself. It can be shown that the deflection of the α particle from its path is quite perceptible after passing through very few atoms of matter. The conclusion is unavoidable that the atom is the seat of an intense electric field, for otherwise it would be impossible to change the direction of the particle in passing over such a minute distance as the diameter of a molecule.

In conclusion, I should like to emphasise the simplicity and directness of the methods of attack on atomic problems opened up by recent discoveries. As we have seen, not only is it a simple matter, for example, to count the number of α particles by the scintillations produced on a zinc sulphide screen, but it is possible to examine directly the deflection of an individual particle in passing through a magnetic or electric field, and to determine the deviation of each particle from a rectilinear path due to encounters with molecules of matter. We can determine directly the mass of each α particle, its charge, and its velocity, and can deduce at once the number of atoms present in a given weight of any known kind of matter. In the light of these and similar direct deductions, based on a minimum amount of assumption, the physicists have, I think, some justification for their faith that they are building on the solid rock of fact, and not, as we are often so solemnly warned by some of our scientific brethren, on the shifting sands of imaginative hypothesis.

Mercurous Sulphate for Standard Cells.

By Charles J. J. Fox, B.Sc., Ph.D.

(Abstract—Section B.)

It is now well established that the chief cause of inconstancy in cadmium cells is usually irregularity in the mercurous sulphate. F. E. Smith has investigated this matter pretty exhaustively, and has suggested four different methods for preparing reliable Hg_2SO_4. The present author wishes to suggest a fifth method which he has used, and which for simplicity and reliability seems to be superior to any of them.

There is no difficulty in purchasing Hg_2SO_4 which is quite free from foreign metals. But these commercially pure preparations, taken as they are, are unsuitable for use in standard cells because they have usually been precipitated from the nitrate solution in the cold, and are therefore not well crystallised; free nitrate and basic sulphate are also present. But if commercially pure Hg_2SO_4 be heated together with a little pure Hg and dilute H_2SO_4 for a day or so at 120° to 150° in either a sealed tube (1 to 2 mm. walled tubing) or bottle with wire-bound stopper, and occasionally agitated, a white crystalline preparation will be obtained even from a specimen of Hg_2SO_4 which is initially discoloured almost black. On opening the tube or bottle it will usually be noticed that the pressure has risen a little, and that there is a trace of NO_2 formed; a little care should therefore be employed if there is more than a trace of nitrate in the original Hg_2SO_4. But the Hg_2SO_4 obtained in this way is itself free from nitrate, especially if the H_2SO_4 be filtered off and renewed during the heating process; it is also, of course, quite free from basic salt. It is filtered off, ground up in a mortar with one or two successive quantities of diluted H_2SO_4, and then with several quantities of saturated cadmium sulphate solution; it is filtered off in a Büchner funnel after each washing. In this way it is possible with very little trouble to prepare quite large quantities of very reliable, well crystallised, white Hg_2SO_4 in every way suitable for standard cells.

By heating with HCl and Hg, it is also a very convenient method of preparing crystalline calomel; but in this case the heating takes about twice as long, owing to the small solubility of calomel compared with Hg_2SO_4.

New Method of Producing a Cadmium Arc.

By T. Martin Lowry, D.Sc, F.C.S.

(Abstract—Section B.)

In order to produce a cadmium spectrum of sufficient intensity for polarimetric work, advantage is taken of the favourable properties of the silver-cadmium alloys. On account of their isomorphism the two metals form an excellent series of alloys which are characterised by good mechanical properties and very high melting points. (An alloy with 60 per cent. Cd melts as high as 700° C.) In striking contrast to the behaviour of the pure metal, the alloy gives a steady arc which can be kept true to centre by rotating the electrodes in opposite directions. The spectrum shows the silver as well as the cadmium lines, but these are so far separated that even with a low resolving power the slit of a spectroscope can be opened to its full width without any overlapping of the brilliant "blocks" of light which take the place of the usual "lines."

A NEW RECTIFIER.

Through the courtesy of the Premier Ampero Electric Co., of Premier House, Dover Street, W., we were recently enabled to inspect an apparatus which they are introducing for converting alternating into continuous current, and which is built on distinctly novel lines.

The general appearance of the device will be gathered from our view, and its mode of operation will be better understood by reference to the diagram.

This apparatus, known as the Premier Ampero rectifier, has been designed to meet the demand for a really efficient apparatus in the smaller powers, and the efforts of the inventors have centred on the production of something compact and simple, and which would work anywhere without special fixing.

Its method of operation is based on the fact that if two secondaries of a transformer are alternately put into circuit at each half period, the induced current feeding the secondary circuit will be unidirectional.

An apparatus built on these lines ought to be particularly efficient, as there should be practically no loss except the ordinary small loss of a well-built transformer, and we understand that practice bears out this anticipation, as tests made with the apparatus show a loss of only 5 per cent. to 6 per cent. on the rectifier, and this includes the energy consumption of the field-magnet coils used to effect the switching in and out of the two secondaries mentioned.

The apparatus put on the market consists of two parts:—(1) A transformer wound with two secondaries in series, or an auto-transformer with a middle point which acts as a phase divider; and (2) the rectifier. In our diagram A, A′ are two small field magnets, and B an oscillating armature pivoted at the centre; the armature is wound with two coils F, F′ and excited by direct current, taken from one of the cells to be charged; the current consumption of this is insignificant, being only 0·1 ampere. If the apparatus is used for a purpose other than charging accumulators, a small cell is provided for this excitation.

The Premier Ampero Rectifier.

The two magnets A, A′ are fed from one of the secondaries, and wound so as to have similar poles facing both ends of the armature. The latter carries a contact piece E, which, as the armature oscillates, makes contact alternately at H, H′. Two springs K, K′, bearing on two regulating screws J, J′, are provided for tuning up the apparatus. The two small condensers L, L′ overcome any tendency to sparking at the contacts, although as the make and break takes place at zero current, there is no tendency to sparking normally.

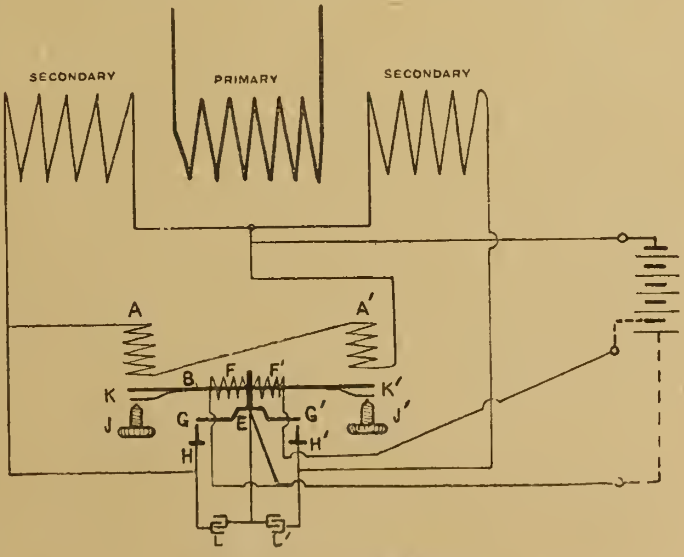


Diagram of Connections.

In operation, as the armature excitation is by means of direct current, and fixed opposite polarities exist at either end, the armature receives an oscillating motion corresponding to the rapid change in polarity of the magnets A, A′, due to their alternating-current excitation; this oscillation alternately produces contact between G, H and G′, H′, cutting in and out first one transformer secondary and then the other, the induced currents feeding the outgoing circuit being always in the same direction. The field magnet excitation requires some 4 watts.

On the occasion of our visit the rectifier was converting 85-cycle A.C. into direct current, and charging several ignition cells, for demonstration purposes; the apparatus is obviously well fitted for this class of work, being much more efficient than the small motor-generator. Moreover, the device itself acts as an automatic cut-out, and in case of failure of the primary supply breaks the accumulator circuit, and so prevents back discharging.

We understand that the apparatus will work on any periodicity in ordinary use; it starts and runs at any load, requires no attention, and compared with the mercury arc or electrolytic types of rectifier, it is an obvious simplification. The 120-watt size only weighs 20 lb., and the 240-watt size 35 lb.

In its various forms, it is being adapted for charging accumulators, electroplating, driving direct-current motors, lighting, medical work, &c.

NOTES ON TRADE ABROAD.

(*Continued from page* 358.)

Hydro-Electric Possibilities Abroad.

Our New York namesake quotes S. Kondo, chief of the Electrical Department of the Japanese Department of Communication, as saying that in a very short time all the railroads in Japan will be operated by electricity, although the conversion of the main lines from steam to electricity is not immediately contemplated. He says: "The element of economy is the greatest consideration, and so far as it is possible to utilise water power in the operation of branch lines, construction of plants for the operation of the roads will be begun immediately." Mr. Kondo has lately been on a tour of Europe and the United States studying electric railway matters. He has probably reached his home in Japan by now. We are not sure whether he made a point of investigating electrical matters in these islands, but we can presumably leave it to British manufacturers of electric railroad requirements, and water, steam and electric plant, to keep him acquainted with what they are able to do, so that when he is giving out his Department's requirements they may receive fair consideration and correspondingly important contracts. We sometimes have it put pretty definitely before us that in China the time is not ripe for railroad electrification—with that point we shall deal in a later issue in certain references that will be made to China as a field for British electrical enterprise—but we have it very plainly told that the time is "right here" in Japan for certain branch lines. Mr. Kondo's remarks regarding the use of water power in this connection serve to once more urge upon British engineers the great need that there is for fitting themselves more and more to meet the hydro-electric requirements of the whole world. It is often said that British electrical engineers do not understand this important department—only during the past few days has a visitor remarked that we have no hydro-electric experts in England—and it certainly seems to be a fact that we have lost much good business because other countries regard us as lacking in experience of this particular kind. It is idle to pretend that the complaint is groundless, for we have been more or less at a disadvantage because the lack of waterfalls in the United Kingdom has not made it a very promising field in which to specialise, so far as the home needs are concerned, but we must not let it be imagined that we are by any means ignorant of hydro-electric engineering matters. Is it not a fact that British electrical engineers, such as the late Lord Kelvin and Prof. George Forbes, were in "at the birth" of the Great Niagara Falls undertaking showing the "how" of the scheme, and its engineering details? Then we early utilised the Falls of Foyers in the manufacture of aluminium; we have in Scotland the important Loch Leven installation carried out so recently for the same company—the British Aluminium Co., Ltd.; we have utilised Welsh water powers for another aluminium company; something British has also been done at Mussoorie, and, in addition, of course, there are many small plants which do not rank highly enough to call for specific mention. We should have done a great deal more as British engineers had it not been for our abundant supplies of cheap and good coal, and had there not been an æsthetic hyper-sensitiveness among some of our people regarding possible disfigurements by pipe lines and so forth. The hydro-electric question has forced itself to the front in other countries because of the paucity of their fuel supplies and because of the existence of big water falls. These comments are offered more by way of excuse than of justification. We have been too busy in years gone by thinking about the small lighting stations with steam engines as prime movers, or in thinking about the profits on the sale of electric switches and lamps, or the losses on electric wiring contracts, to really take a good look abroad as to the future requirements of other races and other countries, and to prepare ourselves for meeting these needs. Our Swiss, American and German competitors in elaborating and executing schemes for the utilisation of their own natural forces, or those of countries just over their borders, have in the past been preparing themselves, and their own manufacturing equipments, staffs and abilities for doing what other countries possessing water falls, but no manufacturing or designing facilities, required. It was so in the case of India when Americans found their way there in connection with the Cauvery Falls system for furnishing electric power to the Mysore Gold Fields and district. We felt it necessary nine years ago to emphasise the importance of this matter in an article on "Electrical Development Schemes for India" (see Electrical Review, November 2nd, 1900). This is what we said then—how much of it ought to be said in still plainer language to-day?

"In course of time no doubt the rivers of India will be made to render great service in connection with the various industries, by being utilised for the generation of electrical energy for lighting, traction and power work.

"Doubtless numerous other schemes of a similar kind have been suggested or drawn up, but, so far as we are aware, practical operations have only been commenced upon one undertaking; we refer to that for whose purpose the Cauvery Falls are to furnish the power, and for which, may we significantly add, the large electrical machinery and equipment contracts are to be carried out by American electrical works. Of course, we are all desirous that India should secure at the earliest possible moment all the benefits which electrical science and engineering are able to confer upon her in the development of that vast continent by the up-to-date utilisation of her natural forces; but even while bearing that desirability in mind, we should be exceedingly sorry to see work of such enormous importance and of so vast a nature taken possession of by other than English manufacturers. There may once have been a valid reason for the execution of English tramway station machinery orders by American houses, but at the end of the century when there is unmistakable evidence of English manufacturers having pulled themselves together, and set their works in order, the requirements of these foreign countries must not be disregarded. It is not up-to-date enterprise which allows a man to sit down satisfied because his books are full of orders, and his works are doing overtime . . . . To fail to bestow the proper attention upon the electrical development of any of our Colonies or dependencies, particularly India, Africa and Australasia, is tantamount to giving a hearty invitation to more enterprising engineers and manufacturers of other nationalities to enter into the land of promise and carry off the spoils. How meekly should we follow after them to gather up the crumbs that fell from the rich man's table! We must look not only to the English manufacturer and his representatives to watch our national electrical interests; the engineer, the exploiter, and the promoter, must precede him making straight the rough places. Are English electrical engineers doing all in their power in this direction? We are tempted to believe not. In the promotion of home schemes their name is legion, and too often they are to be met with tumbling one across the path of another in the pursuance of rival interests, scrambling for the next job, Mr. Wellknown and Mr. Littleknown seeing who can underquote the other for preparing a report, most of which is already filed in well-stocked pigeon holes. We have no intention to undervalue these home development works, but we do think that abroad there is wide scope and a golden opportunity which, if not taken advantage of by the British, certainly will be by the American or the German. Perhaps it might be as well for some of these consulting engineers to turn their thoughts abroad instead of bemoaning the fact that there are too many of them at home. We are well acquainted with instances of consultants who have done well by taking time by the forelock in Australia, India, the River Plate, and so on. If more of this kind of thing be not done we may expect repeatedly to hear of American engineers drawing up electrical engineering schemes for British and Colonial territory, and American manufacturers supplying all the machinery. Why not English engineers and English manufacturers?"

Let us take down another of our past volumes, and look again at what the Electrical Review has published on the self-same point. This time it was one of our Indian correspondents who was the writer. "India as a Field for Electrical Enterprise" was his subject in the Review for August 15th, 1902, p. 252. He then said :—

"The fact that the whole of the plant at the Cauvery Falls works is entirely of foreign manufacture (American) again points to the necessity for the British manufacturer to study the requirements of the British Colonies and dependencies, and endeavour to manufacture what is required. The principal reason apparently why this contract was placed with the American company was because they had had so much more experience in large power-transmission plant, and for similar reasons the turbines were obtained from the eminent Zurich firm (Escher Wyss)."

Now, we do not think that after seven years it ought to be possible to repeat the same words regarding any other similar contract abroad—indeed, they could not be fairly used now as the few plants already completed in these islands have given us something practical to show. But if Japan is going to make full use of us, if in South America with its wonderful possibilities we are not to be passed by, if Spain is going to allow us to have a finger in the utilisation of its enormous hydro-electric possibilities, if Norway is not to feel that we have nothing to show them hydro-electrically, if Canada is not to slip altogether from our grasp into the hands of our American cousins, and if New Zealand is to be prevented from letting out its concessions to others, we must bestir ourselves as has often been our custom in some other departments, and recover lost ground. More and more must we forget, so to speak, the minor matters beneath our nose, and look out far beyond that protruding organ into the places where coal is less and water more, and where the industrial requirements call for the electrical utilisation of the latter. Our pages recently have contained references to steps that some of our manufacturers have been taking to secure contracts for water-power plant in Canada. We hope that they will be followed by a thorough investigation of this matter, both by these same and other firms in the same and other fields. No longer must we sit down excusing ourselves because of the greater experience of our foreign competitors in this particular department. We must move heaven and earth to let it be known in every country that the British engineer has begun to move, to effectively move, in a direction from which he will know no turning back, and that in the designing and execution of hydro-electric installations and in the accompanying high-tension transmission work generally inseparable therefrom, he means to stand well in the running.

To the Goldfields of Klondike.

It is refreshing to turn from the matter upon which we have just written to what has lately been effected by the co-operation of British finance, British manufacturers and British constructing engineers in quite another part of the world. Klondike is not the name to conjure with that it was when the telegraph cables and the Press were aflame with its tales of wonderful discoveries, but it is certainly interesting to note from the *Times* of last week that there is now on the way to Dawson City machinery and other power house equipment to the total value of £80,000, which has been supplied by a number of our leading electrical manufacturers. It is expected to arrive at Klondike in October, before frost occurs on the Yukon River, and it is supplied to the order of the Northern Light, Power and Coal Co., Ltd., of Canada, which is financed chiefly by English capital, and which has acquired the existing power station at Dawson City, together with the local telephone system, the water company, and the only coal mine in the district.

The account given by our contemporary reads like a splendid tribute to the ability of British manufacturers when once a promising piece of business is placed with them, for in a matter of more than ordinary difficulty they have risen to the occasion with admirable enterprise. We read that—

> When the directors of the company went to allotment on June 12th last, no definite plans or specifications whatever had been drawn up regarding the installation, but the managing director, Mr. E. H. Thurston, and the consulting engineer, Mr. C. J. Wharton, have been able, within five weeks, to complete arrangements for the despatch of the material and equipment. With few exceptions everything was supplied by British manufacturers, owing to the advantages offered by the Canadian preferential duties on British machinery and the disadvantages imposed by the high rates of freight on the American railways.

The British electrical manufacturer who sometimes wonders whether a Canadian effort is worth while, should note the advantageous position in which the preferential tariff places him, and in estimating the strength of American competition in that market, he should remember that the high rates of freight on American railways have in this Klondike case been one of the deciding factors in his favour.

> The cargo of machinery is being taken to Mexico, where it will be transhipped across the isthmus on the Tehuantepec Railway and put on board a specially-chartered vessel for Skagway, Alaska. Thence it will go by the White Pass and Yukon Railway to White Horse, and finally by barge for 400 miles up the Yukon River.

The plant is of 10,000 H.P. capacity, and the contracts comprise steel framework for the concrete power house, boilers, stokers, coal bunkers, ash-handling apparatus, piping, condensers, turbo-generators, transformers and so forth, and such familiar names as Babcock & Wilcox, Willans and Robinson, British Westinghouse, Siemens, Weir, and the British Aluminium Co. are among the firms contributing their quota of the equipment. A 40-mile transmission line in copper, and one in aluminium, will run from the mine to Dawson City. The whole undertaking is to be at work supplying electricity by August 1st next year.

We cannot help feeling that were British finance available for the support of our electrical manufacturers, they would be able to show in the actual performance of the work, and the quickness with which they could be ready, many a similar example. A few years ago some of our central stations went abroad for plant because they could not get it from our own manufacturers quickly enough to meet the electricity demand of the approaching winter season. Then there was a great pressure of work upon some of our firms, but now not many of our factories are troubled in that way, and prompter deliveries could be given whether for home or abroad. In engineering performance, in quality of manufacture, there has been no falling away, though as time goes on some will probably make a cheaper line of product to meet the needs of particular markets, where the men on the spot best know what they want and why they want it.

We sometimes think that the British electrical manufacturer has been silent and prosaic too long—the time has come when he should speak and let everybody electrical in every part of the world know that he is here ready to meet any reasonable electrical demand that they may have to make upon him.

American Electrical Exports.

The New York *Electrical World* in its August 12th issue reports a further improvement in the electrical exports figures of the States in June. The rise in the value of electrical instruments and apparatus exported was considerable. It is true that the heavy electrical machinery only showed an increase of some $8,000, but taking the two items together the gain was nearly 20 per cent. as compared to June last year. The net result for the entire year was a fall of $700,000 in electrical instruments and nearly $2,000,000 less of electrical machinery. We quote our contemporary's editorial analysis of the figures for the past three years :—

> Our best customer for electrical instruments by long odds in all three years was British North America, averaging about $1,400,000 a year. In 1906-7 the United Kingdom took $1,580,615, but in the last fiscal year that amount was cut to $583,374. Brazil has been

a good steady customer, averaging nearly $1,000,000 a year, while Mexico has averaged $700,000. Japan was a large customer once, but last year took only $254,928. In the line of heavy electrical machinery, the conditions change somewhat, and Japan proves to be our "best buyer" with an average of $1,300,000 a year, while British North America took about $1,100,000 each year, and Mexico just a shade less. For the last year Japan took $1,175,208, or $400,000 more than Mexico, which came next. The demand from the United Kingdom declined in the three years from $1,139,165 to $608,146. There are evidently many opportunities for a marked rally as well as for an increase everywhere, and the improvement in the world trade will help bring this about. But more will depend on the attitude of the manufacturer and exporter and his enterprise in seeking a market for many lines of goods not now known or placed abroad.

That concluding sentence is just what we feel with regard to British electrical exports.

Our own electrical exports have been steadily advancing for some time past; happily we are not recovering from a big drop. We have, indeed, very little more to do in order to reach the 17¼ million dollars, the figure of the American exports in 1906-7, before the fall began. As a matter of fact, if during the remaining months of the present year we continue to maintain the high figure of the last few months, we shall go considerably better than the trans-Atlantic total. Whatever others may attain to, however, is nothing to us, we must continue the upward tendency of the export curve. We climbed electrically while everybody grumbled about bad trade, surely when the world is beginning a great revival we must climb at an accelerated pace. Much, in the words of our contemporary, "will depend on the attitude of the manufacturer and exporter and their enterprise."

(*To be continued.*)

The European Electrical Industry.—The customary review of the general situation of the electrical industry in Europe is contained in the annual report which has been issued by the Bank fur Elektrische Unternehmungen, of Zurich, for the year ended on June 30th, 1909. It is stated, in the first place, that, contrary to the expectation associated with the reduction in the rates of interest, the general condition of business during the year in question had not yet perceptibly improved. The uncertain political circumstances at times, and the difficulties which arose in Germany in connection with the carrying out of financial reform, were not without influence in this direction. The business of the transmission of power was not stopped in its development, as electricity opens up for itself a still greater introduction by the constant improvement in the production of power and in the lighting systems, and by the increasing possibility of its application. Unfortunately, there is still in these branches, in Germany and Switzerland, only opportunity in a limited degree for the financing of new undertakings, since State and municipal authorities always consider it to be more their own duty to provide the advantages of electricity for their citizens. It could, however, be easily proved, by means of examples, that consumers do not always derive advantage from the transfer of electricity works from private to public working, or by the erection of State or municipal works. The question of electric traction next receives attention. It is pointed out that as almost all large towns have been equipped with electrically-operated tramways, the only field of activity substantially left open is the provision of high-speed city railways of the elevated or underground type, and of inter-urban lines. Several electricity companies have in recent years, and at great sacrifice, introduced electrical working on State railways, and proved the superiority of their systems over steam locomotion. But the hope entertained from this circumstance, that the schemes worked out in the meantime would be realised, has hitherto not been fulfilled, as the State railways do not regard electric traction as a compulsory necessity so long as the unfavourable financial situation imposes reserve upon them. In addition, great difficulties are placed by the authorities in the way of the granting of concessions for inter-urban railways, particularly in Germany, owing to the apprehension that the existing State railways would be prejudicially affected. The report concludes by stating that the degree of employment of the manufacturing companies closely associated with the bank was not unfavourable during the year, but in general complaints were made of low prices, so that it was only possible to obtain suitable profits by a very large output and by reducing the cost of production.

Scottish Tramway Managers' Meeting.—The Scottish tramway managers had a most enjoyable outing at Rothesay last week. Those present included Mr. Pilcher, Aberdeen, president, and Mr. Coutts, Paisley, secretary of the Association. The visitors were received by Mr. A. Robertson, manager, and Mr. H. H. Hill, resident engineer of the Rothesay Tramway Co., and were shown over the local depôt at Pointhouse. At a meeting held subsequently, Mr. Fisher, tramway manager, Dundee, read a paper on „Trackless Trolley Systems," and a discussion followed on matters of interest to the profession.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Sarco" Condenser Leakage Indicator.

Messrs. Sanders, Rehders & Co., Ltd., of 108, Fenchurch Street, E.C., the makers of the device mentioned by Mr. S. Bayntun in our last issue for detecting leakage in condensers using salt water, have sent us the following particulars of the apparatus, which is shown in fig. 1.

The tester is connected by means of a small pipe to the air-pump discharge pipe, and the water to be tested is allowed to fill tank 2, by opening valve 1. Cock 4 is then slightly opened till a fairly rapid flow of drops passes into tipping beaker 10.

All solid matter, &c., liable to clog the cock 4 and the dropping tube is arrested by the fine wire gauze sieve 3, which is placed in tank 2 between inlet and outlet. Pipe 5 provides for overflow, and the water is adjusted by valve 1 till a slight overflow is obtained. By this means a continuous stream of water passes through the apparatus, and a continuous supply of sample drops is taken off by cock 4.

The reagents are placed in bottles 6 and 6*a*, and consist of silver nitrate solution, made up of fixed strength, viz: 4 2 grammes of silver nitrate crystals (pure) in 900 cc. of distilled water, and potassium chromate, of any convenient strength, it being used simply as a chemical indicator.

The reagents are adjusted to flow through the dropping tubes 7 and 7*a* by means of pinch cocks 9 and 9*a*, till a flow of 1 drop of each reagent to about 20 drops of water is obtained. (This gives a limit of about 5 grains per gallon of salt.)

If the water under test is not saline, a deep red coloration will be produced on the mixing of these chemicals with the water in beaker 10, as explained by "Harbee" in our issue of August 13th, due to the formation of silver chromate, which is of a deep red colour. If any sodium chloride be present, silver chloride will be formed, and till all the sodium chloride is acted on by the silver nitrate no chromate of silver can be formed, and, therefore, no red coloration, silver chloride being white.

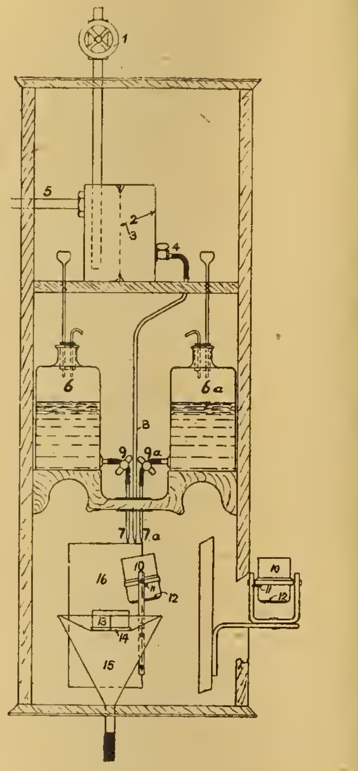


Fig. 1.

The beaker 10 is pivoted as shown in the small detail inset, and is balanced by weight 12, so that it will tip over when full of liquid. A small stop-pin 11 ensures its tipping the right way, and keeps it in the correct position. When the beaker tips over, its contents are thrown into dish 13, and down the waste funnel 15.

A supply of the resulting liquid is thus always in 13 for inspection, light being thrown through it by means of ground glass 16, behind which an electric lamp may be placed.

If any salt, or chloride, above the desired limit is present in the water under test, the red coloration instantly disappears, and a whitish colour is produced in the liquid in dish 13.

The apparatus may be set for any desired limit of salt by adjusting the flow of drops of reagent, the number of drops of silver nitrate being increased in proportion to the limit of salt.

Combined Push-and-Pull Switch-Fuse, and Lamp Lock.

Messrs. Wm. Sanders & Co., of Falcon Electrical Works, Wednesbury, send us particulars of their new combined push-and-pull ironclad switch and fuse, which they have provisionally protected, and which they are manufacturing in all sizes up to 500 amperes, suitable for all voltages up to 600.

The case is of clean iron, carefully lined with asbestos, and suitably bushed for the cables; it is also so arranged that it can be made absolutely gastight and watertight. The slates are screwed to the case, and non-combustible dividing partitions extend beyond the maximum break position. The quick-make and quick-break action is extremely simple, and is achieved by means of two springs, working on sliding link pieces, supported outwardly from two machined slugs, cast on the inside of the lid, and in the centre by means of a gun-metal arm-piece engaging on the push-and-pull spindle. The switch blades are fitted with two quick-break parking contacts, and are arranged to operate simultaneously at all times.

When the switch is closed it is impossible to open the case before the circuit is broken, and, again, it is impossible to close the case in which the switch is enclosed until the switch is in the off position. This is achieved by a very simple and ingenious arrangement.

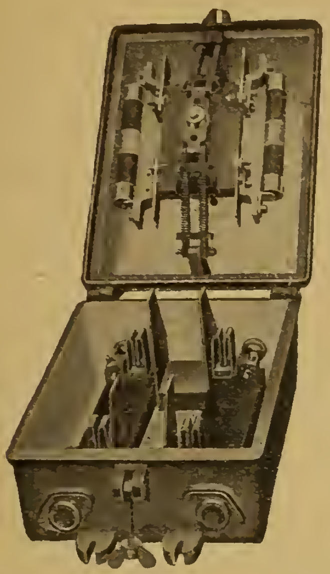


Fig. 2.—Push-and-Pull Switch-Fuse.

A New Lamp Lock.—Many users of electricity have been troubled by the removal of lamps, (by unauthorised persons), from holders in public buildings, railway carriages, works, offices and the like. To prevent this, Messrs. Sanders, have introduced a simple lamp lock, which at a cost of 2d, will, they claim, obviate the use of costly guard fittings.

By using the shade carrier ring, screwing it down on to the lamp lock, as shown in the illustration, the lamp is practically secure from removal. At a small extra charge the lamp lock can be provided with a further fixing arrangement, but it is thought that the lamp lock without any extra attachment is sufficient for all ordinary purposes.

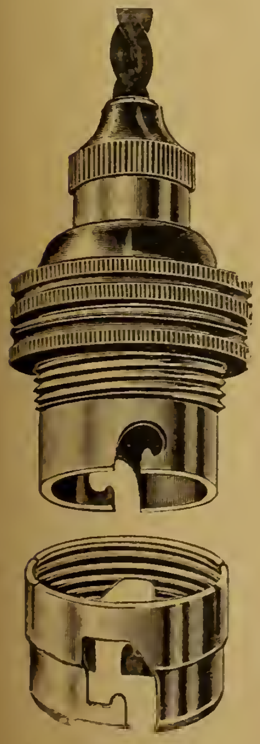


Fig. 3.—Lamp Holder and Lock.

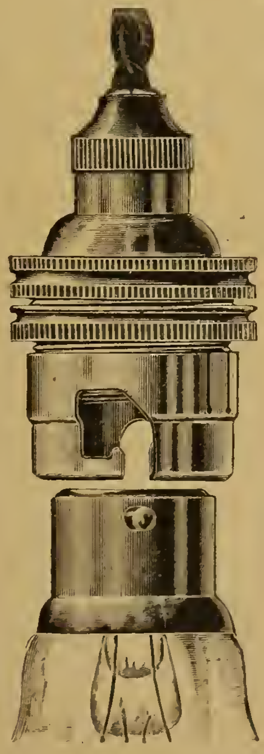


Fig. 4.—Lamp Lock in position to receive Lamp.

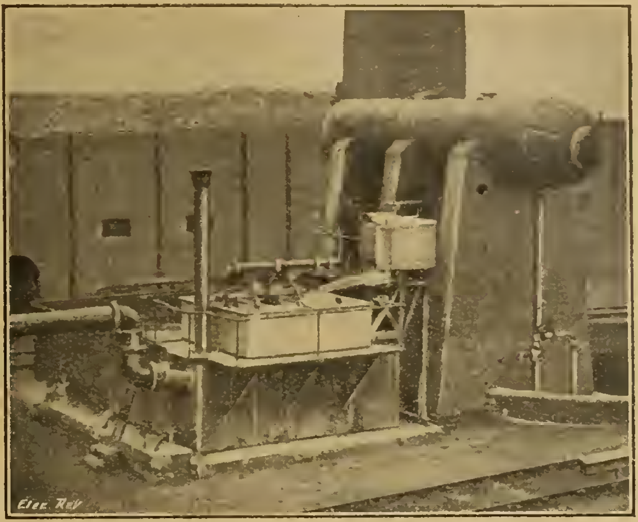
It will be noticed that the lamp lock may be used to convert any standard shade carrier holder into a "keyholder."

It is not offered as a "keyholder," but persons who do not mind turning a lamp in its socket will no doubt use it for this purpose.

There are many cases where lamps are now removed from sockets (spoiling the appearance of fittings and exposing the lamp to risk of breakage or loss while lying about) to save them from being used when wired up with others on a switch, and in these and many other cases, this lamp lock will find a secondary use.

BUSINESS NOTES.

The Lochgelly Co.'s Installation : Water-Purifying Plant.—In our article on the above installation last week, on page 341, we illustrated a water-purifying plant, which we are now informed is a Simplex plant, supplied by Mr. Wm. Boby, and is, of course, distinct from the purifying plant mentioned in the article, which was supplied by another well-known maker, and installed in another position. The Boby Simplex plant, of which a clearer view is shown herewith, has a capacity of 10,000 gallons of water per hour, and utilises exhaust steam for heating the softened and purified water before feeding to the boilers. The water in question, obtained from pit or river, with a total hardness equivalent to 22·75 and 15 grains per gallon respectively, after treatment, remains with 2·5 and 2·75 grains respectively. We have pleasure in drawing attention to this matter.



Simplex Water-Purifying Plant.

Woodeson Water-Tube Boilers.—We understand that some large and important orders for the "Woodeson Patent" water-tube boiler, as manufactured by Messrs. Clarke, Chapman and Co., Ltd., have recently been placed with the firm, some of the most recent being:—Three large boilers for Bury Corporation; one large boiler for the Admiralty; four large boilers for the new coke-oven plant for Messrs. Strakers & Love, making the sixth repeat order from this firm; a large boiler for the Yorkshire Electric Power Co., this being a repeat order, due to the success of a similar boiler installed in that station during the early part of this year; a further repeat order (the third) for two large boilers for the power station in Naples; also orders for large boilers for South Africa and Japan.

Consular Notes.—Sweden.—The British Consul at Stockholm reports that there are two companies in that city providing means of communication by the telephone system. One is the Riks or State Telephone Co. with wires not only in Stockholm, but throughout the length and breadth of Sweden, and connected also with Norway, Denmark and Germany; the other is for the town of Stockholm and places within 44 miles as the crow flies. Such questions as telephone rates, number of subscribers, and so forth, are dealt with at length.

Later in his report the Consul states, regarding electrical smelting of iron ore, that the technical practicability of smelting iron ore by electricity was proved some years ago. A furnace which has been erected at Domnarfvet is estimated to be capable of producing about 3,000 tons of pig-iron per annum; its height is only about 7 metres and its diameter about 3 metres. It is claimed that the product is of excellent quality; sulphur is almost entirely eliminated, and the iron freed from gas and slag.

The British Vice-Council at Lnlea reports that there is a proposal on foot there to have the Kiruna-Norwegian frontier railway electrified. The power is intended to be taken from certain large waterfalls adjacent to the railway. Surveys and experimental work are now being carried on, and it is rumoured that tenders will shortly be invited for the execution of the necessary electrical lines, buildings, &c.

The British Vice-Consul at Skelleftea reports that the Ohrvikens Aktiebolag has contracted with the town of Skelleftea for 800 h.p., and the Ytterstfors Trävaru Aktiebolag has bought 2,300 h.p. The distance from the electrical works to Ohrviken is 27 miles, and to Ytterstfors 31 miles. All the machinery for both these sulphite mills was supplied by Swedish firms. The contract between the town of Skelleftea and Ytterstfors is only in force during one year as to the quantity of 2,300 h.p. Each year Skelleftea has the right of disposing of 800 h.p. of this 2,300 if better offers are received than that at present from Ytterstfors. The total horse-power of Skelleftea town electrical works is at present 4,000 h.p., of which the actual town uses 800 h.p. for its own purposes. Still there are more waterfalls belonging to the town which are not yet used, and there is a plan to develop these falls to give to the town at least 4,000 H.P. more.

The British Vice-Consul at Hernosand reports that a huge electric power station has been built at Forsse by Graningeverkens Aktiebolag, transforming the power from the waterfalls of the Faxälfven (one of the important branches of the Angerman River) into electric current at 40,000 volts, which is partly transmitted to the pulp mills at Kramfors, Franö and Svanö at a distance of about 35 English miles. The pulp mills have to pay for the power they use at the rate of 72 kr. (£4) per year and horse-power. The import of coals is consequently diminished by this arrangement. In the future most likely a great many of the waterfalls, favourably situated, will be utilised in a similar way. The Government railways are making experiments to find out if they can profitably adopt electric power instead of steam for working the railways. The power at Forsse is calculated at 6,000 H P.

China.—The British Consul at Canton, in a recent report, states that the electric light works there, built by the Chinese Light and Power Company, of Hong Kong, are situated at Ng Sin Moon (South Gate). The plant is up-to-date in every detail, and with the exception of an engine, is of British manufacture. It consists of three Diesel oil engines using crude petroleum, the total brake horse-power being 600, five steam engines of a total brake horse-power of 730, four Babcock-Wilcox water-tube boilers burning Japanese coal, and one Green's economiser; induced draught is used, and Contraflo and Worthington condensers. The staff consists of two engineers, one main superintendent, and 121 Chinese. Electric energy is supplied to Canton city and the foreign settlement of Shameen by means of overhead high-pressure mains, carried on iron and wooden poles. The primary pressure is 2 000 volts, the secondary or house service pressure is 100 volts. The current is alternating. The supply in Shameen is continuous, that in the city being from sunset to sunrise. The number of consumers connected to the mains is 2,809, 167 in Shameen and 2,642 in Canton City. The total number of 8-C.P. (equivalent) lamps connected on March 1st, 1909, was 26 510. There are in addition to the above the Canton Arsenal, smokeless powder factory, the provincial mint, a paper mill, a cigarette factory, several shipbuilding and ship-repairing yards, the railway works at the termini of the Canton Kowloon, Canton Hankow and Canton Sanshin lines, and the new river building now in course of construction, which requires steel bridges and landing stages. Lest, however, British firms take the trouble to send out illustrated catalogues and circulars, the Consul states that catalogues as such are useless, and that the only way to obtain orders is to follow the German and American example, and send out competent men who will find out exactly what the Chinese want, tell them exactly what they can supply and for how much, and, in short, be prepared to exercise that patience, tact and business acumen without which in these days big orders are not obtained in China. British manufacturers are too often content to be represented by merchants in China, who, however willing they may be to push their wares, have not the time to devote to the business, and are without the necessary expert knowledge. The Consul is convinced that it is for this reason that so many large orders for railway material, &c., have during the past year gone to German and American firms.

Bosnia.—The British Consul at Saragevo reports that Bosnia is a land rich in natural resources, but it suffers from want of capital. The annexation question having been definitely settled, there is now no longer any reason why speculators should hold back. Bosnia, moreover, possesses mineral resources and water-power which might very well be turned to account in the electro-chemical industry. Coal is present in sufficient quantities for industrial purposes, and labour is cheap, the natives being intelligent and well fitted for manual labour. Much of the present poverty might be alleviated if there were plentiful opportunities of work. Rates and taxes stand at a much lower figure than elsewhere in Austro-Hungary.

Uruguay.—The British Minister in Monte Video, in a recent report, states that a Marconi wireless telegraph station has been established on the beach near Maldonado. Its geographical position is latitude 34° 58′ 15″; longitude west of Greenwich 54° 56′ 57″. The name of the station is Punta del Este, and its minimum radius is 500 km. (310 miles). Last year a Special Committee was appointed to report upon the question of instituting a Government or municipal telephone service; they have recommended the institution of a national telephone service with underground lines, in accordance with plans drawn up by a British engineer, in place of the present overhead wire system, and a project of law dealing with this question, which is, however, beset with certain legal and equitable difficulties in connection with the existing telephone companies, has been submitted to the Chambers by the Government. The cost of the proposed work, calculated at $1,000,000 (£212,766), will probably be met by a loan of $1,500,000 (£319,149) at 5 per cent., and 1 per cent. redemption, the service of which will amount to $90,000 (£19,149) per year. It is not expected that there will be the slightest difficulty in raising this loan, as the Post Office surplus revenue has for several years averaged $90 000 (£19 149) per year, and last year it amounted to $115,924 (£24,664). This revenue will only be under contribution during the time of construction as the telephone service, once it is established, will, it is anticipated, after deducting 50 per cent. for expenses, produce an income of $100,000 (£21,276) per year. The electrification of the tramways of Monte Video, which has been carried out by an Anglo-American firm of contractors, has been completed after nearly four years of work. The contract included the construction of 82 miles of track, the supply of 215 cars, and the building of power houses, as well as the preparation of all the engineering plans and specifications. The engines have been supplied by a Birmingham firm, and British firms supplied the generators, the boilers, and all the cars, and it is fully recognised that the contracts have been most efficiently fulfilled.

Costa Rica.—The British Consul at San José reports that the Costa Rica Electric Light and Traction Co. has extended its tram line in San José, from the Pacific station to Rio Torres, about 1 mile, and is building a further extension to Guadalupe (2½ miles). This company has also acquired rights for a 5,000-H P. hydro-electric power station at El Brazil, and has begun work.

Russia.—The British Consul at Moscow reports that the whole of the work of the concession for the electrification of the Moscow tramway system, to be paid for by Moscow city bonds, was virtually in the hands of a British syndicate, which was to have taken over this loan at the very low price of 75. Unfortunately this very valuable concession was allowed to fall through. The requisite funds were obtained by means of the loan raised in London, but nearly all the plant for the electric trams has now been ordered from Germany. Moreover, this contract for the construction of the electric trams was only the first contract the town was then willing to hand over to the British syndicate—there were other things to follow which would have been even bigger.

Private Meeting.—W. P. THEERMAN, trading as W. P. Theerman & Co., electrical engineers, 263, Oxford Row, Manchester.—The creditors of the above were called together last week, when a statement of affairs was presented, showing liabilities amounting to £6,006 16s. 4d. The claims of unsecured creditors totalled £5,237 4s., while the Palatine Bank, Ltd. were scheduled for £761 2s. 4d. There were also contingent liabilities on bills discounted amounting to £57 2s., of which it was expected that £8 10s. would rank against the estate. After allowing £151 1s. fo preference claims the assets were expected to produce £6,836 8s. 2d. the estate thus showing an apparent surplus of £829 11s. 10d. The assets were as follows: Stock-in-trade £570 4s. 2d., work done on contracts in hand £1,018, plant, &c., at New Brighton £436 16s. 10d., estimated at £350, machinery £500, book debts £1,168 19s. 2d., expected to produce £1,150, office furniture £50, fittings, &c., £75, cottages at Bradford £1,700 (less mortgage of £850) £850, shares in Electric Light, Power & Hiring Co. £750, due on current accounts £1,246 15s., shares in Penrith Electric Supply Co., Ltd., £165, and shares in mill £262 10s. It was stated that with the exception of one or two small amounts for cash advanced, the whole of the liabilities were in respect of trade debts. The business had been in existence for a number of years, and balance-sheets were prepared regularly. In December, 1906, the balance-sheet disclosed a capital of £2,668, and by October of the following year the capital had increased to £3,589. In April of last year the capital stood at £5,848, while in October of the same year the capital had decreased to £3,270. A balance-sheet was prepared at July 31st last, and this showed a capital of £1,400. The difference between this figure and the amount shown in the statement of affairs was accounted for by the various amounts written off the assets. Between January and October, 1907, the business showed a profit of £2,390, while during the next six months there was a profit of about £2 800. Between May 1st and October 31st of last year, the trading resulted in a somewhat heavy loss. Owing to creditors having threatened proceedings, it was decided that the debtor should execute a deed of assignment to protect the assets, and Mr. Peter Gregson, chartered accountant, Manchester, and Mr. G. E Corfield (Messrs. Corfield & Gripwell, accountants), London, were appointed to act as joint trustees. The creditors decided to leave the matter in the hands of a committee of inspection. The committee appointed was as follows: Henley's Telegraph Works Co., Ltd., Messrs. Christy & Lampitt, Northern Accessories Co., Messrs. Wright & Wood and the Sloan Electrical Co.

Aluminium.—It appears that the proposed syndicate of French aluminium makers has not yet been brought into existence, and as a consequence the question of the renewal of the International Convention has not made any progress down to the present time. The French companies, however, still expect to arrive at a definite agreement. A provisional understanding was come to early in August, prior to a conference of representatives of the makers, but certain points were postponed at the request of one of the companies for further examination.

Time Recorders.—Among recent orders booked by the INTERNATIONAL TIME RECORDING CO. are the following:—Joseph Stubbs, Manchester, three recorders; Willans & Robinson, Ltd., Rugby, 10 recorders; Bournemouth Corporation, eight recorders; Joyce & Co., Sydney, five recorders; John Russell & Co., Ltd., Walsall, four recorders; Kodak, Ltd., Harrow, three recorders; Loders & Nucoline, Ltd., London, two recorders; also orders for the Corporations of Manchester, Salford, Huddersfield and Bradford.

Stolen Lamps.—At the resumed hearing of the charge against Withers and Brocklebank, at Manchester, of stealing tantalum lamps, the former was sentenced to a month, and the latter to two months' imprisonment.

Annual Sports.—The members of the ROBERTSON AND OSRAM ATHLETIC CLUB held their fourth annual sports on Saturday last on the ground of the Latymer Upper School, Wood Lane, Shepherd's Bush, by kind permission of the Governors. The entries, which numbered just under 400, were keenly competed for. The relay race for the Wilson challege cup was again won by the General Electric Co. Athletic Club, "London," by about 30 yd. One of the chief items of the day was the Marathon race, from Pinner to the ground, which was won by A. Bailey, in 1 hour and

15 minutes 33 seconds. Another interesting item was the tug-of-war between the Osram and Robertson Works, which was won by the Robertson Works by two pulls to one. Mr. C. Wilson, Mr. C. J. Robertson and Mr. E. G. Sheppard officiated as judges, and the prizes were presented by Mrs. C. Wilson. The North Middlesex Silver Prize Band were responsible for some excellent selections, and also for music for the dancing in the evening.

Trade Announcements.—The address of the Accessories Manufacturing Co., Ltd., is 11, Dean Street, Soho, W., instead of that given inadvertently by us in the firm's advertisement last week.

Messrs. E. L. Adams & Co. have commenced business as electrical and mechanical engineers, at Radcliff Buildings, 89, Clerkenwell Road, E.C., and they desire to receive manufacturers' catalogues, and lists of electrical and mechanical accessories.

Owing to the continued pressure of business in the northern district, the Walsall Electrical Co., Ltd., have increased their accommodation in Liverpool by taking larger offices on the ground floor in Central Chambers, South Castle Street, where there are convenient and roomy stores with a good entrance. Their old stores are being fitted up as a workshop to enable them to carry out repairs more promptly than could be done if these were sent on to their Walsall works.

Messrs. Major & Co., Ltd., of Hull, have lately extended their varnish department, and have erected a large ferro-concrete building, fitted with an up-to-date plant for the manufacture of insulating varnishes and compounds, acid proof and other enamels, and similar specialities for the electrical trades. They have recently added to their electrical testing plant, and these additions enable them to make and mature larger batches of tested varnishes than were previously possible, and to meet the increased demand.

Bankruptcy Proceedings.—Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds.—The first meeting of the creditors in this case was to have been held last week at the Official Receiver's offices, 24, Bond Street, Leeds, but no creditors attended, and the matter, therefore, remains with the Official Receiver as trustee.

Catalogues and Lists.—Messrs. Hawksley, Wild and Co., Ltd., Brightside Boiler Works, Sheffield, and Queen Anne's Chambers, Westminster.—Illustrated circular giving particulars of the "Suckling" water-tube boiler.

Messrs. A. P. Lundberg & Sons, Liverpool Road, N.—Illustrated list (S 20) in the firm's usual style containing 16 pages of information with diagrams of movements and adaptations, also prices, &c., of their "Duplex" switches with central "off" position.

Mr. G. B. Bowell, Terminus Chambers, Holborn Viaduct, E.C.—New catalogue giving illustrations and prices of the "G.B.B." silent electric clocks.

Messrs. Archibald J. Wright, Ltd., Leyton Green Road, N.E.—32-page price list, with illustrations, of a variety of electric supplies for bell, telephone, and light installations.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.—New 16 page pamphlet (K 11), in which are contained full descriptive notes with tabular particulars as to sizes, prices, weights, &c., of the "Santoni" flame lamps for street and shop lighting, the "Santoni" single and double enclosed arcs, inverted open type lamps, &c. The lamps can be seen under working conditions in the show-rooms of the firm.

Messrs. Ludw. Loewe & Co., Ltd., 30 and 32, Farringdon Road, E.C.—8-page pamphlet with fine half-tone illustrations and specified description of a 34-in. vertical boring and turning mill built by the Colburn Machine Tool Co., of America, for whom the firm are the sole British agents.

Messrs. Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, E.C.—20-page catalogue (section C) giving in tabular form prices, code-words and catalogue numbers of bayonet cap, Edison screw, and magnetic lampholders, hand lamps, water tight fittings, wall rosettes, and shade-holders.

Messrs. Aron Electricity Meter, Ltd., 80a, Salusbury Road, Kilburn, N.W.—8-page pamphlet (No. 9) containing an illustrated description of the Aron maximum demand indicators for d.c. and a.c.

Mr. James Hendry, Laminated Leather Works, Bridgeton, Glasgow.—24-page illustrated pamphlet giving full particulars of Hendry's patent laminated leather belting.

Messrs. J. & H. Grevener, Eldon Street House, E.C.—Something quite original in the way of a publicity folder has been issued to draw attention to the "Arcoflame" intense flame arc lamp. That this lamp is "matchless" for outdoor lighting is impressed upon the unsuspecting recipient by the front cover, which carries a real "special Virginian" cigarette above an imaginary empty match box. We are not sure whether that cigarette is intended to be smoked.

Messrs. Eyquem's Patents, 10, Dean Street, Oxford Street, W.—Price leaflet of accessories and engines for model aeroplanes, including sparking plugs, turn buckles, wire clamps, sockets and holders in aluminium.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—New 20-page list (No. 6,012) of low-tension switchgear, the manufactures which are described and well illustrated, including single and double-throw knife pattern main switches, laminated brush main switches, change-over switches, porcelain handle switch fuses, ironclad house service fuse boxes and other lines. Special attention should be directed to distribution boards in cast-iron boxes, 5 to 10 amperes, for small lighting circuits, and power distribution boards in water-tight cast-iron boxes for three-phase circuits, for pressures up to 600 volts. Tabulated sizes, list numbers and prices are clearly set out.

The Fuller & Johnson Manufacturing Co., Madison, Wis., U.S.A.—Descriptive price leaflet, relating to their diaphragm bilge pump outfits.

The Jandus Arc Lamp and Electric Co., Ltd., Hartham Road, Holloway, N.—New arc lamp catalogue. This has been entirely rearranged for easy reference, and forms a very complete list. Special attention is devoted to the new regenerative flame lamp, and full details are given of the firm's ordinary enclosed lamps, photographic lamps, colour-matching lamps, and a variety of arc lamp accessories. The front cover bears an effective coloured representation of the Jandus lamp. The book is finely produced, generously laid out and copiously illustrated. It contains a great deal of information which will be useful to lamp-users and lighting engineers. Copies of the catalogue may be obtained on application to the Hartham Works, which is now the firm's only address.

Book Notices.—*Dictionary of Chemical and Metallurgical Material.* New York: *Electrochemical and Metallurgical Industry.* 1909. Price 50 cents.—This is a directory of the advertisers in the journal above-mentioned, giving concisely particulars of their products; the latter are arranged in alphabetical order, classified and cross-indexed. Part I includes machinery and material, Part II measuring instruments and laboratory supplies, and Part III is a professional directory. The book, now first issued, should prove very useful.

We have received a copy of the first number of *Metal Industry*, a new sixpenny paper devoted exclusively to the non-ferrous metal trades, which is being published by the Louis Cassier Co., Ltd., of 33, Bedford Street, London, W.C. The paper is associated with a paper of the same name in the States, of which it will form the English edition, and the August issue contains a good deal of interesting matter.

"Hydro-electric Developments and Engineering." By F. Koester. New York: D. van Nostrand Co. London: A. Constable & Co., Ltd. 1909. Price 21s. net.

"Examination Questions in Electrical Engineering." London: S. Rentell & Co., Ltd. 1909. Price 1s. net.

"Rules and List of Members of the Iron and Steel Institute." London: The Institute. 1909. Price 1s.

Dissolutions and Liquidations.—W. McLachlan and Co., Empire Works, Wortley Road, Armley, Leeds, engineers and suction plant makers.—Messrs. W. McLachlan & E. K. Green have dissolved partnership. Mr. Green attends to debts and continues the business.

Generators, Ltd.—A meeting is to be held at Duchy Chambers, Clarence Street, Manchester, on October 4th, to hear an accounts of the winding-up from the liquidator, Mr. G. B. Murgatroyd.

France.—The Compagnie Française pour Exploitation des Procédés Thomson-Houston, of Paris, has acquired the accumulator works and business at Neuilly, of the Compagnie Francaise des Accumulateurs Electriques Union.

Annual Outings.—At Clacton-on-Sea, on Saturday last, in glorious weather, the staff and employés of Messrs. Siemens Bros.' lamp department held their annual beanfeast. The party left Liverpool Street by an early train, arriving at Clacton at about 9.30 a.m. Luncheon was provided at the Clacton Palace, on the South Cliff, where the party numbered upwards of 200 employés. During luncheon the orchestra of the Palace played selections, and after the disappearance of the main items of the menu, the company were entertained with songs, &c. Mr. Barfield, manager of the sales department, was unable to be present, and the toast of "The Kindred Firms" (Messrs. Siemens Bros. & Co., and Messrs. Siemens Bros. Dynamo Works, Ltd.), was proposed by Mr. W. H. Le Marechal (the works manager), in a few well-chosen words. This was seconded by Mr. A. B. Holmes, who also proposed a vote of thanks to the Committee.

South African Electrical Cable Contracts.—*Commercial Intelligence* says that the general manager of the Central South African Railways "has invited the representatives of English and foreign manufacturers in the Transvaal to meet him with a view to coming to an agreement in regard to the form in which tenders for electrical goods should be invited. Certain manufacturers, we understand, are precluded from tendering on the present specifications."

Victoria and Albert Museum.—In our article last week we drew attention to the good insulation tests obtained on the new electrical installation at the Museum. We are now informed that while Messrs. W. T. Glover & Co., Ltd., as stated, supplied the paper-insulated main cables, the whole of the wiring was carried out with 2,500-megohm grade rubber-insulated cables made by the Liverpool Electric Cable Co., Ltd., who supplied for the Museum, through Messrs. T. Clarke & Co., something like 40 to 50 miles of cable.

Popularising "Metfil" Lamps.—In a recent issue of the *Daily Mail* a striking advertisement of Royal Ediswan lamps occupied the front page of that paper. The advertisement is of particular interest to the electrical trades, inasmuch as the name and address of the Edison & Swan Co. was not given. Naturally those induced by this advertisement to buy Ediswan "Metfils" will be compelled to go to the electrician from whom they usually purchase their electrical sundries, and not direct to the manufacturer. This will doubtless appeal to the contractor and retail trader.

LIGHTING and POWER NOTES.

Beckenham.—A L.G.B. inquiry has been held into the application by the U.D.C. for sanction for a loan for £741 for the purposes of the electricity undertaking and for the provision of a clinker crusher for dealing with the clinker from the dust destructor.

Bolton.—At a meeting of the Electricity Committee held on August 26th, the borough engineer was instructed to prepare an amended plan, and submit a scheme for a proposed railway siding to the electricity works.

Brazil.—The cotton mill of the Fabrica Alianca, in Rio de Janeiro, and the Bangu Cotton Mills, at Bangu, 17 miles away, are being equipped with electric motors, the first-named concern having contracted for the supply of electrical energy to the extent of 1,700 H.P., and the latter for 900 H.P., from the Rio de Janeiro Light and Power Co.

Burslem.—A L.G.B. inquiry was held on Thursday last into the application of the T.C. to borrow £7,535 for the extension of the electricity works. The following are the details of the proposed expenditure: Condenser, £1,200; foundations, £200; 600 KW. set, £3,155; foundations, £300; switchgear, £100; buildings, £1,000; boiler, £1,400; settings, £200; total, £7,535. There was no opposition to the application.

Burton-on-Trent.—On August 25th a L.G.B. inquiry was held into the application of the T.C. for a loan of £4,000 for E.L. purposes, £1,800 being for mains, £1,100 for feeders, £650 for services, £350 for transformers, and £100 for switchboard instruments. There was no opposition.

Canada.—The city's experts promise that the laying of the condnits in connection with the Toronto electric distribution plant will be completed by November 15th, or by the time the Hydro-electric Power Commission expects to deliver energy from Niagara Falls in competition with the Electrical Development Co. The contracts for the remaining eight transformer stations in connection with the building of the Government power transmission line have been awarded by the Hydro-electric Commission.—*Standard.*

Continental Notes.—HOLLAND.—Application has been made to the authorities of the province of North Brabant for a concession to establish a large central electricity generating station for the supply of electrical energy for lighting and power purposes at Hoorn, Enkhuizen, and other towns in the district.

Cumberland Power Scheme.—According to the *Financial Times*, negotiations are proceeding between the Electrical Co., Ltd, London, and West Cumberland Power Distribution Co. with the object of acquiring all the rights of the latter and erecting large electrical works, the site of which is that of the old North-Western works, on the north side of Workington. Mr. G. R. Beith is acting in the matter for the Electrical Company, and Mr. J. Paterson, Workington, for the Distribution Company.

Fife.—The Fife Electric Power Co. has decided to install a 2,000-H.P. turbine set in the works at Townhill, the result of which will be that the plant will be doubled. At present the company is laying cables in Dunfermline, and it is understood that it has decided to continue the overhead cable from the station at Cowdenbeath right into Lumphinnans and Lochgelly, the extension being for power purposes.

Hastings.—A L.G.B. inquiry was held on August 25th into the application of the T.C. for a loan of £1,002 for transformers, and £1,100 for electricity purposes, viz., a high-tension main as a duplicate. There was no opposition.

Japan.—Advices from Japan show that two new branches (*i e.*, the Bureans of Electricity and Postal Deposits) have been added to the Japanese Department of Communications. The establishment of the former Bureau was necessitated by the rapid extension of electrical enterprises in the Island Kingdom.

London.—FULHAM.—The electrical engineer has reported on the necessity of extending the boiler plant owing to the continued increase in the output. He writes that as regards the engine room the present capacity of the plant is 2,950 KW., which after allowing for reserve the largest plant, is 1,950 KW., assuming no repairs are in progress, and also subject to the whole of the condensing apparatus working perfectly. In the event of a failure of the water supply either from internal causes or from extremely low tides in the Thames, the capacity would be reduced to 1,350 KW., which is insufficient to meet even the output of last year. As regards boiler capacity there was a total evaporative capacity of 92,000 lb. of water per hour; 18,000 lb. was put down as the destructor capacity, and varied with the condition of the refuse, and at Christmas or during a heavy snowfall no steam can be obtained from this source. He estimated the balance available for use at 78,000 lb. if refuse was available, and 60,000 lb. in case of snowfall or holidays, when no refuse was available. The engineer went on to say that the very lowest figure they required was an evaporative capacity of 117,000 lb. per hour. Two years ago he took up the matter, but the introduction of metallic-filament lamps upset the calculations, and it was decided to take the risk and await further developments. It was found now, however, that in spite of metallic-filament lamps the output was still growing rapidly, and the department had to face an extension of plant immediately, especially as regards boilers. The Electricity Committee approved of the foregoing report. Quotations were accordingly obtained for the work, and the Committee provisionally accepted the tender (the lowest received) of the Stirling Boiler Co., at £2,377. It further conditionally placed an order with the Underfeed Stoker Co., Ltd., at £556, for two underfeed stokers. The electrical engineer is to carry out the remainder of the work.

Merthyr Tydfil.—The Lighting Committee of the T.C. has provisionally accepted the offer of the Electric Traction and Lighting Co. for public lighting at Merthyr Vale and Aberfan, to which places the mains are to be extended.

South Africa.—The Far East Rand mines of the Anglo-French Exploration group is reported to have decided not to purchase power from the Victoria Falls Power Co., but to erect its own central electric power station at the New Kleinfontein dam. The mines to draw their supplies from the new station will include the Benoni Consolidated, Boksburg, Apex, Rand Kiip and New Kleinfontein. Steam turbines will be the form of prime movers to be employed, and compressed air will be generated at each mine from electric compressors fed from the central station.—*Commercial Intelligence.*

Stourbridge.—At last there is a prospect of the electric light being placed within the reach of consumers resident in High Street, Coventry Street, Market Street and New Road. The laying of the mains and the connections is to be commenced immediately, and it is anticipated that in the course of six weeks the work, which has been taken in hand by the Midland Corporation Electric Supply Co., will be completed. It may be remembered that the Urban District Council obtained the lighting order several years ago, but did not put it in force—having meanwhile found a sufficiently good speculation in the gas undertaking—and the order was subsequently leased to the company now carrying it into operation.

Thames Electric Launches.—Our contemporary, the *Motor Boat*, in its notes on the Thames, says: "The electric launch still holds its own for hiring purposes, the large fleet that has been on the river for many years presenting still as up-to-date an appearance as when it was first put into commission. Having been well maintained, it is small wonder that these boats are still prime favourites with week-end or Sunday parties from town. There is no doubt that when a trip of more than one day's duration is contemplated, the motor-launch is more convenient than the electric launch, but for a single day, when the distance to be covered is not great, the electric boat is well suited to the requirements of a party that is not entirely composed of motoring enthusiasts."

Trowbridge.—The U.D.C. has decided to oppose the application of the Western Electric Distributing Corporation for a prov. order for electric light. Under a previous order which lapsed, the Corporation went so far as to lay cables in the town.

U.S.A.—Recent American papers refer to the extended application of electrical power in New England textile mills. Some 40 mills now possess some 98,000 H.P. of steam turbine plant for driving or producing power for factory use; a year ago the figures were 22 mills and 41,000 H.P. The General Electric Co. has 16 mills to its credit, with 49,500 H.P. installed; the Westinghouse Co., 13 mills and 15,000 H.P.; and Allis-Chalmers, 11 mills and 23,450 H.P. A large proportion of the above as also of water-generated power is utilised electrically, as some 175,000 H.P. of motors are installed in New England mills.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Electricity Committee last week discussed the question of the arbiter's award between the Suburban Tramways Co. and the T C. The position taken up by the company was that the reference to the arbiter was to fix the charge for energy at so much per unit supplied, whereas the arbiter fixed the price upon the maximum demand system, making a standing charge per annum of £900, and in addition to that a charge of ½d. per unit supplied. This award the company holds to be *ultra vires* on the part of the arbiter, and it declines to abide by it. The Corporation's contention is that, while it does not admit that the award is outside the reference, the company's agent acquiesced in the finding of the arbiter, and was now barred from taking exception to it. A Sub-Committee was appointed to investigate the facts before the Committee should decide whether it should maintain the validity of the award or otherwise. At the same meeting a report was submitted showing the flat rates for electricity which would produce a revenue similar to that obtained for the past year. This question was postponed.

Mexico.—The recent floods at Monterey, whereby some £4,000,000 damage has been done and many lives lost, also resulted in the temporary abandonment of the electric tramways and lighting through out the city. The Monterey Railway, Light and Power Co. is a British-owned concern.

(*Continued on page* 385.)

THE DESIGN AND PERFORMANCE OF THE A.E.G. STEAM TURBINE PLANTS.

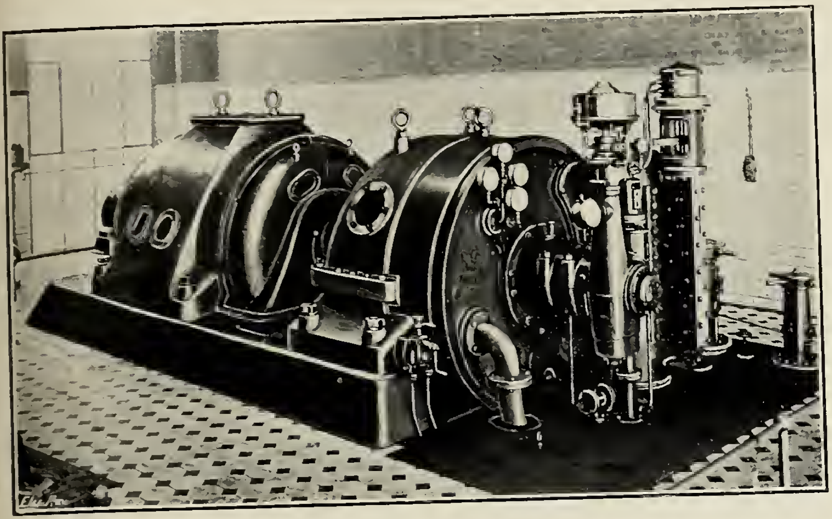


Fig. 1.—Standard 1,000-kw. Turbo-Generator of the Allgemeine Elektrizitats Gesellschaft.

The rapid increase in the number and size of steam turbine plants, both for electrical and for steamship work, turned out during the last few years by the A.E.G., who are represented in this country by the Electrical Co., Ltd., has led to a large extension of their works in Berlin. This extension includes a large boiler house capable of supplying about 130,000 lb. of steam per hour, a central condensing plant as well as a number of separate condensers for use in testing the larger turbines, and test beds capable of accommodating a number of turbine sets at one time. On one occasion, for instance, the following sets were simultaneously erected on these testing beds: a 7,500-kw. turbo-alternator, an 800-kw. one, two separate 1,600-kw. sets, a 1,250-kw. one, a 600-kw. one, a 4,500 kw. one, and four small 150-kw. direct-current turbo sets.

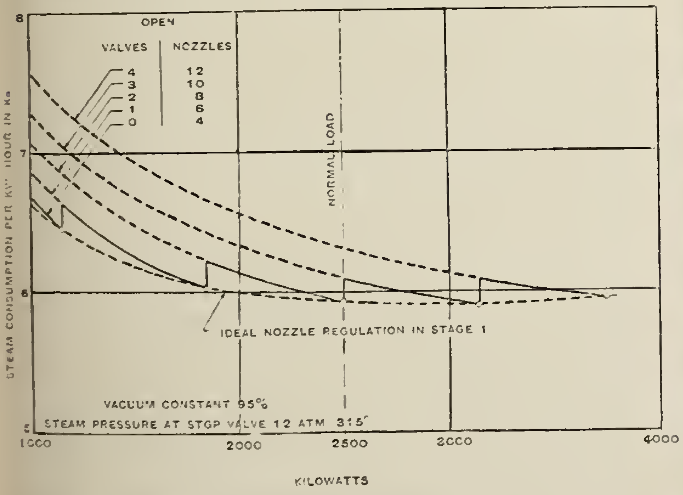


Fig. 2.—Steam Consumption Curves for 2,500-kw. A.E.G. Turbine.

The loading of these sets, as far as turbo-dynamos or alternators are concerned, is accomplished by means of water and wire resistances, and convenient connecting boards and leads are provided for coupling these to the various machines and measuring instruments. In order to save power, the temperature tests on alternator sets are often carried out by loading one machine on another with idle current. In the case of marine turbines, or others not fitted with electric generators, water brakes are used. A series of these is provided, the largest of which can absorb over 12,000 h.p. at 350 r.p.m., and the smallest 100 h.p. at 3,000 r.p.m. In these cases the outputs are measured either by balance weights or, as a check, by means of a torsion device which can be inserted between any turbine and the water brake it is driving.

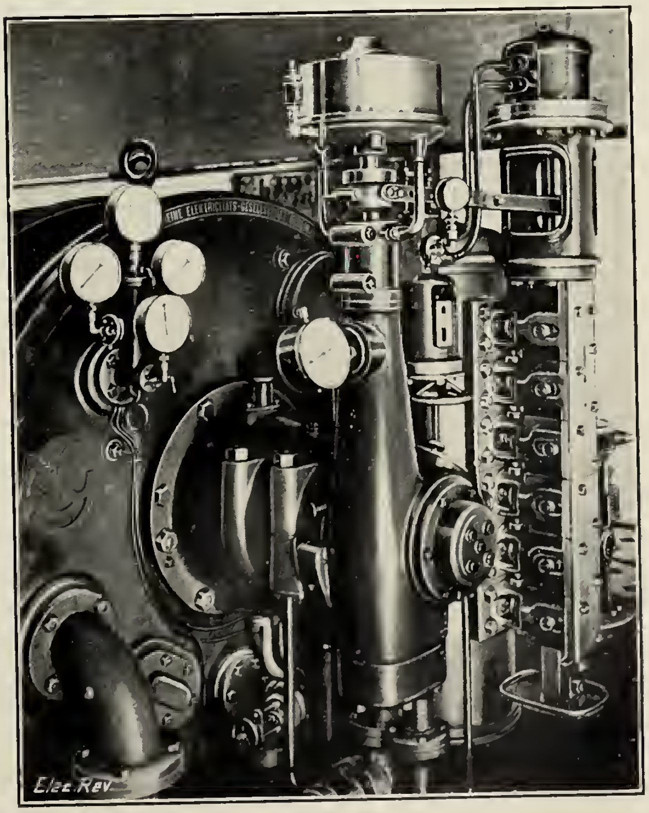


Fig. 3.—Showing Governor and Automatic Control for Nozzles.

The A.E.G. turbine is of the Impulse type, and has a number of pressure steps combined with a number of speed steps. Some four years ago the A.E.G. brought out their 1,000-kw. turbine, running at 3,000 r.p.m., and although this speed was considered high at the time for such an output, no fewer than 150 sets of this one type (see fig. 1) have already been constructed or are at present under construction. The general tendency of turbine design has been towards the use of higher speeds, or, in other words, towards obtaining greater outputs at a given speed. To obtain equal efficiency at low speeds involves the use of increased material and greater care in construction, and the difference is especially marked when the permissible speeds are widely apart, as, for instance, in the case of 50-cycle alternators, where no speed between 3,000 revs. per min. (two poles) and 1,500 revs. per min. (four poles) is possible. The maximum output of a turbine for a given speed is determined by the possible outlet area for the steam leaving the low-pressure wheel, and this point can only be satisfactorily settled by a close consideration of the maximum permissible peripheral speed and the length of blade suitable for a given type of wheel. In the A.E.G. turbine the design of every part has been so carefully chosen that a peripheral speed of 150 m. per second

(29,500 ft. per minute) is permissible whilst retaining a factor of safety as high as 8 or 10. This is possible only because of the use of nickel steel, and because, in turbines, the stresses are steady (uni-directional) and not pulsating, as in the case of reciprocating engines.

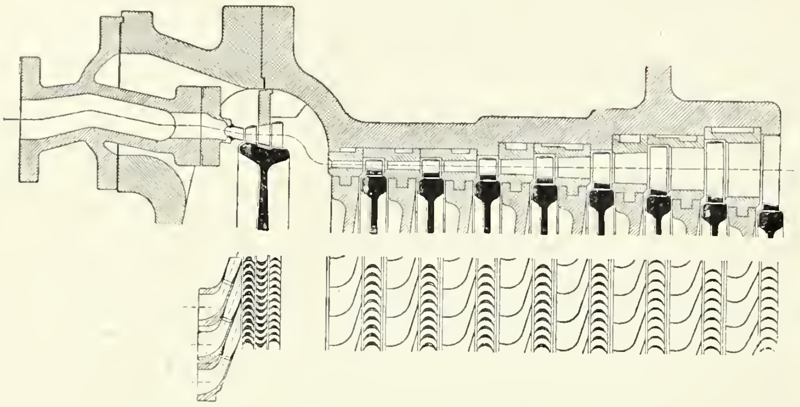


Fig. 4.—Section through Low Speed Turbine Blading.

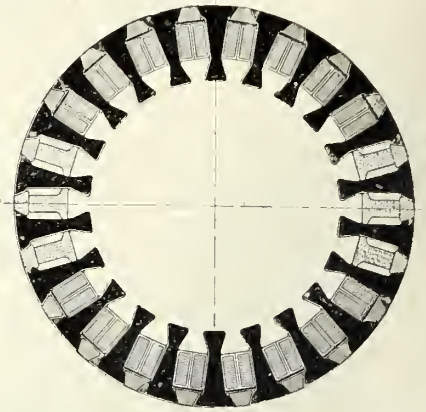


Fig. 5.—Section through Rotor Magnets.

In the lower-speed turbines the blades are formed with a T-shaped foot, but in all the 3,000-r.p.m. turbines the blades are dovetailed into the solid nickel-steel wheel rim. The blades are separated by distance pieces, also dovetailed in. The outer binding ring is merely used as a covering, and has little to do with the support of the blades.

In all sizes of the A.E.G. turbine the high-pressure section has two or three rows of blades—*i.e.*, for each pressure step there are several speed steps. The use of several rows of blades in this way results in the steam, as it leaves the inlet nozzle, having a much higher speed than the peripheral speed of the turbine wheel, the steam speed being four to five times as great in the case of two rows of blades, and six to seven times as great in the case of three rows of blades. This relatively high speed of the steam was at one time expected to increase the rate of wear of the blades, but this is not found to be the case. In fact, when the condensed water is re-used for feed water, as is the case with surface condensation, no wear can be detected after several years' work. Impure or acid steam, however, is more harmful to turbines than to reciprocating engines, because of the absence in the former of the protecting coat of oil which exists in the cylinders of the latter. The fact that so little wear occurs in the turbines also enables highly superheated steam (up to about 350° C.) to be used with safety.

In the case of the low-pressure sections of the A.E.G. turbines, the number of rows of blades depends on the speed and pressure. The 3,000-revolution turbines have only two rows of blades in the low-pressure section, as in the high-pressure one, but the lower speed machines usually have a much larger number of rows in the low-pressure section, as shown in fig. 1. In the case of steamship turbines, the rows are arranged so as to give an excess end pressure one way, so as to neutralise the end thrust of the propeller.

From the characteristic steam consumption curves, reproduced in fig. 2, for a 2,500-kw. 1,500-revolution set, it will be seen that an increased efficiency at light loads can be attained by shutting off some of the nozzles instead of merely relying on the ordinary throttle-valve governor. Many methods of automatically controlling the nozzles by means of the governor have been tried, and recently the arrangement shown in fig. 3, with specially shaped cams operating the several valve spindles, has been adopted with success. The chief difficulty met with is the fact that even momentary variations in an otherwise practically steady load serve to operate the gear.

The construction of the A.E.G. turbo-alternators can perhaps be best explained by means of a description of one particular size—that for 2,000 k.v.a. at 3,000 r.p.m. (fig. 6).

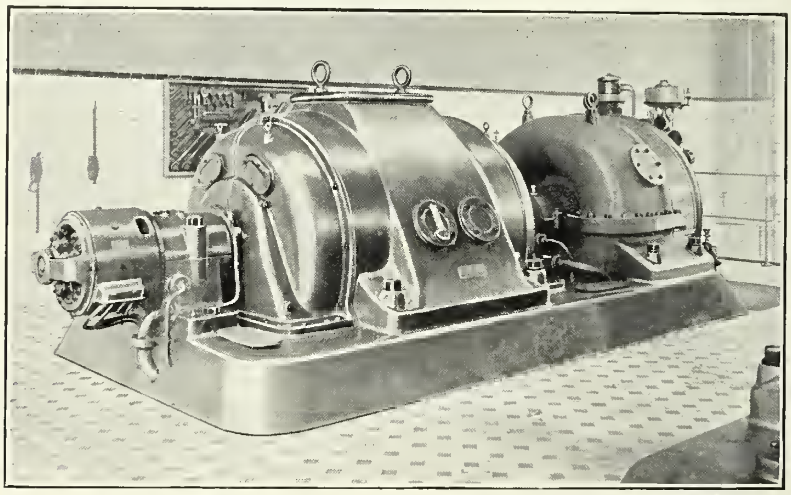


Fig. 6.—2,000 k.v.a. A.E.G. Turbo-Generator.

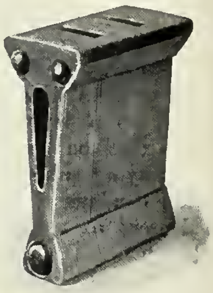


Fig. 7.—Magnet Core of A.E.G. Rotor.

The real limiting factor for the output at a given speed is the rotating part of the alternator rather than any part of the turbine itself, and consequently great care has been employed in its design. The whole construction of the rotor

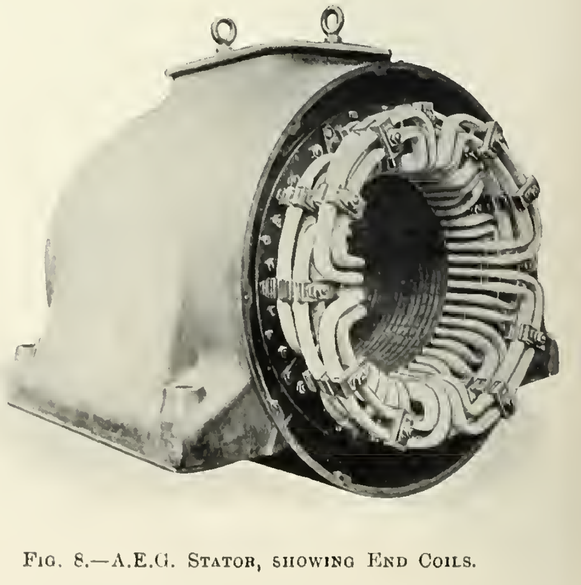


Fig. 8.—A.E.G. Stator, showing End Coils.

is based on the principle that the normal stresses set up in it during construction shall be far in excess of anything that will be superposed due to its rotation, even at a speed 50 per cent. in excess of the normal. Only in this way can the necessary reliability be ensured.

The rotor magnet construction is shown in fig. 5. It is of the uniformly toothed cylindrical type. The coils are of copper strip wound in the lathe, and the turns are insulated with a material capable of withstanding high mechanical stresses. The whole is then baked in vacuo, and is subjected, in heated steel presses, to a pressure well in excess of the working stress whilst at a temperature above the working temperature. The resulting coil has the appearance of a single solid block, and is well able to withstand the rotational stresses for an indefinite period. Some 400 of these magnets have now been made or are under construction, and as yet no case of trouble, through insulation breakdown or change of mechanical balance, has occurred.

The massive forged-steel spindle itself forms the yoke of the magnet, and the teeth forming the magnet cores are dovetailed into this, as shown. These teeth are made up of steel stampings riveted together, as shown in fig. 7, and the excess metal in the outer portion, resulting from the taper shape, is stamped out. The steel out of which these teeth are made is thoroughly tested for bending and tensile stress in the testing machine before use. The magnet coils are laid in the teeth, and held there by means of wedges made of metal with a high electrical conductivity. These wedges are afterwards electrically connected at the ends, and form a very efficient damper system. The driving-in of the wedges not only puts the coils and teeth under high stress, but also puts on a side pressure all round the periphery, which removes all chance of bending stresses being set up in the teeth. The teeth are consequently strained in exactly the same way as when in the testing machine, and the test results are, therefore, directly applicable to the finished rotor. The absence of all castings of complicated shape enables the stresses in every part of the rotor to be checked by a rigid calculation. The finished rotors are all subjected to a test at a speed 50 per cent. above the normal—not as a test for strength, but simply as a balance test to ensure the discovery of any unforeseen irregularity, if such exists.

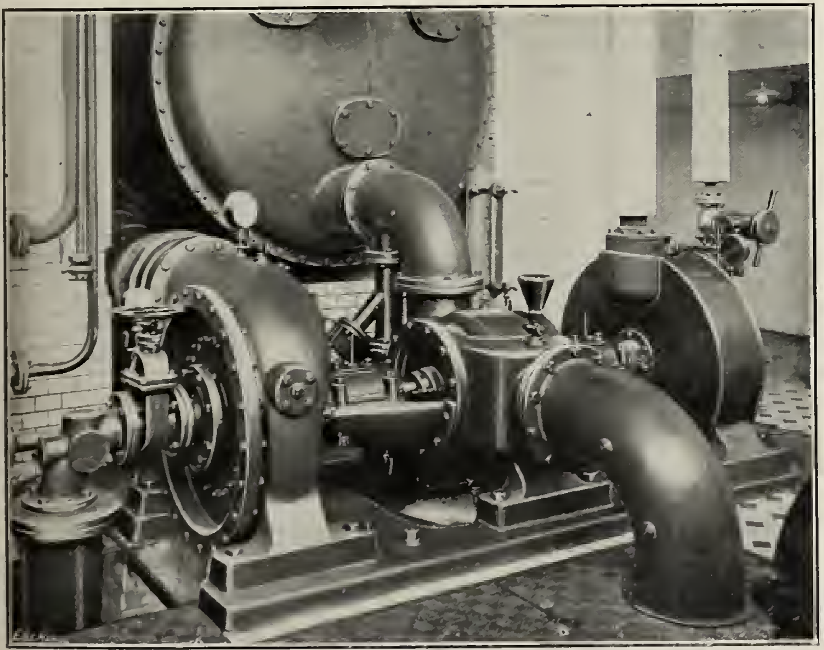


Fig. 10.—Arrangement of A.E.G. Condenser and Turbine Driven Circulating and Air Pumps.

The same care which is devoted to the rotor is also found in connection with the stator construction. The comparatively small diameter of these high-speed machines involves the use of workmanship of the highest class in order to get the necessary amount of winding and the exceptionally thick insulation into the confined space. Special precautions have also to be taken against heavy and long-continued short-circuits on the mains. The arrangement of the clamps on the end windings for this purpose is well shown in figs. 8 and 9.

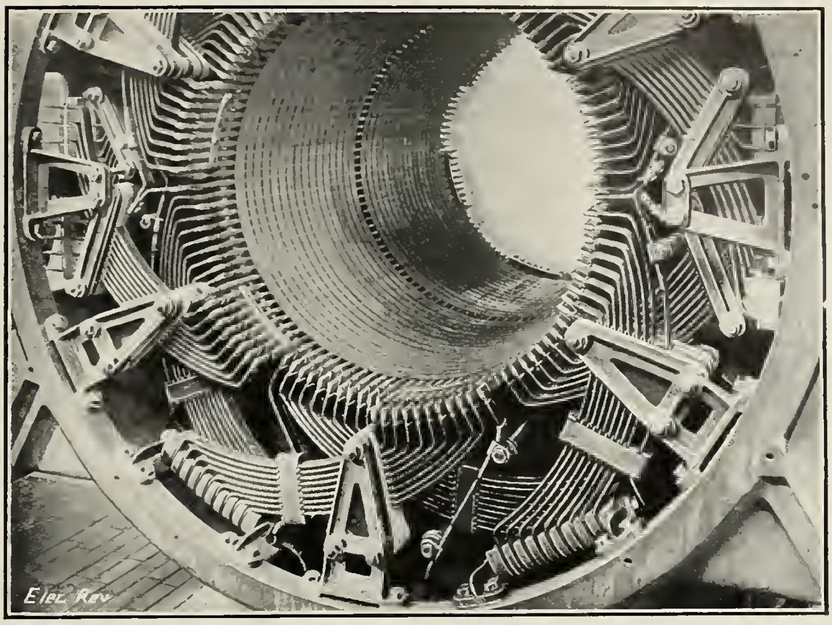


Fig. 9.—Detail View of Stator Construction and End Windings.

The small diameter also greatly reduces the ratio of the cooling surface to the watts lost in the machine, and makes it essential to employ some form of artificial ventilation. When a large volume of air is artificially drawn through the machine, however, some precautions must be taken against the gradual accumulation of dirt and dust. For this purpose the A.E.G. pass the air through a special filter composed of pockets of porous cloth held in wooden frames. These filters can be readily cleaned by beating them or by the use of compressed air, and it is only necessary to wash or chemically clean the cloth after several years' use.

The air used for ventilation purposes is forced through the machinery, as shown in fig. 11, by means of a powerful compressor carried on the rotor spindle.

One of the chief advances made in connection with the A.E.G. turbines is the use of separate turbine-driven condensing plant with them. In a properly constructed turbine the condensed steam is entirely free from oil or other impurities, and so, if treated in a surface condenser, is eminently suitable for return to the boilers as feed water, as it enables both the boilers and turbines to be kept permanently clean.

The condenser pumps and feed pumps have usually been of the reciprocating type, driven by auxiliary engines or electric motors, and with such pumps it is difficult to avoid the introduction of some oil into the water. Consequently numerous efforts have been made to replace the reciprocating pumps by rotary centrifugal pumps. The compact arrangement adopted by the A.E.G. is shown in figs. 10 and 12, the condenser itself being omitted. A small driving turbine is built with only a single pressure step, the steam from which is used either in the main turbine or for heating the feed water. This small and simple turbine runs at 2,000 R.P.M., and is directly coupled to a centrifugal pump, which delivers the condensed steam from the condenser either directly into the feed-water chamber, from which the feed pumps force it back to the boilers, or into a neighbouring overflow tank.

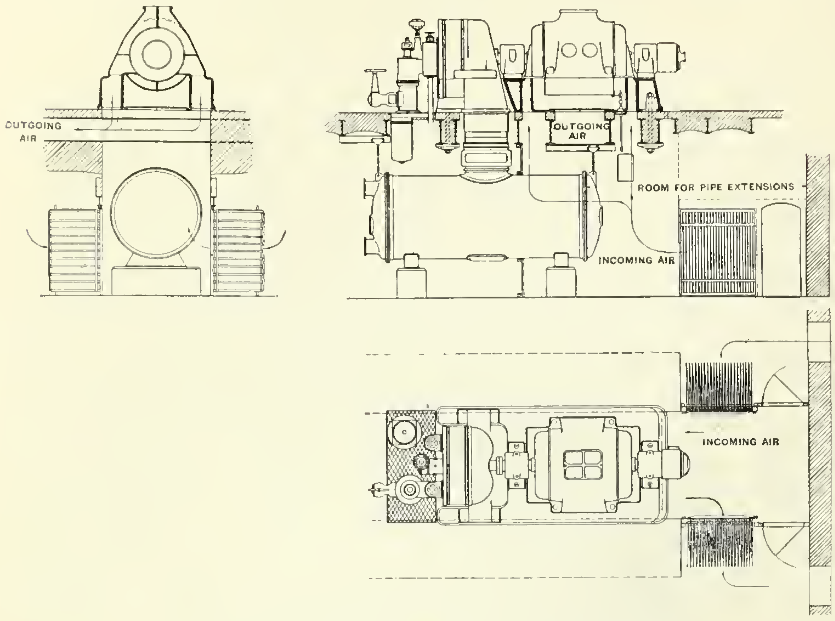
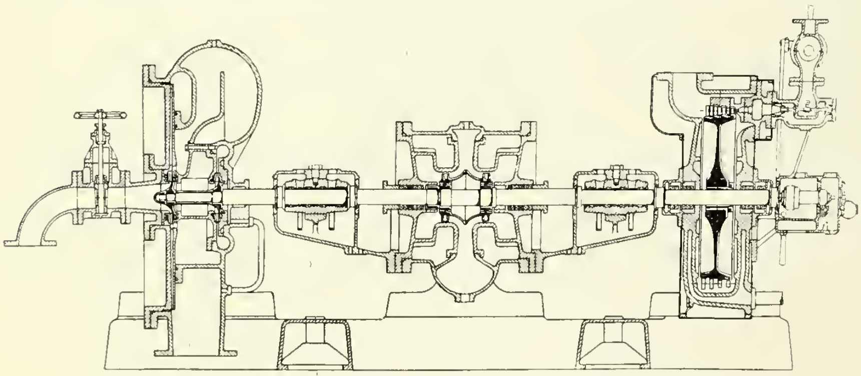


Fig. 11.—Diagram showing Air Circulation.

Mounted on the same spindle, and *in the same casing*, is also a special centrifugal air pump. As this pump has to deal with rarefied air, it is impossible to design it on the same lines as ordinary centrifugal pumps working with denser fluids, and after a considerable amount of experimenting the A.E.G. have hit upon an arrangement which gets over this difficulty satisfactorily. In this pump, the rotating part is similar to the wheel of an ordinary water centrifugal pump. This draws in pure water from a central inlet in the ordinary way, and throws it out radially at the periphery into a gap connected with the condenser. After crossing this space the water passes into a number of channels cut in a stationary frame surrounding the wheel, as shown in fig. 13. In passing into these channels or tubes each small water element forces a certain amount of the air from the condenser in front of it, and as the water passes up the channel this air is gradually compressed more and more under the action of the kinetic energy imparted to the water by the rotating wheel. By suitable design the pressure attained at the outer periphery of the channel frame can be made equal to, or slightly greater than, the atmospheric pressure, and the condenser air is thus expelled into the atmosphere, whilst the water used in the operation passes into a tank, from which it is drawn and circulated once more. The fine sub-division of air and water prevents the heat of compression having any noticeable effect, although in some cases a small surface cooler is used to keep down the temperature of the water used in the pump. The pump for the condenser cooling water is of the ordinary centrifugal type, occupying the mid-position.



Water and Air Pump. Circulating Pump. Driving Turbine.

Fig. 12.—Section through Turbine driven Condenser Pumps.

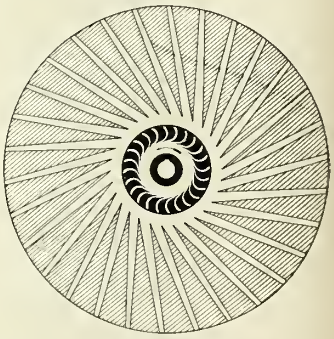


Fig. 13.—Diagram showing Air Pump Runner and Air Channels in Casing.

The saving of space effected by the use of these turbine-driven pumps is very marked, and enables the central station floor space to be selected, merely so as to accommodate the turbo sets without any additional allowance for the condenser plant. Fig. 15 shows the condenser arrangements in one of the Berlin central stations, using the ordinary electrically-driven reciprocating pumps fitted into the smallest possible space; it further shows the reduced space which would be required if the new turbine-driven pumps had been installed. It will be seen that the breadth of the room for two sets (6,000 KW. each) can be reduced from 17,500 mm. in the first case to 14,500 mm. in the second, and the length of the room, in the latter case, could also, obviously, be greatly reduced. The demand for this new arrangement of the auxiliary condenser machinery has been so great that, since its introduction at the beginning of this year, plant for a total output of some 170,000 KW. has been ordered to be fitted with it.

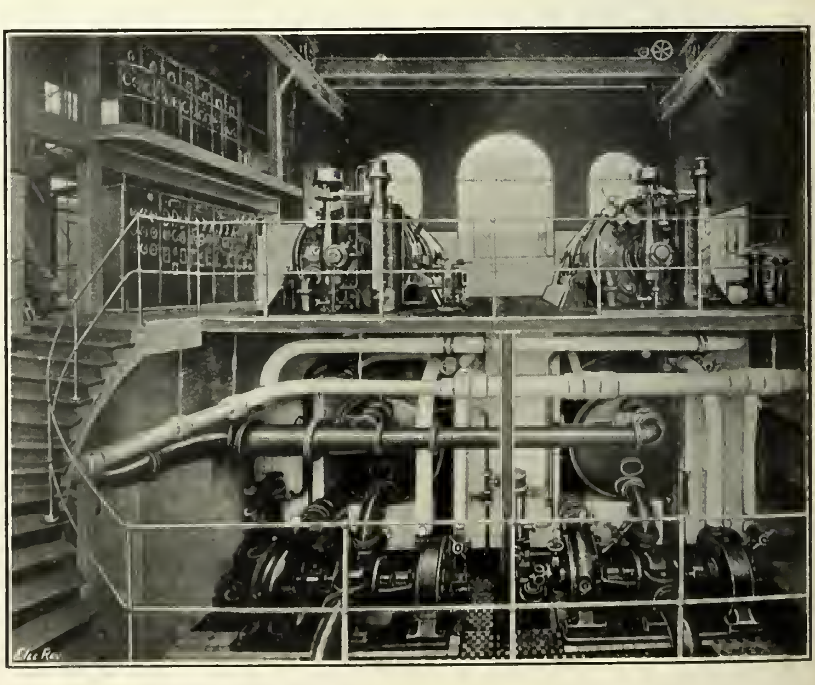


Fig. 14.—Arrangement of Turbines and Condensers, with Pumps.

SUPPLY COMPANIES' APPLICATION FORMS.

The official application form is the permanent documentary link between the supply company and the consumer, and is the producible evidence of the contract between the two. Further, it is a document that has certain latent possibilities in the way of becoming at any moment a valuable legal instrument. In view of this, one might reasonably anticipate that companies would spare no pains in getting the form into proper shape, and in carefully and ingeniously drafting out the clauses necessary to protect their interests.

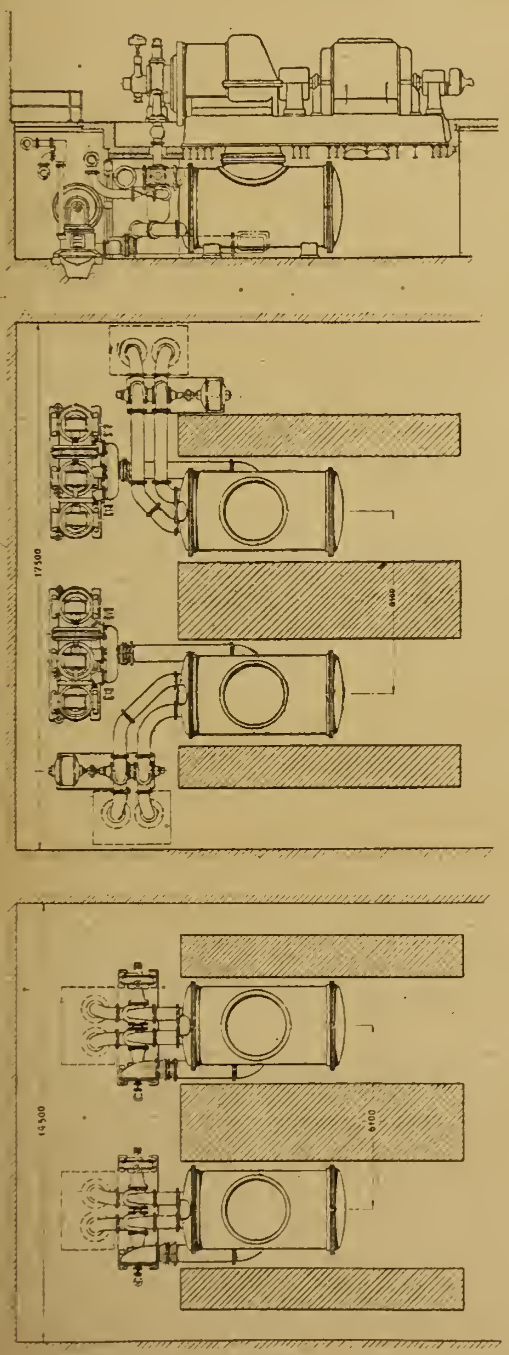


Fig. 15.—12,000-kw. A.E.G. Turbine Plant (p. 382), Showing Space Saved by Turbine-Driven Pumps.

But a survey of the application forms of the various companies would compel the reader to admit that they were anything but masterpieces of painstaking—rather the reverse. In fact, striking an average amongst them, one cannot but detect a certain savour of (if one may be excused an unflattering word) ineptitude. At any rate, to put it mildly, many of them would certainly give the impression that no very extravagant degree of care had been lavished on them. It must be admitted, of course, that in the case of a few of the companies, the form is drafted with foresight and aptitude, and certainly approaches completeness; but most of the forms provide plenty of openings for revision and expansion. To particularise, the Westminster Co.'s form, for instance, might be classed as one of the indiscreet type. In the first place, for some unaccountable reason, the contract form is detachable from the page setting out the conditions of supply. The consumer is directed to tear off the contract page when filled in and send it to the manager, and a perforation is provided to facilitate the tearing-off from the general clauses of the agreement. The contract form begins: "I (We) hereby agree to receive and pay for a supply of electrical energy on the foregoing terms." . . . It is difficult to see, therefore, what peculiar idea prompted the Westminster Co. to arrange for an important part of the agreement to be detached and presumably kept (or thrown on one side) by the consumer. The conditions are obviously put there to protect the company's interests, and to form part and parcel of the contract form that is kept in hand by the company. The Westminster Co. are, therefore, in the remarkable position of having in their possession some thousands of these half-sheet contracts, with the other halves, however, absolutely irrecoverable. Surely it would be an awkward position if one of these halves had to be produced in a Court of Law, and reference to be made to the "foregoing terms" mentioned in the sheet. It would surely be acknowledging a somewhat loose procedure to have to admit that the actual wording signed for by the consumer was not producible by the company. To produce a "half" torn off another agreement form, although identical in wording, is not at all the same thing. The reason for so quaint an arrangement as this detachable sheet is, therefore, difficult to see. *En passant*, one might remark, too, on the somewhat humorous expression in Clause 10, notifying "energy to be supplied continuously, day and night, Sundays included, but . . . ." The "Sundays included" is quite a touch of originality.

The application form of the St. James' and Pall Mall Co. is by no means comprehensive; indeed, it is of a somewhat abbreviated nature. In one of the clauses the purpose of the insertion is apparently expressed rather indiscreetly. The clause evidently refers to stopped meters and the like; the phrasing of the clause, however, runs thus: "Should any meter be found to register inaccurately, or otherwise be unavailable for measuring the supply, the consumer agrees to pay in respect of the electricity supplied for the period in question a reasonable proportion based on the former readings of such meter, or on subsequent readings of a meter substituted therefor." Obviously this is meant to apply to meters under-registering; but a meter that over-registers also comes under the designation in the clause. In practice, when a consumer asks for the meter to be tested, he is often dissatisfied with the small percentage to be refunded, say when it is certified as slightly over-registering, and it is not at all uncommon for him to want to pay the same as some previous corresponding quarter; and the *primâ facie* reading of the clause quoted would seem to give some sort of countenance to the idea.

The Charing Cross, West-End and City Co. make use of a term in their application form which is likely to confuse the ordinary person. They designate themselves throughout as the "contractors." Considering that the word, so far as ordinary consumers are concerned, is understood to mean the people who do the wiring, it is inviting misunderstanding to use the term in a paper for the hands of the public. (Curiously, another company operating in part in the same area—the City of London Co.—print on their application form a notice that, as a supply company, they have no connection with any firm of "contractors.") The Charing Cross Co. have a curious beginning to their contract form. It runs to this effect: "I hereby request you to connect my installation at ——— with your mains on or before the ——— day of ———." There is no precautionary mention in any of the clauses as to due notice being given, and so on, or supply not being guaranteed by any date. With introductory words such as the above, the acceptance of the application might be claimed as being bound up with the condition as to date. The notification of acceptance to each consumer would, therefore, seem to demand that, if the requirement as to date were not complied with, the consumer should be apprised of the fact. Surely it would be more politic merely to leave a space for date when wiring finished, or something akin, which would in no way suggest any obligation on the company in this respect to accept the application.

The foregoing instances by no means exhaust the points open to criticism, but are merely indicative instances to show that many of the application forms would suggest a necessity for a complete redrafting. It is curious, perhaps, that, in view of a few of the companies putting out a more or less complete application form, with adequately expressed conditions, the companies with immature and faulty forms should not at least have followed their lead.

As regards the question of selecting the various items which should be embodied in the application form, the best guide is a consideration of the points of dispute likely to crop up between the company and the consumer, as the bulk of the clauses may frankly be regarded as set down with the single aim of defending the company's interests. These clauses, together with those which are put in purely to give information (such, for instance, as the ones relating to scale of charges, pressure, rent of meters, complaints, &c.) should be grouped together on one side of the page under the comprehensive title of "General Conditions" (under which the company will supply energy).

The other side of the application form consists merely of tabulated spaces, which, when filled in by the prospective consumer, give full details of the installation in respect of which the supply is required. As regards this side, no comment is necessary, since the same is merely a matter of careful tabulation. The "General Conditions" side of the form, however, gives ample scope for a judicious selection of points to be covered. (It might be remarked, however, in passing, that advertising matter of any kind is quite out of place on an application form, seeing that the form comes into play only after the question of supply has been finally decided upon.) Outside the purely informative clauses, the other points may be roughly grouped under the two headings of financial and technical. The "financial" clauses are inserted to cover the company in regard to due payment of the accounts and in defining the responsibilities which attach to the consumer. The "technical" clauses are there to provide against the company being held responsible for certain contingencies, and to cover their interests in regard to the property on consumers' premises, and in respect of their rights for insisting on the consumer's installation being maintained in a proper state of efficiency, and of access to inspect and examine, &c. The company are protected, of course, in regard to the foregoing by the various provisions in their Orders, &c. At the same time, in everyday practice, it gives a satisfactory and immediate finality to a dispute with a consumer if he can be referred to a specifically worded clause to which he has assented by his signature on the Application Form, and which disposes of his ground of contention. To have to rake out a copy of the company's Order is a very clumsy alternative in comparison.

As regards the "financial" clauses, these should at least cover the following points :—That accounts would be rendered quarterly, and must be paid within seven days ; further (and this is of a certain importance) that they may be rendered also at any time during the quarter, and that immediate payment may be requested. The usefulness of this clause comes in, say, in cases where certain facts about a consumer come to the company's knowledge which may give a reasonable suspicion of his becoming financially shaky, but which the company would not be justified in stating to the consumer. The company in such cases can point to such clause and claim that in view of this no special explanation of the rendering of a period account is called for, and so avoid taking any (possibly) serious attitude. The provision for claiming deposits should be included, and this should be worded so that a deposit may be asked for at any time, and not merely at the time of making application for supply. It should also be specified that the deposit thus made will not be allowed to apply to running accounts. Two other points that are cognate with the foregoing are those relating to disconnection on non-payment of accounts and to the necessary notice to determine the agreement. It might also be useful to notify that complaints as regards accounts must be made within, say, a week of receipt of account, and must be made *in writing*. The latter point safeguards the company against the rather shifty type of consumer who, perhaps, delays the payment of account to the last moment, and then tries for still further delay by claiming that he mentioned to the collector or to someone or other that he wanted the account looked into, &c. Tenants should also be made responsible for sub-tenancy accounts.

Disputed accounts should be covered by a clause giving particulars of the consumer's rights to an independent test and the payment of the necessary fees, a stipulation being made that adjustment of accounts will not be made further retrospective than the quarter in dispute.

As regards the clauses which might be classed as the "technical" as opposed to the "financial," the following are some of the points that should be covered. The company should be protected against any claims that might be brought in regard to the company finding out that the premises in respect of which an application has been lodged, are either outside the company's area of supply, or are situated off the present route of the company's mains. It should also be clearly stated that the company, while doing all they can to give supply promptly at date requested, cannot definitely undertake that supply shall be given within any definite time. The stipulated distance that the company are prepared to run services without charge should be stated, and a provision made that wayleaves over any private property must be obtained by the prospective consumer. As regards continuity of supply, in view of possible breakdowns, a clause should be inserted to cover, and also to give the company liberty to disconnect for short periods for their own purposes. A clause should also cover the rights of the company's officer to inspect and read meters, &c., during certain hours, and should state that any such officers will produce, on demand, an official warranty for entrance. With regard to the installation itself and the apparatus, such as arc lamps and motors or connections therewith, there should be a short paragraph referring to the company's rules and to the rules of the Institution of Electrical Engineers, and it should be specifically stated that the approval of the company's engineer must be obtained in regard to the installing of arc lamps and motors. A test by the company should be provided for, and a penalty fee stated for subsequent tests should the installation necessitate such by not coming up to the requisite standard. Also it should be clearly stated that the company is not responsible for any of the consumer's installation beyond the company's cut-outs. A clause should be inserted stating that the consumer is responsible for any damage to the company's property on his premises both by fire and otherwise.

The foregoing indicate the broad lines on which the general conditions should be drafted so as to cover the company in various contingencies. The points mentioned cover what may be considered as the minimum number expedient ; they may, of course, be expanded or added to. The limit is really the space at disposal, and this is governed by the size being kept to handy dimensions. A single-sheet application form is certainly the desideratum—one side for tabulated details, the other for the general conditions. As regards the actual phrasing of the clauses, the provisional orders give a general guide in respect of a good deal of the matter. Finality, in regard to embodying all that is necessary, is hardly to be achieved. From time to time, various points must necessarily crop up which may render it advisable to add a clause or so, or to modify or expand some already included. The form, in fact, should always be carefully revised on each occasion of reprinting.

Copper.—The *Financier* for August 24th publishes an article on stocks and supplies, in which it quotes the statistics of the Copper Producers' Association. According to these, the actual decrease in the world's stocks at the end of July was nearly 5,000 tons, due to increased American consumption. This takes into account the increase in visible supplies. The table of productions for the past seven months given shows June and July 3·8 million pounds, against January 3·6. Deliveries, however, have increased from 1·9 to 4·8 million pounds, and have exceeded production since April. The tenor of the article is that a strong revival in trade is commencing in the United States, and that the production is not expanding to meet it.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 378.)

Bacup.—At the meeting of the T.C. this week, it was reported that Parliament had granted powers to the Whitworth Urban District Council, to construct tramways from the terminus of the existing tramway at Henley, to the borough boundary of Bacup at the Britannia, and that the Rochdale Corporation had agreed to lease the same as far as the Red Lion Hotel at Shawforth, with the option to lease the remainder at any time; it was resolved by the Bacup T.C. that the Electricity and Tramways Committee be appointed to meet representatives of the Rochdale Corporation, with power to arrange with them terms for the lease and working of the suggested extension of the Whitworth tramways from the borough boundary to the centre of Bacup.

British Columbia.—The British Columbia Electric Railway Co. and the City of Victoria have come to an agreement whereby the city agrees not to install a power plant in competition with that of the company without offering to purchase the company's plant at a price to be fixed by arbitration. The company on its part agrees to reduce the cost of electric light to the citizens and to install a power plant at Indian River, some 50 miles from Victoria, at an expense of about $1,500,000. The new arrangement is similar to that existing in Vancouver, and must be ratified by the ratepayers before coming into force.

According to reports, the Canadian Pacific Railway is investigating a scheme for electrifying the Columbia and Western branch of the system. The West Kootenay Power Co. is indicated as likely to supply energy to the sections in the neighbourhood, which deal with a heavy mineral traffic to local copper smelters.

Continental Notes.—Russia.—In connection with the St. Petersburg tramways, to which reference was made last week, the Société Parisienne pour l'Industrie des Chemins de Fer et Tramways is negotiating with the municipality in regard to the taking over of the tramways, and the acquisition of further concessions for lines, all of which would be worked by electricity. The transaction represents an operation of the value of £4,800,000, in the financing of which the Société Générale, of Paris, would co-operate.

Holland.—An agreement has been entered into between the Minister van Waterstaat and the Nederlandsche Buurtspoorweg-Maatschappij, of Utrecht, whereby the latter are granted a concession to construct and work an electric railway from Utrecht to Zeist *via* Bilt. The work of construction must be completed within two years from the date of the concession.—*Board of Trade Journal.*

Turkey.—It is reported from Berlin that a company is in course of formation under German auspices for the purpose of constructing a system of electric railways in the Constantinople district.

Sweden.—A Swedish engineer, Herr Quistgaard, is the author of a project for the construction of an electrical railway under the Sound, to connect the town of Malmo with Copenhagen. The projected line would be 236 km. long, 16 km. of which would be in a tunnel under the sea.

Italy.—The Ministry of Public Works has issued a favourable report in connection with the concession for the construction and working of an electric tramway from Trani to Corato. A favourable report has also been issued relative to a concession for the construction and working of an electric tramway from Badia to Ripoli and Grassina, in the province of Florence.

Halesowen.—The B. of T. has confirmed the Halesowen Light Railways (Transfer, &c.) Order, 1909, by which the Council's powers are transferred to a company.

Haslingden.—At the Haslingden Council meeting on August 26th, it was reported that several letters had been received from Messrs. Dick, Kerr & Co. with regard to the span wires. After some discussion, it was resolved that the tangential suspension system be dispensed with; that ordinary mechanical ears be fixed on the overhead line within the borough as early as convenient, and that Kay's patent grooving machine be used for the fixing of the ears.

Isle of Wight.—At the recent half-yearly meeting of the Isle of Wight Central Railway, the chairman said there had been two proposals for the electrification of the line, neither of them definite. One offer had been dropped, and the other proposal involved buying up the company.

Rawtenstall.—The members of the Whitewell Valley Ratepayers' Association are petitioning the Rawtenstall T.C. in favour of the construction of electric tramways in the Lumb Valley—a rapidly-growing district.

Siam.—The Baker Motor-Vehicle Co., of Cleveland, Ohio, U.S.A., has just completed a small two-seated electrical victoria to the order of the King of Siam, for his personal use on State occasions in Bangkok. The body is painted white, the upholstery being in a delicate shade of pale green broad cloth; all the fittings are silver plated, while the handles of the different levers are of pearl.

South Shields.—Mr. L. E. Harvey, general manager and engineer of the Corporation Tramways, in his first annual report (and the third of the undertaking), refers to two matters of more than local interest, concerning the cost of energy. He says: "The original account for the year for units consumed, rendered by the Electricity Committee, was £8,957, working out at 1·94 units per car-mile, from which a rebate of £1,027 was offered, leaving £7,930 (= 1·707 units per car-mile). I considered that £6 795 (= 1·45 units per car-mile) was a fair amount. The amount finally agreed upon was £7,107, working out at 1·52 units per car-mile." Although the matter has been settled, he regards the amount as too high, as since the meters have been recalibrated, and have been in use four months, the units per car-mile are 1·379. He further suggests the fitting of meters on all the cars. In regard to the price paid for current generally, Mr. Harvey says the price is considerably too much, based on the prices paid by other undertakings. He makes a comparison between the price paid by his department, and the price paid by ordinary power consumer in the borough. The outside power consumer paid 1⅛d. per unit for the first 5,000 units per quarter, and 1d. per unit afterwards, with 2½ per cent. discount. The tramways pays 1½d. per unit for first 400,000, 1·4d. for next 200,000, and 1·3d. afterwards; with no discounts. The accounts which accompany the report show that the total income was £29,580, equal to 9·087d. per car-mile. The expenditure was £19,405, and £10,175 was carried to the net revenue account. Traffic expenses totalled £7,548; general expenses, £2,719; general repairs and maintenance, £2,030; power expenses, £7,106. Interest paid amounted to £6,016; and contributions to the sinking fund totalled £3,899, leaving a net profit of £423 transferred to the reserve fund. This latter fund now stands at £5,979.

Tasmania.—The Launceston tramway scheme does not make much progress; the offer of the London Syndicate for laying down the system was for £65,875, and was much higher than the Corporation engineers estimated (£42,298).

U.S.A.—The Trackless Trolley Co., of New York city, has been incorporated with a capital of $150,000. The company has secured the American rights to a system which has been used successfully in Germany.

The Pacific Improvement Co. is planning to experiment with a trackless trolley. The company will build a 60-mile line for trackless trolley from Del Monte by way of Monterey, Pacific Grove and Pebble Beach back to Del Monte, with a branch 43 miles on the Monterey peninsula.—*Electric Traction Weekly.*

Wolverhampton.—Considerable progress has now been made with the laying of the tramway between Queen Square and Ten Road, which will link up the Pennfields district with the town. It is hoped that in the course of perhaps a couple of weeks this section will have been completed and ready for the Government inspection. The line will be a great boon to the travelling public who have hitherto been served by motor-'buses, which have not been always reliable.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions and Repairs :—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	
Tourane-Amoy	June 17, 1909	
Assab-Perim	July 8, 1909	
Gibraltar-Tangier	Aug. 7, 1909	
Melilla-Chafarinas	Aug. 7, 1909	Aug. 30, 1909
Cueta-Tangier	Aug. 7, 1909	Aug. 27, 1909
Dakar-Conakry	Aug. 20, 1909	

Icebergs and Cable Ships.—The Halifax, N.S., *Morning Chronicle* describes measures taken to get rid of a large iceberg at Cuckold's Cove, where the ends of the new Commercial Cable at Newfoundland are being landed. Gun-cotton was at first tried, without effect, and then dynamite was resorted to. To place the charge a number of men from the cable steamer *Mackay-Bennett* and the Reid Newfoundland Co. had clambered on to the iceberg, when the monster under their weight lost its balance and began to topple over towards the water. Several of the men jumped into the water and were picked up by the steamer's launch. Those remaining on the berg had a marvellous escape, as it ceased its downward roll just as the part on which they were standing reached the water's edge, a new balance having apparently been created. The men then hastily got on shore. Finally the cable ship *Mackay-Bennett* took the berg in tow and conducted it out to the open sea.

New Cables.—The first section of the Germany-South America cable scheme was opened for traffic on 26th ult. between Borkum and Teneriffe.

The length of the new cable of the Commercial Cable Co. from St. John's, Newfoundland, to New York is 1,307 n.m.

The Newfoundland Cable Dispute.—A further communication on this subject has come to hand from the Commercial Cable Co., enclosing a copy of a letter addressed to the Secretary for the Colonies on August 20th in reply to the remarks of the Anglo-American Telegraph Co. The former contends that, far from creating a monopoly, the agreement was made solely to break up a monopoly which the Anglo Co. had had for 50 years, and which would be restored if the agreement were rescinded. The Anglo Co. has 590 miles of landlines in Newfoundland, and competes with the Government for local as well as foreign business, while the Commercial Co. is excluded by its contracts from doing any telegraph business in Newfoundland, except through the Government. If the contracts were abrogated by mutual consent, or if the contract of 1905 was not renewed in 1915, there would then be three competitors for cable business—for, it is hinted, if the Commercial Co. were not permitted to do business in Newfoundland, the U.S. Government would retaliate, in accordance with precedent. The Commercial Co. denies that it was exempted from taxation by the contract, and states that, if it had five cables running through Newfoundland, like the Anglo Co., it would have to pay $20,000 a year to the Government, like the latter, though it would receive $4,000 *per contra* in return for maintaining an office in St. John's. The Commercial Co. takes exception to Sir Ed. Morris's remarks concerning the publication of its letter before he had seen it, and concludes with the statement that it has invested a million dollars on the faith of a reasonable contract with a responsible British Government, which it expects to comply with the conditions likewise.

Rescue by Wireless.—The steamer *Ohio* struck a rock off the coast of Alaska on Friday last, and began to sink; the wireless operator, a Canadian named George Eccles, telegraphed the position of the ship to neighbouring vessels, which sent aid and rescued 128 lives. Unfortunately, the operator, heroically remaining at his post to the last moment, went down with the ship, together with four other persons.

Transvaal.—It is reported that important extensions of the Transvaal telephone and telegraph services are to be carried out, and the trunk telephone lines will be carried to the boundary, with a view to their ultimate extension to the coast. Telephonic communication between Cape Town and Pretoria will be essential under the new *régime*. The outlay for the extensions is estimated at £250,000.

Wireless Telegraphy.—In the House of Commons on Monday, Mr. Crooks asked the Postmaster-General whether he had refused to grant a licence under the Wireless Telegraph Act to Mr. C. E. Kelway in connection with the proposed installations of his sound-locating system on the south and south-east coasts of England; and, if so, whether that refusal was due to objections raised by the Admiralty. Mr. Buxton replied:—Mr. Kelway's sound-locating system involves the use of wireless electric signals, and I was sorry to be compelled some time ago, after consultation with the Admiralty, to refuse the grant of a licence to him for its installation at Dover or on the south or south-east coast of England. The reason for the refusal was the risk involved, in connection with the working of the system, of interference with the naval and commercial wireless telegraphy which is so largely carried on in those regions. A licence was, however, offered to Mr. Kelway for the trial of his system in some locality where this objection did not apply.

Replying to Mr. Crooks in the Parliamentary papers, Mr. Sydney Buxton, the Postmaster-General, says that the capital cost of the Post Office wireless telegraph station at Bolt Head has been about £2,000, and its annual cost, including allowances for interest and depreciation, is estimated at about £750. The work of the station has hitherto been chiefly experimental, and in connection with the arrangements for giving effect to the International Radio-telegraphic Convention. A considerable number of ships report their position to Bolt Head in passing, but happily no messages have had to be received from ships in distress.

Telephones in the vicinity of the Manhattan Beach and Brooklyn Navy Yard are said to be experiencing considerable interference from the neighbouring wireless installations, and if it is found impossible to overcome it, installations will have in future to be erected at such a distance from telephone lines as to avoid this trouble.

The Japanese Government now owns five wireless installations, and several vessels of the mercantile marine are also fitted.

The provision of wireless communication between Teneriffe and Senegambia is under consideration.

A company is being formed to work the Poulsen patents throughout the Empire. A licence has been obtained to erect a station in Canada, and an Irish station is nearly completed.

The Marconi wireless station at Morien was burnt to the ground on August 21st.

Wireless Telephony.—Further experiments in wireless telephony have been carried out on the system invented by Lieuts. Jeance and Colin. It is reported that communications were successfully exchanged for several hours between Toulon and Port Vendres, a distance of 155 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—2,550 common battery telephones and protectors for the P.M.G. See "Official Notices" August 20th.

Ballinasloe.—September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Brazil.—October 5th. Tenders are being invited by the municipal authorities of Corumba (Province of Matto-Grosso) for the establishment of a central electric lighting station in the town.

Dublin.—September 13th. 750 A.C. meters, single-phase, for the Lighting Committee. See "Official Notices" to-day.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

Grimsby.—September 17th. Paper-insulated lead-covered cables for the Corporation. See "Official Notices" to-day.

Hungary.—September 18th. Tenders are being invited by the municipal authorities of Magyarkanizsa, for the establishment of a central electric lighting station in the town.

Isle of Thanet.—Stores for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" to-day.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" August 13th.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" August 13th.

September 7th. Electric light wiring and fittings for the Public Offices extension for the U.D.C. See "Official Notices" August 20th.

London.—L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G. G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

L.C.C.—September 21st. Two 500-kw. and 150-kw. motor-generators, also high and low-tension switchgear, for sub-stations; steam and other piping, valves &c., for Greenwich generating station. See "Official Notices" August 27th.

Oldham.—September 10th. Coal for the Electricity Committee. Mr. S. W. Newington electrical engineer.

Pretoria.—*African Engineering* states that the municipality of Pretoria is inviting tenders for a complete electric tramway system, under 10 separate headings.

Russia.—The municipal authorities of Suchum are about to invite tenders for the construction of an electric tramway in the town.

Turkey.—October 11th. The Turkish Ministry of Finance is inviting tenders for the concession for the establishment and working of a telephone exchange in the capital. It is reported that a French syndicate is in negotiation with the Government.

Warrington.—September 10th. Electrical requisites for six months, for the B.G.; A. Bottomley, clerk, Bewsey Chambers, Warrington.

CLOSED.

Birmingham.—The District Electric Co. Ltd., of Birmingham and Wolverhampton, have received instructions to carry out an installation of electric light at St. Thomas' Church, Bath Row, Birmingham.

Bolton.—The Tramways Committee has accepted the tender of Messrs. G. R. Feather & Co. for patent point controllers.

The tender of Messrs. Musgrave (Bolton) for an overhead travelling crane was accepted by the Electricity Committee on Thursday last week.

Eccles.—The T.C. has accepted the tender of William Boby (London), at £275, for the provision and installation of water softening and purifying plant at the electricity works.

Germany.—The Siemens-Schuckert Gesellschaft, of Berlin, has secured a contract to establish a central electric lighting station in the town of Kolberg, Pomerania.

India.—According to *Commercial Intelligence* the Tata Iron and Steel Co., Ltd., have placed the contract for their power house with the Lahmeyer Electrical Co. The erection of the power house is to be begun immediately. Messrs. Shaw, Wallace & Co., Bombay and Calcutta, are agents for the contracting company.

Salford.—The Guardians have accepted the tender of the Hart Accumulator Co., Ltd., for the renewal and maintenance of the storage battery of 110 cells installed at Culcheth Cottage Homes.

The Rand.—According to *African Engineering* Messrs. Hubert Davies & Co., of Johannesburg, have just secured an order from the East Rand Proprietary Mines for five double-drum electric winders. Each is to be capable of raising a total load of 11,650 lb. up an incline of 45° at a speed of 3,000 ft. per minute.

Messrs. Vaughan & Son, of Manchester, have secured an order for two electric and one hand-power overhead cranes for the same mines, and for two 35-ton, 46-ft. span electric overhead travelling cranes for the Natal Government Railways' new shops at Maritzburg.

Wigan.—The E.L. Committee has considered the following tenders in connection with the extension to the electricity works:—

Pipework and Economisers.

Babcock & Wilcox, Ltd.		£3,755
Stewarts & Lloyds, Ltd.		3,775
Tickle Bros., Wigan	(accepted)	3,778
Crompton & Co.		4,001
" " (alternative)		3,816
Johnson Bros.		4,182
Stirling Boiler Co.		4,405
Musgrave & Sons, Ltd.		4,445

Coal Conveyor.

Gilbert Little & Co.		£2,114
Bennis & Co	(accepted)	2,030
Strachan & Henshaw, Ltd. (no weighing machine)		1,790
" " (alternative No. 1)		2,110
" " (alternative No. 2)		2,240
Drake's, Ltd.		2,120
Graham, Morton & Co. (no motors)		2,255
Cecil Bentham		2,450
R. White & Sons		2,589
Naylor Bros.		2,600
Heenan & Froude, Ltd.		2,783
Babcock & Wilcox, Ltd.		2,905
British Thomson-Houston Co.		3,050
New Conveyor Co.		3,509
West Gas Improvement Co.		3,720
Edgar Allen & Co.		4,285

Previously to the decision of the Committee, the sub-committee appointed to visit Leicester, Coventry and Manchester, to inspect conveyors there, reported.

Mixed-pressure Turbine with Alternator and Condensing Plant at the Wigan Station, and Motor-Generators at the Pemberton Station.

	Wigan.		Pemberton.	
	£	s.	£	s.
British Thomson-Houston Co. (Curtis) (accepted for Wigan station)	6,106	0	2,242	0
Jas. Howden & Co. (Zoelly)	6,286	0	2,180	0
General Electric Co. (Belliss) (accepted for Pemberton station)	6,719	0	1,980	0
British Westinghouse Co. (Parsons)	6,882	0	2,027	0
Musgrave & Co. (Zoelly)	6,876	0	2,075	0
Crompton & Co. (Belliss)	7,077	0	2.142	0
Lancashire Dynamo Co. (Belliss)	7,490	0	2,561	0
Brush Engineering Co. (Parsons)	6,492	10	1,811	0
Phœnix Dynamo Co. (Rateau)	6,628	0	1,910	0
Willans & Robinson (Parsons)	6,855	0	1,647	15

All the foregoing were for 1,000 kw, except the Brush Engineering Co., who offered a 750-kw.

Condensing Plant.

British Thomson-Houston Co.	(accepted)	£1,068
Jas. Howden & Co.		1,247
General Electric Co.		1,100
British Westinghouse Co.		1,400
Musgrave & Co.		1,037

Switchboards.

British Thomson-Houston Co.	(accepted)	£2,470
Crompton & Co.		2,499
Spagnoletti, Ltd.		2,604
Dorman & Smith		2,632
Electric Construction Co.		2,654
Switchgear Co.		2,678
General Electric Co.		2,797
Lancashire Dynamo Co.		8,076
British Westinghouse Co.	(not to specification)	1,994
Johnson & Phillips, Ltd.	" "	2,061
Ferranti, Ltd.	" "	2,198
Siemens Bros.	" "	2,394
Whipp & Bourne	(not fully quoted)	1,272
Cowans, Ltd.	" "	2,178
Drake & Gorham, Ltd.	" "	800
Cox-Walker, Ltd.	" "	833
Dick, Kerr & Co.	" "	2,788
Union Electric Co.	" "	2,081
Lahmeyer Electrical Co.	" "	2,095

The acceptance of the foregoing tenders is subject to the sanction of the Local Government Board being obtained.

NOTES.

Struck off the Register.—The London-Provincial Electrical Co., Ltd., has been struck off the Register and is dissolved accordingly.

Electrician's Strange Death.—The death of Percy Dooley (31), electrical engineer, of Hanover Street, was reported to the Stalybridge police on Monday. He was in the employ of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, and at one o'clock on Monday morning he was discovered by his wife lying dead on the kitchen floor. On April 16th he received an electric shock to his right arm whilst following his employment. He was under the medical treatment of Dr. Rodocanachi up to a fortnight ago, and previously to receiving the shock he had enjoyed good health.

Educational.—The syllabus of classes of the Hackney Institute for the next session has been issued, and gives full particulars of the electrical engineering courses. Mr. W. H. F. Murdoch, B.Sc., is head of the department.

Appointment Vacant.—A lecturer and demonstrator on electrotechnics is wanted for Faraday House (£250). See our advertisement pages for particulars.

Inquiries.—The makers of the "Coombes ejectors" are inquired for.

Electric Shock Fatalities.—A correspondent says that a man named John Garner, aged 39, of Ainsworth, near Bolton, employed by the Lancashire Electric Power Co., was killed on Saturday morning by coming into contact with a live wire.

Institution and Lecture Notes.—Iron and Steel Institute.—Arrangements have been made to hold the autumn meeting of the Iron and Steel Institute in London on September 27th, 28th, 29th and 30th, and October 1st. The following papers are among those offered for reading:—"Determination of the Power Consumption of Reversing Rolling Mills," by C. A. Ablett (London); "The Refining of Steel by Electricity," by Disponent E. J. Ljungberg (Falun, Sweden); "The Maintenance and Renewal of Permanent Way," by R. Price-Williams (London); "The Constitution of Carbon-tungsten Steels," by T. Swinden, B.Met. (Sheffield). Visits will be made to the works of Messrs. Siemens Bros. & Co., Ltd., Woolwich, the London County Council's electric generating station, Greenwich, and the National Physical Laboratory, Teddington, as well as to other works and places of interest.

The next International Congress of Mining, Metallurgy, Applied Mechanics and Practical Geology will meet at Düsseldorf during the last week of June, 1910, under the auspices of the Rhenish-Westphalian Mining Industry. Further information can be obtained on application to the Secretary of the Iron and Steel Institute, or to the Committee of Organisation, Jacobistrasse, 3-5, Düsseldorf.

Institution of Mining Electrical Engineers.—At a Council meeting of the Institution held at Sheffield on the 21st ult., a report was presented by the hon. secretary (Mr. J. G. Williams, 3, Moresby Parks, Whitehaven), showing that the membership had reached 300, with a prospective immediate increase to 400 by the addition of candidates who had not yet been formally elected. The draft memorandum and articles of association were submitted and provisionally approved. It was resolved to create a diploma class of membership, to which candidates could only obtain admission by examination, after having had an approved term of practical experience in charge of electrical plant in mines. It was further arranged that entrance fees should be payable by members of all classes who joined after the incorporation of the Institution.

The Home Office Regulations.—The following order, dated July 23th, 1909, has been made by the Secretary of State under Exemption 3 of the Regulations for the generation, transformation, distribution and use of electrical energy in premises under the Factory and Workshop Acts, 1901 and 1907:—"In pursuance of Exemption 3 of the above Regulations, I hereby direct that in rooms, other than electrical stations, in which the following special conditions are observed, viz., no electrical energy is used except at low pressure, nor for any purpose other than lighting by means of incandescent lamps; and the floor is of wood or otherwise insulating; and there is no machinery or other earthed metal with which a person handling any non-earthed lamp fittings or any portable lamp is liable to be in contact; and no process rendering the floor wet is carried on; and no live conductor is normally exposed so that it may be touched; such conditions shall be deemed for all the purposes of the Regulations adequately to prevent danger." This exemption, it will be observed, removes the difficulties in connection with the earthing or other protection of lampholders in such places.

White City Sensations!—With reference to the programme of arrangements for the "Engineering Day" at the White City, a correspondent (Mr. A. H. White) writes as follows:—"From the enclosed programme of the forthcoming 'Engineering Day' at the Imperial International Exhibition, it is the intention of the promoters, after regaling the company with an intimate inspection of the 'Flip-flap' and 'Wiggle-woggle,' to treat it to a special demonstration of the extraction of hydrogen electrically from the atmosphere (page 6). Unfortunately, I shall be unable to attend the experiment, but I venture to hope that the Review will be fully represented on this interesting occasion, so that I and others of your numerous readers may learn something of this beautiful process."

Electricity in Mines: a New Committee Promised.—In the House of Commons, on Thursday last week, Mr. John Wilson asked the Secretary of State for the Home Department whether he had noted the prominence given by Prof. Redmayne, chief inspector of mines, and Mr. R. D. Bain, inspector of mines in Durham, in their report on the West Stanley explosion, to the dangers arising from the use of electricity in mines, and to the statement in the report that, on the assumption that the explosion did originate in the Busty seam, they were of the opinion that electricity was a more likely first cause than any of the alternatives already discussed; whether he was aware that all the evidence given at the inquest by mining experts and other witnesses went to show that the explosion originated in the Busty seam; and whether, having regard to this evidence as to the Busty seam, and the statement of the inspectors making the report as to electricity being the most probable cause, he would arrange a commission of inquiry into the danger involved in the use of electricity in mining operations. In reply, the Home Secretary signified his intention of appointing a new committee to consider the rules relating to the use of electricity in mines.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. B. Reeder, of the electricity department at Stafford, has been presented with a Ruskin bowl on his marriage.

Tramway Officials.—Mr. James H. Shepherd, who is at present manager of the Dundee and District tramways, has been appointed manager of the Dunfermline and District tramways. Mr. Shepherd served his apprenticeship as an electrical engineer with Messrs. Lowden Bros., Dundee. Following upon the introduction of the electric system into Dundee, Mr. Shepherd was appointed assistant-superintendent of depôts, and subsequently acted as depôt superintendent at the headquarters of the city tramways. He has been for the past four years manager of the Dundee to Monifeith line.

Mr. A. C. Gilbert, tramways manager at Ilkeston, has resigned.

General.—The Governors of Faraday House have appointed Dr. Alexander Russell, M.A., D.Sc., M.I.E.E., Principal of this institution, in succession to the late Mr. Hugh Erat Harrison. Dr. Russell, who graduated in 1882, and was a distinguished pupil of Lord Kelvin, was appointed Lecturer on Applied Mathematics and Head of the Physical Laboratory of Faraday House on its establishment in 1890, and has made his name familiar to the whole of the electrical engineering world by his numerous papers, articles and treatises, his work being characterised by independence and originality of thought and mathematical ability of a very high order. Dr. Russell has repeatedly applied his efforts to the elucidation of abstruse scientific problems having a direct bearing upon the progress of electrical technology, as in the case of the grading of the dielectric of cables, testing the insulation resistance of a network of mains, and the determination of the "skin effect" in concentric mains; his activity in research appears to increase as time goes on, and it is to be hoped that his duties as Principal of the Electrical Standardising, Testing and Training Institution will not interfere unduly with his valuable work in this direction. We tender our hearty congratulations to Dr. Russell, who has for many years been an occasional and highly-valued contributor to our columns.

The Home Secretary has appointed Mr. Granville Poole and Mr. Gilbert Young Tickle to be Assistant Inspectors under the Coal Mines Regulation Act.

The staff of Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford, have presented a marble clock to Mr. Robert Elliot on his marriage.

Mr. H. G. White, for eight years chief engineer to the Sterling Telephone and Electric Co., Ltd., has resigned that position to take over the management of the electrical department of the Soho Scientific Instrument Co., St. Anne's Court, Wardour Street, W. On leaving the Sterling Co., Mr. White was presented with a pair of silver candlesticks on behalf of the directors, and a handsome inlaid rosewood clock, suitably inscribed, from the staff.

The Electrical Engineering Department of the Glasgow Technical College is losing another assistant in the person of Mr. Robert Rankin, B.Sc., A.G.T.C., who has been appointed electrical engineer to the Electrical Co., at Manchester.

Mr. F. B. Spear, for many years manager of the town division of the sales department of the Edison & Swan Co., London, has resigned his position to take up that of sales manager to the E.M.F., Ltd., of 10, Ironmonger Lane, E.C.

The *Times* announces that Colonel R. C. Hellard, C.B., has been appointed technical assistant to the superintendent for one year; Lieut. E. C. Fishbourne, R.E., a technical assistant for one year; and Mr. Mervyn Chute a temporary assistant, in the London Traffic Branch of the Board of Trade.

We note with interest the announcement in the *Times* of August 28th that, on Thursday last week, Mr. H. M. Hobart, the well-known consulting engineer, and a valued contributor to our columns, was married to Miss Edith Walpole, of Sydenham. We offer our hearty congratulations.

Obituary.—Mr. S. R. Bottone.—We regret to learn from last week's *Ironmonger* of the death of Mr. S. R. Bottone, whose name has been known for very many years as a writer of books on electrical subjects, mainly for amateurs, and as a manufacturer of small electrical goods. Mr. Bottone, who was in his 69th year, died at his residence at Wallington, Surrey. Mr. A. E. Bottone, elder son, will continue the pursuits of his father.

NEW COMPANIES REGISTERED.

Samuel Mucklow, Ltd. (104,662).—This company was registered on August 20th, with a capital of £5,000 in £1 shares, to take over the business of manufacturers of and dealers in bolts, nuts, rivets, screws, washers, railway, tramway and telegraph fastenings, &c., carried on by S. Mucklow, at Hope Works, Old Hill, Staffs. The subscribers (with one share each) are:—S. Mucklow, Old Hill, Staffs, rivet manufacturer; Pollie Haynes, Allbut Street, Cradley Heath, clerk; A. E. Mason, 193, Wolverhampton Street, Dudley, chartered accountant; G. Williams, Bank Buildings, Cradley Heath, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are S. Mucklow and Pollie Haynes, each of whom may retain office while holding 100 ordinary shares. Registered by the Solicitors' Law Stationery Society, Ltd., 28-9, Chancery Lane, W.C.

Robert Bowran & Co., Ltd. (104,648).—This company was registered on August 19th, with a capital of £10,000 in £1 shares (3,000 preference), to take over the business of a general and electrical engineer and agent, iron and steel merchant, &c., carried on by R. Bowran as "Robert Bowran and Co.," at 4, St. Nicholas Buildings, Newcastle-on-Tyne. The subscribers (with one share each) are:—R. Bowran, 22, Saltwell View, Gateshead, merchant; W. Latimer, Hollyhurst, Winlaton-on-Tyne, traveller. Private company. The number of directors is not to be less than two or more than five; the first are R. Bowran and W. Latimer, each of whom may retain office while holding £500 shares. Registered office, 4, St. Nicholas Buildings, Newcastle-on-Tyne.

CITY NOTES.

Aberdeen Suburban Tramways Co.

At the half-yearly meeting held on Monday, the chairman—Mr. George J. Walker, Portlethen—in moving the adoption of the report, which recommended a dividend of 2 per cent., referred to the position between the company and the Corporation as regards the supply of electricity. He explained that in negotiating for a new agreement the Corporation had insisted upon arbitration. In the previous agreement the company was not bound to take any fixed supply of electricity, but had merely to pay for that actually used. The terms of the reference to the arbiter nominated by the Board of Trade were to fix the price per Board of Trade unit for electrical energy supplied, and to fix the period of the agreement. The arbiter in his decree had gone entirely beyond his powers by ordaining the company not merely to pay a price per Board of Trade unit actually supplied, but in addition a standing charge of £900 per annum, irrespective of the amount of electricity supplied to the company, and of whether the company took any supply at all. That award, he thought, was clearly bad and outwith the arbiter's powers, and the company had taken up that position with the Corporation. The Corporation asserted that the company was barred from objecting to the award on account of the draft award having been submitted to them before it was signed by the arbiter. There was nothing whatever in this contention, as the secretary of the company had objected to the standing charge, and protested against it immediately the arbiter's finding was disclosed to them. The company had offered to consider any reasonable proposal which the Town Council might make for getting them out of the difficulty into which the arbiter had placed them, and they were waiting such proposals. The difficulty which the Town Council found themselves in was entirely due to the arbiter's mistake, and while the company could not for a moment recognise or agree to pay the standing charge of £900, the directors hoped to be able to come to an arrangement which would be fair to both sides.

The report was adopted.

Underground Electric Railways Co. of London, Ltd.

The directors' report at June 30th, 1909, states that the result of the past half-year shows a substantial improvement. The net revenue from investments and rents, after deducting general expenses and interest, amounted to £62,879. The net income from the operation of the power house was £40,660, and the interest on £775,000 4¼ per cent. power house debentures amounted to £17,437, leaving a surplus from the power house of £23,222, making £86,101. The service of the £1,000,000 5 per cent. prior lien bonds required £26,349, the service of the £2,808,000 4½ per cent. bonds required £66,589, and the payment under the guarantee on Metropolitan District Railway assented extension preference stock amounted to £9,404—£102,342, so that the net revenue was therefore insufficient to meet the half-yearly charges by £16,240. To cover this deficit Messrs. Speyer have purchased from the company, in accordance with the agreement of April 7th, 1908, £10,700 4½ per cent. bonds of 1933 and £16,050 6 per cent. income bonds for the sum of £16,050. This deficit is apparently larger by £4,404 than that shown in the first revenue account submitted in February last, viz., £11,837. That account, however, includes more than one half-yearly dividend on the company's holding of shares in the Tube Companies, and a large part of the fixed charges had been charged to capital under the scheme of re-adjustment. The income from investments for the six months shows an increase of £22,065, or about 40 per cent., over that in the previous half-year. This result has been obtained notwithstanding the fact that the three Tube Companies from which this company receives dividends have set aside for contingencies and renewals out of the net earnings of the last six months the following amounts:—Baker Street and Waterloo Railway Co., £4,000; Great Northern, Piccadilly and Brompton Railway Co., £6,000; Charing Cross, Euston and Hampstead Railway Co., £3,000 =

£13,000. The Metropolitan District Railway Co. have also set aside for renewals out of the net revenue of last half-year, the sum of £10,000. The traffic of the railway companies in which the company is interested is increasing satisfactorily, and summaries of the figures appear in the report. The London United Tramways, Ltd., makes up its accounts annually. No interim dividend has been paid on the preference shares for the past half-year. The receipts of this company are still unsatisfactory. From the power house at Chelsea electric power continues to be furnished to the Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, the Charing Cross, Euston and Hampstead, and the Metropolitan District Railway Companies, as well as to a section of the London United Tramways. The net output of electric energy from the power house during the half-year was 60,152,588 kw.-hours. In regard to the funded debt and temporary loan, arrangements have been made, and are in course of being carried out, for the issue and sale of £1,000,000 4 per cent. power house first debentures for the purpose of redeeming £850,000 4½ per cent. power house debentures and £150,000 4½ per cent. power house second debentures now outstanding. At June 30th there was a loan outstanding of £225,000 (as compared with loans of £809,450 at December 31st, 1908), which will be paid off on the redemption of the outstanding 4½ per cent. power house debentures and power house second debentures on October 1st next. The item of stocks, shares, and other property stands on the books at £12,025,194, and consists of stocks and shares in associated companies, consols, and lands and buildings other than power house property. The company received under the construction contracts during the half-year:—

£74,000 4 per cent. Great Northern, Piccadilly and Brompton perpetual debenture stock.

Credit of £8 per share on 250 Great Northern, Piccadilly and Brompton 4 per cent. guaranteed preference shares, £2 paid.

Credit of £8 per share on 44,700 Great Northern, Piccadilly and Brompton ordinary shares, £2 paid.

Credit of £8 per share on 31,250 Charing Cross, Euston and Hampstead ordinary shares, £2 paid.

The reduction of £448,756 8s. 6d. in the figure shown in the balance-sheet as compared with the corresponding figure at December 31st, 1908 (£12,473,950 12s.), substantially results from the following transactions:—

Sale of £290,000 4 per cent. Great Northern, Piccadilly and Brompton perpetual debenture stock.

Sale of £200,000 4 per cent. Charing Cross, Euston and Hampstead perpetual debenture stock.

Sale of £5,000 4½ per cent. power house debentures.

Purchase of 250 Great Northern, Piccadilly and Brompton 4 per cent. guaranteed preference shares, £2 paid.

The power house depreciation fund amounted at the end of the half-year to £115,880. The market value of the investments under this head shows a considerable appreciation. New offices affording sufficient and convenient accommodation for this company, the Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, and the Charing Cross, Euston and Hampstead Railway Companies, have been rented in a new building erected by the Metropolitan District Railway Co. on the site adjoining their present offices at St. James' Park Station. They are now ready for occupation, and the head offices of the foregoing companies will be removed to the new building. The concentration of all the departments will be advantageous to the associated companies.

Mersey Railway Co.

The half-yearly ordinary general meeting of the shareholders of this company was held on Wednesday last week, at Worcester House, Wallbrook, Mr. J. Falconer, M.P., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, August 20th, page 308) said it was a matter of satisfaction to the board that notwithstanding the continued bad trade in the district which the company served, the results of the half-year continued to show marked and substantial progress. The receipts had amounted to £53,228, as compared with £51,748 for the corresponding half of 1908, showing an increase of £1,444. The report was equally satisfactory as regarded the expenses. They amounted to £34,470, as against £37,145, or a decrease of £2,675. Between the increase in the receipts and the decrease in the expenses the net result of the half-year's working was better by £4,119. He thought the shareholders would agree with the board in considering that improvement in these bad times as a result which they might regard as satisfactory. During the past half-year they had been reaping to a large extent the advantage of the change which they had made in transferring their head office to Birkenhead, and there consolidating the whole of their staff. It was not only in a saving in salaries, but in efficiency of supervision that they were reaping benefit from that change. They had closely studied the traffic during the whole of the half-year, and had given increased travelling facilities over practically the whole day. The policy upon which the board had proceeded ever since they adopted electrical traction was that the true interests of the company was to afford the best possible accommodation to the large population which the line served. They had continued to follow that policy, and the results encouraged them to keep working on the same lines in the future. The real and most interesting comparison for the shareholders was that which compared the position of the company to-day with what it was when they began electrical traction in 1903. They were now approaching the end of the period during which the debenture-holders' interests upon their debenture stocks was contingent upon the profits of each separate year. The results of the last half-year during which the company worked by steam and the last six months were very striking. In the first period, the number of booked passengers, as distinguished from season-ticket holders, was 2,800,000. During the last half-year the number was 5,800,000—an increase of three millions, or something like 104 per cent. The season-ticket holders showed an even more remarkable increase. During the last half-year of steam working, the number of season-ticket journeys, estimated in the usual way, was 512,980. Last half-year the number was 1,384,467—an increase of 868,487 journeys, equal to an increase of 169 per cent. It was a very striking fact that, notwithstanding the large increase in the number of season-ticket holders, the number of ordinary booked passengers had also largely increased. The total receipts for the last half-year under steam working amounted to £29,470. Last half-year they amounted to £53,228—an increase of £23,758, or something like £46,000 or £47,000 a year—an increase of 80 per cent. Looking back over the period of years during which they had been working by electrical traction, and seeing the increase in the receipts, which was still going on, he thought they might look forward with hope to the future that if they could pursue the same policy as hitherto in giving the public the best possible acoommodation, the development of the undertaking would continue on the lines on which it had proceeded in recent years. With regard to the question of the extension of the period during which the interest upon the debentures was dependent upon the profits of each separate year, he would like to say that the question had been most carefully considered by the board, including those members representing the debenture-holders, and looking to the successful result of the arrangement which had been made in bringing about the figures to which he had referred, and to the prospects of the future, they were all unanimously of opinion that it was to the interests of everyone concerned in the undertaking to continue the arrangement which was made in 1900. The biggest interest of everybody was to ensure the efficient management of the company and to place it in a position to take advantage of any opportunity for development. The only alternative to an extension of the period would be that the company should go back to Chancery with a Receiver, and there was nothing better calculated to choke the enterprise. Certainly, as far as the shareholders were concerned, and also he believed the debenture-holders, it was to their interests to maintain the present policy and management.

Mr. H. A. Wakeman-Newport seconded the motion.

Replying to questions, the Chairman said they had been able during the past half-year to pay their way and the interest on the first debenture stock. The later debenture stocks were entitled to any surplus, but before they could get it they must provide for the balance at the debit of net revenue, amounting to £16,000, and that was one of the things which would have to be taken into consideration when they came to deal with the scheme for the payment of the interest.

The report was adopted.

Bank for Electrical Enterprises.

The Bank fur Elektrische Unternehmungen of Zurich, which is an institution for investments and making advances to electrical undertakings, made considerable alterations in its holdings of securities during 1908-9. The funds thus released were re-invested in other enterprises, and the profits resulting from the sales were largely devoted to writing down the value of portfolio securities. The accounts are briefly as follows for the past two years:—

	1908-9.	1907-8.
Share capital...	£1,600,000	£1,600,000
Bond capital	1,552,000	1,580,000
Gross profits	272,600	263,300
Net profits	175,000	174,400
Dividend	160,000	160,000
,, per cent.	10	10

The company's report, from which details were given in a previous issue in respect of the situation of the electrical industry in Europe, presents details of the numerous undertakings in which the bank is interested in various countries. It appears that the company's syndicate share in the first issue of 5 per cent. debentures of the Victoria Falls Power Co. was liquidated, whilst a fresh participation has been assumed in the further emission which was recently made.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—£150,000 6 per cent. cumulative preference stock, in lieu of the preference shares of the Elcetric Lighting and Traction Co. of Australia, Ltd.; 20,000 7 per cent. first cumulative preference shares of £5 each; and a further issue of £100,000 5 per cent. first mortgage debenture stock.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Bombay Electric Supply and Tramways Co.—£150,000 5 per cent. second mortgage debentures of £100 each, Nos. 1 to 1,500, in lieu of the scrip now quoted.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interim dividends, payable on the 31st ult., on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares for the half-year ended June 30th, 1909, have been posted.

MARKET QUOTATIONS.

Wednesday, September 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochlorio	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon	,,	£12	..
a Copper Sulphate	,,	£18 10	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£23 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	3¾d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	74/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£10 15	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£50 to £136	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c ,, Tube (brazed)	,,	8⅛d.	..
c ,, ,, (solid drawn)	,,	7⅛d.	..
c ,, Wire, basis	,,	6¾d.	..
c Copper Tubes (brazed)	,,	8¾d.	..
c ,, ,, (solid drawn	,,	8¾d.	..
g ,, Bars (best selected)	per ton	£72	..
g ,, Sheet	,,	£72	..
g ,, Rod	,,	£72	..
e ,, (Electrolytic) Bars	,,	£61 10	..
e ,, ,, Sheets	,,	£78	..
e ,, ,, Rod	,,	£66	..
e ,, ,, H.C. Wire	per lb.	8d.	..
f Ebonite Rod	,,	3/3	..
f ,, Sheet	,,	3/-	..
n German Silver Wire	,,	1/6	..
h Gutta-percha, fine	,,	5/6 to 6/6	..
h India-rubber, Para fine	,,	8/2	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	51/4½	11½d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£12 15 to £12 17	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	1/- to 1/1½	..
p ,, ,, rolled bars & rods	,,	1/1½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/6	..
o Platinum	per oz.	99/-	variable.
e Silicium Bronze Wire	per lb.	9¼d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£137 to £138	£3 10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/9	½d. inc.
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd,
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd,
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd,
r W. F, Dennis & Co.

Dumbarton Burgh and County Tramways Co.—The report of the directors states that the profit for the year, after allowing for interest on debenture stock, amounts to £6,193, to which has to be added the net balance forward from last year, £1,328, making a total of £7,520. A preference dividend, paid at the rate of 6 per cent. per annum for the half-year to January 31st, absorbed £2,250, and a similar dividend for the half-year to July 31st, brings the total to £4,500. There is left a balance of £3,020, which the directors recommend should be carried forward.

Gandy Belt Manufacturing Co., Ltd.—The directors have declared an interim dividend of 6 per cent. per annum, less income-tax, on the ordinary shares for the past half-year.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended July 30th, 1909, was 904,731, compared with 724,011 units in the corresponding five weeks of 1908.

STOCKS AND SHARES.

Tuesday Afternoon,

WITH money so easy that on Consols it can be borrowed at 1¼ per cent., it is surprising that business does not flow more readily into the investment markets. Here and there are signs of expansion, but on the whole the volume of Stock Exchange business is very quiet.

The appalling floods in Mexico led to a moderate decline in Monterey Railway, Light and Power 5 per cent. Debenture stock. Last week the price was unaffected by the bad fire at Monterey, but the devastation of the town by flood has caused the quotation to decline to 86, which is a fall of 3½. There is a million pounds of the stock issued. According to well-informed sources, the company should not suffer a vast amount of damage.

Mexican Light and Power Common stock came down 3 points, falling to 70, but regaining 1 per cent. of the decline. Mexico Trams, however, have rallied 3 after their drop of last week, and the bonds at 97 have also regained their slight loss. Sao Paulo Trams at 148½ are 1 lower, and Rio Trams at 93 show a point rise. Electrical Development of Ontario bonds have shot up 5½.

Sensational is the mildest word to apply to the movements in American Railroad market, and the violence of the rapid changes keeps the cables busily employed. So the gamble in Anglo-American Telegraph Deferred goes merrily forward, the stock rising and falling in unison with the course of the Yankee shares and the rumours concerning the health of the latest Wall Street "magnate." On balance, the prices of the Preferred and Deferred stocks are both a little better. Direct United States shares improved to a slight extent.

Eastern Extensions have risen appreciably upon relaxation of the recent pressure to sell. The shares have been undervalued for some time past, as compared with Eastern Telegraph stock, and the latter still stands higher than the "China" shares. Globe Telegraph and Trust Preference are better again. Mackay Common stock gained $2.

While National Telephone Deferred has eased off, there has been a good demand for the foreign telephone issues. Oriental shares and Debenture stock were both advanced this (Tuesday) afternoon, and United River Plate Preference went with them. American Telephone and Telegraph capital stock went down, but rallied easily, and shows no change on balance.

The Telegraph and Telephone market is attracting a greater amount of public attention than usual, and manufacturing shares are not neglected. Following upon their recent advances, Callender's and Henley's show further rises. India-Rubber shares and Telegraph Constructions are unaltered, but British Insulated Ordinary are ⅛ better.

Trade conditions throughout the country continue to show gradual improvements, but it cannot be said that the Home Railway market takes any notice of the change. In fact, prices rise a little only to slip back a little more, and as for business, there is not an hour's work per diem done during the week.

Central London Preferred and Ordinary have proved their superiority to general conditions by rising a point apiece, the former stock receiving notice by reason of the fairly liberal yield which it offers, combined with reasonable security. Metropolitan Consolidated and District stocks are both lower; City and South London is unchanged. Great Northern, Piccadilly and Brompton 4 per cent. Preferred shares are 8 *ex* dividend. The Underground Electric Railway Income bonds have further advanced, in spite of a slackening in the prices of the company's other two issues.

It begins to get as monotonous to write, as we are sure it must be to read, that electricity supply stocks and shares are quite steady, and almost unchanged. Notting Hill shares rose 5s. Two or three Debenture stocks have hardened, two or three issues are *ex* dividend. There is really little more to be said about the market.

One feature in the electrical departments is a rise of 6½ in British Columbia Electric Railway Deferred stock. The Preferred is up two points. On several recent occasions the evidence of the company's prosperity has been indicated here on the authority of travellers lately returned from Vancouver. Anglo-Argentine Tramways Preferences are both $\frac{1}{16}$ lower, the 4 per cent. Debenture being ¼ better.

Amongst the miscellaneous shares, Castner-Kellners and Dick, Kerr Ordinary and Preference have gained small fractions, and there is a rise of two in Willans & Robinson Debenture stock.

Stewarts & Lloyds, Ltd.—The directors have declared an interim dividend for the half-year ended June 30th, 1909, at the rate of 10 per cent. per annum on the preferred ordinary shares.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Aug. 24th.	Closing Quotations Aug. 31st.	Business done week ended Aug. 31st, 1909.		Rise + or Fall –	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ – 3⅜	2⅞ – 3⅜	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 – 96	93 – 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 – 146	145 – 147	144½	142½	+ 1	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 – 99	96 – 98	..	..	– 1	4 1 8
558,460	Anglo-American Telegraph	Stock	3¼%	3⅞%	3⅛%	£3 4s.	60¼ – 62½	60½ – 62½	60⅞	..	..	5 3 0
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	103½ – 104½	103¼ – 104¾	104½	103½	+ ¼	5 14 6
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	20¾ – 21	21 – 21¼	21⅜	20 9/16	+ ⅛	1 17 8
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103½ – 105½	103½ – 105½	..	..	..	4 14 9
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 – 8⅜	8 – 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 – 92	90 – 92	91	90	..	4 7 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¼ – 9	8¼ – 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 – 18	17 – 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	6	4 %	4 %	4 %	4 %	2⅞ – 3⅜	2⅞ – 3⅜	..	..	..	5 3 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ – 8⅞	8⅜ – 8⅞	..	..	..	6 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 – 101	99 – 101	..	..	..	8 16 8
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	12⅞ – 13⅜	13 – 13½	13⅛	12 15/16	+ ⅛	6 5 11
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½ – 101½	100 – 102	..	..	+ ½	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	129 – 132	129 – 132	130	129	..	5 6 1
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	84½ – 86½	84½ – 86½	86	84¾	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ – 106½	104½ – 106½	105	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅜ – 11⅞	11¾ – 12½	12 1/16	11 7/16	+ ⅜	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 – 104	102 – 104	..	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 – 102	100 – 102	100½	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ – 10¾	10¼ – 10¾	10½	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅝ – 14⅛	13¾ – 14¼	14⅛	14	+ ⅛	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 – 27	26½ – 27¼	..	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½ – 101½	100 – 102	..	..	+ ½	4 8 3
17,000	Indo-European Telegraph	26	13 %	13 %	13 %	13 %	51½ – 53½	51½ – 53½	53	51½	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 – 84	82 – 86	..	..	+ 2	4 13 0
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 – 79	74 – 78	..	..	..	5 2 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1 1/16 – 1 3/16	1 1/16 – 1 3/16	14/9	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16 – 15/16	13/16 – 15/16	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	6 %	5 %	5 %	¾ – ⅞	¾ – ⅞	..	..	..	5 13 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 – 107½	106 – 107½	107¼	106¼	..	5 11 7
8,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	123 – 125	122½ – 124½	123¼	122½	– ½	4 16 5
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛ – 10⅞	10⅛ – 10⅞	10⅝	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅛ – 10⅞	10⅛ – 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	6 %	5 %	5 %	5 %	5 7/16 – 5 11/16	5 7/16 – 5 11/16	5 9/16	5 7/16	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 – 100	98 – 100	98¼	98⅛	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 – 102	100 – 102	101	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16 – 1 7/16	1⅜ – 1½	..	..	+ 1/16	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 – 1 3/16	1⅛ – 1¼	..	..	+ 1/16	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85½ – 87½	86 – 88	..	..	+ ½	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99½ – 101½	100 – 102	..	..	+ ½	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ – 8⅛	7⅝ – 8⅛	7⅝	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 – 102	100½ – 102½	..	..	+ ½	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 – 133	130 – 133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 15/16 – 7 3/16	6 15/16 – 7 3/16	7⅛	7	..	5 11 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	6 %	5⅛ – 5½	5¼ – 5⅝	..	..	+ ⅛	4 8 10
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛ – 1⅜	1⅛ – 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99½ – 101½	100 – 102	..	..	+ ½	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13⅜ – 13⅞	13¼ – 13¾	13 3/16	12⅜	– ⅛	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½ – 104½	103 – 105	103⅛	..	+ ½	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½ – ⅝	½ – ⅝	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	8 %	6 %	6 %	8 – 8½	8 – 8½	8¼	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 – 9	8 – 9	..	..	..	17 2 4
80,000l	Do. do. 6 % Debs., Nos. 1 to 1,800 ..	100	5 %	6 %	5 %	5 %	101 – 103	101 – 103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 11/16 – 4 15/16	4⅝ – 4⅞	96/10½	91/4½	– 1/16	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 7/16 – 4 11/16	4⅜ – 4⅝	..	..	– 1/16	5 6 9
978,250	Do. 4 % Deb. Stock	..	..	..	..	4 %	92 – 93	92¼ – 93¼	92⅞	92¼	+ ¼	4 5 10
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 – 105	102 – 105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 5/16 – 4 7/16	4 5/16 – 4 7/16	88/1½	86/3	..	4 9 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ – 1½	1⅜ – 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½ – ¾	¼ – ¾	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅜ – 1⅞	1⅜ – 1⅞	..	..	..	18 13 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¼ – 3¾	3⅜ – 3⅞	..	..	+ ⅛	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ – 3½	2½ – 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 – 98	95 – 98	..	..	..	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	146 – 150	152 – 157	155¼	..	+ 6½	5 1 11
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	121 – 125	123 – 127	..	..	+ 2	4 14 6
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	6 %	5 %	108 – 111	109 – 112	110	..	+ 1	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 – 104	102 – 104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 – 105	102 – 105	..	..	+ 1	4 5 9
188,301	British Electric Traction	10	8 %	Nil	Nil	Nil	9/16 – 15/16	9/16 – 15/16	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 – 2½	2 – 2½	47/6	41/3	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 – 88	85 – 88	85½	..	..	5 16 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 – 67	63 – 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ – 7¾	7½ – 7⅞	7¾	7⅝	+ ⅛	6 7 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ – 6½	6⅛ – 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 – 106	103 – 106	..	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 – 96	89 – 94	..	..	– 2	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 – 7/16	3/16 – 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 – 42	38 – 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 – 11/16	9/16 – 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 – 48	41 – 46	..	..	– 2	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 – 31	27 – 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	6	8 %	8 %	6 %	4½%	4 9/16 – 4 15/16	4 9/16 – 4 15/16	98/9	..	..	4 12 2
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4¾ – 5	4¾ – 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 – 100	97 – 100	99½	..	..	4 10 0
85,000	Callender's Cable Construction shares	6	15 %	15 %	15 %	15 %	10¼ – 11	10⅜ – 11⅛	10 11/16	10 9/16	+ ⅛	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	6¼ – 6⅝	6⅜ – 6¾	..	..	+ ⅛	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½ – 106½	105 – 107	..	..	+ ½	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	¼ – ½	¼ – ½	7/6	7/3	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1 13/16 – 2¼	2 – 2⅛	41/6	40/-	+ 1/32	5 17 8
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 – 108	105 – 108	..	..	..	3 14 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 – 63	62 – 64	63	62½	+ 1	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 – 85	84 – 86	..	..	+ 1	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 – 45	43 – 45	..	..	..	6 11 1
1,4[illegible]	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	81½ – 82½	81½ – 82½	82¼	81½	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	6 %	5 %	⅝ – 1⅛	⅝ – 1⅛	..	..	..	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 – 93	9 – 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 24th.	Closing Quotations Aug. 31st.	Business done week ended Aug. 31st, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1¼	1⅛ — 1 5/16	24/4½	24/3	+ 1/16	7 12 5
805.000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 1/32 — 1 7/32	1⅛ — 1¼	..	..	+ 1/32	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1¼%	⅛ — ⅜	⅛ — ⅜	..	..	..	20 0 0
17,139	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	20/3	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1¼ — 1½	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 13⅜	12½ — 13¼	13 1/16	12½	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14¾ — 15½	14¾ — 15½	14 13/16	..	..	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	⅞ — 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 4¾	..	..	— ⅛	10 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	1⅞ — 2⅜	2⅛ — 2⅝	47/6	46/3	+ ¼	13 12 8
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	68 — 71	67 — 70	68	..	—1	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	39¼ — 39¾	38¾ — 39¼	39⅛	38¾	— ½	1 5 5
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 — 67	66	65⅝	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17 — 17½	16¾ — 17¼	17⅛	16⅞	— ¼	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	..	..	..	..
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 — 13/16 xd	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	..	..	..	4 12 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124 —127	127 —130	126⅝	125¾	+3	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	95½ — 97½	96 — 98	97¼	96¾	..	5 2 7
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	34⅝	..	..	2 10 9
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	103 —104	102½ —103½	103½	..	— ½	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	87 — 89	89	..	—1	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	36 — 38	37 — 39	37¼	37 1/16	+1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7½ — 8	7½ — 8	7½	..	..	6 5 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ — 8	7½ — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	82/6	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3⅞ — 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	79/4½	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	100 —103	..	..	+1	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	2¾ — 3¼	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	62/6	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10 25/32	10⅝	..	5 9 1
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	103 —106	104 —107	104	..	+1	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	86 — 88	86 — 88	..	..	..	5 13 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	98 —101	99¾	98 11/16	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅜ — 6⅞	6⅜ — 6⅞	..	..	..	5 16 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5⅛ — 5⅝	5 — 5¼	6 5/32	..	— ⅛	5 17 1
882,255	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	95¼	95	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	5 7 6
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000l	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83½ — 84½	83 — 85	84⅜	84	..	5 17 8
13,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	69 — 73	73⅜	70½	—2	4 15 11
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	106 —110	106 —110	107	..	..	6 7 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	86 — 88	87½	87⅛	..	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	90¼	90	..	4 12 9
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4 — 4½	4⅛ — 4⅝	90/-	..	+ ⅛	2 14 0
131,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4½ — 5	91/3	90/-	— ⅛	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11 — 12	11¼ — 12¼	..	..	+ ¼	5 14 3
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 — 1 3/32	31/32 — 1 3/32	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	103½	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	..	..	..	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜ — 3	2⅜ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1⅛ — 1¼	..	..	— 1/16	5 16 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	10/-	..	..	25 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2	1½ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	77 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	13/16 — 15/16	13/16 — 15/16	16/10½	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅜ — 9⅛	8⅜ — 9⅛	8⅞	8⅝	..	5 9 9
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 3/16	..	..	4 3 0

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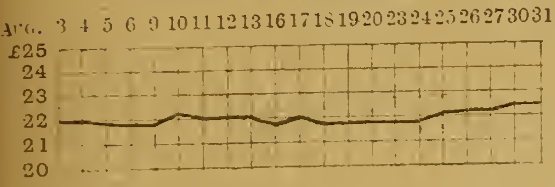
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

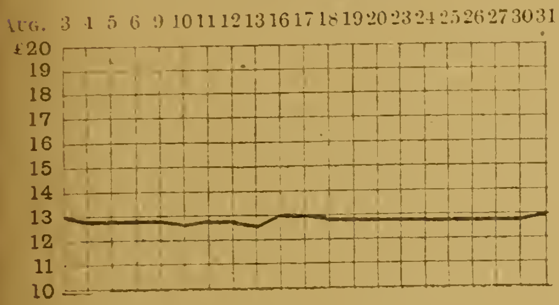
METAL MARKET.

Fluctuations in August.

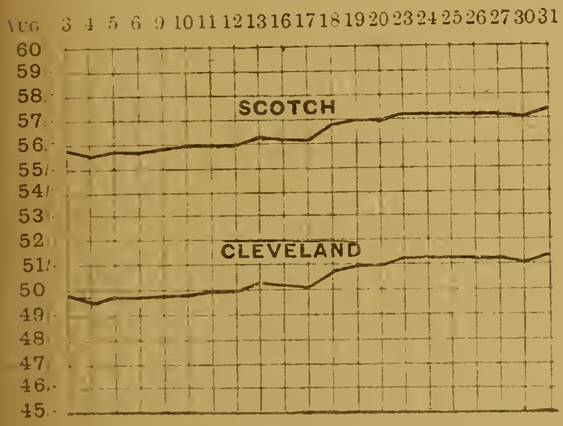
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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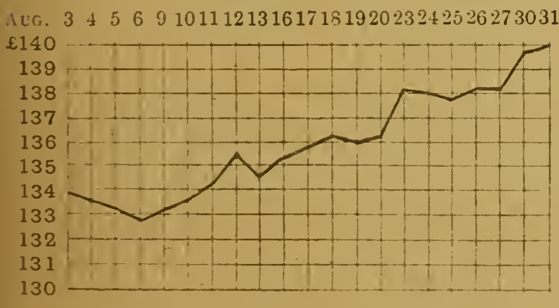
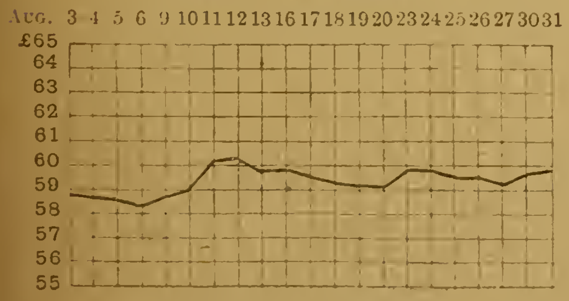


COPPER (G.M.B's.).



Charging Ignition Accumulators by Gas.—A French firm—M. Outhenin Chalandre, of Neuilly, Paris—has recently introduced a thermopile for the purpose of recharging ignition accumulators by means of the ordinary house gas supply, where a source of electrical energy is not available.

THE GENERAL PRINCIPLES OF MODERN TRUCK CONSTRUCTION.

By J. A. O'BRIEN, A.M.I.E.E.

It is curious that with the advance in knowledge of the principles of railway engineering during the latter half of the last century, and up to the present date, one of the most important points has been left unstudied, except by comparatively few people; that is to say, the general relation of the body of a vehicle moving along a line of rails to these rails.

The most that has been attempted in this direction until the last few years has been a kind of tacit understanding among permanent-way engineers that when such a vehicle is subjected to a constant change of direction, such as a railway curve, it is necessary on simple scientific principles to counteract the effect of the lateral forces brought into play by the change of direction by canting the rails in such a way as to introduce a constant counterbalancing force opposed to the centrifugal force.

In presupposing, however, the correctness of the principles on which this canting was carried out, an assumption was made which is now found to be definitely wrong; that is, that a vehicle running along a rail or rails presented no complex problem, but was a simple case of accurate motion along a straight track or a defined curve. This is now shown not to be the case. For example, serious complications affecting the whole general motion of the vehicle are introduced by the method of connecting the vehicle to the rails; that is to say, by the form of truck or under-carriage supporting the vehicle.

The first point on which engineers were led astray was the supposition that a line of rails could be laid to coincide perfectly with a geometrical line—straight or curved.

The recent investigations, however, of eminent engineers, in particular the elaborate studies of M. Georges Marié, formerly chief engineer of the Paris-Lyons Mediterranée (P.L.M. Railway), have shown that irregularities seriously affecting the running of vehicles do exist on the best lines. Whether they existed at the time the lines were laid, or were brought into existence by subsequent transverse action of the rolling stock, is of no importance; the fact remains that irregularities, which the platelayer's eye cannot observe, are sufficient, when traversed by a vehicle at high speed, to disturb the smooth path of the vehicle. M. Georges Marié, indeed, has calculated the exact oscillatory effect which definite irregularities set up, and has studied the problem of deadening it by springs or other means.

The second point to notice in this kind of investigation is that the effect of having a clearance between the flanges of wheels and the rails has not been fully considered.

This clearance, of course, is a condition which comes into force inevitably, even if not allowed for at the time new wheels are fitted on to a vehicle. It was thought, however, that coning the wheels—that is, reducing their diameter gradually from the flanges towards the outer edges of the wheels—provided a centralising effect which invariably kept each pair of wheels running centrally on the track with one-half the gauge clearance at each wheel; and, moreover, that on a curve, since all the forces brought into play by a change of direction tended to move the vehicle outwards, the outside wheels, running on a larger diameter than the inside wheels, would adjust the direction of the vehicle to the curve.

Now, as regards the latter point, Mr. A. M. Wellington, in his "Economic Theory of the Location of Railways," published in 1903, refers to careful experiments on trucks made to scale, and having coned wheels; and it is evident from the results of these experiments that coning alone is of practically no importance in guiding vehicles round curves; in fact, in Mr. J. W. Spiller's recent paper read before the Institution of Civil Engineers, on the subject of "High Speed on Railway Curves," the guiding effect on curves of coned wheels was ignored, and it follows that for practical purposes—even on curves where the vehicle is forced continuously against one rail, and more especially on straight track where the action is intermittent—the wheel treads, for all the effect which coning produces, might as well be parallel.

This fact has been emphasised because it indicates that engineers have really gone along wrong lines in considering the theory of the motion of rolling stock. In practice, the coning is soon worn down by the action of the rails on the wheels.

If, then, we look at the conditions under which good rolling stock has had to run on the best laid tracks, we shall see that they are far from desirable. The rails themselves, which impose a general direction upon the vehicle, are irregular, and it does not seem possible to carry improvement further in this respect. The vehicle is allowed a clearance in which to adapt itself to any possible changes in track direction, but is not built in such a way that any real centralising effect is produced. On this track is placed a truck which has its axles rigidly fixed in a frame, and which, therefore, tends always to follow one definite direction of its own. The result is a form of motion which is altogether a chance action. The truck travels about in a transverse sense over the track clearance, running first of all hard against one rail, and then, owing to some track irregularity or a distortion of the track itself, running hard against the other rail, every change of direction being accompanied by a skidding of the complete truck around some centre, either within or without the wheel-base of the truck.

On a curve, since the truck follows its own natural direction across the gauge clearance, the path actually traversed is a series of chords, and not a curved line.

This, of course, is all very unscientific, but the first question must be : are the effects produced by such motion so undesirable that any practical means of avoiding them is worth entertaining ? That the effects are undesirable is proved by the high rate of wheel wear on rolling stock of rigid wheel-base; by the heavy type of construction which it is necessary to adopt, so that the parts may withstand the severe transverse shocks they are continually being subjected to ; and last, but not least, the unpleasant effects of railway travel on a passenger who is continually having his direction changed in a more or less violent manner.

As to whether a means has been discovered of avoiding these defects, a type of truck construction known as non-parallel axle has now, after four years of action, proved itself to be without the inherent defects of the rigid type of rolling stock ; and in spite of the irregularity of the rails, by constructing a truck in such a way that its direction is not at any time rigidly fixed, it has been found possible to damp almost entirely the effects of such irregularity, at the same time making it impossible for high flange pressures to be reached, and, therefore, very greatly reducing the wheel wear.

A non-parallel axle truck, as its name implies, is one in which the axles are not rigidly fixed in a frame. Each axle is free within certain limits to move round a pivot fixed on the centre line of the truck, and at some little distance from the axle. The limit is set by links hanging over the axle boxes, and the supporting of the truck on the ends of these links. Any transverse motion of an axle round its particular pivot disturbs the links from their normal vertical position, and the weight hanging on the links sets up a constant tendency for the axle to return to its normal position.

It will be seen that this type of construction allows for a great amount of elasticity, but this is not the vital point ; transverse elasticity has already been allowed for in some slight measure by the construction known as swing bolster on bogie rolling stock. What is of the utmost importance is that this elasticity is accompanied by a change in the characteristic direction of the truck so soon as lateral pressure is brought to bear against any one of the wheels. If one of the leading wheels of the truck runs against the rail head the flange pressure rises, the leading axle turns slightly on its pivot, and the leading wheel in question is guided away from the point of pressure. This action goes on continuously, and is perfectly automatic.

When a car is carried on a truck of this type, and the floor boards are taken up so that the movements of the truck can be observed, it is seen that the axles are never still in a transverse direction. They are vibrating continuously in the space allowed by the track clearance, in the same way as the driver of an automobile continually adjusts the direction of the car by slight movements of the steering wheel, and so obtains a smooth line of motion.

The importance of such a method of truck construction lies in the fact that all the mischievous effects of a rigid wheel base are dealt with at the point of contact of wheel and rail, and are not communicated to the carriage body, where it is impossible to do more than damp them slightly. The carriage bodies with the passengers—or goods—follow their natural line of motion without disturbance by the track.

REVIEWS.

Elementary Manual of Radiotelegraphy and Radiotelephony. By J. A. Fleming. London : Longmans, Green & Co. Price 7s. 6d.

Any work on this subject from the pen of Dr. Fleming must perforce attract both interest and attention, even though it be styled "elementary." Beyond stating that the matter is put in the author's usual lucid and easy manner, is copiously illustrated and includes useful chapters on practical methods of measurement of the various electrical quantities concerned in wireless telegraphy and telephony, the occasion hardly calls for any comment of a general nature. That it is brought well up to date, and conveys sound information will go without saying. There are, however, as is inevitable in a subject of this character while it is still in process of rapid development and advance, a number of points of a controversial nature which may be dwelt upon with advantage, more especially as the book is avowedly intended for the student, practical operator, and general reader ; though it will doubtless be widely read also by the practical engineer and all who take an interest in the development of the art. The first point to be noticed is hardly controversial ; possibly it is an oversight. On page 5 representations of various types of oscillations are given, but there is neither here nor elsewhere throughout the book any representation of what is certainly not the least important type of feebly damped oscillation, viz., that which occurs in the antenna of a closed-circuit syntonic transmitting station. All the oscillation curves given are shown as commencing at maximum amplitude, whereas the oscillations in such an antenna are built up to a maximum and then decay. This feature is of some practical importance in questions of tuning and interference, if in no other way. On pages 16 and 17, in dealing with the effective or dissipative resistance of spiralled conductors at high frequencies, the dissipation due to eddy currents resulting from magnetic leakage through the sides of the solenoid appears to be lost sight of.

The question of phase difference between the electric and magnetic components in a travelling electric wave is dealt with on page 123, and the author comes to the conclusion that there is a phase difference of 90°. This is doubtless true of the source where "oscillations" rather than "waves" are concerned, but there are substantial reasons for concluding that no such phase difference exists in the wave proper ; that is, that in the wave proper the electric and magnetic fields are equal and in phase.

The tricky little problem of how to vary the earth's potential is touched upon on page 155. It is not, however, within the region of practicability either appreciably to alter the earth's potential as a whole, or to make use of such alteration, even if it were produced. Any conducting attachments which it is in the power of mortal man to put up on the face of this globe, are, to all intents and purposes, as much screened by the overwhelming proximity of the earth's surface, as though they were completely enclosed by that surface. It is, therefore, almost the same problem as how to vary the potential of a hollow conducting sphere by operations carried on inside that sphere. For the same reason it would be quite impracticable to make use of any variations of potential of the earth as a whole, even if they existed.

On the same page reference is made to Sir Oliver Lodge's views concerning the relative damping of the radiation from earthed and non-earthed transmitters. It is clear that the author is not willing to accept Lodge's statements without considerable reserve. It should, however, be fairly evident that in very many cases of land installations, at any rate, a decreased damping must ensue if the immediate surface of the earth be to any extent eliminated from the oscillating system. It will also be somewhat difficult to refute the direct demonstrations of the sustained character of the oscillations in such a case.

Reverting next to page 141, on which the subject of looped antennæ is dealt with: though the author deals fully with non-earthed loops, the theory is not extended to the former, though they are of considerable practical importance and are again referred to on page 262. It is not within the reviewer's knowledge that any really adequate explanation of the action of closed-loop antennæ has yet been given. A simple explanation, and one which appears to fit the observed results, is not far to seek, however, and may as well be given here in brief. The attachment to earth of one part of the loop determines oscillations, from impinging waves, in the two vertical sides. Though both sides, regarded as individual antennæ, may be tuned to the received wave, it is only when such tuning is determined by different amounts of self-induction and capacity in the two limbs that the loop itself is set into effective oscillation. The difference in self-induction of the two sides determines a difference in phase between the two sets of oscillations, thereby causing a relatively heavy compensating current round the loop. A similar effect can easily be observed when two thermo-ammeters are joined in parallel in a circuit in which high-frequency oscillations are excited. It will be found that even when the greatest care is exercised in the method of joining up and selection of similar instruments, it is next to impossible so to adjust the circuit that the sum of the individual readings of the two ammeters in parallel shall not be greater than the reading when one ammeter only is used. The difference is, of course, due to the compensating current circulating round the two instruments, which again is caused by a slight difference in phase of the oscillations when they divide between the two instruments.

In his claims concerning the oscillation valve or "audion" referred to on page 208 and elsewhere, the author does not make it clear that the use of a suitable "priming" current or E.M.F. in the rectifying part of the circuit considerably enhances the sensibility of this form of detector by causing the oscillations to act on a steep part of the conductivity curve instead of a flatter and much less sensitive part. It is not clear that this feature was embodied in Dr. Fleming's original contrivance.

In connection with the subject of spark resistance dealt with at the end of the chapter on high-frequency measurements, the student may be left with the impression that the resistance measured is a very useful quantity, and one which he can make use of in computing logarithmic decrements, &c.—that it is, in other words, a constant manageable quantity, instead of what it really is, namely, a highly variable quantity, of which the measurement merely gives the mean value. J. E. T.

A Scheme for the Promotion of Scientific Research. By W. B. Priest. London: Stevens & Sons. 1908. Price 3s.

This is the second edition of the scheme which Mr. Priest has devised for the promotion of scientific research for the public benefit with the aid of the resources of the State. The author outlines legislative provisions controlling the grant of funds for the development of a discovery; the investigation of the nature and novelty of the discovery by the Board of Trade, which also is empowered to prescribe the amounts of such grants, and to appoint referees and assessors; the conduct of searches for anticipations by the Patent Office, at the direction of the Board of Trade; and the revocation of a grant on occasion. The scheme occupies 12 pages, and is accompanied by 14 pages of explanatory remarks, and an equal amount of general observations in support of the scheme, indicating directions in which valuable results might confidently be looked for, and citing instances in which the community has derived immense benefits from the prosecution of scientific research in the past. The applications of electricity to the purposes of communication are especially singled out as striking illustrations of the beneficial results of research, while regarding the manifold uses of electricity in other directions, the author says "so vast is the aggregate of material advantages which have issued from the practical applications of electrical discoveries, that their value passes far beyond our powers of computation." He points out that "the great practical applications which issue from original research do not come suddenly, or from any purely independent line of research, but from the advancement of science in certain of its departments," and innumerable instances could readily be found to substantiate this statement. That the enthusiastic workers in pure science, who lay the foundations upon which other men raise up fortunes, rarely themselves benefit in a degree in the least commensurate with their deserts, is a rule the truth of which is only made more manifest by the occasional brilliant exceptions, and any means whereby a more equitable allocation of rewards could be ensured ought to command universal approval. The author has made a sincere and earnest attempt, not precisely to effect this object, but to facilitate and encourage research, which only too frequently is hampered not merely by the lack of reward, but by the still more disheartening want of means to carry it on—were these available, the love of discovery innate in man would provide sufficient driving force, without requiring the incentive of gain. To the author's motive, therefore, we accord our hearty sympathy and approval; but, unfortunately, while this country is governed by politicians, to whom the word "science" suggests only unintelligible treatises, weird odours, and a contemptuous indifference to party politics, we fear that there is little hope of progress in the desired direction. Only at one point do the paths of scientists and politicians coincide; and that is in relation to the physical well-being of the latter. They are no more immune than other men to the ills that flesh is heir to, and thus their interest in medical science has been awakened to some extent; the establishment of the Imperial Cancer Research Fund illustrates this fact, and it may yet come to pass that the patronage thus conferred upon medical research may eventually by gradual stages be extended to the other no less important branches of science which at present are left to fend for themselves. But the millennium is still a long way off.

Transformers for Single and Multiphase Currents. By Gisbert Kapp, Dr. Eng., M.Inst.C.E., M.I.E.E. Second edition. London: Whittaker & Co. 1908. Price 10s. 6d. net.

Twelve years ago the first edition of this book appeared; many things have happened since then, and as the author remarks, "enormous improvements have taken place in the construction of transformers," rendering a new edition imperative. Perhaps a change quite as great has taken place in the general attitude of the electrical industry towards alternating currents. The improvements in transformers "were mainly due and rendered possible by three causes: the more general appreciation of oil as a cooling medium, the advent of alloyed iron, and last, but not least, the growing demand for large units in connection with power transmission"; and the author devotes a good deal of space to an elucidation of the manner in which these causes have acted, and do act.

The first chapter is devoted to principles of action, magnetic leakage, and arrangement of coils, and the fundamental equation for the effective E.M.F. in a transformer coil is worked out. In the following chapter the author goes on to discuss the losses in transformers, the effect due to "alloyed" plates, the factors determining the most advantageous thickness of plates, and the influence of the E.M.F. curve on the hysteretic loss. The conclusion come to is that, although a peaked curve has some advantages, "taking all things into consideration . . . . it is best to use machines the E.M.F. curve of which deviates as little as possible from a true sine curve." The chapter concludes with illustrations and preliminary considerations as to types of transformers.

Chapter III opens with a description of the usual types, and goes on to the construction of the iron part. This is fully dealt with, and then the heating of transformers and the methods of cooling are studied. Values of c, the cooling coefficient, are given, and the theory of heating and cooling is investigated, and formulæ obtained. The effect of intermittent working on the maximum output obtainable is also considered, as well as the influence of linear dimensions on output. This is an important chapter, and the logical sequence of the working-out is well maintained.

The use of vectors for representing periodic functions is gone into in Chapter IV, and a steam engine piston analogy is used as an example of a periodic function. Self-induction and capacity, the influence of higher harmonics, and the power of an alternating current, are then successively dealt with.

In Chapter V we find the magnetic circuit and the energy stored in magnetisation, and this leads on to a consideration of the hysteretic loop. An excellent description of its disturbing influence on the exciting current is given and illustrated by curves. The design of a choking coil concludes this section.

In the succeeding chapter a design for a 20-KW. core-type transformer is fully worked out for a minimum total loss, and the weight and cost of active materials are calculated. In working out this design the author investigates the discrepancy between Arnold's rule for the best distribution of losses and the author's rule of equal losses, and points out where the difference arises. He goes on then to modify the original design to suit the special service conditions imposed by power and lighting loads respectively, and shows the effect these have on the available output. There are also tables showing the yearly efficiency and annual cost of working transformers. This is an important matter: authors are too often unable or unwilling to enter into commercial and financial considerations, with the result that the man of science and the man of business are often at variance as to the most economically efficient methods of operation. Chapter VII is occupied with a design for a 7-KW. shell transformer, and the next chapter with vector diagrams representing working conditions of transformers.

In Chapter IX the calculation of inductive drop is gone into, and the effect of frequency on drop and on output. Here the author introduces the idea of equivalent coils, and he uses this method throughout the remainder of the volume.

The dynamometer, dynamometric and induction wattmeters, and other methods of measuring power in an alternating circuit are described in detail in Chapter X; the Behn-Eschenberg method of measuring power in a three-phase circuit is described, and a proof given of Dr. Franke's method whereby this can be effected by a combination of two wattmeters placed so that the two shunt coils form one moving system.

An important section is that on testing, which takes up Chapter XI. Here are described the various methods of testing transformers and transformer iron. This section is very fully dealt with, and the author seems to fear criticism, as he notes it specially in the preface. The fear was quite unfounded; the methods of the laboratory and the methods of the workshop are alike of interest and of use to the student.

Safety appliances are dealt with in the following chapter, and various forms of transformers, such as balancing and auto-transformers and boosters, are noted.

Chapter XIII deals with the transformer in relation to its circuits, and consideration is given to the rise of pressure through resonance, a determination of the dangerous condition, and the breakdown of cables on large networks. This is a portion of special value to the central-station engineer, who is responsible for the continuity of supply on such systems.

The final chapter gives examples of modern transformers by various manufacturers—British and foreign—illustrated by scaled drawings.

There are three appendices, and two of them at least are important enough to deserve titles in the table of contents. Appendix II gives the meaning attached to all the symbols used in the book, unless otherwise stated in the text, and Appendix III lists and gives page reference to all the formulæ used. This is a useful feature, and one which we would like to see more frequently adopted.

The book is well and clearly written, and is commendably free from serious mistakes, the printers' errors being generally such as can be easily noticed. A paragraph appears on page 290 which has no apparent connection with the context, and refers to illustrations at the end of the volume. There is one very noticeable peculiarity—the author never once uses the words volt, ampere, or watt in the plural. We wonder why? We think that the author might with advantage have included a chapter on the erection and setting to work, &c., of transformers, as it would have completed the practical portion of the subject which has otherwise throughout the book received due attention.

We can only add, in conclusion, that it has been a pleasure to read through this volume, which is undoubtedly of great value to the student, the designer and the engineer who has to deal with transformers in every-day use. J. D. M.

PRIVATE BILL LEGISLATION OF THE SESSION.

[BY OUR PARLIAMENTARY REPORTER.]

ALTHOUGH weary legislators are still detained at Westminster engaged in wrangling over details prior to putting the screw on the unwilling taxpayer, the work of the Private Bill Committees, with one exception, is over, and one is able to take stock of the new legislation of the session, so far as the electrical industry is concerned. For several sessions now, the members of the Bar, technical experts, and the harmless but necessary journalists, looking to electrical Bills to bring grist to the mill, have not been able to put much by for a rainy day as the reward of their energy, but the present session has been the leanest of all. Even London has at last been left alone by exploiters of electric power schemes, whilst promoters of combined motor roads and tramway tracks have failed to renew their efforts of last session. Almost every year some grand new scheme is brought up, such as mono-railways, pneumatic tubes, &c., but this year nothing of the kind has come before a committee. It is true that several go-ahead Corporations proposed to obtain powers for experimenting with the trackless trolley system of tramways, but, one by one, the clauses were dropped, and the only one which came before a Committee was that of the Gateshead Tramways Co., and this, although unopposed, was rejected.

Four electric power Bills were brought in, the most important of which were the County of Durham Electric Power and the North Metropolitan Electric Power Supply, and both were carried with little opposition. The first enables the promoting company, the Newcastle-on-Tyne Electric Supply Co., the Cleveland and Durham Electric Power and the Northern Counties Electricity Supply Co., Ltd., to enter into agreements for mutual assistance. The Committee considering the Bill, however, refused to allow the company to subscribe for shares in undertakings taking a supply of energy from the company. The North Metropolitan Power Co. are authorised to extend their area and to raise £250,000 capital. The West Kent Electric Power Bill also passed. The company are authorised to acquire the rights granted to the Kent Electric Power Co. for the supply of power within the West Kent area of supply. The capital for the company is being found by the South Metropolitan Electric Co. The Somerset and District Electric Power Bill fell out on Standing Orders.

Two electric supply Bills only were promoted by companies, and of these the City of Bath Bill to incorporate a company with a capital of £100,000, was quickly dropped. The York Town and Blackwater Gas (Electric Lighting) Bill led to considerable discussion, as the Aldershot Gas and Water Co. also, incidentally amongst other things, sought to acquire the right to supply electricity in their area. The point at issue was that of the definition of the areas of the respective companies, which for gas purposes was rather complicated, but this was settled by the Committee. The Bill was also somewhat interesting from the fact that Mr. S. Sellon expressed the opinion in the witness box that the district was one in which a gas company would be able to make the supply of electricity remunerative, whereas a company supplying electricity only would make a loss.

Nine tramway Bills were promoted by companies, and two stood out as of considerable interest. In the case of the Folkestone, Sandgate and Hythe Tramway Bill, the promoters asked that they might be relieved of the obligation to construct an underground system, and substitute a combined overhead and underground system. The proceedings were very protracted, and much of the evidence dealt with the merits of the Lorain surface contact system, whilst judging from many of the statements local politics also entered a good deal into the question. Ultimately the Committee refused to allow the company to alter the system, but gave them an extension of two years for carrying out the work. The London United Tramways Co. had a most important Bill from their own point of view, inasmuch as they wished to defer the period at which their terminal lines at Hammersmith and Shepherd's Bush would become purchaseable by the County Council. The Bill was rejected. As before mentioned, the Gateshead and District Tramways Co. proposed amongst other things to work tramways on the railless system, and this proposal would have gone through had not Mr. Moon, K.C. (the Speaker's Counsel) pointed out that as the clause stood the new system would not become purchaseable by the local authority under the Tramways Act. It was pointed out that the clause had been agreed with the local authority, and that as the company could not lay down the system without the consent of the municipality, it was open for the latter to make what terms they liked, as conditional to their consent. In the end the Committee rejected the clause altogether. The Oxford and District Tramways Co. were successful in getting through their Bill for substituting a composite system of overhead and conduit traction for the Dolter system, and the Preston, Chorley and Horwich Tramways Co. got most of the powers they sought for (including a reduction of the share capital). The Torquay and Paignton Tramways, the Holywood Tramways (Extension of Time), and the Southport and Lytham Tramway (Abandonment) Bills, all went through without trouble, as did also the Anglo-Argentine Tramways Bill, which dealt with the reorganisation of the capital of the company.

Of the electric railways Bills, the most important was that of the Central London Railway, which enables the company to extend to Liverpool Street—an extension, which according to Sir Henry Oakley, is likely to bring an immense amount of traffic to the company. The Edgware and Hampstead Railway Bill, and the Watford and Edgware Railway Bill both passed. The former enables the company to enter into agreements with the Charing Cross, Euston and Hampstead Co. with respect to the construction of the railway, and the latter revives the time for the compulsory purchase of land and the construction of the authorised railway. The North-West London Railway came to Parliament with a proposal to abandon the authorised line to Victoria, but to make the line from Cricklewood to Edgware Road, which was to have been worked by the Baker Street and Waterloo Railway. After a considerable hearing the Committee rejected the Bill, which, however, judging from a recent utterance of Sir George Gibb, is not unlikely to be brought forward again in the future. The promoters of the North-East London Railway came for another extension of time, and as the financial witness called seemed to be very optimistic as to raising the necessary capital, the Committee allowed the Bill to proceed. A Bill was also introduced to revive the powers for the construction of a tube railway under the Tyne to connect North and South Shields, but it was dropped after first reading.

Various powers for tramways and electric lighting were sought by the municipal authorities of the country, and, of course, the London County Council promoted its annual tramway Bill. The estimated cost of the tramways and street widenings contained in this Bill was £1,090,000, but as a number of the proposals were dropped, the cost will be reduced. The proposal which met with most opposition was that to bring a tramway down Farringdon Road, which involves the interference with the costermongers who trade there. The Bradford Corporation Bill to spend £147,180 on tramways was not proceeded with. This Bill also contained a clause for the trackless trolley system. The proposal of the Bury Corporation with regard to running powers over the Heywood and Rochdale Corporation tramways was considered with the Bill of the Heywood Corporation, who also asked for mutual running powers, and after a long hearing which was purely of local interest, the Committee settled the powers to be possessed by each body. No opposition was forthcoming to the Bill of the Dudley Corporation to enable them to grant leases of the tramways purchaseable by them. The Liverpool Corporation obtained powers to construct about six miles of tramways, but dropped their proposal for railless tramways in any part of the city. The Manchester proposals on tramways were very modest, the estimated cost of those sought to be constructed being only £30,000. The Oldham Corporation are authorised to spend about £20,000 on tramways, but this body also dropped the railless trolley system. Nothwithstanding the opposition of the Lancashire Power Co., the Corporation were also authorised to supply electricity to premises just outside their area. Salford Corporation sought, amongst other things, to spend £60,000 on tramways, but the Bill was rejected. The Shrewsbury Corporation will be allowed to supply electricity for traction purposes to outside authorities, and the Wallasey Corporation to spend £41,483 on tramways. Several local authorities also obtained minor powers relating to the supply of electric fittings, the keeping of accounts, &c.

The Biddulph Gas Co. introduced a Bill giving them powers to supply electricity, but it was not proceeded with; and the Wells Gas Co. obtained powers to apply for a provisional order for electricity.

Only two Electric Lighting Provisional Orders Confirmation and one Tramway Order Confirmation Bill were introduced by the Board of Trade. The new tramways proposed under five orders only totalled about 11 miles.

PROCEEDINGS OF INSTITUTIONS.

On Heat-Flow and Temperature-Distribution in the Gas Engine.

By Prof. Bertram Hopkinson, M.A., B.Sc., M.Inst.C.E.

(*Abstract of paper read before the* Institution of Civil Engineers, *February 2nd*, 1909.)

In the course of the expansion and exhaust strokes of the gas engine, from a quarter to a half of the whole heat developed in the explosion is discharged into the cylinder walls. This flow of heat, though its effect on efficiency is relatively small, is very important in the practical working of the motor, because it necessitates the provision of special appliances for its removal from the outside of the engine as fast as it is generated within, and it also requires the existence of a temperature gradient sufficient to carry it from the place where it is generated to the place where it is removed.

In consequence, high temperatures must exist in the uncooled parts of the engine and great temperature differences between one part and another. These conditions give rise to dangers from pre-ignition, and also to large mechanical stresses in the metal, which, between them, account for a large part of the practical difficulties encountered in running large gas engines.

Given the rate of heat-flow into every portion of the cylinder per sq. ft., it would be possible by a sufficiently elaborate mathematical analysis to calculate the distribution of temperature throughout the metal. Apart from the difficulty of the mathematical problem, however, the data for its solution are only imperfectly known, and a rough calculation of the general mean temperature distribution is all that is possible. Such a calculation is made in the paper, and leads to the conclusion that the temperature on the inner surface of portions of the engine which are efficiently water-cooled, such as the liner, can never rise above quite a moderate value. But the temperature at the centre of an uncooled piston, 12 in. in diameter, may reach 400° C. or more. It also appears that the temperature at the centre of such a piston will vary as the square of the diameter if the thickness be kept constant, or directly as the diameter if the thickness be increased in proportion thereto.

The paper proceeds to describe experiments made upon a Crossley gas engine of 40 B.H.P., with the object of determining the actual temperature distribution and its relation to the conditions of working. The temperatures were measured by means of thermo-couples inserted into the piston face and into the centres of the valves.

In the first group of tests these temperatures were compared with the total heat loss as measured by the rise of temperature of the jacket water. According to theory, the excess of the temperature at any point over the mean temperature of the jacket water should be proportional to the total heat loss, except in so far as the distribution of that loss over the metal surface exposed to the hot gas is altered. By varying the strength of mixture, keeping other conditions the same, the heat loss was varied between limits of about 1,300 and 2,200 B.TH.U. per minute, the engine firing practically every time; and it was found that the piston temperature was very closely proportional to the heat loss. Under normal working conditions at full load the temperature at the centre of the piston was found to be about 370° C. above that of the jacket water; in the exhaust valve, 400° C.; and in the inlet valve, 250° C.

From a comparison of the temperatures at different points in the piston face and the temperature at the centre, the rate of heat-flow into the face of the piston is deduced, and found to amount to about one-eighth of the total flow into the engine. This agrees well, having regard to the difference of piston temperature, with the results obtained by Prof. Burstall, who measured separately the heat given to a water-cooled piston. It is a considerably smaller proportion than would be expected. It is suggested that an important cause is to be found in the fact that the gas near to the piston is the last to be ignited in the course of the passage of the flame through the combustion-space, and is therefore cooler than the average in accordance with a principle established by the author some years ago.

Of the fall of temperature between the centre of the piston and the jacket water, about one-half, or, say, 180° C., is between the centre and edge of the piston face. In consequence of this inequality of temperature there is a considerable hoop tension at the edge of the piston face. The magnitude of this is investigated, and it is shown that it probably amounts to several tons per square inch. It is pointed out that uncooled pistons of large diameter will be likely to fail by a radial crack at the edge which, in many cases, may be followed by seizing of the piston on account of the sudden expansion which is thus permitted.

The next group of experiments relates to the effect of varying the conditions of running upon the metal temperature. The dependence of heat flow and temperature upon strength of mixture, time of ignition. and degree of compression are investigated.

1. *Strength of Mixture.*—It appears that if the gas charge be increased by 30 per cent., the total heat loss will be increased by 50 per cent., with a corresponding increase in the temperatures of the piston and inlet valve.

2. *Time of Ignition.*—Retarding the ignition by 20°, the gas charge and other circumstances remaining the same, reduces the total heat loss by 10 per cent. The piston and inlet valve are 20 per cent. cooler, these parts receiving a much less share of the heat than before. On the other hand, the exhaust valve receives a greater share of heat than with normal ignition, and its temperature is not materially altered. The thermal efficiency is reduced from 34½ per cent. to 28½ per cent.

Advancing the ignition by 10 per cent. has but little effect upon efficiency. It causes an increase of about 10 per cent. in the heat loss. There is a more than proportional increase in the temperature of the piston and inlet valve. The exhaust valve is again but little altered.

3. *Degree of Compression.*—Comparative trials were made in which the engine was run first in the ordinary way, and, second, with the half-compression cam, which is used for starting purposes, kept in action. The result in the latter case is that about two-fifths of the charge of gas and air is expelled unburnt to exhaust. In fact, the only thing changed is the density of the charge, all other circumstances remaining practically the same. It was found that heat loss was reduced nearly, but not quite, in proportion to density, with a corresponding reduction in the temperatures of all parts of the engine.

Another set of experiments consisted of comparative trials with the engine running on half load, so that every other cycle was a scavenging cycle, and firing every time, the circumstances being otherwise the same. It was found that the quantity of heat removed by the air passing through the engine in the scavenging strokes was insignificant in proportion to the whole.

Finally, a large number of experiments were made on the phenomena of pre-ignition. In order to cause the engine to pre-ignite, an iron bolt carrying a thermo-couple at its end was introduced into the combustion chamber. The end of this bolt was heated by the explosions, and it was found that it could be heated in this way up to a temperature of about 700° C. without affecting in any way the working of the engine, but that if the temperature exceeded 730° C., ignitions would take place from the end of the bolt. The effect of these ignitions is to heat the end of the bolt up more rapidly than before; they thus tend to propagate themselves, and to become more frequent, and if once they start the engine is bound to pull up. It was found that the line of division between the conditions under which safe and continuous running was possible, and those under which the engine was bound to pull up, was very narrow, and can be represented by an increase in the gas charge of only 1 per cent. This instability is due to the fact that the gas near the point of ignition of an explosive mixture is heated to a temperature much above the mean by the rise of pressure which follows its ignition. Thus the fact that ignition takes place through the bolt tends of itself to make the bolt hotter, and so to cause earlier and more frequent ignitions from the bolt.

Elevators.

On August 9th a paper on "Elevators" was read before the Cape Town Section of the Institution of Electrical Engineers by Mr. Albert Vaux, A.M.I.E.E. In the course of his paper, Mr. Vaux traced the development of the modern elevator from the time of the introduction of steam power in the North of England factories during the early part of the nineteenth century, and particularly referred to the "teagles" or warehouse cranes fixed outside factories and warehouses delivering goods to any required floor. Owing to the Cape Town Corporation building regulations, these teagles could not be used in Cape Town. Travelling cranes fixed over a verandah of concrete were, however, permitted, and there were nine examples in the town, in each case the load being lifted by direct-coupled electric motors.

Mr. Vaux next touched on hydraulic elevators, and said that, so far as his experience went, he had only come across one instance in South Africa where a hydraulic elevator was the correct machine to install as compared with an electric elevator, and that was where water was very plentiful at a pressure of about 160 lb. per square inch, and a direct lift of 13 ft. was required, with a capacity of 1 ton per trip. In Cape Town, until last January, there were 18 hydraulic elevators in operation. Two of these have since been converted to electric working. It has been found that the cost of running these two hydraulic elevators, including paraffin for the oil engine driving the pumps, men's wages running engine and pumps, repairs, &c., came to 2½ to 3 times the cost of running the elevators when converted to electric working. Mr. Vaux also showed by other instances that although the capital costs of hydraulic and electric elevators are about the same, the cost of operation is decidedly in favour of the electric elevator.

With reference to the efficiency of elevators, Mr. Vaux calculated that although some makers claimed a mechanical efficiency for their elevators of from 75 per cent. to 80 per cent., the commercial efficiency was never really more than 33⅓ per cent. for electric, and about half that for hydraulic elevators.

Mr. Vaux next described various types of electric elevators and control gear. He did not consider that the push-button control system was suited to the requirements of Cape Town, and referred to several elevators in Cape Town which had been converted from push-button to switch-in-car control. Mr. Vaux went very fully into the questions of cables, gearing, &c. The relative merits of compound and shunt-wound motors for elevator work were also referred to, Mr. Vaux inclining to the opinion that a shunt-wound motor was the correct thing, but if a compound-wound motor were used, a speed governor ought to be fixed for safety. The latest types of gearless 1 to 1 traction type elevators, as selected for the new Singer building and the tower of the Metropolitan Life Insurance Building, New York, were explained.

The paper was very fully illustrated by photographs and drawings. At the conclusion Prof. Bohle briefly criticised the paper, in the main agreeing with Mr. Vaux's opinions.

Mr. J. P. Edwards (late chief electrical engineer to the Post Office Department, Cape Colony) and Mr. C. Proctor Banham (electrical engineer to the Table Bay Harbour Board) also made a few remarks.

AN ATTEMPT TO AVERT THE INEVITABLE.

The few Englishmen who were not at *the* Horse-Show last week may not know that the Dublin and South Eastern Railway (lately known as the Dublin, Wicklow and Wexford) is paralleled between Dalkey and Dublin by the lines of the Dublin United Tramways Co., Ltd. Not only do these rivals run the same course, but for the greater part of the 9 miles the train-way and the tramway are but a few yards apart.

So far as its means allow, and the company is by no means well off, there is a good service between Kingstown and Dublin on the railway, fast or slow trains running every 15 minutes throughout the day. From Dalkey, which is 2 miles beyond Kingstown, the service is approximately half as good. The rolling stock compares, let us say, with the pre-electric stock of the "Underground," and the permanent way is rather rough and noisy.

That the service is not behind the best local service on English lines may be seen from the following figures:—

The fast trains (one intermediate stop) between Kingstown and Dublin, do the 7 miles in 14 minutes, while the slow (six intermediate stops) take 20 minutes. The 9 miles' journey from Dalkey takes 24 minutes by all but one special each way, which makes a non-stop run in 16 minutes.

Finally, the trains run with remarkable punctuality—as one of our contributors, who is a subscriber, knows to his cost.

Now, the coming of the electric tramways was a great shock to the railway, but a considerable benefit to those who preferred to travel by train as before, as the fares were much reduced in consequence of the competition. Since 1899 the tramway company has improved its position greatly, and is gradually improving its permanent way. Its 2½-minute service over 9 miles of the main line is the admiration of all knowledgeable persons, and the popular idea in Dublin that the tramway service is the best in the world, is, perhaps, not too far removed from the truth to be scouted altogether.

The newer cars are excellent examples of the top-covered double bogie design, equipped with two powerful motors and with the British Westinghouse magnetic track and wheel brake.

Except in Kingstown, where the street is narrow, the track is double; there are few severe curves, and as the road is rarely more than a few feet above sea level, there are no steep hills; in short, the line between Dalkey and Dublin presents as few obstacles to fast travelling as any that could be picked.

In 1906 the tramway company secured an increase of maximum speeds. Since 1899 these had ranged from 4 to 10 M.P.H., but the Order of 1906 allows from 8 to 16 M.P.H., according to circumstances.

A few months ago the tramway company made a bold and successful bid for further popularity by instituting a service of express cars between Dalkey and Dublin, morning and evening. At first only one car was run, but a second and a third were put on in quick succession. These cars catered very well for the "clerkers" and the "shirkers," being timed to reach Dublin (level with the railway terminus) between 9 and 10 a.m.

The system on which these cars run is likely to be of more than local interest, so that the following details will not be out of place here. The cars start from Dalkey, and will stop at any of the fixed points over the two miles to the middle of Kingstown, but they pick up only passengers who pay a minimum fare of 3d. Between Kingstown and Dublin (Merrion Street)—7 miles—there are only two or three stops, and the whole journey was scheduled to take 37 minutes, or 27 minutes between the real express points. The result, with relation to speed, is that the average over the complete trip from Dalkey to Nelson's Pillar was about 14 M.P.H., and the average between full express points was about 16 M.P.H. Every tramway man, at least, knows that an average speed of 16 M.P.H. means that the maximum speed attained is considerably higher, and it might not surprise them to hear that the railway company puts this down at 21 M.P.H. or more, probably from actual tests.

Comparing the fares of the two systems without taking into consideration the season and zone tickets offered by the railway company, the advantage lies with the tramway; but that method of comparison is not the one likely to be used by a man who is trying to decide which form of transit will suit best his convenience daily.

Consideration of the relative advantages shows us that a season ticket on the train is likely to be cheaper than travelling by tramcar, and it is evident that the time occupied in the actual journey is less by train than by tram. The scenery is identical from both, so that factor may be put out of count; and, as the railway company give second-class accommodation for less than the tramway's one-and-all fare, it may be said that the railway journey will be more comfortable than the journey by tram.

It is evident, however, from the irate letters of the railway company which are being read at the various local council meetings, that the express trams have given a twist to the knife which the tramway company long ago plunged into the throat of the railway. The general manager states the loss through ordinary competition to be over £30,000 per annum, and he cries out aloud at this new torment.

Apart from the merits of the case, this is highly interesting, for it provides a very tangible proof that we will not walk across a road if we can get someone to do it for us, either by carrying us or by going himself.

What does it matter that the tram takes 10 minutes or a quarter of an hour longer than the train, and costs more into the bargain? One can step into the tram at one's door, and would have to walk 100 yards to the station, and that just after the best meal of the day!

That is an expensive line of argument for the railway company, and they have set the law into motion on their behalf by introducing the matter of speed to the notice of the police authorities, and the current tramway time-table significantly ceases to record the time of arrival at the various points, and starts the morning cars 10 minutes earlier than before.

The tramway company propose to apply to the B. of T. for a further extension of the speed limits, and there seems to be every prospect of a lively contest between the two companies.

We have great sympathy with the railway company in their misfortunes, but it seems to us that their case rises or falls upon the single point—will the higher speeds sought by the tramway company be a source of danger to the public? It is hardly for the B. of T. to consider whether, when the tramways were authorised, they were intended to be worked at high speeds in competition with the railway for long-distance traffic.

Whether the demand for this new form of service was initiated by the public, or pressed by them at the active suggestion of the tramway company, is not in question. That the demand exists, and that much disappointment will be felt if it is not satisfied, is obvious; and we do not think that the B. of T. will be deterred by the unbalanced oratory of a few local councillors from acceding to the reasonable request of the tramway company, so long as that company can demonstrate that the state of its track and cars and the appliances for controlling speed and for saving life are as satisfactory as they can be.

A YEAR'S BOILER EXPLOSIONS.

In the year ending June 30th, 1908, there were 62 preliminary inquiries under the Boiler Explosions Act of 1882 and 1890, and there were 11 formal investigations. Of this total of 73 so-called explosions, half—or, to be correct, 36—caused loss of life or personal injury, there being 23 persons killed and 50 persons injured. It is interesting to trace the reasons for the explosions. Over one-third of the number were due to deterioration or corrosion, including half the cases of non-inspected boilers. In 9 of the formal inquiries it was found that the blame rested with persons owning or otherwise connected with the boilers, and in 8 cases payment of costs was ordered, to a total amount of £295.

There were 29 cases of corrosion or deterioration, 9 cases of defective design or excessive pressure, and 11 cases of water hammer, which appears to point to a number of the explosions being those of pipes only. There were 9 cases of faulty work, material or construction; 12 cases were classed as due to ignorance or neglect, and 3 as miscellaneous. Unless the number of each class of boiler could be known, not very much could be got out of the figures of classes; but the types of boiler involved are given as 16 horizontal multitubular, 8 vertical, 7 Cornish or Lancashire or cylindrical (meaning, we suppose, plain shells), 2 locomotive, 2 water-tube, and 2 cases of tubes in steam ovens; 4 heating apparatus, and 23 pipes, valves, chests, &c.

The best showing is that of the Cornish or Lancashire type, considering their probable number. In 34 cases there had been previous inspection that had not detected defects, and 18 cases of no inspection. In no case of the 11 formally investigated explosions could the explosion be attributed to unavoidable accident; owner's or manager's neglect, an engineer's neglect, and that of the inspector, 30 owners alone were blamed, one foreman, four engineers, a boiler foreman and a mechanic, and so on. In one case an insurance company had to pay £20; a mechanic paid £5; owners paid £30, £35, £50 and £60, this last being the case at Aston, Birmingham, where the boiler owner was fined that amount for failing to ensure that the boiler was worked under safe conditions.

The foregoing is a rough indication of the way British boiler engineering has arrived at its present very fair state of safety. It is somewhat characteristic of our method of muddling through, but is perhaps preferable, as American boiler-inspection experts seem to think, to the American system. In fact, there is no defined system in America. In one State one set of rules and orders prevails; in another State there are other methods. Then there are city ordinances, which presumably override or are to be observed in parallel with State ordinances. In New York City there is, or was, a police system of boiler torture. Like our British sportsman who sallies forth to kill—anything, so long as he kills—the New York policeman, with a touch of national indigestion, sallies forth with a pump and a wagon, seizes an unoffending boiler and jams more water into it than it can hold, ruptures a stay or two more than he did at the last assault and battery, takes another five years off the life of the boiler, and leaves it with a certificate of safety to run another period, or perhaps to burst next day of yesterday's water pressure. We are not yet sunk quite to these hydraulic depths, and have long since learned to apply hydraulic tests with more care and consideration for to-morrow's passers-by than is given by the police bruiser. It is a fearful and painful sight to witness, especially when the onlooker realises the danger and the uselessness of this crude test to destruction, or at least towards it.

Neither care, nor inspection, nor public inquiry, nor public opinion will make safety absolute, but experience has shown that they will go further in that direction than any system of official regulation has yet done. And the curious part of our system of muddle through is that boilers inspected by the boiler insurance companies are actually safer than those inspected by the Board of Trade, which takes upon itself to inquire into land boiler explosions, and to criticise its superiors—if merit is to be awarded in proportion to safety.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GERMANY.—Invoices and consignment notes should state the gross weight of packages and net weight of contents, which should be fully described and the country of origin stated. When various descriptions of merchandise are packed together, the net weight of each class should be separately stated. As a rule, certificates of origin are not required in Germany for goods imported from the United Kingdom. On importation of such goods, however, the importer, when making his demand for clearance, must declare in writing on the clearance form, the country in which the goods were produced or manufactured, and must guarantee, by signature, liability for the correctness of the declaration. At the demand of the Custom House the importer must prove the correctness of his declaration by official certificates of origin, if necessary, with an official translation, or in some other way (presentation of bills of lading, ships' papers, invoices, merchants' correspondence). The following duties are payable on electrical and similar goods:—

Mark = 1s. Kg. = 2·204 lb.

	Marks per 100 kg.
Graphite, moulded (in tablets, lumps, &c.)	2
„ packed for retail sale	3
India-rubber, gutta-percha, raw or refined; all substitutes for caoutchouc	Free
India-rubber, dissolved	3
Soft india-rubber paste, rolled sheets, cuttings and strips; sheets with wire rolled in; gutta-percha paper	5
Cut sheets (patent sheets) not vulcanised; also strips and cuttings of the same, unmanufactured ...	8
India-rubber threads not combined with textile threads	10
Textile materials or felt impregnated or coated with india-rubber:	
Wholly or partly of silk	180
Other	100

	Marks per 100 kg.
Textile materials in combination with india-rubber threads	90
Hardened india-rubber:	
Paste, not vulcanised	5
Plates, bars, &c.; rough goods, shaped, but still requiring further working	10
Tubes, not further worked	25
Other wares not specially mentioned in the Tariff ...	40
Articles of asphalt, except slabs	3
Asbestos paper and cardboard, in sheets, rolls or plates with or without insertions of wire, unshaped ...	10
Ditto, shaped	24
Asbestos thread and string, combined or not with other textile materials, or with core of base metal ...	24
Asbestos tissues, combined or not with other textile materials, or with warp or woof of wire made of base metal or alloys	40
Asbestos articles not specially mentioned in the tariff	60
Articles of stoneware, of one colour	8
Ditto, of more than one colour	16
Articles of earthenware (except china) in combination with other materials	25
Wares of china, biscuit ware, Parian ware, &c.:	
White	10
Coloured, with or without enamelled or metallic coating	20
Combined with other materials, so far as they do not thereby become liable to higher duties by reason of such combination	25
Articles of glass or enamel not included elsewhere in the tariff	24
Wire, rolled or drawn:	
Rough or worked (including wire thinly coated with copper during the process of drawing), having a thickness of 1·5 mm. or more	2·50
Ditto, having a thickness of 0·5 mm and less than 1·5 mm.	3
Ditto, having a thickness of 0·22 mm. and less than 0·5 mm.	3·75
Ditto, having a thickness of less than 0·22 mm. ...	4·50
Polished, lacquered, or coated with other common metals, having a thickness of 1·5 mm. or more ...	3
Ditto, having a thickness of 0·5 mm. and less than 1·5 mm.	4
Ditto, having a thickness of less than 0·5 mm. (except that mentioned below)	5·50
Wire, rolled or drawn, including shaped wire, tinned, of a thickness of less than 0·5 mm. down to 0·22 mm.	4·75

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,783. "Improvements in arrangements for charging and discharging accumulators or secondary batteries." A. M. Taylor. August 16th.

18,789. "Centrifugal power generator." F. N. Maude. August 16th.

18,799. "Improvements in electric lamps and filaments." H. T. Grainger. August 16th.

18,802. "Improvements in or relating to the regulation of the speed of machinery." Siemens Bros. Dynamo Works., Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) (Application for Patent of Addition to No. 14,134, 1908.) August 16th. (Complete.)

18,804. "Improvements in automatic telegraphic transmitters." J. Scotland and H. W. Sullivan. August 16th.

18,808. "Improved manufacture of metallic filaments for incandescence lighting." H. Webar. August 16th. (Complete.)

18,831. "Electric signal." E. Seget. August 16th.

18,847. "Improvements relating to electrical devices for controlling movements from a distance, and methods of mounting the same." P. Viry. (Application for Patent of Addition to No. 18,624. 1909). August 16th.

18,863. "Improvements in electric pocket lamps." S. Kraus. August 16th. (Complete.)

18,864. "Electric lamp for miners and for the house." S. Kraus. August 16th. (Complete.)

18,869. "Improvements in ships' telegraph apparatus." J. R. Broadfoot. August 17th.

18,880. "New or improved cut-out for electric circuits." G. Charlton. August 17th.

18,922. "Improvements in receiving apparatus for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. August 17th.

18,934. "Improvements in telegraph sending machines." A. E. Edwards (J. A. Rosen, United States.) August 17th.

18,939. "Improvements in and relating to electrical conductors." C. Vennier. August 17th.

18,950. "Improvements in and relating to telephone exchange systems." E. E. Clement. August 17th. (Complete.)

18,954. "Improved filament or resistor for heating units or lamps." H. W. Lake. (Parker Clark Electric Co., U.S.) August 17th.

18,965. "Improvements in and relating to electrodes for arc lamps and the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 17th.

18,990. "Improvements in cases for electrical instruments." Kelvin and James White, Ltd., and R. K. Mills. August 18th.

19,012. "Improvements in the rotors of dynamo-electric machines for reducing noises." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) August 18th. (Complete.)

19,024. "Distributor for high tension sparking apparatus." Firm of Unterberg & Helmle. (Date applied for under Sec. 91 of the Act, August 19th, 1908, being date of application in Germany.) August 18th. (Complete.)

19,034. "Improvements in and relating to holders for globes or shades for incandescent electric lamps." F. W. Bethell. August 18th.

19,038. "Improvements in and relating to electric incandescent metal or other filament lamps." S. Horvath. August 18th.

19,040. "Improvements in and relating to electrodes for arc lighting." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 18th.

19,047. "Improvements connected with installations of metal-filament lamps connected in series." N. R. Booth. August 19th.

19,057. "Improvements in magnetic compasses." Kelvin & James White, Ltd., L. W. Pakington Chetwynd and F. W. Clara. August 19th. (Complete.)

19,071. "Improvements in the armouring of electric cables and the like." J. Stratton, C. J. Beaver and E. A. Claremont. August 19th.

19,078. "Improvements in or relation to electric breaks or interrupters, and the method of their employment for radiography and radiotherapy." E. E. Greville. August 19th.

19,082. "Improvements in or relating to sparking or ignition plugs for gas, petroleum or other explosion engines." E. A. H. de Poorter. August 19th.

19,098. "Improvements in or relating to electro-magnetic brakes." Dick, Karr & Co., Ltd. (R. Braun, Germany.) August 19th. (Complete.)

19,111. "Process for regenerating electric accumulators." J. Friedrich. August 19th. (Complete.)

19,178. "Improvements in boosters, balancers and auto-transformers for direct current systems." A. M. Taylor. August 20th.

19,197. "Improved treatment of radio-active substance." W. H. Martindale. August 20th.

19,203. "Improvements in or connected with the recording and indicating of the working of hydraulic and electric lifts or hoists." H. A. Matear, T. F. Kenney and H. Woodhouse. August 20th.

19,209. "Improvements in and relating to enclosed fuse indicators." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 20th.

19,210. "Improvements in dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 20th. (Complete.)

19,215. "Improvements in artificial horizons, magnetic compasses and like instruments." J. C. Dobbie. August 20th.

19,277. "Improvements in electric meters of the induction type." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines A. Gaz. (Date applied for under Sec. 91 of the Act, September 8th, 1908, being date of application in France) August 21st. (Complete.)

19,306. "Improved device for automatically adjusting the time of ignition in internal combustion engines." A. G. Bloxham. (Firm Robert Bosch, Germany.) August 21st. (Complete.)

19,308. "Improved process and apparatus for the treatment of sulphide ores or products by the agency of chlorine (or sulphur chloride) and electrolysis." A. J. Boult. (E. A. Ashcroft, Norway.) August 21st.

19,309. "Improved process and apparatus for the treatment of sulphide ores or products by the agency of electrolysis." A. J. Boult. (E. A. Ashcroft, Norway.) August 21st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Magnetic Separation of Ores and other Material and Apparatus therefor. R. Ullrich. 14,082. July 13th.

Telephony and Telegraphy. J. Schiessler. 16,183. July 30th.

Electric Telegraphy. P. P. O'Neil. 16,462. August 4th.

Apparatus for Wireless Telegraphy. G. Marconi and Marconi's Wireless Telegraph Co. 16,516. August 5th.

Electrical Conductors. C. A. Parsons, W. Greaves and A. R. Hemsted. 16,620. August 6th.

Dynamo-Electric Machinery. C. A. Parsons and A. H. Law. 16,704. August 8th.

Commutators for Dynamo-Electric Machinery. C. A. Parsons and G. L. Parsons. 16,911. August 11th.

Automatic Electric Circuit Breakers. A. J. Boult. (Electrical Manufacturing Co.) 17,748. August 24th.

Apparatus for Suspending and Varying the Position of Electric and other Lights, and for Lifting and Conveying Light Loads. G. Thomson. 18,408. September 2nd.

Printing Telegraphs. E. C. R. Marks. (Burlingame Telegraphing Typewriter Co., U.S.A.) 18,518. September 3rd.

Construction of Quick Make-and-Break Electric Switch. Veritys, Ltd., and W. G. Pipkin. 20,646. October 1st.

Electric Current Generators. W. A. Trier. 21,813. October 15th.

Ironclad Electric Switches. F. S. Horrocks and T. C. Lett. 22,768. October 27th.

Means for Reversing the Connections of Dynamo-Electric Machines. H. Leitner. 27,685. December 19th.

1909.

Machines for Covering Electric Wires and the Like. R. Demuth. 1,125. January 16th.

Electric Motor-Generator Sets. British Thomson-Houston Co., Ltd. (Gen. Elec. Co., U.S.A.) 5,209. March 3rd.

Systems for Lighting Railway Trains by Electricity. Siemens Bros. Dynamo Works, F. R. Broadhead and T. F. Wall. 5,644. March 8th.

Dynamo-Electric Machinery. C. A. Parsons and A. H. Law. 11,822. May 19th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 13,750. June 11th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges, 13,919. June 14th.

THE
ELECTRICAL REVIEW.

Vol. LXV. SEPTEMBER 10, 1909. No. 1,659.

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THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. *Established 1872.*
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.
OFFICE:—4, LUDGATE HILL, LONDON, E.C.
Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.
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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.
BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.
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READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.
FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.
Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1909 EDITION
H. ALABASTER, GATEHOUSE & CO.
4, Ludgate Hill, London, E.C.

TRAMWAY POWER TARIFFS.

THERE is at the present time much dissatisfaction on the part of tramway authorities at the prices they are charged for electrical energy. In some places this has culminated in disputes, which are settled either by compromise, as at Brighton and Sunderland, or by arbitration, as at Aberdeen and Peterborough. To understand the situation, it will be well to look at the question from the tramway manager's standpoint, and it will be seen that he has a good general ground for complaint.

It must be remembered that in many towns the tramways are considered to a large extent as an adjunct of the electricity supply undertaking. This was started first, and when the question of the tramways was under consideration the fact that they would prove a good customer to the electricity supply undertaking was not without its influence on the result. Naturally, when the time came for fixing the price to be charged for electrical energy, the Electricity Supply Authority was in a very strong position, and could literally demand its own terms. In cases where both undertakings belonged to the same authority, it was felt that an overcharge to the tramways was not a serious sin, and when the tramways belonged to an outside company or authority, the obtaining of the best possible price was only a good stroke of business. Commercial considerations have, during the past year, forced many tramway undertakings carefully to consider their position. As the lines get older the repairs and maintenance cost more, while the receipts are practically stationary. Wages cannot be reduced, but power costs may. Efforts are made to reduce the consumption of energy per car-mile, with some success, but little difference is made in the power bill unless the price per unit is altered. What wonder then, that the member of a Tramway Committee listens with interest when he hears it argued in the Council Chamber by the Chairman of the Electricity Supply Committee that it is possible to sell electrical energy for power at a profit at rates often less than one-half of those the tramways are called on to pay? He finds out, too, if he likes to inquire, that in some cases, such as Manchester and Bolton, the average price received for all units sold for power to other customers, is less than three-quarters of the price the Tramway Committees are called upon to pay. They ask why, and are referred to their lower load factor and high maximum demand, but they remain unconvinced.

In some towns, such as Glasgow, Leeds, Sheffield and Hull, the Tramway Committees refused to purchase their energy, but insisted on being separate undertakings. Despite the anathemas which were hurled at them as backsliders from the sacred doctrine of concentration, they insisted on building their own power houses. How have they fared, and what is their position to-day?

The answer to this, viewed from the tramway standpoint, is a complete justification for the separate station for large undertakings, and a direct encouragement for the Tramway

Authority to take up the question of revision of prices with a view to obtaining substantial reductions. For instance, we find that in 1908 the 12 tramway undertakings of Cardiff, Dublin, Glasgow, Huddersfield, Hull, Leeds, Leicester, Newcastle, Portsmouth, Potteries, Preston and Sheffield used 104,334,587 units of electrical energy, which they generated at separate stations at an average cost of 0·402d. per unit, or a total of £175,000, the lowest cost being 0·35d. at Glasgow, and the highest 0·73d. at Hull.

During the same period 10 undertakings—Belfast, Birmingham, Bolton, Bradford, Halifax, Liverpool, Manchester, Oldham, Salford and West Ham—used 104,324,142 purchased units, for which they paid to the respective electricity supply authorities £498,900, or an average of 1·147d. per unit; the lowest was 0·70d. at Belfast, and the highest 1·50d. per unit at Oldham. Here we have, for practically the same number of units, a cost of £175,000 in the one case, and nearly £500,000 in the other.

It is true these figures are not directly comparable, but all load-factor and maximum-demand conditions may be taken as similar. The higher figure includes in many cases transforming and feeder losses as well as the interest and sinking-fund charges on the capital cost of the power house, sub-stations where necessary, and feeders. The total kilowatt capacity of the power stations of the above 12 undertakings was less than 48,000 KW., say, 50,000 KW. If an allowance of £55 per KW. is made for the capital outlay on plant, sub-station plant and feeders for this capacity, or, say, £2,750,000 and capital charges for interest and sinking fund of 6 per cent. be allowed, the annual charge would be £165,000, still leaving a financial advantage of about £160,000 in favour of the self-contained systems.

The same general results are found if individual systems of similar size are compared. Take, for instance, Glasgow and Manchester. Glasgow had, in 1908, 178 miles of single track, and used 25,932,890 units of electric energy, which were generated at an average cost of 0·35d. per unit. Manchester had, in 1908, $176\frac{3}{4}$ miles of single track, and used 29,955,070 units of energy, which were purchased from the Electricity Department at an average price of 1·14d. per unit.

The difference between the two figures of 1·14d. and 0·35d. is 0·79d. per unit, which, on the total load of 29,955,070 units, means no less a sum than £98,602, or nearly one-fifth of the total operating costs of £500,023.

Later figures are, however, available for Manchester. During the year ending March, 1909, the track mileage was increased to $181\frac{1}{4}$ miles, the units of electrical energy used by the tramways being 29,675,249, which were purchased at the reduced average price of 1·04d. per unit. Comparing this with the Glasgow 1908 figure of 0·35d. per unit, there is a difference of 0·69d. per unit, which for the 29,675,249 units represents £85,316.

Making every reasonable allowance for annual charges on the capital cost of a separate generating station, sub-stations and feeders, who can doubt that, so far as the tramways are concerned, the Manchester Tramways Committee would have been well advised to have their own plant?

Compare other towns with practically similar lengths of line, or, preferably, similar consumption of electrical energy, and the results will be consistently in favour of the separate generating station, even after all necessary allowances for extra capital charges have been made.

There is, therefore, no wonder that great dissatisfaction with tramway power tariffs exists; and as the economics of power production become more clearly understood, tramway undertakings will naturally be more and more averse to having their rates calculated with reference to the annual charges on the whole capital expenditure of the supply undertaking, and not on that part alone which directly concerns the tramway power supply. If the prices were determined on this basis, there is no reason why the prices charged to the tramway should not be comparable with the total costs at which they could generate for themselves.

Municipal Trading. An interesting example of municipal trading methods was revealed at Sheffield recently. The Education Committee was considering tenders for the electric lighting installation in a new hostel for men students; 13 tenders were received, ranging from £94 to £328, and a sub-committee recommended for acceptance that of the Corporation Electric Supply Department at £155. Exception was taken to this, however, and an amendment was moved to give the contract to a firm which quoted £28 less than the Corporation department—a firm of high standing, and approved by the architects. The lowest tender (£94) was barred on the score of the inexperience of the contractor.

It was argued by the supporters of the Corporation tender that the higher quality of the work done by the department was well worth the difference of £28, and that no business firm possessing a works department would think of getting an outside contractor to do work that his own staff could do; but both these specious arguments were promptly knocked on the head. It was denied that the Corporation department would do the work better than a contractor, and the folly of doing work at an unnecessarily high cost was pointed out. The injustice of inviting contractors to tender, if it was a foregone conclusion that the Corporation department should get the job, was also exposed, and the amendment was carried by a considerable majority.

One speaker, who voted for the amendment, expressed surprise that outside tenders had been invited at all, and urged that in future any department of the Corporation should serve any other department at cost price, plus a small and reasonable percentage for profit. He appeared to overlook the fact that, in the absence of competition, there would be absolutely no check upon the performance or charges of the department, while the definition of "reasonable profit" would offer an interesting problem. We maintain that where a municipality possesses wiring powers the interests of the ratepayers cannot be properly served unless the wiring department is run on a competitive basis, and is required to show a separate profit and loss account at the end of each year's working. If it cannot show a balance on the right side, it is plainly not justifying its existence, for it is no part of the orthodox theory of municipal trading that customers should be subsidised or a trading department run at a loss.

Electric 'bus Developments. According to our contemporary, the *Automobile Owner and Steam and Electric Car Review*, one unlooked-for effect of the new police regulations requiring the future 'bus not to exceed $3\frac{1}{2}$ tons in weight, has been to draw attention to the electric vehicle. At first sight, it would certainly appear that the electric 'bus, owing to the considerable weight of its accumulators, would be almost a last resort under the circumstances; but, again according to our contemporary, the accumulators are not taken into account in estimating the weight of this type of omnibus. This curiously one-sided arrangement certainly presses hardly on the petrol-driven vehicle, and almost bears out the suggestion that the police are trying to shoulder out such vehicles on account of the many complaints received as to noise and smell. Nevertheless, believers in the electric 'bus, and electrically-driven vehicles generally, have every reason to rejoice in the prospective developments which should take place.

Our contemporary advances the opinion that any considerable curtailment of existing capacity in the petrol vehicle would render it unprofitable to run, and states that the Vanguard Co. has actually converted some of its petrol-motor chassis to electrical driving, apparently on similar lines to the well-known Electrobus, and that vehicles have been privately tested with satisfactory results.

If our contemporary is accurately informed—and we have no reason to suppose otherwise—there appears to be a good time ahead for the electric 'bus, which has everything to gain by a greatly extended use in the way of improved construction and efficiency. The subject brings others in its train, for the extensive use of battery vehicles would inevitably lead to the much-needed provision of charging facilities throughout the metropolitan area, and thus possibly remove one of the most serious objections at the present time to the adoption of electrically-driven vehicles generally for trade purposes. Judging by American contemporaries, the American station engineer has taken the battery charging business more seriously than his British *confrère*, and special departments have been organised to look after this class of business, with good results.

Of course one has to admit that the electric vehicle is much more popular in the States than here—possibly due to the greater encouragement given by those interested in its progress—but, nevertheless, the matter seems, in view of possible developments in the metropolitan area, to be worth some concerted action on the part of London central station authorities.

An Engineer's Responsibility. When a man enters a lawyer's office with the intention of fighting a case, he does not ask advice from the lawyer and ask him at the same time to guarantee a win. If he consults a doctor, he does not make recovery from an ailment a *sine qua non* of payment of the man's fees. Engineers, however, are sometimes credited with a degree of prescience more complimentary to them than to the intelligence of their clients.

Some 15 years ago, an engineer interviewed a large number of station and other resident engineers in London with a view to pointing out to them the waste they were incurring by buying water at 8d. per 1,000 gallons when they could pump a softer supply for about ½d., plus capital costs, or, say, a total of 1d.

In only one central station was any success attained. In that one case, the advice of the engineer in question was listened to, and the well paid for itself three times over, the first year it was at work.

Usually the only response to be obtained from the engineer-in-chief was a request for a guarantee that there was water to be reached by boring for it. It might be pointed out that successful boreholes were in operation on all sides, and that ordinary reasoning warranted the supposition of equally successful finding in the middle of so much success. It might be pointed out that no London borehole had been made anywhere near the particular spot that did not produce so much water as to warrant a boring being made, even if all the water required was not obtained. But it was always the guarantee that was demanded.

Many of those same stations did ultimately have borings made, and probably are in a position to tell to-day, if they would do so, how many thousands of pounds of shareholders' and ratepayers' money were thrown away in the years between. Other engineers can probably cite similar instances where men who occupy engineering positions have endeavoured to throw all risks upon some outsider, themselves shirking the responsibilities of the office they are paid to occupy. Such shirking is derogatory to the dignity of the profession, and cannot fail to prevent that proper recognition of the status of the engineer for which all of us are calling. The engineer at the head of any undertaking ought to be fitted to form correct judgments on the propositions that are put before him; otherwise he is not properly qualified for the post he occupies.

REVIEWS.

Cranes. By A. Böttcher. Translated by A. Tolhausen. London: Constable & Co. Price 42s. net.

This is a large work of about 500 pages, dealing with the design and construction of a large number of different forms of crane. It is not confined to electric cranes, but includes also those driven by steam and hydraulic power.

The book owes its inception to the fact of the author having been engaged by the Vulcan Co., of Stettin, to supervise the rebuilding of their works and the rearrangement of their cranes, and embodies the results of the experience and information gained in the course of the work.

The treatment of the electrical portion of the subject is somewhat meagre, and the chief interest of the book is mechanical rather than electrical. The author has devoted himself particularly to the design of the structural steelwork, and this, together with the many excellent drawings in detail of German cranes, constitute the really valuable portion of the work.

Part I is a summary of the scientific principles underlying the design of crane structures and machinery, and constitutes a short treatise on applied mechanics.

Part II deals with the general arrangement of cranes, and contains a large number of drawings showing the arrangement of almost every known form of crane.

Section 5 of Part III will be of interest to electrical engineers, as it treats of the principles of electrical driving. Curves are given of the relative performances of direct-current series and shunt motors, and three-phase alternating motors, and diagrams of starters and controllers, but, as already stated, the treatment is merely general and somewhat meagre.

Part IV contains much useful and valuable information relating to the design and construction of details of the machinery of cranes, automatic brakes for controlling the lowering being dealt with very fully.

Part V is one of the best sections of the work, as it deals with a subject which the author seems to have made his speciality, namely, the design and calculation of plate and lattice girders. Stress diagrams are given both for static and rolling loads, and in connection with this section, tables are given at the end of the book of moments of inertia, &c., for a number of sections, including I girders of built-up section.

The succeeding part is on crane installations. In this section, drawings are given of a number of German cranes, and in each case the loading of the different parts, the unit stresses, and the driving powers are all worked out in detail. This represents an enormous amount of work, which can probably only be fully appreciated by those who have worked out similar details themselves. The latter portion of this section contains descriptions of English and American cranes, but does not compare in value with the first portion, as the information and illustrations given are only such as can be found by reference to the catalogues of the various firms whose cranes are described.

The book concludes with various tables, and with an index of articles and papers on the subject of cranes.

With regard to the work of the translator, we can appreciate the difficulty of turning the highly technical German into equally technical English. Here and there the German sentences have been translated literally, with a result which is somewhat reminiscent of "Ludwig in London"; but this does not detract from the value of the work, and we congratulate Mr. Tolhausen on the successful completion of his heavy task.

ELECTRIC POWER IN THE WORKS OF MESSRS. ARMSTRONG, WHITWORTH & CO., LTD., MANCHESTER.

The name of Messrs. Armstrong, Whitworth & Co., Ltd., is too well known to engineers and shipbuilders to require any introduction in the nature of a description of this firm's rise and progress. It is only necessary to consider the large measure of confidence reposed in the firm by the Admiralty and War Office of this country, and the large number of orders which are received for military and naval equipments from other countries, in order to recognise in them an impressive testimony to the standing occupied by the firm whose name has become a household word; and the only unfortunate effect of such fame is to tend to make one to a certain extent oblivious of the fact that, in addition to works of this large order, the firm also undertake the construction of machine tools, motor-cars, electric plant, pressed work, forgings and steel manufacture on a scale which is, perhaps, unparalleled by any private firm in this country. Inasmuch as the Manchester works were originally commenced under the control of that master of engineering research whose name is perpetuated in the most eagerly coveted scholarships of the country, it may be interesting to describe in some detail the way in which electric motive power has entered into the operation of the Manchester section of this undertaking.

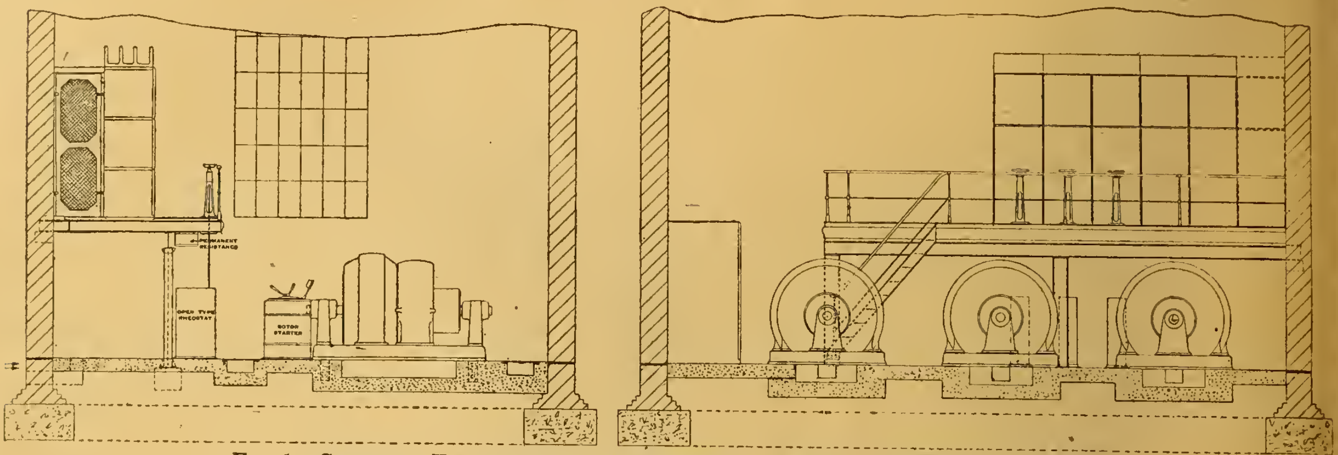


Fig. 1.—Sectional Views showing arrangement of Whitworth Street Sub-station.

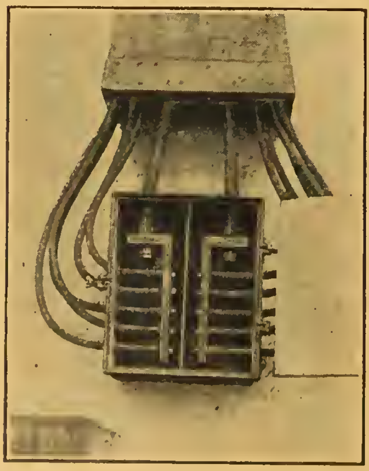


Fig. 2.—Ironclad Distributing Box.

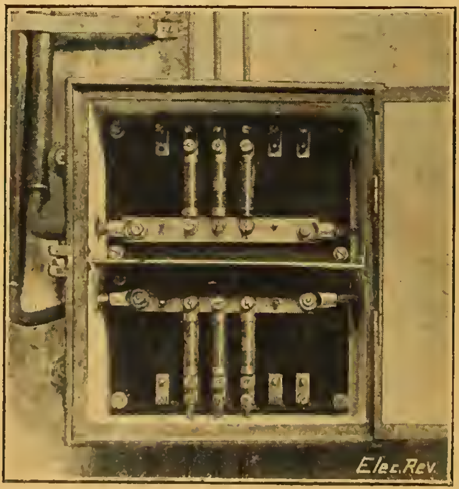


Fig. 3.—Sub-distributing Box, Supplying Motor Circuits, &c.

Electric power as first used by Messrs. Armstrong, Whitworth & Co., at Manchester, was generated in their own station, which is still in operation, and takes the bulk of the load, supplemented by an auxiliary supply from the Manchester Corporation electrical department, and it will be useful first of all to describe its development. The generating station is situated in the geographical centre of the old works, in order to render the lengths of distributing cables in each direction as uniform as possible, and to equalise the voltage drops on the system. The first set in the generating station was set to work in 1898 and consisted of two Schuckert dynamos giving 250 KW. each for power and lighting at 220 volts. These were direct coupled to Browett-Lindley enclosed vertical engines running at 310 R.P.M. supplied with steam at 160 lb. pressure. As all the water in the generating station had to be obtained from the town mains, all the engines ran non-condensing. At the middle of 1899 it was found necessary to install another set of 500 KW. capacity running at 180 R.P.M. In 1900 an 800-KW. set consisting of a dynamo coupled to a Browett-Lindley vertical engine and running at 150 R.P.M. was installed, and in 1904 owing to the rapid spread of the use of electric motive power in the works, an Armstrong-Whitworth dynamo, built at the Elswick works of the firm, and coupled to a Browett-Lindley engine, running at 150 R.P.M. and giving 750 KW., together with an Armstrong-Whitworth combined set consisting of a 250 KW. dynamo and an enclosed high speed engine running at 350 R.P.M., were installed.

The increase in the power requirements of the firm still continued and the ground space was by this time valuable. As more power was wanted an arrangement was made with the Manchester Corporation Electricity Department in 1907, whereby a bulk supply was brought to a transforming station about 12 yards away from the private generating plant. The supply of three-phase current at a pressure of 6,500 volts was commenced on January 19th, 1907, and two feeders of 1,000 KW. capacity each are now laid from Stuart Street generating station with an interconnector with the North Street sub-station, feeding Messrs. Armstrong, Whitworth's new works situated some 700 yards from the Whitworth Street or old works sub-station.

The Corporation sub-station at Whitworth Street, elevations of which are given in figs. 1 and 2, is of 2,000-KW. feeder capacity, and the high-tension switchboard contains panels for two feeder switches, one interconnector switch and three machine panels. The board is of the Ferranti cellular type, and is mounted on a concrete and iron gallery. The space underneath is intended for the reception of transformers for a three-phase static supply should it be required. At the present time, however, three Bruce Peebles converters, manufactured under the La Cour patents, each of 500 KW. capacity, are installed, and convert from 6,500 volts three-phase, at 50 periods, to 220 volts direct current, when running at 375 R.P.M. The alternating and direct-current machines of this set are mounted on combined bases, and the whole set is of the two-bearing type. The direct current ends are arranged to give 220 volts at no-load and 230 volts at their normal full load of 500 KW. These sets have a large overload capacity and an exceedingly high efficiency, especially at the lighter loads, this being much higher than can be obtained with any motor-generator. The advantage is also gained that the power factor is practically unity at full load, and there are, of course, no transformers used in conjunction with these machines, the high-tension current being taken direct to the stator windings. This type of machine has proved so successful in operation, that with the two machines above referred to, there are now over 30 motor-converters running on the Manchester Corporation extra-high-tension system, varying in size from 150 to 1,500 KW. capacity each, particulars of which have appeared from time to time in our pages.

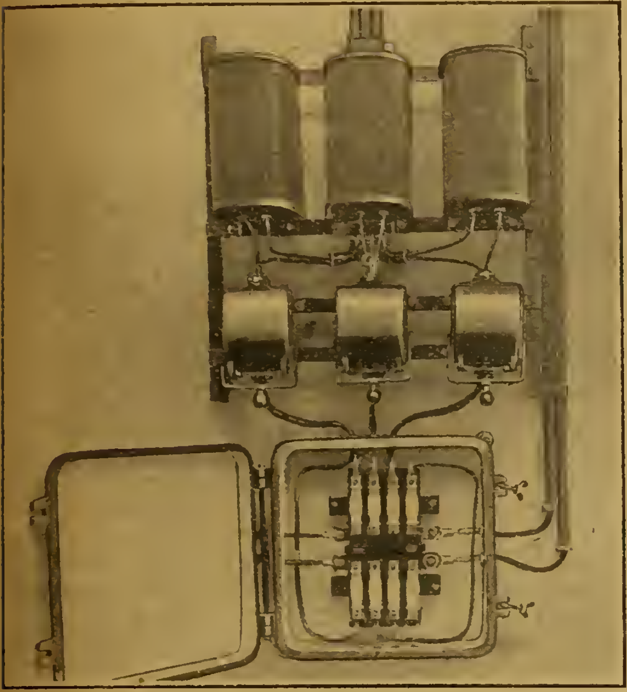


Fig. 4.—Lighting Sub-Distribution Board, with Four-Way Box.

The high-tension switchboard panels conduct the current direct through Ferranti oil-break switches with a charging arrangement in order to smooth down voltage oscillations on the feeders, which are about $1\frac{1}{4}$ miles in length from the Stuart Street switchboard to the sub-station. These charging arrangements consist of glass water pots in the form of cylinders, at the bottom of each of which is fixed an electrode or terminal, and which also contains a vertical sliding electrode connected to the switch handle, so that the moving electrode slides down in contact with the fixed electrode as the switch closes. The feeders enter at the bottom of the board, a tapping being taken to the potential transformers, the main circuits passing to the oil break switch, and thence upwards to the bus-bars at the top of the board. Suitable current transformers, ammeters, voltmeters, maximum time-limit relays, &c., are provided, and spark gaps are provided for discharging surges. For energising the power factor indicator and integrating wattmeter, a three-phase potential transformer converting from 6,500 to 100 volts is provided, furnished with dust fuses in a concrete cubicle at the side of the board. The converter panel connections are generally similar to the feeder arrangements, the cables passing down from the bus-bars, through suitable measuring instruments, to the oil switch, and so to the bottom of the board. Isolating switches are provided so as to cut off any cubicle from the high-tension supply when this becomes necessary for cleaning or repair. An additional feeder panel was installed to accommodate the high-tension link between the Whitworth Street sub-station and the new works at North Street, to which reference will be made later.

The low-tension board, which is also mounted in the same gallery at a distance of 10 ft. to the nearest point of the high-tension board, contains three sets of circuit-breakers of 3,000 amperes capacity each, fitted with overload and reverse-current cut-outs, and manufactured by Messrs. Bertram Thomas, of Manchester. The switchboard consists of three panels 4 ft. 3 in. × 1 ft. ½ in. The left-hand panel contains a Kelvin & White electrostatic voltmeter on the upper portion, and a 3,000-ampere circuit-breaker on the lower portion. On one of these generators the circuit-breaker is arranged for overload and reverse operation. It is the intention of the firm to have the remaining breakers fitted up in the same way, but at present these provide for overload only. The right hand of the panel carries a 12-in. scale ammeter reading from 0 to 2,500 in the upper portion, and in the lower portion a circuit-breaker for a capacity of 3,000 amperes overload only. The circuit-breakers have laminated edgewise brushes, and open circuit in a strong magnetic field. The main brush is protected by auxiliary metallic contacts, no carbon being used at any part. The circuit-breakers are also provided with loose handle attachment, so that if closed on the circuit when an overload exists the breakers will immediately open the circuit again in spite of the handle being held. Also the arrangement is such that the circuit-breaker cannot be closed unless the reverse current attachment has been set. The features of these circuit-breakers are the very large opening of the breakers, the strong magnetic field, the good arrangement of the brushes for cleaning their contacts and enabling each leaf of the brush to make its own separate connection with the block, and the very strong construction of all mechanical parts. The whole board is necessarily of a very simple character, and the back is kept very clear, unabling all bolts and nuts and connections to be easily got at.

Shunt regulation is also provided for the direct-current side of the converter, which supplies current to a two-wire, 220-volt board, feeding a 220-volt two-wire system of distribution. The necessary voltmeters and ammeters are also installed.

This low-tension board is coupled to the bus-bars of the private generatimg station by means of copper bus-bars, carried overhead and protected from the weather ; these bars having a current capacity of 6,000 amperes, and a length of 72 ft. from bus-bar to bus-bar of the switchboards. The Corporation supply is thus in parallel with the private plant, and during the day when the power requirements are at the heaviest, the Corporation supply takes up the bulk of the running, the private plant taking the remainder, which includes the most important departments. At night it is usual to run an 800-KW. set of the private plant for the purpose of running the works lighting and incidental motive power, thus relieving the Corporation of about 500 KW. of load.

The switchboard in the works generating station has passed through a series of progressive steps coincident with the additions to the electric generating plant. As a result, a series of panels has been evolved which in their construction are purely the outcome of Messrs. Armstrong, Whitworth's own design, based on the needs of their peculiar requirements. The switchboard is divided into two sections, so far as its distributing panels are concerned, one section consisting of 12 panels dealing with the lighting of the works, the other section, at present of 22 panels, with provision up to 30 panels, being utilised for the power switchboard. The lighting circuits each consist of 0·3 sq. in. feeders, running to suitable points in the works, and the positive pole of each feeder is protected by an overload circuit-breaker of considerable strength and solidity. The positive cable is led in at the top of the back of the board to the circuit-breaker, and through it to the positive bus-bar. The negative cable is led in at the front and bottom of the board, and passes through a single-pole switch and fuse of the porcelain tube variety, and a meter to the negative bus-bars. As each panel is 6 ft. long and 12 in. wide, it will be seen that it is practically impossible for a workman to cause a short-circuit between positive and negative behind the board without wilful carelessness. Each panel is constructed to carry 250 amperes, and the feeders go to main lighting boxes in different parts of the works.

The same system is followed for the power panels with a few minor differences. Each panel is 15 in. wide and 6 ft. long, and designed to carry 1,000 amperes passing to a 1 sq. in. feeder. A Whitworth circuit-breaker controls the positive pole, and the negative has two knife switches mechanically coupled together, of a similar type to those on the lighting board. The porcelain-covered fuses are replaced by strips of sheet-copper of considerable section, these being very rarely blown. In the event of a fault, the circuit-breakers on the positive poles are relied on to take the break, and the only possible conjunction of events which would cause the negative strips to fuse, would be, say, three or four leaks on the positive, and an earth on some negative main. Even then it is possible that the positive circuit-breakers of the two circuits effected would be tripped. Having regard to the considerable amount of horse-power behind the circuit-breakers and the capacity of the cables, it is evident that the breakers must be designed to give a very smart and safe interruption of circuit, and for this reason there are three breaks on each circuit-breaker, in parallel with one another. The first is on the main contact, which consists of a laminated copper brush pressing on the surface of the copper block. The second break occurs on a copper auxiliary spring contact, while the final break takes place through carbon tips. In addition to the power and lighting panels on this board, there is a 5,000-ampere double-pole circuit-breaker for controlling the supply to the board from the 800-KW. generator. There are also circuit-breaker panels provided for the 500-KW. set, and one by Messrs. Armstrong, Whitworth & Co. for the 650-KW. set, together with a panel for the starting of the motor-generator installed in the works generating station, for a reason to be mentioned shortly. At the centre of the board is a small panel for the station lighting, containing four double-pole switches, and eight single-pole fuses. The total length of the main switchboard is 65 ft. In the case of the 250-KW. sets the control panels are independently placed with regard to the main switchboard, and are situated close to their generator. This is because of the fact that owing to the rapid extension of the generating station the main smoke stack for the boiler equipment happens to occupy a position in the centre of the generating station, and it is, therefore, impossible to see a considerable portion of the board from these machines. As it is always advisable for the man who is putting in a machine to be able to see exactly what is happening on the set at the time he is regulating and switching in, the panels, which were made by Messrs. Armstrong, Whitworth & Co., and fitted with circuit-breakers, are placed in the position mentioned above.

Mention was made of a motor-generator installed in this generating station which is used for testing machine tools made by the firm, and also in order to provide an earth return through the motor-generator for some of the motors requiring earthing used throughout the works, such as those used in the various shops to drive trolley cars and other apparatus. The generator is mounted on the same shaft as a motor of 200-KW. capacity. Its normal speed is 450 R.P.M., but by varying the shunt resistance on the motor, a 25 per cent. variation is obtained. By this means and by varying the field resistance on the generator a variation of voltage for testing purposes of from 80 to 220 volts can be obtained. It will be seen that the ground space of the private generating station is of necessity over-well filled, and it is therefore interesting to give a comparison of the ground space per KW. installed required in the private plant and the Corporation sub-station respectively. The first figure is 2·4 KW. installed per sq. yard, while the second is 1·4 KW. installed per sq. yard, thus showing the very important advantage of Corporation bulk supply for power and works lighting purposes, from the point of view of space. The steam plant in this generating station is fed from a battery of boilers which is common to the whole works, and it may be incidentally mentioned that elsewhere, throughout Messrs. Armstrong, Whitworth's establishment, steam is only used for a section of steam hammers, and a single steam engine of large capacity, which is used for the main rolling mill for manufacturing armour plates, requiring upwards of 10,000 H.P. to drive it.

The system of distributing the power throughout the works adopted by Messrs. Armstrong, Whitworth & Co., is of considerable interest, as it embodies the result of experience on a very large scale. The power feeders of 1 sq. in. section are run from the generating station, which, as mentioned, is linked up to the Corporation sub-station. Most of the works are under cover and practically the only section of pole line distribution is to be found immediately outside the generating station, where an H-frame with suitable insulators is fixed for carrying the leads out to the various destinations. In the shops the cable is run principally in the tie rods of the roof, wood cleats being fixed to these having holes for the cables spaced 4 in. apart. The cables are strung through these cleats, which are then tightened, and hence, as the roof spans are fairly close together, the weight of the cable is so uniformly distributed throughout the building as to render this method of distribution very safe. It has the further advantage of being inexpensive and of leaving the cables free of all obstruction to plant and cranes. This method also lends itself admirably to rapid work in installation. As an example of this, 1 mile of 1 sq. in. cable was installed in cleats already fixed, in a week-end of 20 hours by the electrical staff attached to Messrs. Armstrong, Whitworth's works. This probably constitutes a record in high-speed cable fixing. All main cable is of 300-megohm C.M.A. grade, insulated with paper-vulcanised rubber, taped and braided, made by Messrs. W. T. Glover & Co., Ltd.; these cables being run to distributing boxes of an ironclad type. On the walls of the shops the cables are brought down to these boxes through troughs of wood, whose ends near the box are splayed out for convenience in bringing the cables into the boxes. A view of one of these boxes with the front open is shown in fig. 2, and the very simple arrangement of circuits therein is well displayed.

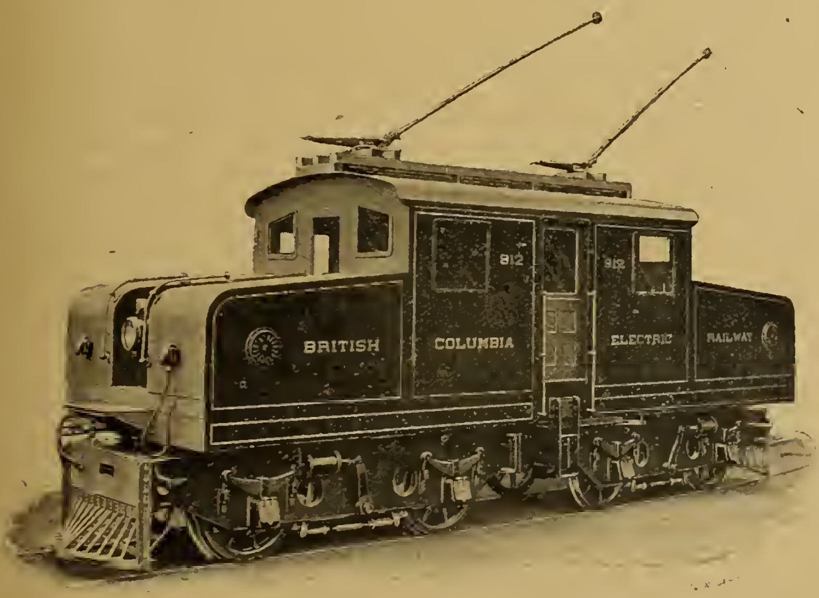
From the middle bus-bar shown, five pairs of 0·3 sq. in. mains pass direct to similar distributing boxes, fig. 3, and thence to the motors and other energy-consuming devices as required. Due regard is paid in this portion of the installation to the proper reduction of cable section consistent with a limitation of voltage drop. An example of this is found in No. 2 bay of the heavy gun shop of the works. There are here three large lathes, each driven by a 60-B.H.P. motor mounted direct on the lathe. The 0·3 cable from the main distributing box is brought direct to the first motor, and through this to the second motor, while from the second to the third motor is looped a power circuit having conductors of 0·25 sq. in. section; thus 1 sq. in. cable feeds 0·3 cables, which, in turn, feed into 0·25 sq. in. cables, and, as the result of experience obtained in these works, it is found that the current-carrying capacity of a main power cable reckoned at a density of 1,000 amperes per sq. in., should be about one-third the total nominal capacity of the machines connected to it. This figure is a variable quantity for different classes of work, and may be taken only as an average value for industrial motors in works of this description.

The lighting cables from the panels on the main switchboard are run in the same manner as the power cables described above, to ironclad wall-boxes, from the bus-bars of which are carried four 50-ampere circuits suitably fused, while from the bus-bars of this first wall-bracket a 0·15 sq. in. feeder is carried to a similar box in another adjacent shop, or portion of a shop, where it is required. Each 50-ampere circuit goes to a pair of bus-bars in a sub-distributing box (fig. 4), feeding four 10-ampere circuits utilised for arc lighting and other illumination, while from the sub-division box another pair of 0·15 sq. in. cables passes to a similar adjacent sub-distribution box of four 10-ampere circuits. It is thus seen that each main circuit of 250 amperes capacity feeds two sub-circuits of 150-ampere capacity, each of which feeds two branch circuits of 50 amperes capacity, either of these last two circuits feeding two sets of four circuits each of 10 amperes capacity. It is thus seen that the principle of proportioning current-carrying capacity to the normal, and not the full lighting requirements, is followed out throughout the system. Moreover, by this system of sectionalising the circuits and interposing fuses, a fault on any one circuit can be easily located and isolated. The large ironclad wall-boxes for power and lighting purposes were made by Messrs. Armstrong, Whitworth & Co. themselves, while the smaller boxes were obtained from Messrs. Eckstein, Heap and Co. The lighting wires are carried either in steel tube casing and capping, or porcelain cleats, as is best adapted for the requirements of each shop. The switches used for controlling the circuits are of the enclosed gas-tight, waterproof type, and on the last distributing box three circuits are appropriated for arc lighting and one 10-ampere circuit for the incandescent lighting distributing fuse box by means of which not more than five amperes are allowed on any one incandescent lighting circuit. It will, therefore, be seen that the lighting arrangements of this series of works have been carried out in a way which should contain considerable instruction to manufacturers who are grappling with that always great difficulty in industrial concerns, the efficient and safe distribution of factory lighting.

(*To be continued.*)

ELECTRIC LOCOMOTIVES FOR BRITISH COLUMBIA.

Through the courtesy of Messrs. Dick, Kerr & Co., Ltd., we are enabled to illustrate some electrical locomotives recently built by them for the British Columbia Electric Railway, the electrical equipment being supplied by their Preston Works, while the mechanical work was turned out at their Kilmarnock Works. These locomotives are of the four-axle type, with one motor per axle, and have a maximum rated tractive effort of 16,000 lb., while the maximum instantaneous effort is 25,000 lb. A feature of interest is the system of coupling the two trucks together, by means of a massive hinge, having lateral flexibility, but vertical rigidity. This arrangement prevents any tendency to tilting of one truck by another.

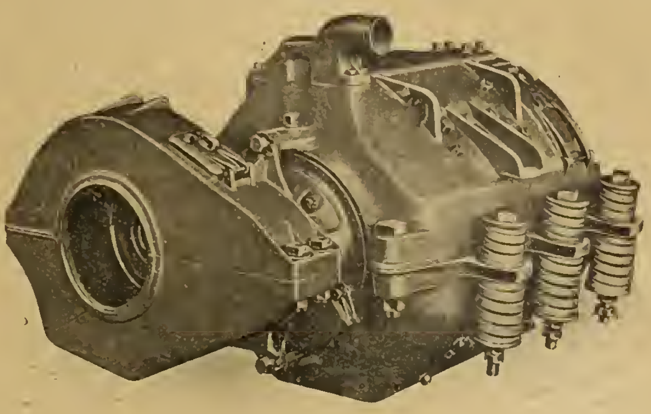


Dick, Kerr Electric Locomotive for British Columbia.

The centre pins and cab platform framing are not subjected to any longitudinal stress, except that due to inertia when starting and stopping, the whole pull of the motors being transmitted direct from the motors through the trucks.

The spring suspension is of the locomotive type, the weight being carried by semi-elliptical springs resting on the journal box saddles.

An interesting view shows the cab interior, with the two master controllers, one at each end; the contactor boxes, circuit breakers, switches, &c. The control equipment is of the standard Dick, Kerr multiple unit type, with series magnets operating the various contactors. The resistances are placed in the sloping ends of the superstructure.



Dick, Kerr Motor used on Locomotive.

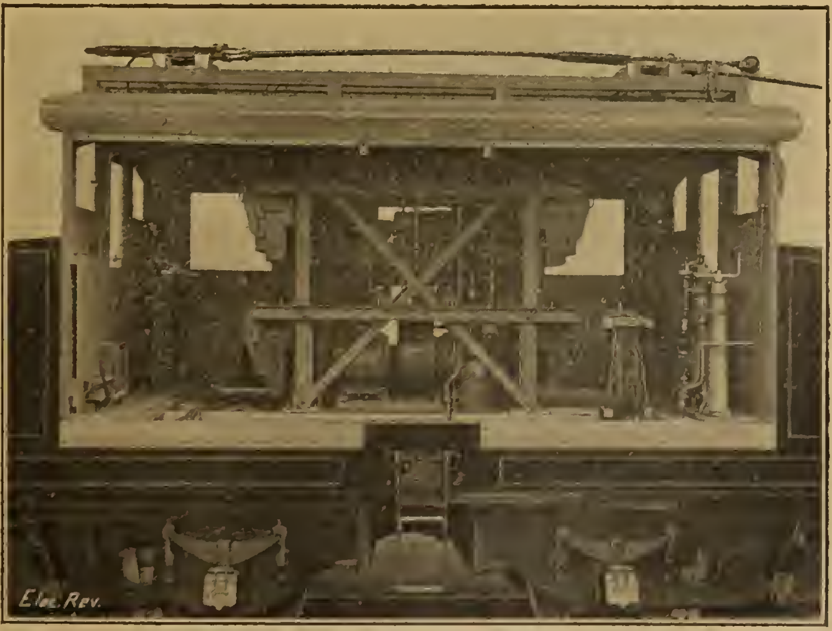
Each of the four motors, when operating on a 600-volt circuit, will give a tractive effort of 4,000 lb. on the periphery of the 42-in. wheels and a speed of 15 m.p.h. at the one hour rating; each motor is fitted with reduction gear having a ratio of 3·64 to 1.

The armature bearings are lubricated by oil rings which are specially designed to prevent flooding when running at high speeds; the axle bearings are lubricated by a system of wicks immersed in oil wells, and no grease is used as an emergency lubricator. The gearing is enclosed in malleable iron oil-tight gear boxes, supported by the axle bearings at one end, and by the pinion bearings and motor shells at the other end.

The motors are provided with forced ventilation, the air, which is blown into the motor shell at the end farthest from the commutator, passes out at suitable openings provided at the commutator end.

The air for the forced ventilation is obtained by means of a centrifugal blower situated in the centre of the cab, and driven by a Dick, Kerr motor; the controller for operating this motor is situated near the right-hand master controller seen in our view of the cab interior.

An electrically-driven air compressor with suitable air



Interior of the Cab, showing Controllers, Ventilating and Brake Equipment.

reservoirs is provided for the air-brake equipment, the locomotive being fitted with combined straight and automatic air brakes; this compressor is mounted above the ventilating blower in the cab.

Two current collectors are provided, of the straight underrunning trolley type, the current being collected from an overhead trolley line. The trolleys are equipped with retrievers.

The total wheel base of the locomotive is 24 ft. 6 in.; the wheel base of each truck 8 ft.; and the length overall 35 ft. 7 in. The total weight of the locomotive is 50 tons.

ENGINEERING DAY AT THE WHITE CITY.

Last Saturday was "Engineering Day" at the White City, and great efforts had been made by the Organising Committee to ensure its success. The object was to afford a meeting place for engineers, irrespective of the particular branch of work in which they were engaged, and so promote the feeling of unity which, in these days of specialisation, is very apt to be forgotten. It was unfortunate that the weather was so unfavourable, as this, no doubt, affected the number of visitors. The White City has such a reputation to live up to, that those who compared the attendance on wet days last year with the total of engineering as well as ordinary visitors last Saturday could not help confessing a feeling of disappointment, which possibly the actual state of affairs did not warrant.

The proceedings may be divided up into three parts—first, the personally conducted tours round the principal engineering exhibits and the inspection of the machinery used in connection with the various amusements; second, the course of engineering lectures in the Congress Hall; and third, the reception by the Lord Mayor of London in the afternoon and the banquet in the Garden Club Banqueting Hall, under the chairmanship of the Hon. A. Stanley, M.P., in the evening.

Had the weather been finer, there is no doubt that the opportunity to see how the various side-show amusements were operated would have proved the most popular feature of the day. As it was, a number of parties under the guidance of members of the Committee braved the elements and were shown the flip-flap, wiggle-woggle, spiral railway, Canadian toboggan, witching waves and scenic railway, as well as Messrs. Joseph Baker & Sons' complete equipment of machinery for bakers and confectioners, Messrs. McVitie and Price's biscuit-making machines, Messrs. Lyons's producer gas refrigerating plant and the sub-station supplying electrical energy to the Exhibition. This is the first time that many of these features have been open for inspection, and all agreed that the engineering genius shown in working out the details of the side-show amusements was of a very high order. Special displays were also arranged at many of the exhibits in the Machinery Hall, but those who expected to see the commercial process of "hydrogen" being extracted electrically from the atmosphere, as promised in the official programme, were disappointed, the more prosaic, but possibly more useful, process of making nitrate of lime, as carried on at Notodden in Norway, taking its place.

It is not possible here to give any detailed description of the engineering exhibits, which, though far inferior both in number and range to those on view last year, will yet repay careful inspection.

Perhaps the two of greatest interest to the electrical engineer are the Cowper-Coles display of electro-metallurgical processes, and the "Silundum" electric cooking appliances on view in the "model house" fitted up in the grounds by "Simplex Conduits, Ltd."

The second division of the day's activities consisted of a series of six lectures delivered in the Congress Hall near the cascade, the first being given at 2.45 p.m. and the last at 7.0 p.m. The first related to water-power and turbines, the second and third—arranged by the Institute of Marine Engineers—dealt with the uses of electricity on shipboard and the treatment of marine boilers on long voyages respectively; the fourth showed the present position of the large gas engine, and the last two the applications of a new method of teaching drawing to the needs of architects and engineers. It will be seen that all branches of engineering work were as far as possible considered. Many of the lectures were illustrated with lantern slides, and it was gratifying to find they were well attended.

Mr. W. B. Bryan, M.Inst.C.E., presided at the lecture given by Mr. Alph. Steiger, M.Inst.C.E., on "Water-Power and Turbines."

The lecturer pointed out the erroneous character of the general belief that the water powers of this country were of little value, and instanced the Foyers, Kinlochleven and North Wales electric power installations as examples of what might be done. He was of opinion that at least 1 million B.H.P. might be utilised in this country. He acknowledged that the cost of the works necessary to utilise this power would be very great, and might average as high as £40 per B.H.P., but the low working costs would to a very large extent counterbalance this disadvantage. The developments which were taking place in electro-metallurgy, especially in regard to the electric furnace for iron smelting, would make cheap power more than ever a necessity of the near future, and would justify the most careful examination of our available sources of water power. Whereas the cost of coal was practically proportional to the power developed by a steam plant, the incidence per unit, or per B.H.P.-hour, of the capital charges of a water power were reduced as the load factor was increased.

The lecturer then referred to the different types of waterwheels and turbines, pointing out that the modern turbine was three times as efficient as the overshot water-wheel, and he exhibited some diagrams showing how closely the speed of a turbine could be governed throughout wide ranges of load, concluding by referring to the water-power plants on the Continent, and the Swiss scheme to spend six millions of money on improving the canal communication between Basle and Lake Constance, which it was expected would render available for commercial use 150,000 B.H.P.

The two Institute of Marine Engineers' lectures were presided over by Sir Fortescue Flannery, M.Inst.C.E. The first paper, by Mr. J. McLaren, outlined the economies which could be effected by driving all the auxiliaries on board ship electrically, generating the power by a gas engine supplied from a suction gas producer. The paper is a strong condemnation of the steam-driven hoists, winches, capstans and refrigerators at present used, pointing out their inefficiency and cost as well as the inconveniences often met with in working them, and proposing to use alternating electric currents not only for driving all auxiliary machinery but also for lighting and heating the ship, as well as for all cooking purposes. The author claimed that during a discharge of cargo the fuel used would be only one-fifth of the amount required for ordinary steam working—though by a misprint in the paper itself the figure appears to be twice as great—and the total saving of fuel would far more than repay any additional capital outlay on the gas and electrical plant.

The second paper, by Mr. H. Ruck-Keene, dealt with the treatment of marine boilers on long voyages. The conditions under consideration are so different to those met with in electric power work that it may be said no comparison is possible. At any rate, the care required to keep salt out of the boiler, and the absolute necessity of keeping up steam without intermission for weeks at a time, differ from land practice, but the importance of constant, careful inspection of gauge glasses and the need for keeping oil out of the feed water is the same for all boilers, and the information and warnings on these points given in the paper might be read and heeded by all in charge of steam-raising plants.

The large audience showed that to many the chief event of the day was Mr. Percy R. Allen's lecture on "Large Gas Engines," presided over at 5.30 p.m. by Mr. Dugald Clerk, M.Inst.C.E. The lecturer commenced by describing the Otto cycle of working, and the general construction of the usual pattern of horizontal engine. The impetus given to the industry by the late Mr. B. H. Thwaites's demonstration that blast-furnace gas was a suitable fuel for gas engines was then mentioned, and the developments which have during the past fourteen years taken place on the Continent in the use of this gas, with large gas engines, were described. It was mentioned that the 600-H.P. gas-driven blowing engine shown at the Paris Exhibition of 1900 was still at work at Messrs. Cockerill's blast furnaces at Seraing. The two-cycle method of working, as developed in both the Körting and Oechelhäuser engines, was explained, and a number of slides gave a very fair idea of the present position of the industry abroad. The lecturer then dealt with the general design of large gas engines, as shown both in America and Continental practice, pointing out that the vertical pattern gas engine had been adopted to a far larger extent in this country and America than on the Continent.

The various methods of governing and the heat efficiency of the engine then received attention. As regarded the possibility of utilising some of the waste heat in the exhaust, the lecturer stated that: "An ordinary gas engine may be roughly reckoned to consume about 70 cb. ft. of producer gas, having a calorific value of 145 B.TH.U. per cb. ft., per B.H.P.-hour, and this will be found to raise about 2 lb. of steam at 70 lb. pressure for each B.H.P. exerted."

Passing on to the subject of gas producers, the early work of Wilson and Dowson, and the development of the suction gas producer, were referred to. The Mond and Duff bituminous coal producer was also explained, and since the lecturer has had under his control for the past seven years at Weston Point, near Runcorn, a plant of this type capable of gasifying 700 tons of fuel per week, it says much for its efficiency that he "can readily testify to the absence of trouble and the economy resulting from its use."

The question of ammonia recovery was then considered, and in view of the large yield—from 90 to 100 lb. of ammonia sulphate per ton of fuel gasified—and the probable increased demand for this compound for use as a fertiliser in the future, the lecturer considered their higher capital cost and maintenance fully justified for large plants.

The reliability of the gas engine was shown by the non-provision of spare plant in many Continental steel works dependent upon gas engines for their power, and the extent to which gas engines are being adopted may be ganged from the 24,000-H.P. plant at Bruckhausen, near Duisberg, and the 65,000 H.P. installed in one power house at Gary.

The lecturer then considered the relative advantages of gas and steam plants, and pointed out that in cases where the load factor was high the 25 per cent. increase which at present approximately represented the extra capital outlay on a 10,000-KW. gas-driven complete plant over a corresponding steam one was more than justified by the fact that the fuel consumption for a given output was practically halved, and he concluded by pointing out the possibilities of the oil engine when worked on the Diesel principle, mentioning that the coming application of the two-cycle system of working to the oil engine would largely increase its commercial value.

The last two lectures, given by Mr. T. R. Ablett and Mr. C. A. Ablett respectively, described a new method of teaching drawing, the aim being to develop any natural taste or originality the student might possess.

Remarkable results, as shown by the lantern slides, had been obtained with quite young children trained on this system, and there can be no doubt that, apart from the actual value of the power to draw, the trained faculty of observation of a student trained on this principle would be of great value in engineering work.

The reception, held on the terrace of the Imperial Tower at 5.0 p.m. by the Lord Mayor of London (Sir G. W. Truscott), was well attended, and at 7.45 p.m. the banquet was held in the Garden Club Banqueting Hall, under the chairmanship of the Hon. A. Stanley, M.P. Among those present were the Lord Mayor, Sir Fortescue Flannery, Sir Thomas Pile, Sir John Cockburn, Mr. Worby Beaumont, Mr. F. S. Courtney, Mr. Dugald Clerk, Mr. J. W. Orde, Mr. W. B. Bryan, Mr. J. Paxman, Capt. H. Riall Sankey, R.E., and Mr. J. Adamson.

After the usual loyal toasts, the chairman proposed that of "Engineering." Comparing periods within the recollection of many present, he spoke of the advances which had been made in every branch of engineering work, notably in telegraphs and telephones, and the varied developments of the internal-combustion engine which had rendered possible the recent conquests of the air, as well as of the depths of the sea. As evidence that in the advance of engineering, we, as a nation, were not lagging in the rear, he instanced the Assouan Dam in Egypt, which would last as long as the Pyramids, the Forth and Victoria Falls bridges, and the Transandine Railway in South America, which under British auspices was just being completed.

Mr. W. Worby Beaumont, in seconding the toast, explained why the gathering had been arranged, and Mr. F. S. Courtney, on behalf of the Executive, expressed the hope that the results would justify the gathering becoming a recognised annual function. Mr. J. W. Orde, referring to the progress made recently in this country in motor-car engineering work, stated that a few days ago a contract was signed in Paris for the supply of 800 British-made cars for the French market.

Mr. Cornish, in proposing the toast of "Mining and Metallurgy," emphasised the interdependence of the miner, metallurgist and engineer upon each other, and pleaded for more support for British—more particularly Cornish—mining projects, claiming that many of them were far sounder from a financial point of view than the much-boomed foreign schemes which so often ended in disaster.

Sir John Cockburn proposed the toast of "Architecture and Building," pointing out that the tendency in all modern buildings was to depend more and more on the engineer, the outside stonework becoming merely a covering for the steel and concrete lining within, and Mr. F. L. Rawson, M.I.E.E., that of "The Press."

NOTES ON TRADE ABROAD.

(*Continued from page* 374.)

A Foreign Missionary's Report.

FROM the *Canadian Electrical News* just to hand we gather that Mr. H. C. Siddeley, A.I.E.E., the London manager of the Lancashire Dynamo and Motor Co., Ltd., of Trafford Park, left Canada for home on August 13th, having completed a tour of the world in the interests of his firm. The enterprise and initiative of the Lancashire Dynamo Co. is not a new story to us nor is it unfamiliar to many of their friends engaged in electrical trade in this country, and we are sure that as a result of the tour of its London manager the business of the firm will be greatly benefited. Our contemporary remarks that Mr. Siddeley's trip was largely one of inspection, though he reports having also obtained a number of good orders. In Toronto the company are opening up operations through Vandeleur & Nichols, and the first-named partner in this firm (Mr. J. F. B. Vandeleur) was journeying to this country in company with Mr. Siddeley. The following is a brief statement of some of the things ascertained by the latter gentleman in the course of his globe-trotting:—

In India, he states, the chief development work is in the hands of the Government, but a great amount of business was to be expected soon, through the development of the collieries which are being opened up in Bengal. Large irrigation works are also being carried out, and they are being combined with hydro-electric schemes. In the Malay Straits the great tin mines are now being developed extensively by electrical power. In China, great railway projects are being developed, and their works are being electrically driven. In Johannesburg, Mr. Siddeley booked an order for a steam plant, which was shipped from England and placed in operation in the short time of seven weeks.

In Japan, Mr. Siddeley says, they are well advanced in matters pertaining to electricity. Most of the small towns have electrical companies in operation, but there is some municipal development of street railway operation. The city of Tokio has taken over all its street car systems and combined them in one system. There are a great number of water powers in Japan, and they are being extensively developed. In Hokkaido Island, to the north of Japan, a plant has been installed for the large steel works and gun factory, which Mr. Siddeley went to start up. His company installed a 3,000-KW. steam plant there with separate motors for operating each of the tools, 30 in all.

Speaking of Canada, Mr. Siddeley said, "I think that British Columbia, especially in the neighbourhood of Vancouver, will be an enormous centre for electrical enterprise." In Victoria his company installed an automatic booster.

A Canadian Booklet.

Last year our contemporary, *Canada*, sent out an expert salesman, Mr. Herbert J. Rodgers, as Trade Commissioner to inquire thoroughly into the conditions governing British trade with the Dominion. His observations were published in that journal in a series of articles, and they have now been produced in the form of a handy shilling booklet. The object of the handbook is to enable the British manufacturer to determine whether his goods are suitable for the Canadian market, how best he can introduce them, and what his rivals are doing. From a perusal that we have made of the contents, we can imagine that it might be interestedly and profitably read by anyone thinking of studying the market in person, but naturally it is quite impossible for a general salesman to appreciate the many special points of a more or less technical description that inevitably arise when he touches upon a market with which he has no direct familiarity. It is therefore not surprising to find that of electrical information relating to the market there is very little indeed, and what there is is hardly to be treated as a reliable guide. When the articles were appearing in our contemporary's pages, we "lifted" the electrical remarks and published them in our "Business Notes," and some of the statements were traversed very severely by an electrical correspondent who knew the Canadian electrical market intimately. Mr. Rodgers says: "The main demand for electrical goods is, of course, in traction (street cars, &c.), motive power for plants, &c., telephones and lighting"—the mere method of expressing himself is no more than one would expect—"In every one of these there is enormous development going on, and inasmuch *as there is comparatively little variation in electrical appliances and accessories in use in Canada from similar items in England*, the British maker should find a wider trade with ordinary attention to the market." It was the italicised words for which the Trade Commissioner was taken to task, our own contributor pointing out that the things in demand in Canada were not those sold every day in England. He showed what things are called for, and why, in our issue of April 23rd, 1909, page 668. If we turn over to the author's "Machinery" section we find observations which might appropriately have been substituted for what he says concerning electrical appliances and accessories: "The whole machinery problem is one that any reputable English firm should find it worth while to study on the spot, *find out local requirements*—Canada is a continent, not a county—and follow up the results of such investigation with an energetic campaign. The booklet contains many points which would, no doubt, interest the would-be traveller personally.

This all-important question of knowing the exact requirements of the market before you attempt to cater for it is very strongly brought out by Mr. F. A. McKenzie, who is now in Canada as a Special Commissioner for the *Daily Mail*, and is writing a series of notes on the "Land of Opportunity" in that newspaper. He tells a story of lines of trade that have been lost, because in a field where British firms thought they were secure, foreign competitors entered with the same sort of thing with a small difference which made it more acceptable to the Canadian purchaser. The "new thing" "took on," and when the British makers were urged to lay themselves out to retain the market by meeting the new requirements they refused, because they "were doing very well with things as they were." That particular market is now lost to the firm in question, purely as the result of that one act of refusing to move or be moved out of the satisfied rut in which they had got fixed. The special line was not in any way connected with electricity, but the case may be cited as one more instance of the imperative necessity that exists for studying closely and continuously the particular needs of a market, and offering for sale what is actually required, not what we would like to sell. If what we are already making fits the case, let us push it for all we are worth; if by a little modification it may be made more suitable, make the modifications for that market—was it in South Africa that a particular article would not sell until, under the advice of one who knew the whims and fancies of the people, it was embellished with a pretty little red label, and then it sold like wildfire? If what we make is unsuitable, either with or without modification, there are new lines that we can take up and fit in with our other manufacturing operations if we will.

American Exports.

Last week we referred to the American electrical export figures, and showed that the total of these exports for the year 1906-7 was 17¼ million dollars. It is amusing to find one of our contemporaries taking "a glance" through these figures, and saying, "our electrical demands from the United States are rapidly diminishing, being of the order of 17 million dollars in 1906-7, 15 millions in 1907-8, and 12½ millions in 1908-9, so that if these figures be indicative of our reliance on home products they are gratifying. But it is more than probable that they are caused by the general slump in our home trade." "It is more than probable" that our contemporary is a little out of it, seeing that the figures relate to the exports to all other countries as well as to the United Kingdom. The United Kingdom took 1½ millions in instruments and less than 1¼ millions in heavy electrical machinery in 1906-7, both of these sets of figures falling very considerably in the two following years.

Our contemporary will now admit that this country depends less upon the foreign manufacturer than it thought to be the case—or does it believe that, if our general home-trade revives, the American electrical exports to this country will go up by leaps and bounds? We do not believe they will do anything of the kind.

Tours Abroad.

Several years ago the Institution of Electrical Engineers arranged a series of tours in foreign countries where electrical engineering developments had taken place, which it was desirable, from whatever point of view one regarded them, for English electrical men to see. These visits were immensely enjoyed by all who took part in them, were very impressive and educative from the technical point of view, and confirmed the opinion that in certain directions Continental designers and manufacturers were in advance of British. The spirit of comradeship between electrical men in England, Switzerland, Germany, Italy, and the States, was notably fostered, and probably from our foreign friends we picked up a point or two which have leavened our own methods in some respects. All that is to the good, and we revere the memory of the lamented secretary of those days, who wore himself out in the interests of the Institution which he so faithfully served up to the hour of his death. We will not speculate upon whether orders went abroad which would have stayed at home had there been no visits—probably they did, but against that we set the gain already mentioned, together with the advantage of international fraternisation for all engineers. Those were not tours in search of business, they were tours in search of knowledge and instruction. We had all heard of things that were being done, and we wanted to see them for ourselves. Nowadays what we require is tours of quite another kind—tours in search of information regarding the openings that other countries are able to present for the British manufacturer to sell electrical machinery and apparatus. Maybe that in commerce we are all so much in rivalry with our fellows that we shall prefer to make our studies individually—of course, generally speaking, we do not make a practice of letting makers in the same line of goods know from whom we are seeking orders. Yet is it not worth while considering whether we might not nationally do better than we are doing if half-a-dozen, or a dozen, or a score or more, electrical men capable of exercising a sound and safe judgment and discrimination were to make a visit of examination to some of the markets that have been less cultivated by the British electrical manufacturer than they ought to be? We were advised by a Consular authority in Spain a few years ago to get a representative British electrical organisation to study the general position and prospects of that country. We supported the suggestion, but we have no organisation that could do it. The Institution of Electrical Engineers was named by the adviser, the National Electrical Manufacturers' Association was named by us, but nothing conjointly was done, though we have heard of one and another electrical exploiter who has since been personally the other side of the Pyrenees. Does the suggestion apply more forcibly to Spain than to a number of other countries that might be mentioned? Whatever benefit came to British electrical manufacturers nationally as a result, would come to them individually. Is there no good in the idea? Chambers of Commerce from other countries come here and our own Chambers repay the visits; but the electrical elements in these Chambers is, as a rule, either very small or it does not exist at all. We observe that the City of London International Commercial Association is going for a tour in France next month, visiting Paris, Rouen, Havre, Lille and Dunkirk, as it did the South of France in 1907. This is very good from a general commercial point of view, but is there any electrical element in it? The electrical trade, *that* is our concern, much as we rejoice at all general development. Individual enterprise in extending trade abroad there must be—that is indispensable whether we go in companies or not to get a general intimate idea of electrical possibilities; but the conjoint effort ought to improve the chances of the individual traveller.

Porto Rico's Future Electrically.

Our American namesake alludes to a Bulletin recently published by the American Census Department, regarding the electrical industrial position in Porto Rico. It appears that the electrical enterprises for the island are not yet extensive, but there is great promise for the future. Turbine and water wheel electric plants are operated by railway, light and power companies, the total capital expended upon these undertakings, excluding the telegraph system, being, roughly, half-a-million sterling. Only six towns are lighted by electricity, and the total arc lamps numbered 469, the incandescents 34,519, and the motors 61. Three electric street railways are operating and one is constructing. Electric traction is stated to be the most important electrical branch in the island.

"The operation is on a small scale as yet, compared with the progress in the United States, but the density of population, which is greater there than in the majority of the States, warrants the belief that the increase during the current five years will be much greater than for the preceding period. The output in current of the electrical generators reported for 1907 was three times as great as for 1902."

Foreign Trade in August.

As we go to Press the trade returns for the month of August are being discussed in the newspapers. The improvement in both imports and exports continues. The exports are better by 5·8 per cent. than in the corresponding month of 1908, this increase valuing at £1,772,024, making a total of £32,114,700. Electrical goods and apparatus imported show a decrease in value of £27,846, and there is a small decrease (£3,172) in exports of the same class. For the eight months of the year, however, the exports of electrical goods and apparatus other than machinery and telegraph and telephone wire, are better by £239,932. The chief improvement in exports occurs in cotton and woollen goods, and this leads one to hope that before long these trades will begin to feel a substantial benefit, leading them to modernise their mills electrically, and in some places to complete the electrical equipments that they set out upon when the late boom was too far advanced for them to get the full benefit from them. As the *Times* says, the exports have not yet "wiped out" the serious reduction shown during the first five months of the year, and they show a decrease of 3·7 per cent. In March, April and May the decreases were heavy compared with the corresponding months in 1908 and 1907, but "the year 1907 was a year of abnormally high figures, following two other very good years, and it is not surprising that during 1908, and a considerable part of 1909, there were reductions in our trade with foreign countries and British possessions, as a whole." In June the tide turned, and July and August both reflected improvement. The *Times* comments on the slight decreases recorded in iron and steel manufactures and machinery, thus:—"The sluggishness of these very important classes of goods appears to indicate that although the period of depression has come to an end, it cannot be said that the period of revival has actually begun." We believe that in following months it will be possible to trace the effects of revival in these items as well.

Continental Offices.

"To carry the war into the enemy's camp," is an expression often used by those ambitious to get into Continental countries competing with the foreign manufacturer on his own ground. We meet men who are convinced that tariffs notwithstanding, it would not be a Herculean task to sell British electrical machinery and other manufactures in Germany at competitive yet profitable prices. Others are of opinion that to go there to manufacture is more hopeful, but there does not appear to be much capital about for this class of venture, nor are we particularly desirous of helping in the establishment of electrical factories in other countries to give employment to the peoples of those parts. But the effort to sell electrical goods on the Continent is worth the making, and a Continental office or two is necessary if one is to build up and maintain a business connection there. We are interested to learn from a Coventry firm of machine-tool makers (Messrs. Alfred Herbert, Ltd.) that they are opening an office in Berlin next week in order to be able to deal promptly with inquiries received from Germany and Austria-Hungary for their line of labour-saving machine tools. A practical man will be on the spot able to talk intelligently and convincingly regarding these particular manufactures. We shall be glad later to hear what measure of success attends this new step, though we have little doubt as to a good reward being gained. It is for British electrical manufacturers of specialised lines to see how far it would pay them to go and do likewise.

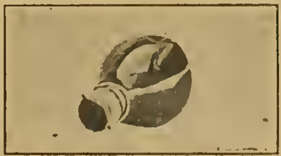
(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Curious Lamp Failure.

The accompanying photograph shows an extraordinary accident to an electric lamp bulb in use in Pinkston Tramway Power Station, Glasgow. It is an ordinary 100-volt carbon-filament lamp, and burned quite normally for weeks on one of the main engines. One morning it was found in the condition shown in the photograph. The glass, from some cause which cannot easily be determined, had become momentarily plastic, and it was dinted like an india-rubber ball. The bulb was not broken in any way, and externally was quite clean. Internally it was coated with a deposit of soot which rendered it quite opaque. The lamp was subsequently broken and the filament found to be intact.



N. B.

What is an Electrician?

The word electrician is a term that we hear very often used, and I should be very pleased if you would kindly insert this letter so as to obtain other readers' views on the subject, as I find the expression is very often used by, and to apply to, men in all classes of positions in connection with the electrical trade, *i.e.*, wiremen, arc lamp trimmers, motor attendants, electrical fitters, &c. In fact, it appears as if anyone connected with plant maintenance may style himself an electrician, whatever that may be. I cannot find where the term is recognised by any reliable authority. For instance, take the City and Guilds of London Institute and examine their programme, and we find that they have no courses of instruction for anyone styling himself electrician. Instead, they provide for two district callings, namely, electrical engineering for those who aspire to become electrical engineers; and, secondly, electric wireman's work, for those who desire to become wiremen, and the second year's work on the same subject for those whose ambition is to take charge.

1. An electrical engineer is one who has a thorough all-round knowledge of the trade, or should have.

2. A wireman is one who understands and is capable of the following, or should be :—

(Extracts taken from the City and Guilds programme, first and second year's work.)

Electrical Machinery, C.C. and A.C. Motors.—Principles of action; the practical importance of the back E.M.F. and conditions of producing it; field windings and their connections with the armature and the supply circuit, causes of breakdowns and their remedies.

C.C. and A.C. Dynamos—Their installation and running; regulation by resistance in the field circuit; principles involved; testing of dynamos and motors for insulation; temperature tests under load; testing for faults.

Starting Switches—No-voltage and overload release devices; principles involved.

Secondary Batteries.—Their installation and practical treatment; precautions in charging and discharging and testing same.

Magnetic Properties of Materials.—The magnetisation of iron by electric currents; permeability; the law of ampere-turns; electromagnets.

Electrical Properties of Materials.—Conditions which hasten deterioration.

Electrical Measurements.—Application of Ohm's law; methods of measuring resistance, E.M.F. and current.

Calculations of contact areas for switches and cross-sectional area for bus-bars, cables, &c.

Joints on cables up to ½ sq. in. sectional area; jointing and connecting of lead-covered cables, including V.R. or paper-insulated concentrics; the making of vulcanised joints.

In addition he is expected to have acquired sufficient knowledge of mechanical drawing and sufficient skill in hand sketching to enable him to make a dimensioned sketch roughly to scale, which would be understood in the works or drawing office.

Therefore from the foregoing I take it that the man who should have charge of plant running and maintenance, failing an electrical engineer, is the wireman, and not one who terms himself an electrician; yet often if a qualified wireman applies for a position in charge of plant, he is ignored because they want an electrician.

I should be very pleased to see other readers' views on the subject as to what constitutes an electrician. The City and Guilds do not appear to recognise this class of workman. The Electrical Contractors' Association only recognise the following: labourers, assistant wiremen, wiremen and charge hands (this coincides with the City and Guilds recognised classes of men). The Standard Electrical Dictionary does not mention the term.

Alpha.

[Our view is that a man who has qualified in the two years' course of training in electric wireman's work, and has acquired some experience in running electrical machinery, is quite correctly styled an "electrician."—Eds. E.R.]

Unemployment.

Much has been written from time to time regarding this subject. I wonder if the following concrete case will interest any of your readers.

I am 28 years of age, with varied experience at home and abroad on central station erection, shift and distribution work, and for this have good testimonials, &c.; yet, since February last, when I finished up as charge erector at several well-known stations, I have been unable to hear of anything. I have advertised, but it's almost waste of money; and as to answering advertisements—well, it's more than disheartening. The odds seem to be at least 100 to 1 whether your letter is even opened. The result is, September is here, the outlook is blank, and I cannot afford to idle the winter away. The only other alternative seems to be emigration. I am offered farm work in Canada, and, seemingly, shall be forced to take it on.

When I look round and see how some of the high and responsible positions are filled, it makes my blood boil to think that I (also others), an educated and essentially practical man, with good capabilities, am compelled to emigrate. There is something radically wrong when England forces men who would be valuable to her to leave her shores for pastures new. Possibly, if I cared to help to lower the tone of the profession by accepting station and plant work at 25s. a week, I might get something; but, as I always try to play "cricket," I don't intend to try. Farm work would be more creditable.

Omar.

September 6th, 1909.

Lighting Circuit with Earth Return.

Is it practicable to change from an existing electric lighting circuit which has an earth return and is of 110 volts 80 amperes D.C., extending between a private generating station and a private house ½ mile away, to A.C., and would there be any bad effects from the change-over?

The existing D.C. arrangement has run for 15 years with an earth return without giving any trouble, but the generating station is now being converted to A.C., and the current transformed down from three-phase 3,000-volt to single-phase 110-volt for this particular service. The location is a country village.

Puzzled.

September 4th, 1909.

[Earth returns for currents of this magnitude are rarely met with, though quite practicable in country districts, where there are no water pipes, &c., likely to be injured; but, with direct current, one would expect the earth plates to require renewal at rather frequent intervals. With alternating current this trouble would be reduced to a minimum, and the only consideration likely to cause annoyance would be that of interference with the Postmaster-General's property, particularly with telephones; even this, at 50 cycles per second, should not greatly affect private telephone circuits, but the P.M.G. is very jealous of his rights.—Eds. E.R.]

Electric Miners' Lamps.

I was pleased to see that my successor in charge of the electric miners' lamp installation at Fence Houses has contributed to this discussion.

Referring to his correction of my statement as to the proprietary of the colliery in question, I must point out to him that the Lambton group constitutes the Durham group, Lambton being the family name of Lord Durham. The Joicey group were interested in the Lambton, or Durham, group, hence my term Durham-Joicey group. The collieries under the joint control number about 16.

In his further correction he states that the Ediswan bulbs were ultimately found the more successful. This is welcome news. I can only repeat such was not my experience, which extended over 12 months and was gathered from three separate collieries.

It would add to the interest in this discussion if Mr. Turquand would communicate some actual results of his experience with the Ediswan bulbs, giving weekly figures over a reasonable period, and also stating at what collieries he has obtained such results. I should also like to hear of any successful working results from the adoption of the gas-detecting apparatus mentioned in his letter. His figures giving the working costs of the lamp he has himself designed, as also estimated by himself, appear to be quite impossible, and if such economical results could be actually attained in practice, there would be no difficulty in securing its adoption in almost every colliery in the country. The estimated working cost is given for installations of 2,000 lamps as 1·2d. per lamp per week.

In the first place, where are the collieries that would require this amount? If Mr. Turquand proposes to supply many collieries from one station, then labour charges alone would amount to the figure he quotes as the total working costs, including interest on capital. Bulbs averaging 800 hours' life, and costing only 8d. each, would mean an expenditure of ½d. per lamp per week; while an allowance of 1d. per lamp per week, for such items as renewal of battery plates, damaged cases, broken glasses, flexible connectors, worn-out and broken lugs, complete smashes due to falls, split ebonite cases, &c., including distilled water, sulphuric acid, lead rivets, and general repairing material—would be an exceptionally small cost, even if possible. An installation of this magnitude would involve an outlay to the colliery proprietors of £1,000.

Assuming that batteries would be charged in four sections —it would be possible to charge them in three—to meet the requirements of the different shifts at the colliery, a 5-KW. dynamo would be required to run almost continuously throughout the week. This item, even at a colliery, must be considered when dealing with working costs.

The total energy required to charge the batteries would amount to 400 B.T.U. per week, which, including oil, waste and separate attendance, would amount to ½d. per unit. This item increases the cost per lamp per week by ·1d.

Again, some allowance for capital expenditure must be included, which, at 5 per cent. on £1,000, adds a further ·1d. per lamp per week. An item involving ·1d. per lamp per week would be found in depreciation, which again, at 5 per cent. of capital value, would cost this figure. This would allow the value of the plant to be written off in 20 years, and must not be on any account omitted.

Here, then, we have a modest estimate of the working costs of electric miners' lamps—as those who have been concerned with costs will admit—running into a total of 3d. per lamp per week, and, in my opinion, it would be more prudent finance to increase this amount to 4d.; as is well known, many things crop up in practice which are never thought of in estimates. Besides these costs, we should have to make some provision against breakdowns.

Now, nothing is said of profits. Are the collieries to make their own lamps and batteries, or are they to be purchased from a company? In any case, it is not going to be done without further capital, which must add to the cost one way or another.

Giraldus Jones.

Birmingham, *September 6th*, 1909.

The New Theory of Electricity.

May an electrical engineer who has made a very close study of the principles of electricity, and who has been very actively engaged in its practice for over 35 years, ask the advocates of the new theory of electricity to give us some more proof than they have hitherto offered? I think everyone who has studied the subject will have noticed two important gaps in the chain of evidence. The writer of your very appreciative article in this week's issue of the ELECTRICAL REVIEW notices one, the complete absence of any knowledge of the positive electron. This gap may fairly be taken as one that could be filled in later on. There is another and far more serious gap, however, viz., the proof that the negatively electrified corpuscle and negative electricity are one. In an article that was written by Prof. Fleming, seven years ago, he deals with the matter thus:—"At the present moment we have no evidence that we can separate the electron charge from the corpuscle itself. If this is the case, then the corpuscles taken together constitute for all practical purposes negative electricity. . . . . For this reason it is sometimes usual to speak of the corpuscle carrying its charge of one electron of negative electricity simply as an electron, and to drop all distinction between electric charge and the vehicle in or on which it is conveyed." Apparently upon this, which on the face of it is a pure assumption, have been built up all the somewhat startling theories as to electric currents, &c., that have followed. Surely the acceptance of a scientific theory requires more substantial proof than this. If we take the case of heat, for instance, a heated body flying through space is not heat; why should we be asked to say that an electrified body flying through space is electricity?

A careful study of all that has been written on the subject will, I think, bring any impartial thinker to the conclusion that nothing which has been stated by the advocates of the corpuscular theory of electricity is inconsistent with a wave theory of electricity.

We have a wave theory for heat and light, which has been accepted for a very great many years. Electricity is as easily converted into heat or light, and the converse, as heat is converted into light, and the converse; why should not the wave theory of heat and light be extended to electricity?

I join heartily in the appreciative references in your article to the splendid work which has been done, particularly by Prof. Rutherford, but one cannot help making two observations upon them. When dealing with such very minute bodies, such very minute quantities, as those who have been working with radium have handled, can they be quite sure that their measurements are correct; and also, that they have eliminated all sources of error, not only in measurement, but that bear upon the important question of the explanation of the phenomena? The other observation is, while one can sincerely admire the skill with which, according to his own account, Prof. Rutherford has handled the α particle, one would again remark that an electrically-charged particle is not electricity. A procession of electrically-charged particles would imitate an electric current, but I think we should ask for further evidence that they actually constitute an electric current, and that the phenomena are the same as those produced by the ordinary working currents.

I think one reason for the divergence which I venture to think exists between the views of electricity held by what are called advanced thinkers, such as the present President of the British Association and his followers, and those held by practical electrical engineers, is that the advanced thinkers have come to the study of the question from the induction coil, and the Crookes's tube; the theory has been built up directly from a fact, which Crookes noted a good many years ago, that the cathode rays carried electricity; while practical electrical engineers have approached the study from comparatively low-tension electricity. With the advance of electrical transmission through long distances, the practical men are getting on to the ground of the advanced thinkers, and the work that is being done upon the corona, observed round high-tension transmission lines, ought to be of great value in helping to solve the question "What is electricity?"

I do not know whether I am correct in supposing that Sir Joseph Thomson, Sir Oliver Lodge, and those who work with them, will consider that practical electrical engineers have no concern with advanced theories, except to accept them when offered. If so, I would remind those gentlemen that the practical engineer must, of necessity, be the final and absolute judge of their work. The theory of to-day, if correct, may be the working hypothesis of to-morrow. The day has long gone by when the practical engineer worked from hand to mouth. The work which Sir Oliver Lodge and others have done in educating the engineers who have come into practical work during the last 25 years, though it may not always have been as wise as some of us would have liked, has produced one effect, viz., that the modern engineer is also a scientist in the fullest sense of the term. He has not the time to investigate problems in the manner they are investigated in a laboratory, but he is constantly thinking backwards, referring every new phenomenon which comes under his notice, and they are constantly cropping up in practical work, right back to first principles. It should also be remembered that every large firm has now its laboratory, in which probably quite as valuable work in demanding its secrets from nature is done, as in some of the college laboratories.

I trust that the remarks that I have made will be taken in the sense in which they are written. I do not know if Sir Joseph Thomson or Sir Oliver Lodge sees the ELECTRICAL REVIEW. If not, I trust that some friend will point out to them the fact that practical engineers look askance at their theory, and ask that the two gaps in the chain of evidence, and particularly the one connecting the corpuscle with electricity, shall be filled.

Sydney F. Walker.

Bath, *September 6th*, 1909.

[The answer to Mr. Walker's question regarding the separate existence of the corpuscle, or unit quantity of negative electricity, is given in Sir J. J. Thomson's address. The whole of the mass of the moving corpuscle, it has been shown, is due to its charge; the conclusion seems unavoidable that the corpuscle *is* the charge—unless our correspondent is prepared to dispute the accuracy of the experimental data. There is no suggestion that the α particle is electricity; it appears to be an atom of helium, carrying a positive charge.—Eds. E.R.]

Naval Voltages.

A few lines in further reply to "The Writer of the Article." The summary of apparatus installed in a warship, as given in my previous letter, was a general and not a specific one, and would roughly apply to as far back as the *King Edward VII* class, which earlier boats can hardly be classed "the very latest type." My letter does not describe the electrical installation as it may be expected in a few years' time, but as it is, and, generally speaking, has been for the past six years. 100-volt ships are a long way in the majority, not 80, which latter are rapidly becoming the exceptions. Personally, I should think anyone wishing to get an idea of naval electrical practice, would not choose much other than a fairly modern ship to look over. Ships prior to *King Edward VII* class carried little electrical apparatus, in comparison with that class, and later. Wireless telegraphy was not in use when the 80 volts ruled as standard, but, as stated in my previous letter, was taken back to 80-volt ships.

In conclusion, I am not aware of having used personal invective. Further, I have no desire to parade my knowledge, but deem it necessary to correct an article written in evident ignorance of the subject, especially when such article makes light of the ordinary intelligence possessed by those professionally engaged in naval electrical matters.

H. P. B.

Long-range Electric Alarm.

Can you, or any of your readers, inform us if there is an electric alarm on the market capable of being heard over a radius of 1 mile? The apparatus would be fixed on the exterior of a building in the centre of a town.

Bowden, Higlett & Co.

Guildford, *September 6th*, 1909.

X-Ray Tubes.

Mr. Bastian's letter in your issue of August 27th is surely written under some misapprehension, because I have never heard it suggested that the vacuum in a Geissler tube would change in any way in the absence of any leakage through the walls of the tube.

I have often sought some explanation of the change in vacuum in an X-ray tube, and shall be glad if Mr. Bastian, or any of your readers, can suggest something less abstruse than that it is due to "ionising action," which latter is in itself not too well understood.

I may not specifically describe the apparatus referred to in my last letter, but I may say here that it is designed to contain a liquid in a sealed-glass vessel, through which platinum leading-in wires have been used carrying very small currents—considerably under 1 ampere.

My trouble is that the liquid is very apt to leak out around these leading-in wires, and I cannot understand why there is apparently more difficulty in making these seals than there is in making the seals of an incandescent lamp. The apparatus has been made by skilled glass-blowers, and the trouble certainly cannot be ascribed to careless workmanship.

Jacey.

A Supply Company's Enterprise.

I beg to bring to your notice, and to the notice of the electrical contracting trade, the unfair methods that are being made use of by the County of London Electric Supply Co., Ltd., to cut up the electrical contractors in their district. They are not only supplying transformers, but their agents are now engaged in canvassing private people and shopkeepers with fittings and Osram lamps. All that is left for the contractor is a job worth a few shillings for fixing, &c. How long this will be left for him is an open question, for now the thin end of the wedge is inserted I should not be surprised to learn any day that they had started a wiring branch. Their mode of business is especially hard upon small contractors, men who, by their persistent canvassing, have secured hundreds of customers for this company. Another flagrant case against them is that during last autumn, when metallic-filament lamps and transformers were "going great guns," and contractors were beginning to see plenty of business ahead, this company sent a circular letter to their customers advising them not to alter their mode of lighting as they had proved it was no saving (poor contractor). However, finding it did not stem the tide much, in a couple of months they performed a wonderful feat, turning a somersault and coming down on the side of the M.F. lamp and the transformer, canvassing the very clients whom they had tried to turn against them, and pushing their transformers (on the hire system) for all their worth. Now, Sir, what can be done when a large company tries on such dirty tricks? Verily, it looks rough on tallymen and hire-furnish people if this company are set upon improving (?) business. I should be pleased to learn the opinion of other contractors who find, like me, that they are being hit by this unfair competition.

Putney Contractor.

Technical Classes in the Daytime.

We desire to advise those shift engineers who have written to you on the subject of day classes, and also those who have not written, but who nevertheless have felt the same need, that our Correspondence Courses were specially drawn up to meet their requirements. We have never claimed that tuition by correspondence is better than oral tuition given by the same teachers, nor do we claim that a student, after taking one or more of our courses, will be able to command the salary of a managing director, but we have gratifying evidence from our students that our lessons have been of real service to them in their every-day work. There are numbers of people engaged in the various branches of electrical engineering who cannot attend either day or evening classes, and to all such we shall be glad to send particulars of our Correspondence Courses on receipt of name and address.

The British Correspondence School of Electrical Engineering.

London, W.C., *September 7th*, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A New Electric Flasher.

An electric flasher of a new type has recently been brought to our notice by the inventor and patentee, Mr. C. H. Jukes-Brown, of 76, Weston Road, Strood. The arrangement is exceedingly simple, and its mode of operation can be gathered by reference to the diagram (fig. 1). It consists essentially of a zinc tube A, surrounded by a resistance coil B, which in operation alternately heats and cools the tube, the movement of which (due to expansion and contraction) is communicated to a bell-crank lever having at one end jaws carrying adjustable screws, L, C. Screw L has an insulated point, while screw C is uninsulated.

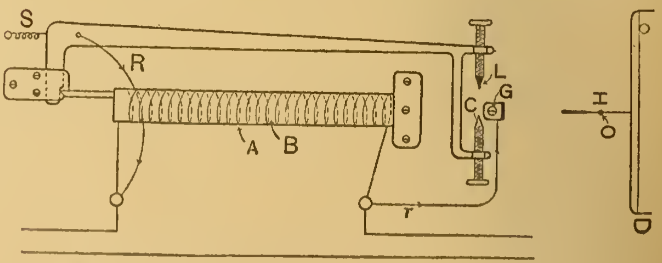


Fig. 1.—Electric Flasher.

Between the screw points is suspended a contact arm H, pivoted at O (see end view), and resting on support G. This contact maker carries a small ball race, and, of course, lies in a plane at right angles to the diagram, and central with the two screws.

In operation the oscillatory movement of the lever swings the contact arm H to just beyond the middle position, when, the balance being upset, it tilts over to the opposite contact, and *vice versa*. The making and breaking of these contacts successively completes circuits *via* the resistance (when the lights go out), or *via* screw C, lever and wire R direct to the lamps for lighting them. The to-and-fro motion of the ball gives a quick make and break, and tends to keep pressure on the contacts. By adjusting the distance between the screw points the flashing intervals can be varied from a few seconds to as many minutes. The device is only 9 in. long over all, and the inventor suggests that its operation alone would prove an attraction for shop windows.

A Petrol-Electric Riveter.

Somewhat of a novelty in the way of riveting machinery is the Ryerson internal-combustion riveter, a self-contained apparatus designed for the use of gas or liquid fuel. The essential parts are a cylinder and piston, the latter coupled by toggle levers to the head of the die; also a small electric motor mounted on the cylinder, which drives a little carburetting pump. To start the machine the operating lever is thrown over, switching in the motor, which pumps a carburetted charge into the cylinder, forcing the piston forward and causing the die head to descend on to the rivet. This arrests the motion of the piston, causing the pressure to rise in the cylinder, and operates an automatic device which cuts out the motor and at the same time ignites the cylinder charge, thus closing the rivet head. The reversal of the operating lever opens an exhaust valve, allowing the burnt gases to escape, the piston being returned to the head of the cylinder by means of a spring in the toggle mechanism.

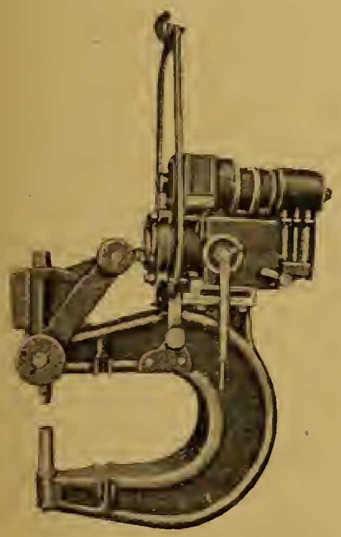


Fig. 2.—The Ryerson Riveter.

The machine is shown in fig. 2; it is very portable, and its action is so rapid that rivets are driven at their full heat.

An auxiliary control lever is provided, by means of which the cylinder charge and resultant pressure on the die can be regulated to suit the condition of the rivet, thus doing away with the necessity for uniform heating of the rivets.

The machine will drive 4,000 ¾-in. rivets per gallon of petrol.

Auto-Transformer Switch.

We have received particulars of their automatic auto-transformer switch from Messrs. D. Burr & Son, 85, Gracechurch Street, E.C., who are sole agents for this device. Its mode of action is shown by the diagram here given; when all lamps are off, the switch is opened by gravity, but when a lamp is switched on, the fine wire coil in circuit between A and B closes the switch, completing the circuit between C and D through the thick-wire coil, which holds the switch in. The lamps are then connected across half the transformer and the transformer across the mains, while the fine-wire coil is cut out.

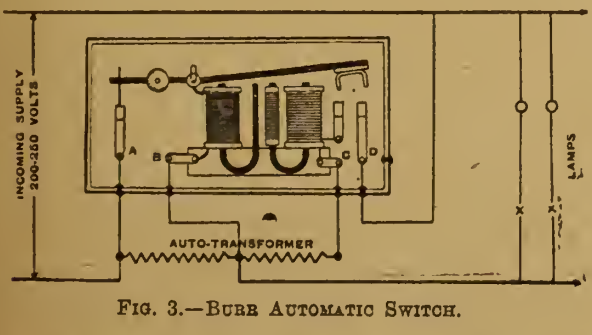


Fig. 3.—Burr Automatic Switch.

The switch is built up on an oiled slate slab and mounted in a cast-iron case with glazed front, having porcelain bushes for the incoming leads. No special wiring arrangements are necessary with this apparatus, and it will operate when a single 16-watt metallic-filament lamp is switched on or off. The pressure drop over the series coil is negligible. The apparatus may be employed in conjunction with any of the auto-transformers at present on the market. It is claimed that the complete apparatus is very strong, and not likely to get out of order, while it is quite silent in working and absolutely reliable.

"Therol" Electric Water Heater.

Quite a new departure from the beaten track has been made by Messrs. Spagnoletti, Ltd., of Goldhawk Works, Goldhawk Road, W., in their electric water heater. When invited to inspect this device at the firm's new West-End showroom, we at first regarded the proposition to heat water with electricity as one of those luxuries reserved for the very rich, for the high specific heat of water entails a consumption of energy which, unless paid for at a very low rate, renders the cost exorbitant. Messrs. Spagnoletti's proposal, however, was found to provide a novel and original solution of this difficulty. In brief, the apparatus consists of a block of cast-iron, which is heated up by a small but continuous electric current, thus storing energy. When the water is drawn off

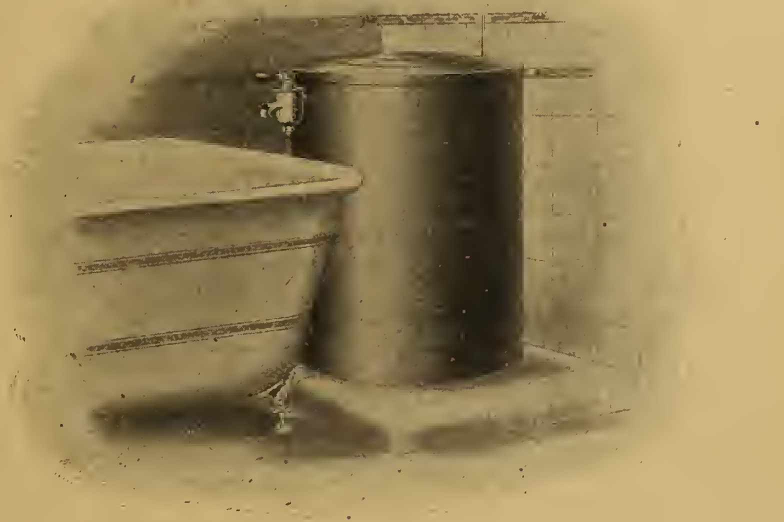


Fig. 4.—"Therol" Heater in Bathroom.

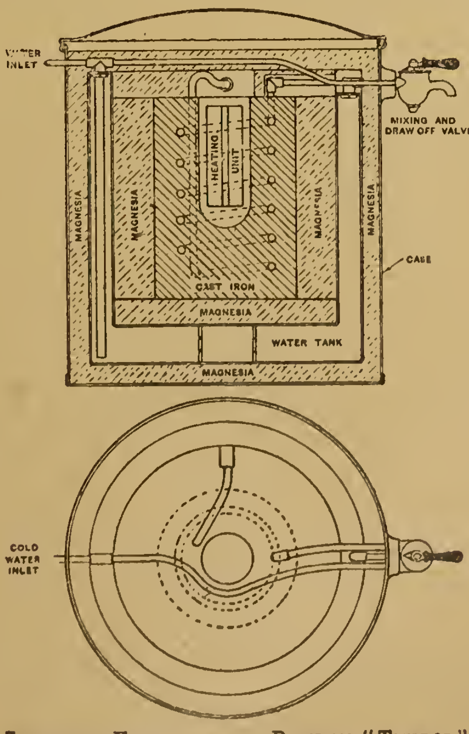


Fig. 5.—Sectional Elevation and Plan of "Therol" Heater.

it is heated while passing through the hot block, the temperature of the outflow being regulated by a special mixing valve.

Fig. 4 shows the complete apparatus installed in a bathroom, fig. 5 gives a plan and section of the heater, and fig. 6 shows the construction of the mixing valve. The heater consists of a block of iron weighing about 2 cwt. (25-gallon size) cast round and upon a spiral tube, through which the water flows. A cavity in the top of the block receives the heating element, which absorbs 200 watts continuously, and the whole is surrounded by a thick layer of heat-insulating material, consisting mainly of magnesia. As an economiser, or "feed-water heater," an outer tank is provided, through which the water passes before entering the spiral, and this again is heavily lagged, while a polished copper case further retards radiation. When no water is drawn off, the temperature of the iron block may reach a maximum of 500° F., at which temperature the radiation losses equal the input; thus the block and heating element can never attain a dangerous temperature, and the outer case remains only moderately warm.

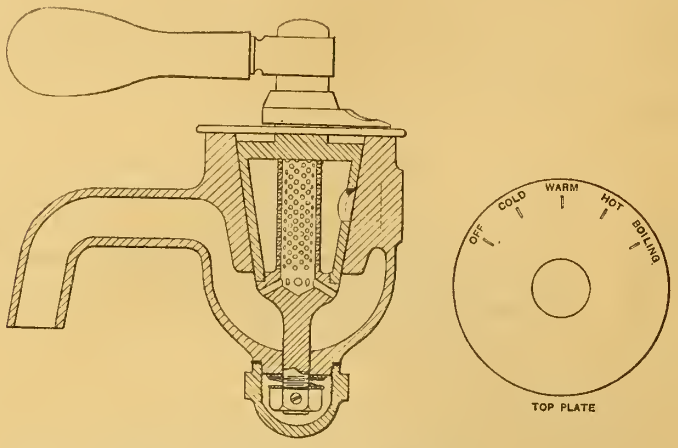


Fig. 6.—Section of Mixing Valve, and Dial.

As water passing through the block necessarily becomes superheated steam, the mixing valve is an essential feature of the system, and the inventors found it necessary to devise a new pattern to satisfy their requirements. As shown, this consists of a hollow plug working in a conical seat, having three inlet apertures, connected respectively with the cold, the luke-warm (economiser) and the hot supply pipes. A pointer attached to the plug indicates five stages on a dial, from "off" to "boiling," which insensibly merge into one another, so that the temperature of the water is under perfect control. To ensure thorough mixture of the hot and cold supplies, a difficult but essential condition, the incoming streams are made to pass into a perforated tube and out again by other perforations in the apex of the plug, with the result that effectual mixture is obtained.

It is pointed out by the makers that as the input to this device is constant, the current need not be put through a meter, and it possesses a load factor of 100 per cent., so that central-station authorities should welcome it as a consuming device; further, it may be cut off during peak hours, without much affecting the hot-water supply, thus further cheapening the cost of generating the energy used, or it may be connected with a cooking circuit in such a way that current is diverted from one to the other as required, keeping the load constant. Suppliers, therefore, may justly be asked to charge even less than 1d. per unit thus used for heating water. As regards the performance of the apparatus from the consumer's point of view, the 200-watt size heats 25 gallons of water per day from 50° to 110° F., a larger quantity to a lower temperature, or a smaller quantity—9 gallons—to boiling point, according to the mixture effected by the valve. Greater quantities can be drawn off in one day, up to a maximum of about 37 gallons at 110° or 14 gallons at boiling point; but then the quantity available next day will be correspondingly reduced. The heater can give its full output after one day's continuous storage of energy. Owing to the system of lagging adopted, an efficiency of over 90 per cent. is claimed, with an average wait of 8 hours between draw-offs. The 200-watt (No. 1) Therol heater measures about 2 ft. each way; other sizes are in course of preparation.

On a schedule of £1 per kilowatt per quarter plus ½d. per unit—a scale actually quoted by a number of stations—the cost of energy would average 0·61d. per unit, or a total of £4 9s. 1d. per annum for 25 gallons of hot water per day, and this is said to be equivalent to gas at 3s. per thousand cubic feet. The "Therol" system is described in admirably compiled pamphlets issued by the company, and is worthy of the close attention of station managers.

D.G. Enclosed Arc Lamp.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., are placing on the market a single-enclosure lamp of their own registered design, as shown in fig. 7. This is of the shuntless type, fitted with a patented device to prevent the lamp burning out of balance. The case of the lamp is dark green, with a polished copper spinning, giving the lamp a well-finished appearance. The case is also practically airtight, rendering it specially useful for dusty positions. It is well adapted for hiring-out purposes.

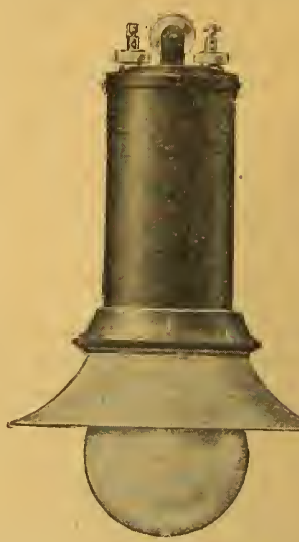


Fig. 7.—D.G. Enclosed Arc Lamp.

The firm's price list No. 148, a copy of which has been sent to us, gives details of several of the leading makes of flame lamps.

Spiral Self-Centring Chucks.

Mr. Charles Taylor, of Bartholomew Street, Birmingham, has sent us particulars of his patent chucks, which are usually made with three jaws. He has also brought out a four-jaw chuck, which we illustrate in fig. 8, and for which the following advantages are claimed as compared with the three-jaw pattern:—It is well adapted for holding square or octagon bars, castings, &c.; it is far more efficient for very heavy work on round bars that are practically true, such as drawn steel, because the tendency of the bar under a heavy cut in a three-jaw chuck is to wedge itself sideways between the jaws, putting great stress upon them and loosening the grip. The four-jaw chuck is free from these objections, and has an equally firm initial grip.

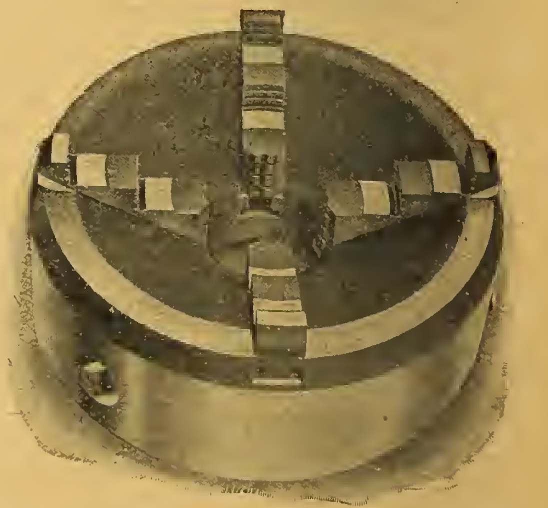


Fig. 8.—Taylor Patent Spiral Self-Centring Chuck with Four Jaws.

A SIMPLE METHOD OF LOADING A TRANSFORMER.

Several methods of testing transformers under full load conditions, without the use of load resistances or the expenditure of the energy corresponding to the full-load output, are in use, but most of them involve the use of a second similar transformer, or at least of some form of auxiliary transformer. It is, however, possible, as is pointed out by Dr. Benischke in *E. & M.* for July 4th, to test a single transformer in this differential way without the use of auxiliary apparatus, provided that one of the windings can be split up into two approximately equal parts. This can be done in most transformers without trouble. If the two parts have exactly equal numbers of turns, and are connected together at both ends in such a way that their induced voltages oppose one another, they will each set up the normal voltage, but no current will circulate in them. If, however, one number of turns is slightly in excess of the other, a current will circulate round the closed circuit, of sufficient amount to dissipate this excess voltage by combined resistance and inductive drop. The necessary excess of voltage required to cause the normal full load current to circulate can be readily obtained by winding a few additional turns on one of the limbs or on the yokes, or, if tappings are available, a few of the turns of one limb can be omitted.

The connections are shown diagrammatically in fig. 1. The number of auxiliary turns should be sufficient to give a voltage equal to the short-circuit voltage of the transformer, and then the correct full load current J_2 will circulate in the secondary. At the same time, since the normal supply voltage will be applied to the primary, the transformer will be working under normal flux conditions. The whole of the losses, and only the losses, are supplied through the primary, so that its current is, of course, low, and depends only on the amount of the losses in copper and iron, and on the leakage flux of the transformers. The conditions during the test are, therefore, not the normal full load ones, since the primary copper losses are practically those corresponding to the no load instead of the full load current. This detracts from the value of the method for temperature tests. The slight extra loss in the auxiliary turns is not usually appreciable. The method is applicable to both single-phase and multiphase transformers.

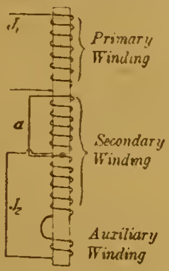


Fig. 1.

EARTHING THE "NEUTRAL" OF THREE-WIRE SYSTEMS.

[COMMUNICATED.]

The question concerning the extent to which the middle wire of a three-wire system should be earthed has been much discussed, and very different opinions on the matter are still prevalent. There can be little doubt that the main should be earthed to some extent, but beyond this bare principle there are many alternatives and difficulties. The Board of Trade regulations in this country are that the middle wire of every three-wire system shall be earthed at the generating station and efficiently insulated over the rest of its length. As is shown below, either such earthing, or complete earthing, over the whole length of the main is necessary. If the earth at the generating station be through an appreciable resistance, as is advisable for reasons mentioned later, this earth should be the only one on the main, which should be carefully insulated at all other points. If, however, a very low resistance earth be preferred, then the main should be earthed throughout its length, a number of local earths being undesirable. A permanent very low resistance earth is open to objections, and below is mentioned a system of earthing which combines the advantages of "dead" earthing and of earthing through resistance, providing due care be taken to maintain the insulation of the neutral conductor.

The main object of earthing the neutral is to prevent the negative outer conductor from gradually assuming earth potential by electric osmosis, and so forcing the positive outer to 400 or 500 volts above earth. Not only would the insulation be unduly strained in the latter eventuality, but also the B. of T. regulation, that no part of a three-wire lighting system shall be more than 250 volts above earth, would be violated. It is, however, to be noted in passing that the St. Pancras three-wire system ran for about 13 years with an unearthed neutral to which no fire or accident of any sort was attributable. The B. of T. has since insisted on its regulations in the matter being observed in this, the only notable instance of their disregard of which the writer is aware.

The middle wire of a three-wire system should never be capable of other than intentional interruption—*i.e.*, a switch should be placed at the central station or sub-station to allow of the disconnecting of the neutral from earth for testing purposes, but it should be impossible for the middle wire circuit to be *opened* at any part of its length by fuses or cut-outs (though in certain cases these may be used and shunted by resistances which provide alternative paths on the operation of the fuse or circuit breaker). Further, the middle wires of various distributing sections of feeder should be thoroughly interconnected, the outer mains being isolated, section to section, in the usual way. The necessity for the observance of these rules will be readily understood. The middle wire of a three-wire system is a "balancing" conductor, and any interruption of its continuity will allow the pressure balance of the system to be disturbed unless (which rarely happens) the load on the two sides is equal. Though complete interruption of the middle wire or the occurrence of any very heavy current flow through it, such as would be caused by a fault on either of the outers, is undesirable on the above grounds, yet, allowing the heavy current to flow uninterruptedly till the fault is isolated, is liable to cause serious damage to the cable sheath and insulation near the point of entrance of the current. Hence the most satisfactory form of earth connection, where the middle wire is well insulated except at the station earthing point, is that shown in fig. 1. A suitable resistance, usually a bank of lamps in parallel, capable of carrying 10 to 15 amperes at the normal pressure between either outer and the neutral, is shunted across a fuse and switch as shown. The fuse F may, in such a case, be of 50 amperes capacity; the switch S is necessary to enable safe renewal of the fuse; an isolation switch should be provided for use when testing the neutral.

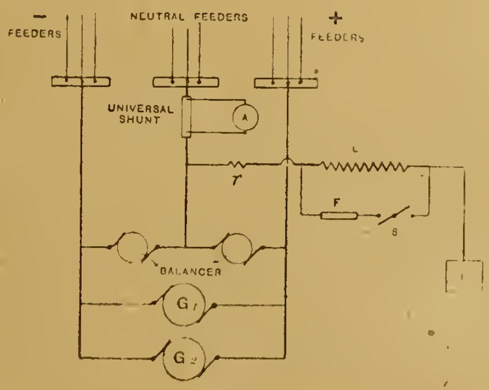


Fig. 1.

On the occurrence of a fault to earth on either outer, the current *via* F S rises, and, on its exceeding 50 amperes, F blows. The current flowing is then diverted *via* L, being thereby so reduced as to avert what might possibly have resulted in a station shut down and, at any rate, minimising the damage due to the fault. The damage done is, of course, considerably greater than it would be were the neutral entirely disconnected by the opening of F, but the advantage of retaining an earth connection, though of higher resistance than initially, is as follows: Directly the fault is removed by the opening of the fuse, cut-out or switch controlling it, the middle wire, being still earthed, will almost restore the normal potential and potential difference conditions. Otherwise, the entire disconnection of the neutral by the failure of F would permit the fu normal P.D. between the outers (400 to 500 volts) to exis between the sound "outer" and earth after the isolation of the fault and pending the replacement of F. By employing such a shunt path L, greater convenience of working is obtained. Intermittent faults constitute a great nuisance if their occurrence always involves the manual replacement of a switch before the middle wire can again become fully operative as a balancer. In the latter case, a heavier cut-out current would have to be allowed than in the arrangement of fig. 1, to prevent too frequent operation of the safety devices. Owing to the detrimental effect of heavy earth currents, this is a serious disadvantage. It may sometimes be advisable to insert quite a small resistance *r* in series with both branches (L and F, S), but in general the "dead" earth *via* F, S is preferable for normal working, L being cut in automatically should the earth current assume values likely to damage the cable sheathing, &c., at the point of its inflow. The total resistance of the path *r*, F, S to E should not exceed 1½ to 2 ohms.

Where three-core concentric cables are employed, the outer being, of course, the neutral, it is usual to earth the station end of the middle wire as above, thoroughly maintaining its insulation at all other points. As an alternative it has been recommended to lay the cable with the outer conductor, covered with a lead sheath, to protect the copper from corrosion, but in direct electrical contact with the earth throughout its length (either literally, or in effect, by very frequent bonding).

The only objection to this course is the possibility of very heavy earth currents flowing on the occurrence of a fault on the outers, the heavy current damaging both the cables between which it flows, as well as any other cable near.

Where metal-sheathed cables are employed, they should be thoroughly inter-bonded, and bonded to water pipes at frequent intervals, so as to ensure metallic paths between all possible failures of insulation.

In this way the prolonged flow of small "fault" currents, capable of doing a deal of damage before their detection, is avoided. All faults, as a result of the metallic paths between them, develop into "clean," easily-localised breakdowns.

If the middle wire be insulated at all, it must be insulated thoroughly. Otherwise, owing to the earthing resistance *r* at the station (if any), and the resistance of the cable itself between the station and any particular fault, the potential of the neutral at faulty spots in its insulation will be above that of the earth, and hence earth currents will flow from them.

This statement only holds absolutely if the current in the middle wire is the same at every point; local equalising currents may set up potential gradients more or less accentuating or annulling the P.D. produced, as above; in general, a P.D. + or − will exist at every fault on the neutral main, and hence leakage currents will flow. These leakage currents, besides the electrolytic damage they cause, have been known to char, and even fire, the insulation, and melt the sheathing. Again, between two such faults in the "neutral" insulation, leakage currents may flow, the available P.D. being the net voltage drop in the intermediate length of cable, and the path frequently taken by the current being the sheaths of adjacent cables. Electrolytic, or worse, damage again ensues.

The extreme importance of thoroughly insulating the middle wire and of bonding all sheathed cables together and to earth at close intervals cannot be too strongly insisted on.

If the middle wire is not thoroughly insulated throughout, except at the station earthing point, it should be nowhere insulated, being laid bare and completely earthed; the objection to this course has been given.

A "short" or very heavy load on one side of a three-wire system tends to raise the pressure across the other side, and to minimise this tendency the third wire should have as low a resistance as possible. This is secured, with minimum expenditure of copper, by solidly inter-connecting the third wires of all distributing sections. This will in any case be performed, to some extent, by the earth itself, but a definite metallic connection gives the lowest resistance.

However low the current in the middle wire may appear at the station as read by A (fig. 1), this current varies from point to point along the neutral, and some sections of the conductor may temporarily carry very heavy equalising currents. For this reason no part of the neutral should be fitted with fuses, and it is a good plan, desirable also for other reasons, to fit all the consumers' switches and fuses on the outer mains, leaving the neutral quite clear, and hence always at, or only a few volts above, earth potential.

The middle wire insulation should be very frequently tested, and must be kept at a high value for the reasons already cited. Where this main is intentionally earthed at the station, there is a great tendency to ignore this precaution, all faults and the damage due to them being, in consequence, rapidly aggravated. Besides the deleterious effects of such faults as regards electrolysis and heating, they inevitably lead to attraction or repulsion of moisture by electric osmosis. In the first case, the fault is aggravated; in the second, weak spots in adjacent cables are fed with moisture. Concentric cables with neutral outers are, on developing a fault in the latter, protected from the rapid formation of faults to the inner cores by osmotic repulsion of moisture from the second conductor, which is usually made the positive "outer" for this reason.

Owing to the very variable magnitude of the "neutral" current, any ammeter used in this conductor, and such is highly desirable as indicating the state of balance of the system and the existence of faults on the outers, must be of wide range. To secure this conveniently and with reasonable accuracy throughout the scale, A should be a low current instrument shunted across a universal shunt of suitable ranges. The instrument is normally left across the lowest resistance shunt for safety.

Calculations regarding Neutral Earthing Conductors.—The chief of these concern (*a*) the cross-section to be allowed in the earth wires; (*b*) the resistance to be included in the earth circuit.

(*a*) *Cross-Section of Earth Conductors.*—This area is naturally proportioned to the maximum current that is likely to flow. Assuming this current on a liberal basis a section of not less than 0·00155 sq. in. (1 mm^2) should be allowed per 10 amperes to be carried. This, the V.D.E. rule, corresponds to a current density of 6,460 amperes per sq. in., which is permissible only if the currents producing it are very intermittent and far above the normal. A minimum section of 0·0248 sq. in. (16 mm^2) should be used in any case. On the above basis, this suffices for maximum earth currents up to 160 amperes. The earth wire must be protected against mechanical and chemical injury, and is connected to a suitable earth plate or grid of any recognised design, size and method of installation.

(*b*) *Resistance to be included in the Earth Circuit.*—The desirability of some resistance in the earthing circuit, even though, in some cases, it may cause greater damage at a fault than would occur were the middle wire completely disconnected by the blowing of the fuse, has already been explained. The magnitude of the allowable earthing resistance is not specified by the B. of T. regulations, but it is generally convenient to employ a permanent resistance *r* (fig. 1) of 1½ to 2 ohms in addition to any greater resistance which may be arranged to come into circuit on the blowing of a fuse (see fig. 1). The exact magnitude of the latter emergency resistance cannot be specified here. Rough proposals regarding it have already been made. The higher it is, the less will be the damage done at and near the fault after the opening of the direct earthing path F, S—the employment of a considerable resistance prevents any possibility of the damaged section being exposed to excessive currents before isolation or during localisation. Too high a resistance is, however, undesirable as detracting from the potential balancing effect of the neutral on the occurrence of a fault (see Table I). The design of the earthing resistance as regards temperature rise will seldom offer difficulties owing to the extreme intermittence of its service. As already mentioned, a bank of lamps grouped in parallel to carry 10-20 amperes at half the voltage between outers, forms a suitable and conveniently erected resistance. The fact that such a resistance automatically announces its coming into circuit, is of minor importance, other signals of a breakdown on an outer not being wanting.

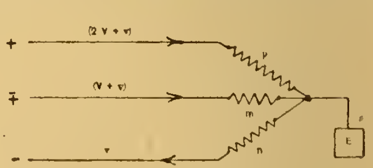


Fig. 2.

The exact magnitude of the permanent resistance *r* in the earth circuit (fig. 1) is of considerable importance, since this determines by how much the neutral conductor exceeds earth potential under normal conditions. To determine the potentials of the various conductors of a three-wire system, the following method may be used. Referring to fig. 2, let—

p = resistance of faults from the positive outer to earth ;
m = resistance of neutral earthing circuit ;
n = resistance of faults from the negative outer to earth.

Further, let P.D. between outers = 2 V, and the potential of $n = v$. Then—

$$\left.\begin{aligned} C_p &= \frac{2V + v}{p} \\ C_m &= \frac{V + v}{m} \\ C_n &= \frac{v}{n} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

and, by Kirchoff's network laws, the algebraic sum of these three currents must always equal zero, *i.e.*—

$$\frac{2V + v}{p} + \frac{V + v}{m} + \frac{v}{n} = 0, \quad \ldots \quad \ldots \quad (2)$$

a relationship which gives v ; V, p, m and n being known.

As a particular example is assumed a three-wire system, with 460 volts between the outers, a fault of 40 ohms on the positive, and of 35 ohms on the negative outer (exceptional, of course). These faults are assumed constant, but the effective resistance in the earthing wire (= r + all contact and conductor resistances) is assumed to vary from 0 to 120 ohms, the potential and earth current distribution then being as in the following Table, these values being calculated from equations (1) and (2) :—

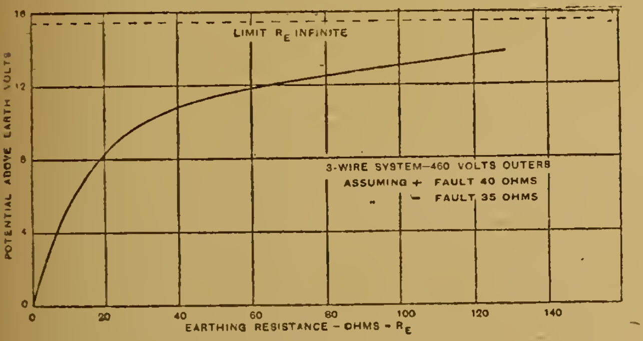


FIG. 3.

Ohms.	v volts.	C amperes.	$(230 + v)$ volts.	C amperes.	$(460 + v)$ volts.	C_p amperes.
0	−230 00	6 56	0·00	0 810	+230 0	5·75
5	−226·76	6·48	+ 3 24	0 648	+233·5	5·82
10	−224·50	6·42	+ 5 50	0 550	+235·0	5 88
20	−222·00	6·345	+ 8 00	0·400	+237 0	5 92
30	−220·00	6 29	+10·00	0·330	+240·0	6·00
50	−218 80	6·25	+11·20	0·224	+241·0	6 02
70	−218 00	6·23	+12 00	0·171	+242·0	6·05
90	−217 30	6·20	+12·70	0·141	+242·7	6 07
120	−216·50	6·19	+13·50	0 1125	+243·5	6·09
∞	−214 50	6 13	+15·50	Nil	+245·5	6·13

It will be seen that the higher r the higher the potential of the neutral above earth, and hence the greater the tendency to electrolytic and other damage *via* faults on the neutral as already explained. Also, the higher r the greater the strain placed on the less faulty outer, and as a consequence the greater the leakage current from the latter. This usually results in rapid aggravation of the fault till it becomes worse than that on the other outer : the latter fault then becomes subject to increase, and the net result is a rapid extension of both faults if not immediately isolated.

This tendency is the greater, the greater r, hence it is that the latter is only a few ohms as a rule : $1\frac{1}{2}$ to 2 ohms suffices for the permanent resistance (r + leads) and $\frac{V}{10}$ to $\frac{V}{20}$ ohms being suitable for the emergency resistance (fig. 1), where V = half voltage between outers.

In figs. 3 and 4 are represented graphically the results of the table. The remarks already made concerning the effect of rising r are excellently illustrated by these curves. The tendency of the potential of the neutral and the leakage currents from the outers to become asymptotic to lines representing their values when $r = \infty$, is clearly shown.

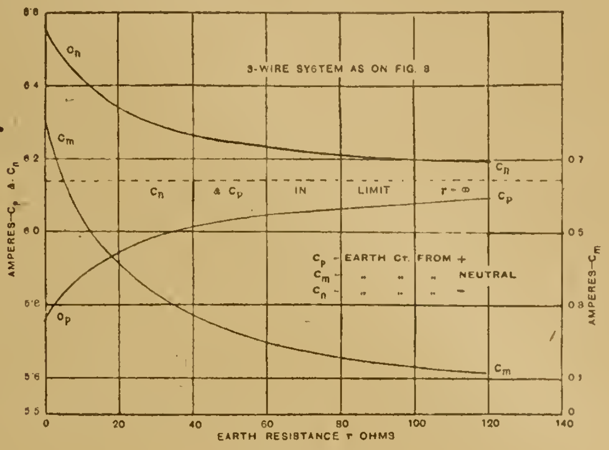


FIG. 4.

It is evident that, once r exceeds quite small values, increasing it further has little effect on the probable deleterious effects ensuing.

BUSINESS NOTES.

Busy Installation Contractors.—The following very imposing list of installations represents work which, with other smaller contracts, is at present engaging the attention of MESSRS. DUNCAN WATSON & CO. :—

King's College Hospital, Denmark Hill.—Wiring, underground mains, and fittings.
Maytham Hall, Kent, for Mr. H. J. Tennant, M.P.—Complete power scheme, with plant, electric lifts, wiring, electric bells, telephones, fittings and refrigerating plant.
Ovingdean Hall, Sussex.—Complete plant, direct-coupled petroleum set, wiring and fittings.
The Oaks, Sunningdale, Berks, for Mr. H. Batty-Smith.—Complete plant, wiring and fittings.
"Charters," Ascot.—Complete plant, including direct-coupled set, storage battery, wiring and fittings.
Sunningdale School, Sunningdale, Ascot.—Wiring and fittings, underground cables.
Ashurst Lodge, Sunninghill, Berks, for General Blundell.—Wiring, fittings and underground cable.
"Gilmuire," South Ascot, for Hon. Lady Ponsonby.—Electric light wiring, fittings and underground cable.
Large showroom and warehouse in London Wall.—Wiring, fittings and transformers.
Large block of mansions in Maida Vale.—Complete wiring.
Large manufacturing works in Northampton.—Electric installation in connection with suction gas plant, switchboard and accessories.
Manor House, Haslemere.—Reconstructing installation, wiring and fittings.
St. Mark's Church, Hamilton Terrace.—Re-wiring and fittings.
37, Hamilton Terrace.—Wiring and fittings.
Crolton Lodge, Orpington, Kent.—New storage battery, general overhauling of installation.
62, Finchley Road.—Electric light fittings, storage battery and plant.
New building, 180, New Bond Street.—Complete wiring throughout.
New Radium Institute.—Electric lighting and bells.

Trade Announcements.—THE NEW BROTHERTON TUBE CO., LTD., of Excelsior Works, Commercial Road, Wolverhampton, inform us that, by licence from the Board of Trade, they have altered the style of their firm to that of "Brotherton Tubes and Conduits, Ltd.," which name has been duly registered with the Registrar of Joint Stock Companies. The trade are requested to take note of the alteration for future correspondence and business.

MESSRS. TETLEY & CO., of Salford, have appointed Mr. S. Mansel Jones, of 7 and 8, Western Mail Chambers, Cardiff, and 63, Wind Street, Swansea, as their sole representative for Cardiff and South Wales ; a stock of their standard manufactures will be held at each depôt.

MESSRS. J. & H. GREVENER have appointed Mr. Sandys Ball, of Monte Rosa, St. Leonards-on-Sea, as their representative for the South Coast.

Book Notices.—"Science Abstracts." Sections A and B. Vol. XII. Part 8. London : E. & F. N. Spon, Ltd. 1909. Price 1s. 6d. each section.

"Proceedings of the American Society of Civil Engineers." Vol. XXXV. No. 6. New York : The Society. 1909.

"Analyse des Métaux par Electrolyse." By A. Hollard and L. Bertiaux. Paris : H. Dunod & E. Pinat. 1909. Price 9 fr. 50.

"Calendar of the Municipal School of Technology, Manchester." Session 1909-10. Manchester : *Guardian* Printing Works. Price 6d.

"British Trade in Canada." Hints to Manufacturers and Commercial Travellers.—Published by the "Canada" Newspaper Co., Ltd., 34-35, Norfolk Street, Strand, London, W.C. Price 1s. net.

American Electrical Factories.—The course electrical trade is taking in the States may be gathered from the following remarks of our contemporary, the *Electrical World*, concerning the business of two of the largest electrical manufacturing undertakings there:—

"The entire force of the Westinghouse Electric and Manufacturing Co. at East Pittsburg was placed on full time last week, and is now working 10 hours a day. Heretofore a majority of the workmen were employed only eight hours. A representative of the company states that at the present time there are between 10,000 and 11,000 men on the pay-rolls, as compared with 6,000 at the low point last year. The gross business is now running at about $2,500,000 per month, or $30,000,000 per year. During July the business was $3,000,000, but this is recognised as being above the average. The foreign companies are also making excellent returns. In connection with this increased business, there has been a renewal of the talk of the early resumption of dividends. It is reported that the payment of the back dividends accrued on the preferred stock may be made in October, and that a 5 per cent. dividend on the assenting stock may be paid early in 1910. When the reorganisation plan was under discussion, those who took the assenting stock at par were assured that dividends would be paid at the earliest possible moment.

"Officials of the General Electric Co. report that business is slowly improving, but that as yet the majority of orders are for small machinery rather than for heavier apparatus. Manufacturing plants all over the country are considering the introduction of electrically driven machines, and many inquiries are being made, and many specifications being considered, in this direction. The demand for domestic appliances is said to be constantly on the increase."

Protection of Ely Cathedral.—Lightning conductors were first fitted to Ely Cathedral about the year 1859 to the specification of Sir William Snow Harris, F.R.S., adviser on lightning conductors to the Crown, but doubts were entertained as to whether these were still in an efficient condition. Mr. Alfred Hands, F.R.Met.S., author of "Lightning and the Churches," was therefore instructed by the Dean and Chapter to make tests and report as to the advisability of adopting more modern methods. Snow Harris's conductors, formed of short copper tubes screwed together, proved to be so defective that it has been found necessary to install an entirely new system of copper tapes. This comprises two conductors on the western tower with branches from the flagstaff and four turrets, two from the towers over St. Catherine's Chapel, and four from the eastern or lantern tower, as well as from the nave, choir, transepts and lady chapel. The system has been arranged so as to be scarcely noticeable, and does not detract from the appearance of the Cathedral, and the work has been carried out by Messrs. J. W. Gray & Son, of 91, Leadenhall Street, London, E.C., under Mr. Hands's direction.

"Lea" Recorders.—Among recent orders booked by the Lea Recorder Co., of Manchester, for these recorders are the following:—The Electrical Consumers' Co., Treforest, and the British Westinghouse Electric and Manufacturing Co., for the Buenos Ayres and Pacific Railway Co., recorders for measuring steam consumption; the Worthington Pump Co., for Birmingham Corporation, recorder for measuring condensing water; Messrs. Davis Perrett, Ltd., for the Central Electric Supply Co., repeat order for recorders for measuring steam consumption; also J. G. White & Co., for South America, for measuring boiler feed water; East Rand Proprietary Mines, South Africa, two more apparatus; also for Messrs. Babcock & Wilcox, and others.

Catalogues and Lists.—The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, Cannon Street, E.C.—Twenty-six page illustrated catalogue of their electro-medical appliances, including "Solarium" or electric sun bath, constant, faradic and sinusoidal current apparatus, hydro-electric chairs, electrical vibration apparatus, high frequency apparatus, and luminous radiators.

The Midland Engineering Co., Ltd., 2, Victoria Square, Birmingham.—Folding circular containing a description, with sectional diagram, of the "Zylba" patent double-acting air pump, without foot or bucket valves.

Messrs Vickers, Sons & Maxim, Ltd., 32, Victoria Street, S.W.—Illustrated pamphlets describing the "Vickers" one-lock adjustable reamer and the operations connected therewith.

Schiersteiner Metallwerk G.m.b.H., Schwernistr, 3, Berlin W. 57.—Leaflets giving particulars of their automatic flashing switch, and motor-driven switch-gear in various sizes, for controlling electrically lighted signs.

The Lea Recorder Co., 28, Deansgate, Manchester.—Leaflet "2" relating to the Lea recorder for the measurement of water over weirs or through the V-notch.

Messrs E. S. Hindley & Sons, 11, Queen Victoria Street, E.C.—Catalogue No. 330 dealing with the firm's high-speed vertical gas engines, and superseding previous lists. This catalogue is an excellent production, containing a specification and particulars of the essential features of the firm's gas engine productions, which are illustrated in sizes from the 12 B.H.P. single-cylinder engine to the 225 B.H.P. six cylinder engine. The constructive details of these engines include special features in cylinder design, ignition and governing; interchangeability has been carefully studied, and the makers emphasise the advantages of the type for export purposes, the net weight being only some 1 cwt. per B.H.P. The engines are specially designed for direct coupling to electric generators.

The Fortuna Machine Co., Ltd., Deacon Street, Leicester.—Leaflet relating to patent automatic hoisting winches for raising and lowering electric arc lamps, &c.

Messrs. Donovan & Co., Barwick Street, Birmingham.—Special net trade price list of a variety of electrical accessories, fittings, bells, blocks, cables, switches, conduits, and so forth; also a fully illustrated and priced circular of porcelain and brownware insulators.

Messrs. Erith's Engineering Co., Ltd., 70, Gracechurch Street, E.C.—Illustrated leaflet, No. 193, relating to the Erith grateless underfeed stoker. A working chart shows the load fluctuations in the electric traction steam plant which operates the St. Clair tunnel electric trains. The two large boilers with Erith's grateless stokers are shown to keep a practically constant steam pressure, although the load ranges in only 14 minutes, between a merely nominal load and a peak load of 1,700 KW., and down to nominal load again; it is claimed that with this system both fuel and air simultaneously and automatically respond to variations of load.

Messrs. Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.—New catalogue (No. 24 E) of 40 pages wherein they give full descriptive notes with excellent half-tone and line diagrams of the Sentinel Junior engines for electrical and other service. Tabular, price and other particulars are also given of boilers, dynamos and piping for working with same, in order to enable the purchaser to easily ascertain the cost of a complete plant delivered on site. Other plant shown in the catalogue includes air compressors, steam-motor wagons, steering gears, hoisting machinery, and valves and fittings.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.—New 50-page catalogue very fully particularising, with a large number of illustrations, their "Kalkos" tinned-tube wiring system. A large number of new fittings and appliances have been added which are intended to render the system more complete, and its application still wider, than it already was. In many cases considerable reductions have been effected in prices of both tubes and fittings. Wiring contractors and others interested in wiring systems should find the catalogue of service.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—Advance copy of a well-illustrated brochure of 16 pages, containing views of a number of high and low-tension switchboards recently manufactured by them.

The Lahmeyer Electrical Co., Ltd., 109-111, New Oxford Street, London, W.C.—Two new illustrated lists: one (No. 7,014) describing their latest type of high-speed motor for large outputs, with the windings specially insulated in accordance with the mining regulations. The company also supply motors with vertical shafts for all outputs and voltages in commercial use, and specially suited for modern shaft-sinking pumps in mines. The other list (No. 7,087) describes their single- and three-phase oil-immersed transformers, showing a number of their most recent installations of the latest type, and summing up their advantages. We have also received from this company a 24-pp. catalogue in stiff red covers in which they give a great deal of tabulated data (sizes, weights, resistances, &c.) with prices, of vulcanised india-rubber wires and cables, flexible wires, overhead wires, &c., of the Felten and Guilleaume-Lahmeyerwerke A.G., whose works the reader finds, have an annual production of 120,000 tons, employ 6,500 hands, have equipment which comprises engines of 7,500 H.P., and are fitted for the testing of cables up to 60,000 volts.

Messrs. S. H. Heywood & Co., Ltd., Reddish, Stockport.—Folding card illustrating and describing an electric overhead travelling crane of unusually wide span that they have recently built.

A large and effective wall show card presumably intended for shop windows or walls has been issued to inform the metal-filament lamp-using public that the "Aegma" lights the world. It depicts a writer who has been moved by this great thought, sitting before a remarkably tidy desk with a lighted "Aegma" above his head shedding its rays upon a revolving globe. He is writing on "A light subject," but what he is putting down no one but a compositor could make out!

Messrs. Charles Price & Son, Broadheath, near Manchester.—Catalogue (No. 3) of 20 pages devoted to paraffin, petrol and other engines petrol, electric lighting sets, and so on. An accompanying tabulated list gives prices, code-words, shipping dimensions, &c. The firm have on order at the present moment, paraffin and petrol engines of 1, 2 and 4-cylinder types for lighting purposes, for South Africa, South America, Siam, Holland, Sweden, and for the home markets.

The Langdon-Davies Motor Co., Ltd., Southwark Works, Deverell Street, S.E.—Pamphlet containing, in addition to lists of the firm's standard D.C. and A.C. (one, two and three-phase) motors, a few useful tables of mechanical data. One gives power equivalents in watts, horse-power, forces de cheval, and kilogrammetres per minute (the words "per minute" should be added in the fourth column heading).

Works in America.—The following statement appears in the daily Press:—"In view of the extent to which they find their trade in balata and other beltings with the United States handicapped by the high tariff, the directors of R. and J. Dick, Ltd., of Glasgow, have decided to establish a factory in that country. The matter has been the subject of prolonged consideration, but as no way out of the difficulty could be found, the decision mentioned was arrived at. A number of the directors left Liverpool on Saturday for America to select a site, and to decide whether the factory shall be built on American or British lines."

The Silvertown Company.—A number of the daily papers have published statements to the effect that the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., were going to remove their works from the borough of West Ham, owing to the heavy rating. It is, of course, a fact that the company pays an unconscionably heavy sum every year in rates without having a voice on the Council as to the conduct of the municipal affairs, but the statement of removal seems to go a little too far. The company is not leaving West Ham, but it is not extending there. For increased manufacturing facilities that are required by the company, the directors propose to erect a factory in the provinces, and a Midland centre may be selected, but nothing definite appears to have been decided.

Bankruptcy Proceedings.—E. A. Brandon.—The creditors of Ernest Austin Brandon, mechanical and electrical agent and factor, trading at 33, Devonshire Chambers, Bishopsgate Street, E.C., under the style of E A. Brandon & Co., met on Wednesday last week at the London Bankruptcy Court. The Official Receiver reported that the debtor had stated that he commenced business in January, 1906, with £50 cash capital, at 55, Barbican, E C. He removed to Devonshire Chambers in June, 1907, and had since traded there under the same style, also in a small way as the Atlas Engineering Co. The failure was ascribed to lack of capital and bad trade. A statement of affairs was lodged, showing unsecured debts £1,137, and fully secured debts £839, the assets being valued at £5 11s. 8d. In the absence of any offer the case was left in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy. Appended is a list of the principal creditors:—

Armorduct Mfg. Co.	£63	W. Richards & Son	£16
Oswald Carr	24	Sloan Electrical Co.	39
City Glass Co.	22	John Spencer, Ltd.	64
T. W. Dickson	22	International Elec. Co.	88
Electrical Co.	89	Tubes, Ltd.	107
Enright & Thompson	88	Lloyd, Richardson & Co.	60
Foster Arc Lamp and Eng. Co.	10	E. P. Allen & Co.	10
Gilbert Gilkes & Co.	14	Alice E. Barnes	42
J. & H. Grevener	14	J. Macgregor	32
Hobbs, Hart & Co.	33	E. E. Patland	43
F. Krasa & Co.	19	J. Buckingham	13
London Sherardising Co.	12	W. H. Nicholls & Son	13
Ercole Marelli & Co.	59	Fully secured creditors	839
Morris-Hawkins, Ltd.	45	Preferential creditors	14
Rhodes Motors, Ltd.	40		

Herbert J. Burdett, electrical engineer and contractor, 16, Regent Street, Rugby, and Coventry.—A receiving order has been made on debtor's own petition at Coventry.

"Victoria" Turbo Pumps.—Messrs. Willans and Robinson, Ltd., have recently taken up the manufacture of centrifugal pumps, for dealing both with high and low lifts, and have at the present time some 12 pumps under construction. We understand that a series of tests has recently been completed on one of these pumps, which has shown that the high efficiency estimated by the designer (Mr. Jens Orten-Boving) has been fully realised in practice. The pumps in question are of a particularly simple design, and are being built with a view to requiring the minimum amount of attention in working. In view of the large number of high lift sinking pumps imported into this country, it is felt that there is plenty of room for a well-built reliable British-made pump.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. J. A. Bell, electrical engineer to the Corporation, in his annual report, states that the year just completed has been unique in the experience of the department, being the first since the start of the undertaking in which the units generated show a decrease on the preceding year. Due, however, to economies in distribution, &c., the output sold shows a small increase. This small increase in output is partly due to the general depression in trade, but it is principally the result of the installation of metallic-filament lamps by the present consumers. It is estimated that there are already on the mains some 25,000 metallic-filament lamps which have displaced the older type of carbon-filament lamp. Motors representing 408 h.p. have been coupled up since the last report. The output for private lighting consumers for the year was 14,024 units, and for the power consumers 65,851 units in excess of the previous year. The total number of units sold for the year for all purposes amounted to 5,170,421, being an increase of 6[illegible]385 over the preceding year. The Electricity Committee has agreed that a uniform rate of 3¼d. per unit for lighting be fixed, with the alternative to consumers using over 5,000 units per half year to elect to be charged the same rate as at present, viz., 5½d. per unit for the first hour of maximum demand, and 1½d. per unit for all subsequent demand. A flat rate of 1½d. per unit for cooking and heating was also fixed.

Australia.—The Sydney Council has invited tenders for the erection of an eight-cell refuse destructor at Pyrmont; steam plant will be installed, including Babcock & Wilcox boilers.

The Sydney Electric Light Committee has decided to call for fresh tenders for turbine equipment. It will be remembered that Mr Mackay, the engineer, protested against a proposal to install a 4,000-kw. set at 1,500 r.p.m., with a view to saving in capital cost, on the ground that a lower-speed machine was preferable.

Bentley (Doncaster).—A L.G.B. inquiry was held recently as to sanction to carry out a scheme of sewerage for Bentley colliery model village, Rostall, and also building estates up the Askern Road. The engineers—Messrs. D. Balfour and Son, of Newcastle-on-Tyne — fully explained that the sewage will be conveyed to a pumping station, where, after screening, it will be discharged into two separate tanks from which it will be pumped by centrifugal pumps worked by electric motors in duplicate. The pumps will be placed in an underground chamber adjacent to the storage tanks and worked by a spindle from the motors in the motor house to be built above ground. The motors will be automatically started and stopped by floats. Each pump will be capable of delivering 30,000 gallons per hour of sewage at the existing sewage disposal works.

Brazil.—An electric driving plant is being installed at the mills of the Rio de Janeiro Flour Mills and Granaries, Ltd., and the concern has contracted with the Rio de Janeiro Light and Power Co, Ltd., for the supply of the necessary electric energy—about 1,800 h.p.

Brighouse.—The electricity supply was inaugurated at Brighouse on Monday. The old generating station in Hall Street, which has for a long time inadequately met the growing requirements of the district for electric light and power, has been superseded by the completion of the bulk supply arrangement with the Yorkshire Power Co., and distribution by the Corporation to its customers. The cost of the new transformer installation has been £2,950.

Chile.—A company has lately been formed at Antofagasta, with a capital of £30,000 and the title La Companhia de Alumbrado y Fuerza Motriz Electrica do Antofagasta, to establish an electric generating station for lighting and power purposes in the town.

Continental Notes.—Russia.—The Kharkov City authorities have applied for powers to contract a loan of about £633,000, bearing 5 per cent. interest. Among other things, it is proposed to devote £100,000 to electric tramway construction, and a further £50,000 to the building of a new electric station for lighting and power purposes.

Sicily.—Two hydro-electric stations are in course of construction on the Cassibile, to the south of Syracuse, and on the Alcantara, near Taormina. It is intended to link the two plants and to supply power by electric transmission to the whole of the east coast of Sicily, from Messina to Syracuse, and eventually to Ragusa. The length of this line will be about 220 km., and for the present it will be fed from the central stations of Cassibile and Alcantara. The requirements of the region are estimated at about 10,000 h.p.—viz., Catania, 5,000; Messina, 3,000; Syracuse, 1,500; and Taormina, 500.

A further project is on foot for the establishment of an electric power station on the River Simato capable of producing 10,000 h.p. It is calculated that the hydrologic conditions of Sicily would permit of the erection of hydraulic stations over the island capable of generating about 50,000 h.p., and it is thought that it would be possible to link such stations together, so as to embrace the whole island with the principal stations at Palermo, Messina, Catania and Syracuse.—*Board of Trade Journal.*

Galicia.—The municipal authorities of Tarnow have lately invited tenders for the establishment of a central electric lighting station in the town.

Bohemia.—The municipal authorities of Rochlitz have recently decided on the establishment of a central electric lighting station in the town.

Dartford.—Mr. J. D. Pember, resident engineer, in issuing his report on the working of the Council's electricity undertaking, points out that the last year's working was the first in which a profit has resulted since the supply was commenced in 1901. Briefly, the revenue amounted to £8,230, as against £7,920 in 1907-8; working expenses amounted to £5,405, being a reduction on the previous year, which is attributable mainly to a saving of nearly ¼d. per unit on coal consumption, due to the use of improved furnaces. Including all financial charges, the total expenditure amounted to £8,173, leaving a net balance £57, as compared with a deficit of £1,145 in 1907-8. Mr. Pember's report shows that the output sold amounted to 904,999 units, being an increase of 68,797 units, towards which power supply contributed 66,000 units. The tramways took some 13,000 fewer units than in the previous year.

Farnworth.—On Thursday last week the new extensions to the U.D.C. electricity plant were officially opened. It will be remembered that on the advice of the engineer, Mr. R. B. Leach, the Council decided to purchase energy in bulk from the Lancashire Power Co., and to install suitable plant at its own generating station for dealing with this supply. The power company's supply is delivered as three-phase current at 10,000 volts and 50 cycles; this is dealt with in two 300-h.p. Westinghouse transformers, with a step-down ratio of 10,000/500 volts, and converted to direct current at 500 volts by two G.E.C. 270-kw. motor-generators running at 600 r.p.m. The switchgear, both h. and l.t., has been supplied by the Westinghouse Co. The Council has agreed to purchase a minimum of 400,000 units per annum from the company; the Council's output last year included 411,926 units for traction, 89,354 for lighting, 222,416 for power, and 55,672 for street lighting, making 779,368 units in all. At the same time a Heenan & Froude refuse destructor, to deal with 45 tons per working day, was officially opened. This plant is of the Heenan "front feed" type, combined with a Lancashire boiler, regenerator, Green economiser, &c., and is estimated to be capable of generating some 400,000 units per annum in connection with the electrical undertaking. The boiler was supplied by Messrs. Musgrave & Sons, Bolton, and is provided with Hopkinson fittings and a Foster superheater.

Fife.—The contractors for the Rosyth Naval Dockyard works—Messrs. Easton Gibb & Son—are to erect a private power station at Rosyth. An order has been placed with the National Gas Engine Co., Ltd., for four gas engines and suction gas plants with a maximum output of 1,100 B.H.P. Electric current is to be supplied at 500 to 550 volts to all the workshops on the site. Besides lighting, the electric power will be used on the cranes, in the machine shops and sawmill, and for pumping. It is estimated that the cost of energy will not exceed ⅜d. per unit, including all standing and working charges. The intention at first was to get power from one of the large private companies in Fife.

Little Lever.—The U.D.C. has under consideration an application from the Lancashire Electric Power Co. for permission to supply electricity to several premises in the township by means of overhead wires along Booth Road and Market Street.

London.—Hackney.—Application is to be made to the L.C.C. for sanction to borrow £3,650 to cover certain expenditure on cables for giving an increased supply in the Hackney Wick and other districts. The Electricity Committee is informed that Messrs. G. Ellis & Co. intend to install a further 200 H P., also that Messrs. Austin & Son are erecting a factory, and will require some 150 H P., and it is consequently the intention to carry out the work without delay.

Longton.—The Gas and Electricity Committee has recommended the T.C. to amend the scale of charges for power so that consumers of more than 10,000 units per quarter may be charged at 1d. per unit.

Mansfield.—The T.C. has received from the L.G.B. sanction to a loan of £500 for economiser extension and water softening plant.

Mexico.—The British Vice-Consul at Guadalajara reports that the interests of Senor Don Manuel Cuesta Gallardo and the Compania de Tranvias, Luz y Fuerza de Guadalajara, Sociedad Anonima (Tramways, Light and Power Co., of Guadalajara, Ltd.) have now been merged, and that a well-known Berlin firm have contracted to advance £750,000 for the construction of works and the erection of machinery for the production of hydro-electric power on the Santiago River. In addition to the power scheme, 300,000 hectares (about 750,000 acres) of land will be drained and irrigated, and, under the Irrigation Law, the Mexican Government will pay the irrigating company the sum of $25 for each hectare (£1 per acre) irrigated by them. Guadalajara is already supplied with over 10,000 H.P. of electrical energy by the old company, but the new company is installing turbines to give an additional 8,400 H.P., which will be largely used by the mines in the Hostotipaquillo district of the State. It is possible that electric power may even be transmitted from the generating stations to Aguascalientes in the State of that name, where important industries requiring power exist.

Northampton.—Considerable extensions to the lighting mains are about to be carried out by the E.L. and Power Co., Ltd.

Portsmouth.—Since June, 1894, when the T.C. started to supply electricity, the rates of the borough have been relieved by means of its electricity undertaking by a total sum of £12,000. But, up to six years ago, only £1,000 had gone in relief of rates. It was in that year that Mr. W. S. Foale was appointed engineer and manager, and under his management a profit of £11,000 has been made since 1903, and the reserve fund, which then stood at £7,725, has been increased to £27,823, while an insurance fund, with £3,871 to its credit, has also been started. The revenue in that short period has grown from £35,000 to nearly £49,000, which was the total of receipts last year, although that represented a decrease of £6,500 in a year, due chiefly to concessions to private consumers and the abolition of meter charges. The Council has, during the years it has owned the undertaking, increased the number of arc lamps for street lighting from 78 to 432, besides 463 incandescent lamps. The total number of units sold last year aggregated 3,476,000. There is not much manufacturing carried on in the town, so there is little demand, comparatively, for electricity for power purposes, although the demand increased last year from 204,559 to 343,390 units.

Runcorn.—The Castner-Kellner Co., having asked the R.D.C. for consent to its application for a prov. order for electric lighting, the Council has asked for full particulars of the scheme.

Swinton and Pendlebury.—The Council is to consider a recommendation of the Electricity Committee that it appoint an electrical engineer for the management of the undertaking; the undertaking is now managed by the Lancashire Electric Power Co., to whom the Council pays £150 annually for such services.

Tavistock.—At a meeting of the U.D.C. on Tuesday, Mr. Foster (chairman of the Lighting Committee) stated that, in view of applications being made by an outside firm for a provisional order to supply Tavistock with electric light, the Lighting Committee recommended that the Council should apply to the B. of T. for a provisional order. He contended that if they were going to have electric light in Tavistock, the Council should be the proprietors, and not a private firm. Mr. E. C. Spooner seconded the motion. He knew of towns where the introduction of electricity in the hands of the local council had been a paying affair, and it was a good investment. The clerk stated that they would be required to deposit £50 to cover the ordinary expenses of the order, and pay any additional expenses. After a long discussion as to the advisability of such a course, it was resolved to refer the matter back to the Committee for further consideration.

Southport.—The Electric Lighting Committee has appointed a deputation to interview the Birkdale District Electric Supply Co. on the question of supplying electrical energy at Ainsdale, a suburb of Southport.

Wimbledon.—At the last meeting of the Council it was reported by the borough electrical engineer that although the contract for the erection of the Howden-Siemens turbo-alternator should have been completed by April 30th, he anticipated that it would not be until September 22nd that the plant would be ready for running on load. The foundations were completed on February 18th.

TRAMWAY and RAILWAY NOTES.

Argentine.—According to the *Review of the River Plate*, the Lacroze Tramway Co. (Buenos Ayres) is proposing to add some 15 km. to its tramway routes. The power plant will be correspondingly increased, and it is intended to add two 2,300-H.P. engines, coupled to 1,500-KW. generators; this additional 3,000 KW. of plant brings the company's installation up to 6,000 KW. The boiler plant, consisting of seven Babcock boilers, will also be extended. Some 50 additional two-axle cars, and 20 four-axle cars are being put into service to deal with the increased traffic, and a shed to accommodate 150 cars, together with repair shops, is to be built and equipped. The company has just opened a new route between Calle Reconquista and Villa Urquiza.

Australia.—The report of the Government Commissioner on the working of the State railways and tramways for the year ending June 30th last shows that 151¼ miles of tramways were worked, carrying 185 million passengers, an advance of 14 millions on the previous year. The undertakings earned £1,097,565, and the return, after meeting working expenses, was £5 12s. 6d. per cent. on the capital invested.

Mr. J. A. Boyd, who recently spent considerable time in examining the various electric railways in Europe and America, has on his return to Melbourne presented a report to the Premier, urging that further consideration should be given to the suburban electric railway scheme for Melbourne which was rejected by the Victorian Railway Commissioners.

Mr. Boyd has come to the conclusion that the single-phase system with overhead trolleys offers a greater chance of success than the direct-current third-rail system suggested by Mr. Merz; he advocates that Mr. Merz, or some qualified American engineer, should make a further report on a scheme for single-phase traction. He quotes the views of Mr. McHenry and Mr. Murray, of the New York, New Haven and Hartford Railroad, that the single-phase section is not only preferable but more profitable than the direct-current third-rail section of that company's line. Mr. McHenry further stated that on the Long Island Railroad, with the protected third-rail, it was found necessary to employ an independent staff to look after it.

Continental Notes.—Norway.—The first Norwegian single-phase railway has been recently installed by the British Westinghouse Co. between Thamshavn and Lokken. The line runs through the valley of the River Orkla and serves to tap the rich ore deposits there, as well as to deal with a rising tourist traffic. It passes through seven stations in all. The power for the line, as well as for the town of Thamshavn, the various villages along the line and for the mines at Lokken, is derived from a waterfall near Thamshavn. The power is generated and conveyed to the various towns as a three-phase supply at 15,000 volts, 50 cycles, whilst the power for the railway line is converted into a single-phase supply at 6,000 volts, 25 cycles, by means of motor-generators in a sub-station at Thamshavn. This sub-station forms part of the main station and contains two 250-K.V.A. motor-generator sets with room for a third set as well as for three oil-cooled three-phase 15,000/6,600-volt transformers for 250 K.V.A. each. The motor-generators each consist of a three-phase 6,600-volt, 50 period induction motor with slip rings direct-coupled to a 6,600-volt, 25-cycle single-phase generator. The trolley wire voltage is automatically controlled by a Tirrill regulator. The single line track laid down is of 1 metre gauge, and is, on the whole, very level and free from curves, though at one point gradients up to 4 per cent. exist. The station buildings are provided with incandescent lamps supplied, through small transformers, from the trolley wire. The trolley wire has a catenary suspension, and is divided into six sections by section insulators, which are normally short-circuited, but can be opened by hand by means of a long pole when necessary. The rolling stock consists of three locomotives, one saloon motor carriage, four passenger carriages, and 21 goods trucks. Each locomotive weighs 20 tons, and carries four motors—two on each bogie. The locos. are fitted with automatic couplings, Westinghouse air brakes, and pantograph bow collectors. The motors are Westinghouse compensated series ones for a one-hour rating of 40 H P., and are geared to the axles through spur gearing having a 14 : 76 ratio. Each loco. can exert a draw-bar pull of 6,600 lb. at a speed of 11¼ miles per hour. The four motors are used in two groups of two in series. The regulating transformer carried on the locomotive has seven tappings on the low-tension side for 110, 240, 300, 360, 420, 480 and 540 volts respectively.—*E. K. and B.*

France.—The important French railway Paris-Lyons-Méditerannée is at present carrying out experiments in conjunction with Messrs. Alioth, with a view to converting the Cannes-

Vintimille section of its line from steam to electricity. The experiments are being made on the Grasse-Mouans-Sartouse section, which is very convenient for the purpose, as it includes some of the steepest gradients and sharpest curves, and is also not crowded with traffic. The overhead wire is suspended flexibly by means of a system patented by Messrs. Alioth, which does not involve the use of separate suspension wires. Wooden poles are used at present, but these are to be replaced by metal lattice work supports later on. The locomotive used weighs 140 tons, and is approximately the same length (65 ft.) as the normal steam locomotive, including the tender. There are eight axles, of which the four central ones are driving axles with large wheels. The overhead line is supplied with single-phase alternating current at 12,500 volts, but this is converted on the locomotive by means of a special permutator, devised by Messrs. Anvert & Ferrand, into direct current at a voltage adjustable between 0 and 600 at will. The motors are ordinary direct-current ones of 450 h.p. each, and there are four of them. They are flexibly geared by means of spur gear to the four driving axles. The total draw-bar pull exerted by the locomotive is 16,400 lb. at a speed of 37 miles per hour, and 10,600 lb. at a speed of 62 miles per hour.—*E. K. & B.*

Erdington.—An extension of two years for completing the lines under the Tramways Act has been granted to the U.D.C. by the B. of T.

London.—Arrangements have been made for opening the widened portion of Blackfriars Bridge on September 14th; the tramways connecting the Embankment and Blackfriars Road sections will be opened at the same time. It is stated that the Bridge House Estates Committee will adopt the St. Paul's Bridge scheme, and that the Castle Baynard Ward strongly favours the construction of tramways on the new bridge and their subsequent lease to the L.C.C.

Newcastle-on-Tyne.—Mr. Ernest Hatton, general manager of the Corporation Tramways, has just issued his annual report. It is for the year ended March 31st, 1909, and in it Mr. Hatton says that the total mileage of single track worked by the Corporation is 60¼ miles, of which the Corporation owns 54⅐th. In reference to the maintenance of plant in the power station, he states that the two batteries originally installed at the station have been replated, and put into first-class condition, and two automatic reversible boosters have also been installed, working in conjunction with those batteries. He continues: It is too early for me to speak definitely as to the actual saving to be accomplished, but I might state that since the above plant has been put into commission, whereas previously we were compelled to run our two largest generating sets in parallel during the heavy peak loads in the winter months, due to the workmen's traffic, we have since been able to run through the heavy evening loads with one generating set running in conjunction with the batteries referred to. Also during the summer months we are now able to shut down the running plant for some hours during the night, as the batteries are at this period capable of taking the load on the station. During the year the two sets of pumps have been installed in the pumping station on the riverside, and an additional suction pipe 2 ft. in diameter has been laid from the pumping-station under the quay to the river. This plant is now in successful operation, and from the results obtained so far will show a saving of 25 per cent. in the current used for circulating purposes. With the installation of this plant one of the serious difficulties which the department has laboured under for the last four years is now at an end, and the additional plant which has now been installed in the pumping station is now fully capable of dealing with the loads that we are likely to get on the power station for many years to come." The low consumption of coal is still continued, the coal consumption per unit being 3·57 lb., and the average saving in tonnage during the past four years has been 2,417 tons per annum, representing £937 9s. 2d. per annum. The total b.t.u. generated was 9,864,969, a decrease of 143,616 units, which is accounted for by the service of cars being curtailed during the period of the strike which prevailed during the year. Of the total output, 8,118,719 units were utilised for traction. The car-miles run were 4,289,997, and the consumption was 1·892 b.t.u. per mile. The coal consumption during the year was 15,742¼ tons. As to the finances (of which details have already been given in our columns) Mr. Hatton says, "The revenue of the undertaking shows a considerable decrease both in the gross takings and in the earnings per car-mile. This is largely accounted for by the unfortunate strike which embraced the whole of Tyneside during the financial year under review, as also by the extra facilities given to the workpeople and in the extensions of fare charges. The pronounced increase in the general expenses is due to one cause only, viz., the large increase in the rates on the excessively increased assessment referred to in my last annual report." He states that the expenditure on the maintenance of the cars shows an increase over the previous year, and that it is unlikely that that item can be reduced. The cost of maintenance of permanent way shows a considerable increase, and he comments on the difficulty of increasing the revenue.

Pontypridd.—The refusal of two employés of the Council's tramways undertaking to join the tramway men's union will probably result in a strike of the other employés in a week, unless the two employés consent to join the union or are dismissed. At a meeting of the men it was pointed out that there were no differences between the Council and its employés.

Salford.—The Tramways Committee recommends the discontinuance of the system of return tickets for workmen, and the concessions to the female workers and school children, on the ground that the 12 months' experiment has led to a great decrease in traffic receipts.

South Shields.—At a meeting of the T.C. on the 1st inst. Mr. Wylie moved the adoption of the Tramway Committee's report for the past year. He said this was the first year in which they had to face any renewals out of revenue, and their balance, although he admitted that it was small, would bring up their reserve fund to practically £6,000. There were one or two savings that they hoped to make in the near future. There would soon be a reduction in the sinking fund, and they also hoped to make a reduction in the cost of power. Mr. Henderson seconded the adoption of the report. He pointed out that on the turnover of £29,600 they were only down £182. In Newcastle-on-Tyne, where, of course, the undertaking was very much larger, they were down £9,000, and Sunderland, which was a system twice as large as that of South Shields, was also down £9,000. He pointed out that their working costs came out very low—at 5·73d., compared with Newcastle-on-Tyne, 6·28d., and Sunderland, 6·38d.

Wakefield.—The Wakefield and District Light Railway Co. has applied to the B. of T. for permission to abandon portions of the tramways authorised under the Order of 1901-2, viz., a portion in Horbury, the line to Alverthorpe, a portion from Rothwell to Oulton, and a portion of the Ardsley line.

Wallasey.—The U.D.C. has decided not to put out to tender the work of constructing the extension authorised by the Wallasey Tramways and Improvement Act, 1909, but to carry it out by the Council's own departments. Major Greene (tramways manager) and Mr. G. H. Travers (engineer) will forthwith proceed with the work.

Whitworth.—It is intended to commence the construction of the new tramway from Ending through the Whitworth Valley early next spring, and the extended lines are expected to be ready for traffic about three months later. The question of a through service of cars to Bacup has been revived, and the prevailing feeling is that Rochdale should construct the track in the Bacup section, and run the cars on a lease, as the Rawtenstall Corporation is doing in another part of the Bacup borough. The Rochdale Tramways Committee has received a letter from the town clerk of Bacup on the matter, and the whole question has been referred to a Sub-Committee.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions and Repairs:—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	
Tourane-Amoy	June 17, 1909	
Assab-Perim	July 8, 1909	
Gibraltar-Tangier	Aug. 7, 1909	
Dakar-Conakry	Aug. 20, 1909	
Balikpapan-Kwandang	Sept. 2, 1909	

Russia and Press Telegrams.—The Russian Government has agreed to the introduction of a Press tariff over the Siberian telegraph lines, and the Great Northern Telegraph Co. will shortly be able to accept Press messages for China, Japan and the Philippines at the rates prevailing on the Eastern Telegraph system.

Telephone Statistics.—An examination of official statistics shows that Germany, Australia (Commonwealth), Austria, Belgium, Bosnia, Bulgaria, Cape, Ceylon, Portuguese Colonies, Denmark, Egypt, Spain (Government only), France, Great Britain and Ireland, Greece, Hungary, Dutch Indies, French Indo-China, Iceland, Italy, Japan, Luxembourg, Madagascar, Natal, New Caledonia, Orange River Colony, Holland, Roumania, Russia, Servia, Switzerland and Tunis together used the telephone 3,964,721,335 times, and about £14,000,000 sterling was paid for these calls. It will be noticed that figures for the whole of America (North, South or Central) are not included.

Wireless Telegraphy.—From Canadian contemporaries we learn that the amount of damage done to the Marconi wireless station at Glace Bay was about $8,000. All the receiving and sending apparatus in the operating room was destroyed, as well as a good many duplicate parts for the station which were stored in the condenser room. The loss of instruments is not included in the above sum. Mr. Paget, manager of the Marconi Co. at Port Morien, informed the *Montreal Gazette* that it would take a month to restore communication, and that the spare instruments on hand were insufficient for this purpose.

The fire started, he states, in the main office of the sending department, and nothing has been left standing except the boiler house and the four huge towers. One of the latter is badly damaged, and was only saved from destruction by the energetic steps of the staff and firemen.

It is reported that the Dominion Government contemplates spending $36,000 in improving the wireless telegraphic system on the Pacific Coasts. Certain stations are to be enlarged and new ones built at points to link up a chain throughout British Columbian waters.

The steamers *Ben-my-Chree*, *Empress Queen* and *Viking*, sailing between Liverpool and the Isle of Man, are now fitted with wireless, and the charge for telegrams (*via* Seaforth) is 1½d. per word, with a minimum of 1s. 6d.

Wireless Telegraphy and the Post Office.—As the result of the negotiations which have been in progress for some months, it is reported that the Marconi Wireless Telegraph Co. has agreed to transfer six of its wireless telegraph stations to the Post Office, for a consideration not yet disclosed. The stations in question are situated at Liverpool (Seaforth), the Lizard, Niton (I. of W.), Caistor, Crookhaven (near Queenstown), and Rosslare. The company's licence for these would have expired in three years. The trans-Atlantic service *via* Poldhu and Clifden remains in the hands of the company, as well as the communication with lighthouses and lightships; but the Post Office has secured the right to use the Marconi system for 14 years for communication between the mainland and islands off the coast of the United Kingdom, thus avoiding the cost of laying and maintaining cables. The Post Office will work the wireless system as part of the general telegraphic system of the country for communication with passing ships and with islands. It is anticipated that the stations at Withernsea and Hull, now disused, will be re-opened. The Post Office takes over the North Foreland station, which at present is under the joint control of the Marconi Co. and Lloyd's, an arrangement which has caused some friction. The company will retain control over its installations on board ship, which number about 230. The present staff of the shore stations will be taken over by the Post Office for a year, and the Government may eventually retain their services.

In reply to a question in the House of Commons on Tuesday, the Postmaster-General stated that the above announcement was premature, and did not emanate from the Post Office, as the arrangements were not yet complete, and were, to some extent, contingent upon negotiations with Lloyd's, which also were not complete. He promised to make a statement when they were completed.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" to-day.

Telegraph and telephone material for the P.M.G. Melbourne. See "Official Notices" to-day.

Common battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" to-day.

Belgium.—September 28th. La Société Nationale des Chemins de Fer Vicinaux of Brussels (14 Rue de la Science) are inviting tenders for the supply and erection of the overhead equipment for the Anderlues-Lobbes section of the Carnieres-Thuin electric railway.

Bristol.—September 21st. E.L. installation at Alexandra Park Schools, Fishponds, for the T.C. (deposit £2 2s.); Rodway and Dening, architects, Gaunt House, Orchard Street, Bristol.

Burnley.—September 20th. The Guardians are inviting tenders for electrical supplies to the workhouse. Particulars from the Clerk, to whom tenders must be sent by the 20th inst.

Canada.—Toronto.—October 14th. A New York Exchange says that the city of Toronto is inviting tenders for four 1,500-h.p. synchronous motors, two 1,500-h.p. induction motors, four 500-h.p. induction motors and two 225-h.p. synchronous motors, with exciters, switchboards and connections; also for a number of large-sized turbine pumps, piping, valves, &c.

Dublin.—September 13th. 750 a.c. meters, single-phase, for the Lighting Committee. See "Official Notices" September 3rd.

Fulham.—September 22nd. 150 electricity meters for the Corporation. See "Official Notices" to-day.

Great and Little Usworth (Co. Durham).—Lighting certain roads (overhead lines) by electricity, for the P.C.; J. R. Elliott, clerk to the P.C., Fern House, New Washington.

Grimsby.—September 17th. Paper-insulated lead-covered cables for the Corporation. See "Official Notices" September 3rd.

Hungary.—September 18th. Tenders are being invited by the municipal authorities of Magyarkanizsa, for the establishment of a central electric lighting station in the town.

Isle of Thanet.—Stores for the Isle of Thanet Electric Tramways and Lighting Co, Ltd. See "Official Notices" September 3rd.

London.—L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

L.C.C.—September 21st. Two 500-kw. and 150 kw. motor-generators, also high and low-tension switchgear, for sub-stations; steam and other piping, valves &c., for Greenwich generating station. See "Official Notices" August 27th.

Oulton Broad.—The U.D.C. invites applications fro those willing to carry out its E.L. order. See "Official Notices to-day.

Transvaal.—The *Board of Trade Journal* quotes a Sout African paper to the effect that the tenders are to be invited fo the supply, to the Johannesburg Town Council, of electric generat ing plant, &c., to the value of some £57,000, as follows:—Fou boilers, each capable of producing 14,000 lb. of steam per hou £9,460; four mechanical stokers, £3,200; economisers, £2,000; on chimney and necessary flues, £2,200; steam, exhaust and circulatin piping, £1,500; two cooling towers, £2,000; cooling pond, £750 two feed-pumps and house, £600; one borehole and pump, complet with house, and reboring existing borehole, £790; removing si boilers, steam pipes, &c, £500; engines, about £34,000.

CLOSED.

Admiralty.—The Electrical Apparatus Co., Ltd., has received the Admiralty contract for all enclosed fuses, from 35 to 60 amps. inclusive, up to December 31st, 1911.

Birkdale.—The U.D.C. has accepted the tender of the Horsfall Destructor Co., Ltd., of Leeds, for a refuse destructor, at £2,699.

Blackburn.—The T.C. has accepted the tender of the Wigan Coal & Iron Co., Ltd., for coal for the electricity works.

Bradford.—The Corporation Electricity Committee has recommended the acceptance of tenders as follows for the work of installing electric light and power plant at the Technical College:—

Crossthwaite Fire Bar Syndicate, Ltd.—Cooling tower, £168.
Cole, Marchent & Morley.—Low-speed engine, with rope pulley, also surface condenser and jet condenser, £1,200.
Campbell Gas Engine Co.—Gas engine, with suction gas plant, starter, &c., £1,100.
Tudor Accumulator Co.—Battery of 220 cells, £332.
Siemens Bros., Ltd.—Motor-generator, £171.
Phœnix Dynamo Co.—High-speed set, low-speed set, booster and balancer, gas set, £600.
Thwaites Bros., Ltd.—High-speed engine, £260.
T. Green & Sons, Ltd.—Economiser, £104.
Holdsworth & Sons.—Lancashire boiler, £368.

The total amount of the tenders is £4,303.

Burnley.—The E.C. has accepted Messrs. Siemens Bros.' tender to supply 1,900 yards of ·1 square inch cable and 950 yards of ·05 square inch cable; also that of a firm for the supply of two mechanical stokers.

Dundee.—The contract for the lighting by electricity of St. Leonard's School Laboratory, St. Andrews, has been secured by Messrs. Maxwell (Dundee), Ltd.

Glasgow.—The Corporation Tramways Committee has recommended the acceptance of the following tenders:—

Single core lead-covered cable.—Standard Cable Manufacturing Co., Ltd.
36-in. copper rail bonds.—U.S. Steel Products Export Co.
Lead-covered and armoured cable.—British Insulated and Helsby Cables, Ltd.

Mansfield.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for water softening plant for the electricity works, at £220.

Nelson.—Messrs. James Batty & Co., of Burnley, have received the contract for lighting and ventilating work at the new Palace Theatre and Hippodrome now being built in Nelson.

Pontypridd.—The following is a list of the tenders received by the electric lighting and tramways department (Mr. J. E. Teasdel, engineer and manager), for one 500-kw. combined generator, consisting of one 720-b.h.p. engine, together with one 350-kw. and 150-kw. dynamos:—

	Engine.	Dynamo.	£
Brush Elec. Eng. Co.	Brush	Brush	2,824
Phœnix Dynamo Co.	Belliss	Phœnix	2,873
Browett, Lindley & Co.	Browett	Bruce Peebles	2,893
Siemens (accepted)	**Belliss**	**Siemens**	2,894
J. Howden & Co.	Howden	Brit. Elec. Plant	2,908
Browett, Lindley & Co.	Browett	Siemens	2,913
Elec. Construction Co.	Belliss	E.C.C.	2,913
J. Howden & Co.	Howden	Bruce Peebles	2,919
Rees Roturbo	Belliss	Rees Roturbo	2,928
Bruce Peebles & Co.	Belliss	Bruce Peebles	2,936
Browett, Lindley & Co.	Browett	E.C.C.	2,955
Brit. Elec. Plant Co.	Belliss	Brit. Elec. Plant	2,955
Browett, Lindley & Co.	Browett	Lanc. D. & M.	2,968
J. Howden & Co.	Howden	Westinghouse	2,980
Lanc. Dynamo and Motor Co.	Belliss	Lanc. D. & M.	2,991
Brit. Thomson-Houston Co.	Belliss	B.T.-H.	2,998
Brit. Elec. Plant Co.	Howden	Brit. Elec. Plant	3,000
J. Howden & Co.	Howden	Lanc. D. & M.	3,025
General Electric Co.	Belliss	G.E.C.	3,029
British Westinghouse	Belliss	Westinghouse	3,042
Siemens	Howden	Siemens	3,045
Siemens	Browett	Siemens	3,061
J. Howden & Co.	Howden	E.C.C.	3,061
Bruce Peebles & Co.	Browett	Bruce Peebles	3,085
British Westinghouse	Allen	Westinghouse	3,119
General Electric Co.	Allen	G.E.C.	3,124
J. Howden & Co.	Howden	G.E.C.	3,139
British Westinghouse	Howden	Westinghouse	3,145
General Electric Co.	Howden	G.E.C.	3,188
British Westinghouse	Browett	Westinghouse	3,190
General Electric Co.	Browett	G.E.C.	3,202
Dick, Kerr & Co.	Belliss	Dick, Kerr	3,214
J. H. Holmes & Co.	Belliss	J. H. Holmes	3,409

The tenders for independent surface condensing plant (including £100 for contingencies) were:—

Worthington Pump Co. (accepted)	£1,560	John Thompson	£1,771
Midland Engineering Co. ..	1,570	Mirrlees Watson Co.	1,803
Brush Elec. Eng. Co.	1,579	Belliss & Morcom	1,803
W. H. Allen, Son & Co.	1,610	R. J. Mitchell	1,930
Isaac Storey	1,626	British Westinghouse Co. ..	2,031
Willans & Robinson	1,662	Richardsons, Westgarth & Co.	2,076
Cole, Marchent & Morley ..	1,721	Loe, Howl & Co.	2,078

Rochdale.—The T.C. has accepted the tender of the Lorain Co., of Johnstown, Penn., for points and crossings for the tramways, at £422.

Swansea.—The Education Committee has accepted the tender of Messrs. Mills, English & Co., Ltd., Swansea, for electric light fittings, &c., for the Technical College extensions, at £375.

York.—The Tramways Committee has accepted the tender of the British Thomson-Houston Co., Ltd., at a cost of £10,914, in connection with the tramways reconstruction. It has been decided to cease running the horse cars this week, and to substitute 'buses, in order not to impede the work of electrification.

NOTES.

Municipal Tramways' Association: Annual Conference.—The eighth annual Conference of this Association is to be held in London at the County Hall, Spring Gardens, S.W., on September 22nd, 23rd and 24th. Mr. A. L. C. Fell will deliver the presidential address. Following this there will be papers and other arrangements as follows:—

Wednesday, September 22nd.—
"Medical Examination of Tramway Employés," by Councillor A. W. Chapman, vice-chairman of Manchester Tramway Committee.
Luncheon at the Trocadero at the invitation of the chairman of the L.C.C.
"The Central Repair Depôt of the London County Council," by Mr. W. E. Ireland, rolling stock superintendent, L.C.C. tramways.
Association Dinner at the Garden Club, White City, at 7.30 p.m.

Thursday, September 23rd —
"Some Comparisons of Continental and British Methods of Operating Tramways," by Mr. A. R. Fearnley, general manager, Sheffield Corporation tramways.
"Current Consumption," by Mr. R. S. Pilcher, general manager, Aberdeen Corporation Tramways.
Luncheon at the Holborn Restaurant at the invitation of the Highways Committee.
Visit to Central Repair Depôt, and Greenwich generating station, followed by tea provided by the President.
Reception at Mansion House, by the Lord Mayor of London, at 9 p.m.

Friday, September 24th.
Business Meeting, followed by an excursion to Windsor.
The Waldorf Hotel is to be the headquarters of the Association during the Conference. Mr. A. R. Fearnley is secretary of the Association.

Electric Lift Fatality.—At Warrington on August 25th an inquest was held into the death of William Taylor, 26, a shopman at the Co-operative Stores. It appeared that Taylor was unloading an electric lift, when he set it in motion apparently intending to raise it 2 or 3 ft. It, however, continued rising, and dragged deceased with it, crushing him between it and the ceiling. It was suggested, says the *Manchester Daily Guardian*, that the starting button, or "plunger," was defective, and that it was apt to stick. Thomas Hardman, who was working with Taylor at the time of the accident, admitted that it had been sticking on and off for a month, but that no formal report had been made to the management. The shop manager knew of the defect, but understood that it was not material. The chief electrical engineer of the Stores said that Taylor disobeyed instructions in starting the lift from the outside. Had it been started from the inside with the gates properly closed it would have been impossible for the accident to occur. The Coroner's officer said that he examined the "plunger" an hour after the accident and found that it was rusty and that it stuck. The jury found a verdict of accidental death, and attached no blame to the Society or its officials. They, however, recommended that the "plunger" should be encased in a non-corrosive box and that there should be periodical examinations of it. It would be preferable to provide automatic safeguards, which would render it impossible to start the lift with the gates open.

Breakdown at Niagara.—One of the new 10,000-H.P. turbines in power house No. 3 of the Niagara Falls Hydraulic Power and Manufacturing Co. broke down recently, and two employés were injured. The casing burst, and a piece of metal was hurled across the station, which was partly flooded with the outrush of water. At the time the wheel was moving under about 75 lb. pressure, but has withstood much higher pressure. A defect in the casting is suspected as being the cause of the break.—*Power.*

Lecture Notes.—On August 23rd, at the South-Eastern Agricultural College, Mr. E. Kilburn Scott delivered a lecture on the application of electric power to the manufacture of manures and for expediting plant growth by high-tension discharge. The audience included the staff and about 90 schoolmasters of Kent and Surrey, resident at the college. Mr. Kilburn Scott first referred to the prophecy of Sir William Crookes in 1893, that a time would arrive during this century when the output of sulphate of ammonia from gas works and coke ovens, plus the natural deposits of guano and of sodium nitrate from Chile and Peru, would fall short of that necessary to keep up the supply of the world's wheat, &c. He then described the manufacture of calcium nitrate and calcium cyanamide. Both the above manures have the advantage over sodium nitrate of depositing lime in the soil when they give up their nitrogen. They are, therefore, very good for clayey, sandy, and such other soils as are naturally short of lime. The concluding part of the lecture dealt with the high-tension discharge experiments which for the past two years have been carried on near Gloucester. Mr. Kilburn Scott's lecture was somewhat similar to one he delivered last year at the leading Agricultural College in Australia, whilst he was head of the Electrical Engineering Department at the University of Sydney, New South Wales.

Appointment Vacant.—The Swinton and Pendlebury Electricity Committee has decided to appoint its own electrical engineer for the management of the electricity undertaking. Hitherto the management has been in the hands of the Lancs. Electric Power Co., to which the Council has paid £150 per annum.

Electrical Fatality.—The *Daily News* says that John Dent Thompson, a miner, of Sheldon, employed at a colliery electric pump, on Tuesday took hold of a live wire with his naked hand, and was instantly killed.

Parliamentary.—Third Reading.—In the House of Commons last week the Telegraph (Arbitration) Bill was read a third time.

El Dorado.—The Llandilo Council received 400 applications for particulars of the post of electrical engineer recently advertised; 216 sent in formal applications. The E.L. Committee selected six for the Council's consideration. The salary is to be from £100 to £130, and the age between 25 and 45.

Sequel to an Electric Train Accident.—At the Lancaster County Court on Friday, Judge Hans Hamilton heard an action against the Midland Railway Co. arising out of an electric train accident on the Lancaster and Morecambe line on June 18th, when a landau and horse belonging to Henry Needham, of Morecambe (the plaintiff), were cut up. The damages claimed were £40. It was urged that the company were guilty of negligence through their servants in not giving sufficient warning of the approach of the train at the level crossing where the accident happened, and in leaving the crossing in charge of a woman, who did not open the gates when requested. In the course of the hearing, Motorman Woodhouse said he sounded his hooter repeatedly, and the driver of the vehicle never looked up. The line was straight for nearly 2 miles.—His Honour found there had been contributory negligence on the part of the driver of the landau, and non-suited the plaintiff. He added that the motorman did all he could to avoid the accident.

Sheffield Electrical Department.—The following motion was down on the agenda for Wednesday's meeting of the Sheffield Corporation:—

"That it be an instruction to any Committee of the Council (including the Education Committee) requiring work done by an electrician not to apply for or accept any tender for such work—but that the same be entrusted to the electric department of the Corporation; which department is hereby instructed to execute such work at the actual net cost thereof with an addition of 5 per cent. to cover standing charges."

The Overcrowded Profession?—It is reported in the Press that the Shoreditch Board of Guardians has given the appointment of assistant relieving officer to "Mr. H. L. White, an electrician," son of the Board's chairman.

Educational.—Glasgow and West of Scotland Technical College.—The Calendar for 1909-10 has come to hand, and gives the usual particulars relating to the courses of instruction; the new session opens on the 23rd inst., and the third section of the new buildings will be brought into use.

Northampton Polytechnic Institute.—We have received a copy of the "Announcements" for 1909-10, a volume which yearly increases in size, and gives particulars not only of the educational but also of the many social features of the Institute. Besides the usual technological courses, the Institute provides special instruction in technical optics and horology. The head of the electrical engineering department is Dr. R. Mullineux Walmsley, principal of the Institute, with whom is associated Dr. C. V. Drysdale; Mr. A. C. Jolley is the senior demonstrator and lecturer. Special lectures are given by Mr. H. M. Hobart (Electrical Engineering Design), Dr. J. Erskine-Murray (Radio-Telegraphy), Mr. J. H. Stephens (Submarine Cable Work), Mr. W. H. Winny (Applied Electricity) and Mr. E. K. Scott (Quantities and Estimates), and there are special classes for postal telegraph officers, conducted by Mr. A. W. Martin, with four assistants. A course in Electro-chemistry has been organised, and a new departure has been made in the addition of a class in Aeronautical Engineering. It will be seen, therefore, that the Institute is in close touch with present-day practice. The volume gives full particulars of the courses of instruction, with illustrations of the laboratories. Evening work begins on the 27th inst., and day work on October 4th. The new building is now in use, providing much-needed accommodation for the enlargement of the engineering laboratories.

Manchester Municipal School of Technology.—The calendar for session 1909-10 has been issued, and forms a bulky volume of over 500 pages; an abridged calendar of 20 pages is also issued. The new session opens on the 20th inst.; Prof. Schwartz is the head of the Physics and Electrical Engineering Department, and among his staff are Messrs. C. F. Smith and W. Cramp. Prof. W. W. Haldane Gee is Professor of Pure and Applied Physics. Excellent half-tone illustrations are given of the laboratories, which are admirably equipped, with very full details of the numerous courses provided.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Longton T.C. has increased the salary of Mr. W. Langford, manager of the gas and electricity works, from £500 to £550 per annum.

Mr. C. Furness, borough electrical engineer at Blackpool, who underwent an operation on August 28th, is making satisfactory progress towards recovery.

The Sydney City Council has confirmed the appointment of Mr. E. J. Cochrane, A.I.E.E., of Ballarat (V.), as chief assistant to Mr. H. R. Forbes Mackay, city electrical engineer, at £500, rising to £600 per annum.

On Friday, August 27th, at the Tiger Hotel, Pontmorlais, Mr. A. J. Howard, chief assistant engineer to the Merthyr Electric Traction and Lighting Co., Ltd., was presented by the staff and employés with a portmanteau, writing case and Dawson's "Electric Traction Pocket-Book," on the occasion of his leaving, after 2½ years' service with the company. Mr. Lewis W. Dixon, managing engineer, made the presentation.

The Hove Town Council has received the resignation of Mr. G. M. Harris of his post as resident electrical engineer to the Aldrington electric lighting undertaking, in consequence of ill-health.

Tramway Officials.—Mr. W. W. Webster, chief inspector of the Burton-on-Trent and Ashby Light Railway, has been appointed instructor to motormen by the Bournemouth T.C.

Mr. Daniel Fisher, son of the manager of the Dundee Corporation Tramways, has been appointed manager of the Dundee, Broughty Ferry and District Tramway Co., Ltd., in succession to Mr. J. H. Shepherd.

General.—We have much pleasure in announcing that Mr. T. Mather, Wh.Sch., F.R.S., has been appointed Professor of Electrical Engineering at the Central Technical College, S.W., in succession to the late Prof. W. E. Ayrton. The appointment will give great satisfaction to Prof. Mather's numerous friends, especially to the army of "old students," who regard their association with him in their college days as one of their most valued privileges. Mr. Mather for many years held the post of chief assistant in the Electrical Engineering Department, and is a member of the Faculty of Engineering of the University of London, as well as of the Board of Examiners and Board of Studies in Electrical Engineering of the University, and Member of Council of the Institution of Electrical Engineers, and of the Physical Society. Of his numerous inventions many are in every-day use in electrical works and laboratories, and his scientific papers, many of which were prepared in collaboration with Prof. Ayrton, have made his name familiar to the electrical engineer; in particular the Ayrton-Mather moving-coil galvanometer, electrostatic voltmeters, non-inductive resistances, and universal shunt may be mentioned as especially noteworthy. Under Mr. Mather's immediate supervision the electrical engineering department at the College has been reorganised and extended during recent years, and is able to hold its own with any of the admirably equipped laboratories which have been organised in our great cities, modelled largely on the pattern of the C.T.C. Mr. G. W. O. Howe, Wh. Sch., M.Sc., who was formerly for several years with Messrs. Siemens Bros. & Co., and Messrs. Siemens and Halske, of Charlottenburg, and has been chief lecturer and demonstrator at the C.T.C. since 1905, has been appointed Assistant Professor of Electrical Engineering at the Central Technical College; we have pleasure in offering our congratulations to both parties.

Mr. G. H. C. Risch, M.I.E.E., who has had an exceptionally varied and thorough electrical engineering experience extending over more than 20 years, and who for eight years held the position of chief electrical engineer for the Transvaal and Orange River Colony Railways, is now in England. We understand that he is here with a view to entering upon a new appointment when opportunity arises.

The *Times* announces that Major C. G. Burnaby, R.E., now serving at Falmouth, has been appointed Chief Instructor at the School of Electric Lighting, Plymouth, in place of Major St. G. R. Caulfeild, whose appointment has expired.

We are asked to state that the note in our last issue respecting Mr. Rankin's appointment does not refer to the Electrical Co., Ltd. (A.E.G., Berlin), Manchester.

We regret to learn from our trans-Atlantic contemporaries of the sudden death of Mr. A. A. Knudson, a well-known New York consulting engineer and expert on electrolysis. Mr. Knudson was a very frequent contributor to the Press on the subject mentioned.

Mr. R. W. Hogarth, of 16, Rutland Square, Edinburgh, whose late partner, Mr. Buchan, recently died, has made arrangements with Mr. C. S. Vesey Brown, M.Inst.C.E., and Mr. Wilfred Hall, A.M.Inst.C.E., for carrying on with them practice as consulting electrical and mechanical engineers at the above address, and also at Newcastle and in London, under the firm name of Buchan and Partners.

On September 3rd, at Turnham Green, the marriage took place of Percy, eldest son of Mr. S. Alfred Varley, of dynamo fame, to Violet, daughter of the late J. E. Bloom. The Rev. Telford Varley, M.A., brother of the bridegroom, performed the ceremony.

The Sunderland Education Committee has decided to appoint Mr. W. T. MacCall, M.Sc., of Halifax, head of the Electrical Engineering Department at the Sunderland Technical College.

Mr. Horace H. Leage, A.M.I.E.E., announces that he is giving up his address at 10, City Road, London, E.C., having taken an appointment with Messrs. A. W. Pocklington & Co., 47, York Street, Westminster.

Mr. William Murray, of the firm of Williamson, Murray and Co., has joined the board of the Edison & Swan United Electric Light Co., Ltd.

On Saturday last the electrical staff of the Frodingham Iron and Steel Co., Ltd., made a presentation to Mr. A. G. Cutts, who is leaving to take up the position of chief electrical engineer to the Leeds Copper Works, Ltd.

Obituary.—The death is announced from Sydney of Mr. D. Kirkcaldie, assistant commissioner of the New South Railways.

NEW COMPANIES REGISTERED.

Prestwich & Burt, Ltd. (104,596).—This company was registered on August 16th, with a capital of £1,500 in £1 shares, to acquire the interest of E. C. Lea in the business carried on by him at South Lane, Kingston-on-Thames, as Prestwich & Burt, and to carry on the business of manufacturing electricians, electrical and mechanical engineers and contractors, founders, dealers in electrical accesories, &c. The subscribers (with 450 shares each) are:—A. Vandam, 17, Evelyn Mansions, Carlisle Place, S.W., electrical engineer; C. Zee, 17, Evelyn Mansions, Carlisle Place, S.W., electrical engineer. Private company. The number of directors is to be three: the first are A. Vandam, C. Zee and C. Lea (all permanent, subject to holding 450 ordinary shares). C. Zee is the first secretary. Table "A" mainly applies. Registered by William Hurd & Son, 25, Bucklersbury, E.C.

Bowers & Barr, Ltd. (104,680).—This company was registered on August 23rd, with a capital of £2,000 in £1 shares, to take over the business of electrical engineers carried on by F. C. Bowers and E. V. Barr, as "Bowers and Barr," at Great Yarmouth. The subscribers (with 100 shares each) are:—F. C. Bowers, 134, Lichfield Road, Great Yarmouth, electrical engineer; O. A. Hubbard, Northfield, North Walshsm Road, Norwich, electrician. Private company. Table "A" mainly applies. Registered by Ferrier & Ferrier, 33. Hall Plain, Great Yarmouth.

International Electric Transport and Enterprise Co., of Alsace-Lorraine, Ltd. (104,668).—This company was registered on August 21st, with a capital of £200,000 in 195,000 preferred shares of £1 each and 100,000 deferred shares of 1s. each, to undertake and develop electric carriage and other enterprises in Alsace-Lorraine and elsewhere, and to carry on the business of constructors of electric tramways and railways, motor-vehicles, tunnels, bridges and roads, carriers of passengers and goods, &c. The subscribers (with one preference share each) are:—K. S. Thompson, Farnaby, Sevenoaks, solicitor; E. T. Wheeler, 47, Durlston Road, Upper Clapton, N.E., accountant; F. H. Fletcher, 3, East India Avenue, E.C., solicitor; A. Molock, 3, East India Avenue, E.C., secretary; F. J. Allen, 3, East India Avenue, E.C., secretary; A. F. Argles, St. Stephen's House, Victoria Embankment, S.W., surveyor; W. H. Quarrell, 3, East India Avenue, E.C., solicitor. Minimum cash subscription, £2,000. The number of directors is not to be less than two or more than eleven; the first are C. Simon and A. Sautier (both of Guebwiller, Alsace, Germany) and A. F. Argles; qualification, £100; each director is to receive £1 per board meeting attended, in addition to travelling and hotel expenses, and also £4 per day "during absence from place of residence"; directors and managing director also to be entitled to a fixed remuneration, to be decided on by the board. Registered office, 3, East India Avenue, E.C.

E.M.F., Ltd. (104,699).—This company was registered on August 24th, with a capital of £20,000 in £1 shares, to adopt an agreement with J. M. Bein, A. J. Grose, T. H. Satchwell and O. H. Bishop, and to carry on the business of electricians, mechanical and electrical engineers, suppliers of electricity for light, heat, motive power, or other purposes, &c. The subscribers (with one share each) are:—J. M. Bein, 103, Muswell Avenue, Muswell Hill, N., electrical engineer; A. J. Grose, 14, Ashchurch Grove, Shepherd's Bush, W., gentleman; O. H. Bishop, 7, Layer Gardens, West Acton, W., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are J. M. Bein, A. J. Grose and O. H. Bishop; remuneration of J. M. Bein and A. J. Grose, £450 per annum; of O. H. Bishop, £500 per annum. Registered by Barfield & Barfield, 47, Finsbury Square, E.C.

Bullivant's South African Co., Ltd. (104,728).—This company was registered on August 26th, with a capital of £5,000 in £1 shares, to carry on in South Africa and elsewhere the business of dealers in wire rope and netting, torpedo defence nets, wire tramways, mining and hauling plant, telegraph cables, and all apparatus and appliances connected therewith. The subscribers (with one share each) are:—W. P. Bullivant, 72, Mark Lane, E.C., wire rope manufacturer; F. A. Bullivant, 72, Mark Lade, E.C., wire rope manufacturer; P. J. Bullivant, 72, Mark Lane, E.C., wire rope manufacturer; B. S. Bullivant, 72, Mark Lane, E.C., wire rope manufacturer. Private company. The number of directors is not to be less than two or more than four: The first are W. P. Bullivant, F. A. Bullivant, P. J. Bullivant and B. S. Bullivant. Registered office, 72, Mark Lane, E.C.

Plutte, Scheele & Co., Ltd. (104,840).—This company was registered on September 3rd, with a capital of £6,000 in £1 shares, to adopt an agreement with F. Plutte for the acquisition of the business of Plutte, Scheele and Co., and to carry on the business of manufacturers of and sellers of articles and accessories required in the electrical and allied trades, &c. The subscribers (with one share each) are:—J. N. Cooper, 18, 19, Queenhithe, E.C., electrical engineer; P. Kuppers, 18, 19, Queenhithe, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are J. N. Cooper and P. Kuppers; remuneration as fixed by the company. Registered office, 18 and 19, Queenhithe, E.C.

National Lighting Corporation, Ltd. (104,780).—This company was registered on August 30th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, manufacturers of and dealers in electric lights and electrical appliances and novelties, &c. The subscribers are:—A. Lange, 93, Aldersgate Street, E.C., merchant, two shares; I. Frohwein, 93, Aldersgate Street, E.C., merchant, one share; S. Mundler, 35, Cock Lane, Snow Hill, E.C., business manager, one share. Private company. The number of directors is not to be less than two or more than five: the first are A. Lange, I. Frohwein and S. Mundler; qualification (except managing director), £100; remuneration, one guinea each per board or general meeting attended, Registered office, 35, Cock Lane, Snow Hill, E.C.

OFFICIAL OF RETURNS ELECTRICAL COMPANIES.

Llandudno and Colwyn Bay Electric Railway, Ltd. (89,639).—Trust deed dated July 27th, 1909, to secure £75,000 1st mortgage debentures, charged on the railway undertaking authorised by the Llandudno and Colwyn Bay Light Railway Orders 1898 to 1907, and the company's general assets, present and future. Holders: Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, Old Broad Street, E.C.

A memorandum of satisfaction in full on July 27th, 1909, of debentures dated March 11th, 1909, securing £50,000, has been filed.

Kent Electric Power Syndicate, Ltd. (72,742).—Debenture for £1,038, dated August 5th, 1909, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Kent Electric Power Co., Strood.

Memoranda of satisfaction (*a*) in full on November 8th, 1905, of charge dated February 14th, 1905, securing £4,275, (*b*) to the extent of £1,800 on July 24th, 1908, of charge dated May 26th, 1905, securing £1,850, and (*c*) in full on August 13th, 1906, of charge dated July 3rd, 1905, securing £750, also notified on August 1st, 1909.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Charge under Land Transfer Acts, dated August 11th, 1909, to secure £25,000, charged on freehold land and buildings at Southfields, S.W. Holders: J. G. B. Stone, 9, Draper's Gardens, E.C.; and J. Venning, 5, Gray's Inn Square, W.C.

Chipperfield Lamp Syndicate, Ltd. (98,008).—Issue on August 13th, of £60 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

British Thomson-Houston Co., Ltd.

The report of the directors to be submitted to the meeting to be held at 83, Cannon Street, E.C., on September 14th, covers a period of 12 months from April 1st, 1908, to March 31st, 1909. It reads as follows:—

Works at Rugby.—The buildings and machinery of the company have been maintained in first-class condition during the year, and while the directors have not been able to make depreciations, except as hereinafter mentioned, they have made a number of improvements and additions, the most important being the extension of the steam plant, at a cost of £8,766. They have also followed their usual practice of making reserves to cover risks in connection with bad debts, depreciation of shares held by the company, and for other contingencies.

Curtis Steam Turbines.—As stated in the last annual report, the company now owns all the patents for the United Kingdom for Curtis steam turbines, excepting the marine rights. During the financial year the company sold 12 turbines aggregating 15,000 KW., and the directors feel confident that the business of the company in steam turbines will be large, due not only to the unrivalled excellence of the company's apparatus, but also to the unique fact that the company can supply either the vertical or the horizontal type, whichever is best suited to each installation. In this connection it is interesting to note that since the end of the year under review the company has sold 18 turbines, aggregating 18,569 KW.

Industrial Developments.—The volume of business in this direction during the year has not been satisfactory, due to the depressed condition of trade generally, yet a large number of important contracts have been secured, and marked progress has been made.

Central Station Developments.—The most important contracts have been for turbines, the sales of which are referred to above.

Traction Work.—The quantity of electrical equipment for tramway and railway work sold in Great Britain during the year has been very small, but the company has received its fair share of this business.

Switchboards.—The company has closed several important contracts for switchboards during the year.

Metallic-Filament Lamps.—The company has made further satisfactory progress in the development of metallic-filament (tungsten) lamps, and, to meet the increasing demand, is extending its manufacturing facilities.

Debenture Redemption.—Under the terms of the trust deed securing the issue of the company's debentures, the company had to pay to the trustees on February 28th last the sum of £3,339, to be applied by them in purchasing debentures in the market. Debentures of the par value of £3,500 were purchased prior to March 31st (the end of the year under review), making the total par value of debentures retired to date £7,060.

The directors regret that the balance-sheet shows a loss of £825 as the result of the year's working, after paying interest on debentures and on loans. They deem it wise, however, to write off certain items, and to that end have carried into the profit and loss account the balance brought forward from last year—viz., £2,467 and the reserve of £15,409, which have been applied as shown in the profit and loss statement. Mr. J. F. Nauheim has been elected chairman of the company.

United Electric Car Co., Ltd., Preston.

The directors' report for the year ending June 30th, 1909, states that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £2,500, and charging £5,646 for depreciation, the profit for the year is £8,896, to which is added £6,187 brought from last year, making a total of £15,083. After deducting preference dividend for the six months ending December 31st, 1908, £3,000, there is an available balance of £12,083. The directors recommend that this amount be dealt with as follows:—Preference dividend, less income-tax, for the half-year ending June 30th, 1909, £3,000, a dividend of 2½ per cent., less income-tax, on the ordinary shares for the year ending June 30th, 1909, £3,750, carrying forward to next year £5,333.

The meeting is to be held at Preston on September 15th.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. on the capital stock has been declared, payable on October 1st.

Canadian General Electric Co.—The directors have declared a dividend of 1¾ per cent. on the common stock for the three months to 30th inst., being at the rate of 7 per cent. per annum.

British Columbia Electric Railway Co., Ltd.—The directors have announced to shareholders their intention to make a further issue of £500,000 of capital offering same to the preferred and deferred ordinary stockholders. The new capital will take the form of 5 per cent. cumulative preference shares (200,000 of £1 each at 1s. premium), 5 per cent. non-cumulative preferred ordinary (200,000 of £1 each at 2s. premium), and deferred ordinary (100,000 of £1 each at 3s. premium). The new capital is required to keep pace with the rapidly increasing business in every department.

Ibbotson Bros. & Co., Ltd.—The thirty-seventh annual report states that the profit for the year ended June 30th amounts to £23,154, to which has to be added £10,492 brought forward. The directors recommend that a final dividend be paid of 6s. per share, tax free, making 10 per cent. for the year, that £3,000 be added to the reserve fund, and that the balance of £11,116 be carried forward.

Germany.—The balance-sheet of the Hamburgische Electricitätswerke Gesellschaft, of Hamburg, for the last financial year shows a net profit of £100,349 as contrasted with £100,647 in the preceding 12 months. A dividend at the rate of 8 per cent. is again being declared.

Doulton & Co., Ltd.—The directors announce (says a financial daily) that they are advised that the trading of the past six months does not warrant the declaration of an interim dividend on the preference shares.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a dividend of 2s. each on the ordinary shares.

Dundee and Broughty Ferry Tramway Co.—The directors' report states that the profit (including sum brought forward from last year) amounts to £4,512. From this there falls to be deducted interim dividend paid on 6 per cent. preference shares on February 1st last, £1,500, leaving a balance of £3,012. The directors recommend the disposal of this sum as follows:—(1) To pay final dividend on 6 per cent. preference shares, £1,500; (2) to renewals fund, £600; (3) to fund for redemption of debenture stock, £600; and (4) to carry forward to next account, subject to remuneration of managing director for part of year, £312. The total earnings for the year amounted to £12,835, an increase of £227 over last year.

Prospectuses.—*Krubong (Malacca) Rubber Plantations, Ltd.*—There has been offered this week an issue of 13,666 shares of £1 each in this company.

Batu Kawan Rubber and Coconut Plantations, Ltd.—This company, operating in the Straits Settlement, is offering 42,500 shares of £1 each for subscription.

The Ivory Coast Rubber Estates, Ltd.—An issue of 50,000 shares of £1 each was offered for subscription last week. The company is to purchase two concessions granted by the Government of the Ivory Coast Colony of West Africa.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Sept. 1	3,179	+ 86	13	20,948	— 600	..	..
Ayr	,, 4	731	+ 33	16	6,543	— 193	8	..
Bath	,, 1	1,810	+ 202	35	27,2[illegible]9	+ 1,229	..	..
Belfast	,, 3	7,409	+ 238	21	86,436	+ 3,827	37	..
Birkenhead	,, 5	2,222	+ 66	22	24,549	— 375	18·63	..
Birmingham Corp.	Aug. 28	12,846	+ 290	22	141,693	+ 3,727	..	..
Blackburn	Sept. 1	1,070	— 116	23	26,052	— 988	13·97	..
Blackpool-Fleetw'd	,, 4	3,005	+ 509	9	14,488	+ 639	..	..
Bolton	,, 5	4,698	+ 215	23	54,228	— 675	42	..
Bournemouth	,, 1	4,494	+ 146	22	40,462	+ 265	21·96	..
Bradford	,, 4	9,860	+ 539	22	112,580	+ 2,477	54·9	..
Brighton	,, 6	2,510	+ 314	23	24,423	+ 1,119	9·5	..
Bristol	,, 8	11,712	+1,735	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Aug. 27	473	+ 15	34	7,411	— 100	3·65	..
Barnsley	,, 27	415	— 47	,,	5,745	— 316	..	..
Barrow	,, 27	531	— 46	,,	7,904	— 606	5·37	..
Cavehill	,, 27	239	+ 17	,,	3,059	— 137	..	..
Devonport	,, 27	768	— 224	,,	12,597	— 3,071	8·85	..
Gateshead	,, 27	2,334	+ 15	,,	33,885	— 295	11·25	..
Gravesend	,, 27	499	— 32	,,	7,132	— 139	6·5	..
Greenock	,, 27	1,351	+ 129	,,	18,729	+ 526	7·25	..
Hartlepool	,, 27	571	— 19	,,	8,017	— 223	6·72	..
Kidderminster	,, 27	279	+ 13	,,	3,755	— 221	..	..
Leamington	,, 27	418	+ 9	,,	5,977	+ 182	..	..
Merthyr	,, 27	445	+ 18	,,	7,820	+ 103	2·9	..
Metropolitan	,, 27	13,479	+1,522	,,	209,768	+16,535	22	..
Middleton	,, 27	812	— 67	,,	11,628	— 949	8·5	..
Mid. Joint Com'tee	,, 27	11,550	+ 197	,,	193,687	— 2,270	..	..
Oldham—Ashton	,, 27	1,211	— 84	,,	19,106	— 1,218	9·18	..
Peterborough	,, 27	189	+ 6	,,	4,042	— 330	5·31	..
Potteries	,, 27	8,451	+ 135	,,	60,064	— 1,284	29	..
Rothesay	,, 27	1,179	+ 72	,,	8,089	— 129	2·75	..
Southport	,, 27	738	— 27	,,	10,075	— 811	8·17	..
S. Metropolitan	,, 27	1,937	+ 195	,,	27,228	— 394	..	..
Swansea	,, 27	2,193	+ 110	,,	32,825	+ 575	12·5	..
Tynemouth	,, 27	907	+ 152	,,	8,730	+ 564	3·75	..
Weston-s-Mare	,, 27	900	+ 48	,,	5,531	+ 264	3	..
‡Worcester	,, 27	671	+ 19	,,	9,555	— 70	5·75	..
Wrexham	,, 27	225	— 5	,,	3,336	— 148	..	..
Yorks. Wool. Dist.	,, 27	1,998	+ 85	,,	30,860	— 383	17	..
Miscellaneous	,, 27	533	+ 55	,,	7,155	+ 124	..	..
Burnley	Sept. 4	2,522	+ 139	..	..	..	..	..
Burton-on-Trent	,, 5	547	— 23	23	6,208	— 170	6·63	..
Bury	Aug. 29	2.3 5	— 3	21 4/7	26,084	— 593	22·5	..
Cardiff	,, 28	4,581	+ 126	22	49,548	+ 4 8	..	..
Carlisle	Sept. 3	364	— 30	35	5,859	— 244	..	..
Chatham and Dist.	,, 2	1,929	+ 207	35	28,700	+ 1,690	14·98	..
Cork	,, 2	1,009	+ 44	35	15,482	— 767	..	..
†Croydon	Aug. 27	3,342	+ 676	..	33,355	+ 1,220	11·25	4·75
†Darlington	,, 28	197	— 15	22	4,133	— 276	..	..
Darwen	Sept. 4	488	— 7	22	5,654	— 228	4·36	..
†Dover	Aug. 28	671	+ 95	22	4,990	— 381	4·75	..
Dublin	Sept. 3	12,670	+ 829	..	56,628	+ 1,235	54·25	..
Dundee	,, 1	2,585	+ 126	15 4/7	18,899	— 422	15	..
East Ham	,, 4	1,964	+ 356	22½	23,119	+ 3,210	8 43	·68
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 4	33,868	+ 145	..	230,572	— 3,848	90·5	1·5
Hastings	,, 2	3,058	+ 171	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
†Hull	Aug. 28	2,571	+ 214	21	51,388	+ 1,433	14·5	1·5
Ilkeston	Sept. 1	303	— 3	22	3,068	— 194	..	..
Ipswich	,, 4	999	+ 93	23	9,787	+ 143	10·5	..
Kilmarnock	,, 4	283	— 6	16	2,476	— 88	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	,, 1	2,632	— 301	35	46,615	— 565	..	..
Leeds	Aug. 28	14,027	+ 892	22	149,539	+ 2,391	54	5
Leicester	Sept. 4	4,350	+ 74	..	..	..	..	..
Leith	Aug. 28	1,298	+ 261	15	9,893	+ 1,193	6	..
Liverpool	,, 28	21,830	+ 391	34 2/7	367,376	— 2,375	104	
‡L.C.C.	,, 21	74,707	+4,558	..	747,525	+26,192	121	4·25
London United	Sept. 4	13,684	+ 178	.	216,585	—20,789	..	..
Lowestoft	,, 4	791	— 14	49	10,016	— 1,031	3·5	..
†Manchester	Aug. 28	14,793	+ 340	..	328,238	— 8,463	90·5	6
Newcastle	Sept. 4	7,892	— 43	..	88,190	— 1,160	..	..
†Newport	Aug. 28	681	+ 23	22	14,781	— 309	14·5	..
†Oldham	,, 29	1,985	— 180	23	42,823	— 3,128	23·75	..
Pontypridd	,, 28	802	+ 48	21½	9,155	+ 1,116	5·5	1·75
Portsmouth	..	..	..	..	..	..	..	..
Preston	Sept. 1	1,510	— 12	..	..	..	..	..
Rotherham	,, 2	1,184	— 48	22	13,284	— 593	10	·66
Salford	Aug. 30	8,820	— 118	21 5/7	101,165	— 3,517	..	..
Sheffield	Sept. 5	11,189	+ 344	23 3/7	131,759	— 1,236	37	1·25
Southampton	,, 1	2,424	+ 124	22	24,647	— 421	..	..
Southend-on-Sea	,, 1	1,604	+ 182	22	13,592	+ 2,114	..	..
South Shields	,, 4	1,172	— 12	22 3/7	13,237	+ 10	..	..
†Swindon	,, 1	154	— 8	.	..	..	..	..
Tyneside	,, 1	875	+ 19	9	4,267	+ 222	..	..
Wallasey	Aug. 28	1,959	— 38	21 3/7	21,040	+ 485	..	·22
Walthamstow	Sept. 4	1,418	+ 173	23	15,952	+ 815	9	..
†West Ham	Aug. 19	2,392	+ 193	20	48,487	+ 2,810	15·13	·43
Wolverhampton	Sept. 1	1,533	— 74	22	18,116	— 950	12·5	..
Baker St.-Waterloo	,, 4	5,420	— 215	9	25,995	+ 650	4·25	..
Cen. London Rly.	,, 4	9,211	—4,486	9	44,199	—18,545	6 32	·55
Char. +, Eus. Hamp.	,, 4	6,845	+ 7 0	9	32,690	+ 4,115	7.75	..
City & S. Lon. Rly.	,, 5	5,858	— 89	9	27,821	+ 1,170	7·3	..
Dublin-Lucan Rly.	,, 3	847	+ 49	9	1,561	+ 55	7	..
G.N. and City Rly.	,, 4	2,450	— 26	9	11,128	— 48	3·5	..
G.N., P'y. & Brmtn.	,, 4	9,125	— 80	9	43,660	+ 675	9·25	..
L'pool Overh'd Rly.	,, 5	2,802	+ 71	9	14,787	+ 90	6·8	4·3
Llandudno-Col. Bay	,, 3	1,883	+ 145	40	11,884	+ 1,807	..	..
Mersey Railway	,, 4	3,736	+ 61	9	17,146	+ 570	4·5	..
Metropolitan Rly.	,, 5	30,168	— 252	.	140,603	+ 1,665	24·5	..
Met. District Rly.	,, 4	17,638	+ 240	9	84,193	+ 5,500	24	..
Anglo-Argentine	,, 2	77,712	+7,989	..	1,864,409	+84,627	..	..
§Auckland	..	..	..	..	..	..	..	..
Bombay (B.E.T.)	Aug. 5	4,689	+ 469	31	77,464	+ 4,453	..	..
§Brisbane	..	..	..	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 4	6,880	+ 82	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	..	..	..	..	..	..	..	..
Madras	Aug. 31	1,409	+ 201	..	20,349	+ 407	..	..
§Melbourne	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Sept. 3	2,663	+ 228	..	49,264	+ 232	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Holidays are now practically over, and all—or most—of the children have gone back to school, so there is no longer any real excuse for their fathers to be "slack." But in the Stock Exchange, trade cannot be forced beyond a certain, very near, point, and it has still to be acknowledged that business in all except a few favoured securities is as coy as the subject of Sir Walter Scott's famous lines.

One of the few departments in which any state approaching activity obtains is the iron, coal and steel market. Many of the companies, and, indeed, the industry itself, are intimately related to the electrical trade, and the advance in prices will be watched with keen interest. Starting amongst armament shares, the rise in Vickers & Armstrongs has spread to shares in such companies as Babcock & Wilcox, besides those which are more directly connected with the iron and steel business. The movement is the more welcome in that it points to the better conditions of the country's trade, as a whole, having permeated one of the most important classes of industry. Recent advances in shares and stocks such as Henley's, Callender's and Telegraph Construction are fully held.

Yet the state of the Home Railway market is still a very disappointing one, and prices seem quite unable to lift themselves for long together out of the ruck of depression into which they have dropped. The weariness of the market extends even to Metropolitans and Districts, both of which are again on the down grade. However, there is a rise of 2 in the 4½ per cent. bonds of the Underground Electric Railway, thanks to the statement issued the other day, which was accompanied by the intimation that the company will, after this, publish monthly statements of profit. In the dim and distant future, other railways will do the same thing.

British Columbia Electric Railway Deferred and Preferred stocks are *ex* the right to apply for the new issue, and the falls of about five points represent what the rights are worth. Anglo-Argentine Trams are strong. The Second Preference, which are 5 per cent. cumulative shares, gained $\frac{3}{16}$, and the 4 per cent. Debenture stock is ¼ better. Cape Electric Trams dismally dwindle. Mexico Trams are again pursuing their upward course, while Mexican Light and Power has more than recovered its loss of last week. These rallies are due more than anything else to the subsiding of the floods at Monterey, which enabled the power company to resume work and caused the 5 per cent. Debenture stock to regain 3 points, hardening to 89. Of others in the same group, Rio Trams are rather easier at 92, the bonds being steady at 95. Mexico Tramways bonds went *ex* coupon last Wednesday, and at 94½ have attracted buyers who think the security looks cheap again. The Sao Paulo Tramway Company has declared a dividend of 2½ per cent. on its ordinary stock.

Notting Hill shares are the most favoured of the electricity supply list, and at 12½ they show a further 10s. gain. Brompton and Kensington Ordinary are 2s. 6d. lower, and Folkestone Ordinary lost a similar fraction. No other changes have occurred, so that the despair of the young gentleman who had to write half a column of breezy notes around this trio of movements will be fully appreciated.

Excitement in the American railroad department having cooled to something under fever pitch, the gamble in Anglo-American Telegraph Deferred stock has also simmered down, and the price with it. The decline, however, is insignificant. Eastern Telegraph stock drooped, but lower-priced shares, such as West India and Panama and West Coast of America, are stronger. Great Northern Telegraphs lost their rise of a week ago.

Marconi shares firmed up to 15s., on the announcement that the company had come to an agreement with the Government in connection with certain of its stations which, a few years hence, would have been compulsorily acquired. This is satisfactory, so far as it goes, but it is wholly insufficient ground upon which to advise the purchase of the shares. National Telephone Deferred has again weakened, while a point rise lifted American Telephone and Telegraph capital stock to 147 middle.

Stock Exchange Notice.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—Mexico Tramways Co.—£1,250,000 6 per cent. 50-year mortgage bonds of £100 each, Nos. 1 to 12,500, in lieu of the scrip now quoted.

Davis & Timmins, Ltd.—The directors recommend a 6 per cent. dividend on the preference shares for the six months ended June 30th.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Aug. 31st.	Closing Quotations Sept. 7th.	Business done week ended Sept. 7th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ – 3⅜	2⅞ – 3⅜	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 – 96	93 – 96	94½	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 – 147	144 – 146	146	144⅜	..	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 – 98	97 – 99	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	60⅓ – 62½	60⅓ – 62½	..	..	..	5 3 0
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	103¼ – 104¾	103¾ – 104¾	104½	103⅞	..	5 14 6
3,220,770	Do. do. do. Deferred	Stock	⅜%	1¾%	1 %	8/-	21 – 21¼	20⅜ – 20⅞	21⅛	21	— ⅜	1 18 4
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103½ – 105½	103½ – 105½	..	..	..	4 14 9
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 – 8⅜	8 – 8⅜	..	..	..	4 14 1
3,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 – 92	90 – 92	90½	..	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ – 9	8½ – 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 – 18	17 – 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ – 3⅜	2⅞ – 3⅜	65/-	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ – 8⅞	8⅜ – 8⅞	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 – 101	100 – 102	..	..	+1	3 16 6
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13 – 13½	13 – 13½	13⅜	13¼	..	6 5 11
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 – 102	100 – 102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	129 – 132	128 – 131	129½	128	—1	5 6 10
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	84½ – 86½	84½ – 86½	86	85	..	4 0 0
1,396,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ – 106½	104½ – 106½	..	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ – 12½	11¾ – 12¼	12⅛	11 13/16	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 – 104	102 – 104	102	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 – 102	100 – 102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ – 10¾	10¼ – 10¾	10 5/16	10¼	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾ – 14¼	13¾ – 14¼	14⅛	13¾	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26½ – 27½	26 – 27	26⅜	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 – 102	100 – 102	100	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	13 %	13 %	51½ – 53½	51½ – 53½	53	..	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	84 – 86	84 – 86	..	..	..	4 13 0
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 – 78	74 – 79	..	..	..	5 2 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	11/16 – 13/16	23/32 – 27/32	17/6	15/-	+ 1/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16 – 15/16	13/16 – 15/16	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ – ⅞	¾ – ⅞	..	..	..	5 13 8
2 225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 – 107½	106 – 107½	107¼	106 1/16	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122½ – 124½	121½ – 123½	123	121½	—1	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛ – 10⅝	10⅛ – 10⅝	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ – 10⅝	10⅛ – 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 – 5 11/16	5 7/16 – 5 11/16	..	..	..	4 7 8
2 000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 – 100	98 – 100	98¼	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 – 102	100 – 102	101¼	100¼	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ – 1½	1⅜ – 1½	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅛ – 1¼	1⅛ – 1¼	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 – 88	86 – 88	87½	86⅜	..	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 – 102	100 – 102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ – 8⅛	7⅝ – 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ – 102½	100½ – 102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 – 133	130 – 133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6 15/16 – 7 3/16	6⅞ – 7⅛	7⅛	6 15/16	— 1/16	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼ – 5⅝	5¼ – 5⅝	5½	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛ – 1⅜	1 3/16 – 1 7/16	23/7½	21/6	+ 1/16	4 10 10
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 – 102	101 – 103	..	..	+1	3 17 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13¼ – 13¾	13¼ – 13¾	13 9/16	13¼	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 – 105	103 – 105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	½ – ⅝	9/16 – 11/16	13/9	11/3	+ 1/16	N
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 – 8½	8 – 8½	8⅜	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 – 9	8 – 9	..	..	..	17 2 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 – 103	101 – 103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Aug. 31st.	Closing Quotations Sept. 7th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝ – 4⅞	4⅝ – 4⅞	96/3	93/9	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4⅜ – 4⅝	4 9/16 – 4 13/16	93/1½	..	+ 3/16	5 3 11
978,220	Do. 4 % Deb. Stock	..	..	..	..	4 %	92¼ – 93¼	92½ – 93½	93⅝	92½	+ ¼	4 6 6
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 – 105	102 – 105	103	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	20 %	4 5/16 – 4 7/16	4⅜ – 4½	90/-	89/4½	+ 1/16	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ – 1½	1⅜ – 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼ – ¾	¼ – ¾	13/9	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅜ – 1⅞	1⅝ – 2⅛	40/3	..	+ ¼	16 9 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ – 3⅞	3⅜ – 3⅞	72/6	67/6	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ – 3½	2½ – 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 – 98	95 – 98	..	..	..	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	152 – 157	147 – 152	155	143½	—5	5 5 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 – 127	117 – 122	119	..	—5½	4 18 2
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 – 112	109 – 112	111	..	..	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 – 104	102 – 104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 – 105	102 – 105	104⅜	..	..	4 5 9
188,301	British Electric Traction	10	8 %	Nil	Nil	Nil	9/16 – 15/16	9/16 – 15/16	13/1½	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 – 2½	2 – 2½	47/6	42/6	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 – 88	85 – 88	86	85½	..	5 16 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 – 67	63 – 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7½ – 7⅞	7½ – 7⅞	7¾	7 9/16	..	6 7 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ – 6½	6⅛ – 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 – 106	103 – 106	..	..	..	4 4 11
204,910l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 – 94	89 – 94	..	..	— 2	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 – 7/16	3/16 – 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 – 42	38 – 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 – 11/16	9/16 – 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 – 46	41 – 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 – 31	27 – 31	28½	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4 9/16 – 4 15/16	4⅝ – 5	..	..	+ 1/16	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ – 5	4¾ – 5	96/0½	96/3	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 – 100	97 – 100	99½	99	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜ – 11⅛	10⅜ – 11⅛	10 13/16	10 17/32	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝ – 5¾	5⅝ – 5¾	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 – 107	105 – 107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	¼ – ½	3/16 – 7/16	..	..	— 1/16	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 – 2¼	2 – 2¼	42/-	41/3	..	5 17 8
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 – 108	105 – 108	..	..	..	3 14 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3¼%	62 – 64	62 – 64	62½	..	..	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 – 86	85 – 87	86	85	+ 1	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 – 45	43 – 45	43½	..	..	5 11 1
1,460,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	31½ – 32½	31½ – 32½	32¼	31½	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	⅞ – 1⅛	⅞ – 1⅛	..	..	..	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	9 – 93	90 – 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 31st.	Closing Quotations Sept. 7th.	Business done week ended Sept. 7th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅛ – 1 5/16	1⅛ – 1 5/16	24/6	24/-	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1⅛ – 1¼	1⅛ – 1¼	..	..	..	4 16 0
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 – 103	100 – 103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ – 13¾	12¾ – 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1¼%	⅛ – ⅜	⅛ – ⅜	..	..	..	20 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½ %	1 – 1½	1 – 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	68 – 73	68 – 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 – 87	84 – 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 – 11/16	7/16 – 11/16	..	11/-	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 3/16 – 1 7/16	1 3/16 – 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	7¾ – 8¼	7¾ – 8¼	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 – 88	85 – 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ – 1	¾ – 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ – 10¾	10¼ – 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 – 108	102 – 103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ – 13½	12½ – 13½	13	12 15/16	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ – 5½	5⅛ – 5½	5⅝	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ – 107½	106 – 108	..	..	+ 1	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14¾ – 15½	14¾ – 15½	13 11/32	..	..	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ – 15/16	⅞ – 15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ – 4¾	4½ – 5	..	..	..	10 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ – 2½	1½ – 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ – 2½	1½ – 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅛ – 2⅝	2⅛ – 2⅝	..	..	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 – 70	67 – 70	..	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38¾ – 39¼	38 – 38½	39	38⅝	— ¾	1 6 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 – 67	65 – 67	66⅝	65¾	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16¾ – 17¼	16 – 16½	16½	16	— ¾	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 – 21/32	19/32 – 21/32	10/-	..	..	..
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 – 5/32	1/32 – 5/32	9d.	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 – 13/16	11/16 – 13/16	16/-	14/6	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 – 97	94 – 96	..	..	—1	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	127 – 130	128 – 131	130	128¾	+1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	96 – 98	93½ – 95½	94¾	94¼	—2	5 4 9
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ – ⅜	⅛ – ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ – ¾	½ – ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 – 89	86 – 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ – 36	34½ – 36	35½	..	..	2 10 9
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 – 102	100 – 102	..	..	..	8 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½ – 103½	102½ – 103½	103¼	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 – 89	89 – 91	89¾	88½	+2	4 18 11
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	37 – 39	37 – 39	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ – ⅞	⅝ – ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ – 3⅛	2⅝ – 3⅛	60/-	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock	.	4 %	4 %	4 %	4 %	76 – 80	78 – 82	..	..	+2	4 17 7

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Aug. 31st.	Closing Quotations Sept. 7th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ – 4¾	4¼ – 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 – 96	93 – 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7½ – 8	7⅜ – 7⅞	..	..	— ⅛	6 7 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ – 8	7½ – 8	..	..	..	4 7 6
396,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 – 100	97 – 100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 – 4½	4 – 4½	82/6	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ – 4⅞	4⅜ – 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ – 4⅜	3⅞ – 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 – 99	96 – 99	98½	97¼	..	8 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ – 4⅛	3⅝ – 4⅛	..	..	..	5 9 1
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 – 103	100 – 103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ – 10⅞	10⅜ – 10⅞	10 11/16	10⅝	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ – 12¾	11¾ – 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 – 124	121 – 124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 – 103	100 – 103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ – 3¼	2¾ – 3¼	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3 – 3½	3 – 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ – 95½	93½ – 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ – 8⅛	7⅝ – 8⅛	8	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ – 11	10½ – 11	10⅞	10 13/16	..	5 9 1
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	104 – 107	104 – 107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 – 103	100 – 103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛ – 5/16	⅛ – 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅛ – ⅜	⅛ – ⅜	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 – 61	58 – 61	..	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	86 – 88	84 – 86	81½	84	—2	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ – 5⅛	4½ – 5	..	..	— ⅛	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 – 5½	5 – 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 – 100	97 – 100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ – 7⅝	7⅛ – 7⅝	7⅜	7 5/32	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 – 101	98 – 101	99½	98½	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅝ – 6⅞	6½ – 7	6 15/16	6¾	+ ⅛	5 14 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 – 98	95 – 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅞ – 2¼	1⅞ – 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5 – 5¼	5 – 5¼	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 – 97	93 – 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛ – 4⅝	4⅛ – 4⅝	..	..	..	5 7 6
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ – 5	4⅝ – 5	..	..	..	4 10 0
285,000l	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 – 108	105 – 108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ – 86½	83½ – 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83 – 85	83 – 85	83¼	..	..	5 17 8
13,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	69 – 73	71 – 75	74	72½	..	4 15 11
$4,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	106 – 110	106 – 110	..	..	..	6 7 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 – 88	85½ – 87½	86¾	86¼	— ½	5 14 11
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 – 97	95 – 98	..	..	+1	4 11 10
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛ – 4⅝	4⅛ – 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4½ – 5	4½ – 5	..	..	..	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 – 101	99 – 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½ – 12½	11¾ – 12¾	12	..	+ ½	5 9 10
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 – 6½	6 – 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 – 98	95 – 98	..	..	..	4 1 8
119,694	River Plate Elety. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 5/16 – 1 7/16	1 5/16 – 1 7/16	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 – 1 3/32	31/32 – 1 3/32	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 – 105	103 – 106	103½	..	+1	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ – 9	8½ – 9	..	..	..	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 – 7½	7 – 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 – 88	84 – 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 – 13/16	9/16 – 13/16	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ – 3	2⅝ – 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 – 9/16	5/16 – 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ – 1¼	1⅛ – 1¼	..	..	..	5 16 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 – 105	102 – 105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ – 1	½ – 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ – 2	1½ – 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 – 81	77 – 81	80	78½	..	5 11 1
806,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	13/16 – 15/16	27/32 – 29/32	18/3	17/3	— 1/32	5 9 7
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅝ – 9⅛	8½ – 9	..	..	— ⅛	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 – 5⅜	5 – 5⅜	..	..	..	4 8 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent. April 1st, 1909.

NOTES ON LIFE IN WESTERN AUSTRALIA.

By H. J. RITCHIE.

Perth, as the chief city of Western Australia, should naturally receive first consideration in these notes. From a visitor's point of view the immediate environments of Perth are delightful. Anybody who is fond of scenes with broad reaches of river views and stretches of surrounding wooded country, would be in his element during a river trip from the Port to the city, and should he be fond of sailing, he will find great possibilities of enjoyment, especially should he be nearing the city on a Saturday afternoon or Sunday during the summer months, for he will then see the wide expanses of water dotted in all directions with little white sails. It is an ideal river for small craft, and great battles are fought out in miniature on this lovely river, "the Swan."

The living expenses in Perth are not excessive; in fact, a bachelor of moderate tastes can live very comfortably in Perth on £200 a year. Board and lodging can be had for from 25s. to 30s. a week; the boarding house keepers much prefer men to women boarders. In order to give the electrical engineer some idea of comparisons in wages, it may be stated that the ordinary wireman's wages are £3 per week; of course, he provides his own kit. There is little or no demand for armature winders only, but the wage set by arbitration for this work is £3 15s. per week of 48 hours—8¾ hours per day, with the usual half-day on Saturday after 1 o'clock. Most shopkeepers of the city give their employés the Wednesday half-holiday and keep open on Saturday afternoons and evenings, everybody devoting Sunday to a quiet day of enjoyment or rest, according to their individual tastes. The open-air life of the Colony, with its bright, sunny days and beautiful cool evenings, tempts most people out of doors in the summer. The hills are within 20 to 30 miles from the city, and a short ride in the train will carry one to some of the most beautiful wooded country imaginable, with its hills and dales and clear little streamlets running in all directions. Quite a number of city business people have taken up holdings in the hills of upwards of 200 acres, and they spend their week-ends in these delightful spots, employing labour to clear and fence their immediate surroundings, planting acres of strawberries, potatoes, and all kinds of vegetables, the land being watered by springs, and even requiring draining in places. For the hunter there are plenty of kangaroos and wallabies in these hills. Ducks abound in large numbers on the Upper Swan, and on the neighbouring lakes and marshes, but these are preserved from being shot within certain limits. The river abounds in fish of all descriptions, as is evidenced by the numbers of pelicans and other fish-eating birds, which dot the shoals here and there. The islands lying off the coast, which shelter Fremantle, are ideal fishing grounds for the followers of Izaak Walton, and a short run in either a sailing boat or one of the river excursion steamers which call at these islands, will bring one in close touch with these camping grounds.

Perth at the present time is hardly a good hunting ground for those looking for employment in the electrical line, as the building of the city, which has been going on very rapidly for the last 10 or 12 years, has reached the requirements of the Goldfields, to which it owes its phenomenal growth of late years, and until the agricultural industry begins to return some of the immense amount of capital put into it recently, the building trades cannot experience much activity.

From an engineer's point of view the Goldfields are the next (if not the first) places of interest, for it is on these to a large extent that the great wealth of the colony depends. The Kalgoorlie Goldfields, centring in the Golden Mile, are of paramount interest. It is into here that a tremendous amount of machinery has been pouring from all parts of the world for some considerable time past. The writer was one of the first men to put electrical machinery up on the mines themselves (both Coolgardie and Kalgoorlie had municipal plants before that time, namely, 1896). The living on the fields is somewhat dearer than in Perth. Drinks form a large item in one's expenditure, and at one time it was almost useless to attempt to interest a business man in anything you had to put before him without first inviting him to moisten proceedings with you. But that is not so general a feature nowadays, though, the temperature being so much higher and the atmosphere so much drier, it is almost essential to drink something.

The water scheme, which supplies the Goldfields as far as Kanowna with a splendid supply of water, was carried out by the Government at a cost of £3,000,000. This is a magnificent piece of engineering, and is very interesting from an engineer's point of view, especially as the water has added some grave complications, inasmuch as the minerals in solution are eating away the main supply pipes a good deal faster than was at first thought possible.

The mines employ a great number of electric motors for driving outlying parts of their machinery, and the looking after and repairing of these motors requires on some of the larger mines an electrician with two or three assistants. These take their shifts of eight hours each—the mines and their entire plants running continuously. The electrician, if single, usually lives on the mine in the quarters set apart for the mine officials, but the dust which is blown from the numerous dumps makes life close to the mines anything but pleasant. The pay of a mine electrician is usually between £5 to £7, and that of the assistants from £3 to £4 per week. The temperature, which sometimes runs up to 110° in the summer months, is not so noticeable in that extremely dry atmosphere; but the *dust*, when the wind comes up, is everywhere, and is the most trying part of one's sojourn on the Kalgoorlie Goldfields.

For the ordinary visitor there is every comfort provided in the luxurious hotel accommodation, including iced drinks and cool and refreshing lounges, which are most welcome after the excessive heat of the outside atmosphere. The winter months on the fields are delightful, the days being pleasant, and the nights nice and cool—indeed, quite chilly. The rain generally falls during the storms that occur from time to time in the winter, and the place would be admirable to live in, if there were any neighbouring spots of interest from a scenic or amusement point of view to go to; but the surrounding country is very uneventful and comparatively level, with an occasional hill rising a few hundred feet. Kalgoorlie is at a fair altitude above the sea (1 200 ft.), and, the air being so dry, the hospital at Coolgardie has been almost completely turned into a sanatorium.

In regard to opportunities for electrical engineers and others in the electrical profession in Western Australia, there should be great advances made in the future through the use of cheap fuel, especially in the timber districts, where so much fuel in the shape of sawdust is going to waste every year. Some of England's principal makers of gas producer plants are already on the look-out for any opportunity of this kind. The coal mines of the State at Collie are using electric coal-cutters and various other electrical devices. There are several schemes of electrification on the Goldfields which require capital to work them and the right kind of man to take them up. Even the Stalactite Caves, which are a show portion of the State, are lit by electricity.

New countries are more inclined to take up modern ideas than older countries, as they are not surfeited with that bugbear of civilisation, "vested interests."

LIFE IN INDIA.

In our issue of July 16th we reprinted from an engineering contemporary a letter, from a correspondent using the *nom de plume* "Entropy," on "Salaries and Prospects for Engineers in India."

We have now received from India a letter from another writer, in which he says that, from his personal experience, he can confirm every word in "Entropy's" letter. The conditions of living, &c., on his side of India are, at any rate as regards cost, very much under-estimated. Our correspondent writes more particularly to warn young men who contemplate going out to India against the unreliability of Indian houses—not always electrical, but various trade and commercial houses—on the point of agreements. He alludes to the malpractices and injustices which professional and other men often have to put up with at the hands of unscrupulous firms. He enters into certain details regarding an experience of his own, which has ended in legal proceedings being set on foot by him against a firm of agents out there. He does not appear to be impressed at all favourably with the standard of business *morale*, and on that ground he desires us to impress upon young men the importance of having the conditions and terms of their employment most clearly defined in their agreements. The writer alludes to the question of the status of the engineer, and says that, if the Institution of Electrical Engineers takes up this matter seriously, it should formulate such regulations as will guard the truly qualified engineer from "such treatment as is generally associated with the ordinary mechanic and labourer on hourly wages." He proceeds to offer the following interesting notes on the conditions and cost of living in Bombay :—

"Engineers in this country have a higher social status than that which they are accustomed to at home, and they are expected to live up to it; by reason of this fact alone their salaries should be commensurate with the position they are called upon to fill in Society. It is necessary, therefore, if they are to fill their positions to do full justice to the prestige of the profession and credit to themselves, that a salary of not less than Rs. 600 (£40) per month should be asked by any engineer over 24 years of age possessing even the most ordinary qualifications, and an unmarried man.

This figure is based on the consideration that it is not worth while for any man to come out to a country such as this unless he is able to save out of his earnings at least three times what he would at home, and even that is little or no compensation for the ills which he must necessarily bear on account of the climate, and so forth.

I lived for a period of 16 months in a hotel, and I have taken the average for that time. It must, however, be borne in mind that I obtained a concession for a long term of residence, and occupied a room which was graded at the lowest price, excepting those on the ground floor, which were Rs. 30 per month cheaper. Living on the ground floor in Bombay is considered unhealthy, and for that reason alone the cost should not be based on this figure.

Hotel (board and lodging, including minerals)	Rs. 225
Clothing averages about	45
Dhobie (washing)	6
Boy (servant)	20
Clubs and incidentals	150
	Rs. 446

or, say, £29 14s. 8d. per month.

If with a number of three other fellows a "chummery" is formed and a flat taken, its cost, including lights, lifts, servants, would work out to a matter of about Rs. 50 to Rs. 60 per month cheaper than hotel life. In any respectable locality in the Fort a flat cannot be obtained under Rs. 250 per month, and then it would be difficult to get four bedrooms with it. A married man should demand a salary proportionately higher, but my advice is that India is no place for women and children, and the man who brings his wife to the country must be prepared for additional expenses in the way of providing changes to the hills, and so forth. The flats are rented exclusive of furniture."

RAPID FLOW OF GASES THROUGH BOILERS.

With reference to the findings and conclusions of the U.S. Geological Survey Department on the subject of draught through boilers, the following statements may be noted :—"With gases there is no pulling, only pushing. Gases travel from places of higher pressure to places of lower pressure, the motion of the gas taking place because of its expansion." Such a statement ought to be axiomatic. A fan induces a draught by creating a locus of low pressure by centrifugal action. The action of a chimney is precisely the same in effect, though the mode of producing the effect is very different. The Department's experiments were made with layers of lead shot to represent the fuel bed on a grate surface. Presumably this lead shot device would act very much as does a layer of fuel; but a layer of burning fuel is a constantly varying quantity of constantly changing resistance, and it would be difficult to deduce a law from any observed resistances under such variable conditions. As observed then, with layers of shot, the rate of flow of air through a bed of shot is approximately proportional to the square root of the pressure drop through the layer.

An increase of the thickness of the shot bed causes at first a rapid decrease in the amount of air passing through. Further increase only produces slow diminution. This result is what might be expected, for the reduced volume of air will find little resistance from the top layers of shot.

To drive air at the same rate through a double thickness of shot requires twice the pressure difference and double work.

The work of a fan will probably be doubled, if any of the three following quantities be doubled, viz. :—

The number of rows of tubes in a cross-flow water-tube boiler.

The length of tubes in a parallel-flow boiler.

The thickness of the fuel bed.

The above supposes an equal weight of gases to be put through in each case.

If in a multi-tubular boiler the tubes be lengthened and their diameter be kept the same, the heat absorbed will be slightly increased if the pressure difference between the tube ends is the same, though there will be less air passing through.

High rates of combustion do not follow on a large pressure drop through the fuel bed; the reverse is more likely to be true. High-pressure drop always means a high resistance. This is a point that would naturally be anticipated; a high resistance, for example, would attend on a fire that was much choked with small coal.

This pressure drop only has special significance when considered in connection with the total pressure drop.

The capacity of a boiler or its ability to produce steam increases with the difference of pressure between the uptake and over the fire. Where the total pressure drop is constant, the boiler capacity, as a consequence of the foregoing, decreases as the pressure drop through the fuel increases.

The general conclusion may be drawn from the foregoing observations that every reasonable endeavour should be made to preserve a fire so open as not to offer serious resistance in the fuel bed. Now, this end is likely to be attained where all the fuel particles are of the same size. In a run-of-mine coal the large lumps act as an effectual barrier to the passage of air so far as regards the projected area of the lumps; but if all the lumps are large, there will be considerable air space between lump and lump. But when all round each lump there is a mass of smaller coal of all sizes, the air spaces will be choked. Some air will get through any agglomeration of small coal, but no air can get through a lump of coal of any size. Hence the difficulty in burning run-of-mine, and the advantage in burning sorted coal of even sizes. For with every coal the larger pieces afford a solid resistance to the passage of air, and the passage round about the larger pieces is blocked where smaller coal is present.

Generally a small coal will not burn at the rate of large coal. It is true that in a fire, say 9 in. in depth, the fuel may be alight all the way through the mass if the coal is small, whereas with lumps of approximately 9 in. cube there can only be two horizontal surfaces alight; but the sides of such large pieces are exposed to a very rapid draught action through the open air spaces.

Practice, however, would not employ such large pieces unbroken unless in the fire-box of a locomotive, where the fire-bed is very deep. Experience teaches a fireman to break large lumps into pieces the size of the fist, and this is the outcome of what is pointed out above, that large pieces when surrounded with smaller coal are absolute barriers to air flow. The relative advantages of graded coal as compared with ordinary mixed fuel could doubtless be shown fairly well by the methods adopted by the U.S. Geological Survey Department, employing shot of mixed sizes, so as to illustrate the amount of resistance that would be introduced by large coal enveloped in slack.

It is fortunate that, in burning, coal breaks up and speedily affords passage-way for air, and because of this, the full effect of big lumps is not experienced. They break up and open up fissures before they get down to the grate surface, and they are thus prevented from causing their full detrimental effect. On the other hand, any coal with a fusible ash may completely cover a grate surface with a sheet of clinker that will stop all combustion of the solid carbon on the grate; hence the demand for bars which can be rocked so as to break up the clinker, or even cut it out from the base of the fuel bed and drop it into the ash-pit. The difficulty is that, unless such clinker is bared of fuel, it will not break up, but will simply bend above the rocking bar fingers. In the choice of fuel, therefore, very much may hang upon other qualities than high calorific power. A coal that does well with a gentle draught, and a moderate grate temperature, may quite fail if the work is pushed and the fusion point of the clinker is exceeded. And so with the use of lime to absorb sulphur from the coal; even if the lime will do this, it may also help to liquefy the clinker and produce a choking effect that would not otherwise be produced.

One of the things that are required is a larger grate area in ordinary boilers, in order that full advantage may be taken of gentle draught. Heavy draught has more limitations than the large power it demands. It may mean, as above, a liquefied clinker, and coals otherwise good may be ruled out of a coal contract. Ruling out any one coal invariably means that those not ruled out will be more highly priced. And should the high velocity idea possess even a sound basis in theory, there is much in practice that will render its application of very doubtful value, for what we burn on a fire-grate is not all combustible matter, nor is it infusible, and the limit to extreme draught is set by temperature at the grate surface. It will not be denied that a large grate surface might have small gas passages through the boiler so as to secure the high velocity everywhere except through the grate; but there is an early limit to this as the Bulletin shows, for much power is required to push air through very narrow passages. Those who advocate such high velocities have not, perhaps, waited to calculate fully the power effects. B.

THE PECKHAM PATENT PENDULUM GEARED TRUCK.

Mr. Sayers has reported well of the newest "cure-all" truck, and he has been rewarded by seeing his name mis-spelled on almost every page of the catalogue just issued by the Peckham Truck Co.

To those who have little faith in the radial truck, in one of its many guises, or to those who have faith, but insufficient means to buy them, it would appear from Mr. Sayers's report upon the truck which he tested at West Ham, that the pendulum gear offers all the advantages of the radial truck at a smaller cost.

"The special feature of the truck is that the weight is taken on the axle boxes through pendulum links or shackles which permit of independent lateral movement of the wheels and axles, a movement which is sufficient, when applied to so short a wheel base, to follow track curvature and irregularity without excessive flange pressure. Attending such lateral displacement there is always a restoring force due to the inclination of the links, which tends to bring the body and the wheels back to the normal relative position corresponding to straight track as soon as the curve is left. The motor suspension is so arranged that the motor moves freely with the axle, and therefore obviates those side pulls on motors, &c., which produce excessive wear of bearings, collars and gears.

"The cross bars carrying the motor suspensions are also utilised as cross braces or stiffeners between the main side frames, and are braced together by diagonal struts forming with the main frames a stiff structure of great strength, calculated to keep 'in square' against all stresses likely to be brought against it. It is obvious that the lateral freedom of the axles and motors reduces these stresses, so that the truck is at once less severely tried and more adequately strengthened against them than are four-wheeled trucks of the usual types."

One of these trucks has been in constant use on the West Ham Tramways for 14 months, and has required less attention than the other trucks. This fact helps us to believe that the pendulum support prevents shock and side blows to motors, gear trucks and body.

Mr. Sayers further considers that rail corrugation would be reduced or eliminated by the use of the pendulum gear, and that power consumption and cost of maintenance will be lowered.

THE PRESERVATION OF POLES.*

There are about 40,000,000 poles in use in the United States, by telegraph, telephone and other companies, valued at $5 to $7 each on an average, or a total of $200,000,000 to $280,000,000. It requires about 3,800,000 poles each year to replace those that have become useless from decay. The average life of white cedar and chestnut poles in the United States, other than the Gulf States, is about 12 years. Hence, the depreciation is about 8½ per cent. per year, or $17,000,000.

It is now a well-established fact that the cause of the decay of poles at the ground line is a fungous growth. Furthermore, it is known that this growth attacks the pole from the outside and not the inside, except, of course, in cases of butt rot.

It is a popular notion that deep penetration of germicides is necessary effectively to preserve timber or poles. This is not true. The wood-destroying germs begin their ravages on the outside and work toward the centre of the pole. It follows, then, that if the germs on and near the surface of the pole at the ground line can be destroyed, and the myriads of germs in the air and in the soil surrounding the pole can be excluded, the pole will be preserved. The only advantage there is in deep penetration when using the old methods is that it requires a longer time for the germicides to be leached or washed out.

As most germicides which are cheap enough and powerful enough to be used in preserving poles are soluble, any mechanical device adopted must serve the following purposes: It must exclude the germ after the pole is treated and at the same time retain and protect the chemicals in constant contact with the pole at the ground line; it must also prevent the chemicals from being taken up and absorbed by the surrounding soil.

The method adopted by the Universal Post and Pole Preserving Co., of Circleville, Ohio, is first to dig down around the pole a distance of about 14 in. from the ground line, and clean off any decayed wood from the surface of the pole. A layer of Portland cement mixed with sand is then placed around the pole at the bottom of the excavation. Next, a "hydrobestos" jacket is placed around the pole, and 1 to 2 in. therefrom, imbedding the lower edge of it in the cement. The two edges of the jacket are lapped from 1 to 2 in., and fastened with a specially prepared cement and tacked upon a lath inside the jacket. The space between the pole and the jacket is filled with germicides in a dry state, mixed with sand. Around the top of the jacket is formed a reinforced cap or collar of Portland cement, embedded in which are one or more wires around the pole. The collar protects the chemicals and jacket from the action of the rain and snow, and, if along steam railroads, protects the pole against the numerous grass fires. The chemicals are slowly dissolved by the natural moisture in the pole, and pass into it by capillary attraction. As they cannot pass out into the surrounding ground they go into the pole, thus destroying all fungi and wood-destroying insects. Thus there is a continuous absorption of chemicals and a mechanical exclusion of germs.

The hydrobestos jacket used around the pole is a pure mineral, composed of specially prepared and purified asbestos and asphaltum. This material is subjected to a pressure of about 27,000 lb. per square inch in its manufacture, and is a very important factor in the method. There is no animal or vegetable fibre in it, and it is practically indestructible in the situation used. In some special locations the jacket may be made of cement.

The reinforced Portland cement cap is an important part of the protective device. It prevents the rain and snow from entering the receptacle, holds the germicides, and gives a stability and attractiveness to the pole.

The germicide used consists of hydrated lime and chloride of sodium, mixed with coarse sand and one-fourth to one pound of sulphate of copper (per pole), according to size and condition of the pole. These proportions may be varied somewhat in the case of partially decayed poles, according to condition.

On small jobs the men work in gangs of three. One goes ahead and digs around and cleans the poles, and the other two follow with a one-horse wagon or hand truck containing the chemicals (if the line of poles is along the road or on the streets of a city), and finish the treatment. Or the material may be distributed in small sacks to each pole from a hand car, if along a railroad.

One gang of men can treat from 20 to 30 25-ft. poles per day. A much larger number of new poles can be treated in a day. The cost depends upon the accessibility of the poles and whether the materials are purchased in carload lots or not, and also the price of labour; but it may be said that the cost would be from 75 cents to a dollar per pole, including royalty for the patent on the process. Some very large poles worth from $50 to $75 have been treated at a cost of $1.50 up to as high as $2.50. Even this will pay, when the cost of removal and renewal of the pole is taken into consideration. These figures may be reduced on large contracts.

According to the Government experts, the open-tank treatment costs 67 cents per pole, not including hauling.

Poles which were partially decayed when treated, after over nine years show no increase in the decay, and the protecting device is in good condition.

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* Abstract (from the New York *Electrical Review*) of a paper by H. P. Folsom, presented before the 28th annual convention of the Association of Railway Telegraph Superintendents, at Detroit, June 23rd, 24th and 25th.

EXHIBITION OF MACHINERY FOR WIRE-DRAWING, &c.

For the last few weeks an exhibition of wire-drawing machinery has been held at the works of Messrs. Sir James Farmer & Sons, Ltd., of Salford, who are now building the continuous wire-drawing machines covered by the "Geck" patents. Many firms interested in this class of machinery have attended, and most of the important wire manufacturers have inspected the machines in operation. The wire to be drawn is, by means of rollers, pulled through special die plates of "Vienna" steel on to the finishing block. These rollers run at different speeds to compensate for the lengthening of the wire in the process of drawing. A trough of lubricant is provided in which the rollers run whilst the machine is at work; this trough is so made that it can be lowered whilst threading up the machine, or when the machine is standing empty. The largest machine, No. 00 (fig. 1), takes mild steel rod of No. 5 or 6 s.w.g., or copper rod No. 3 s.w.g., and reduces it to No. 14 s.w.g. in one operation through five dies. This machine running at 35 r.p.m., with a finishing block of 16 in. diameter, produces daily about 13½ cwt. of mild steel wire. When dealing with copper and running at 80 r.p.m. it is capable of turning out about 42 cwt. per day. Other machines were on show varying in size and capacity, the smallest turning out wire of 35 s.w.g. These continuous wire-drawing machines are in operation in some of the most important of the English wire mills.

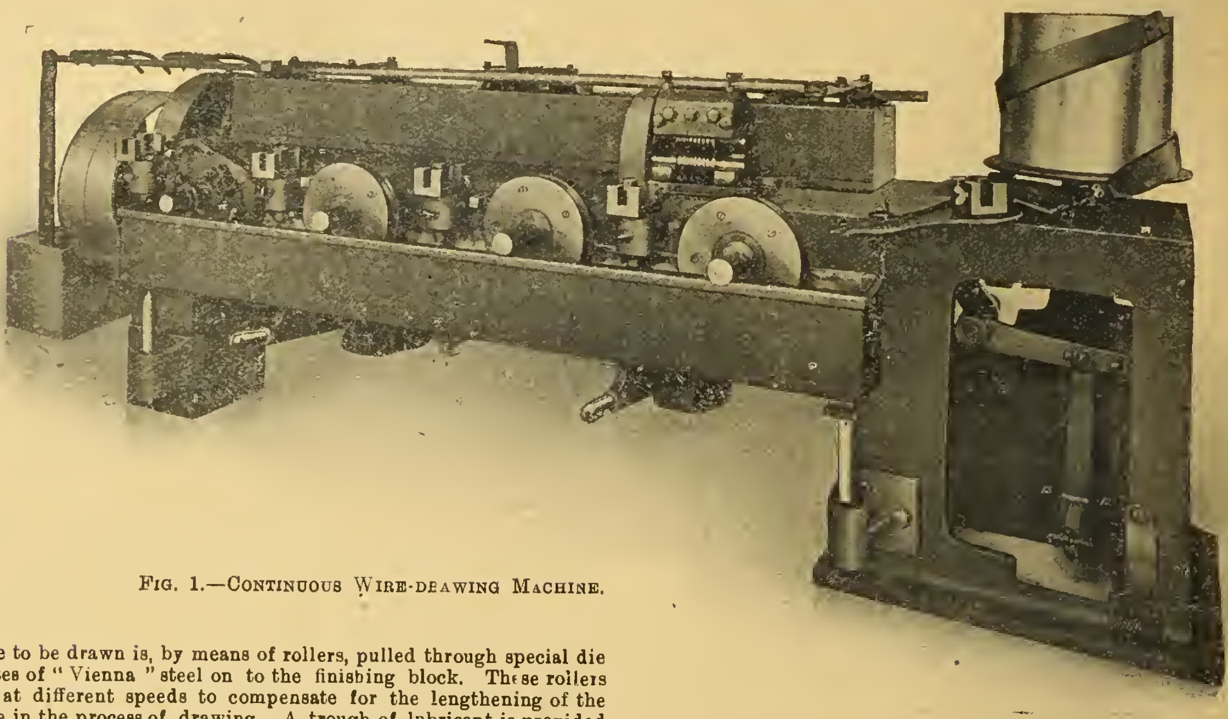
Fig. 1.—Continuous Wire-drawing Machine.

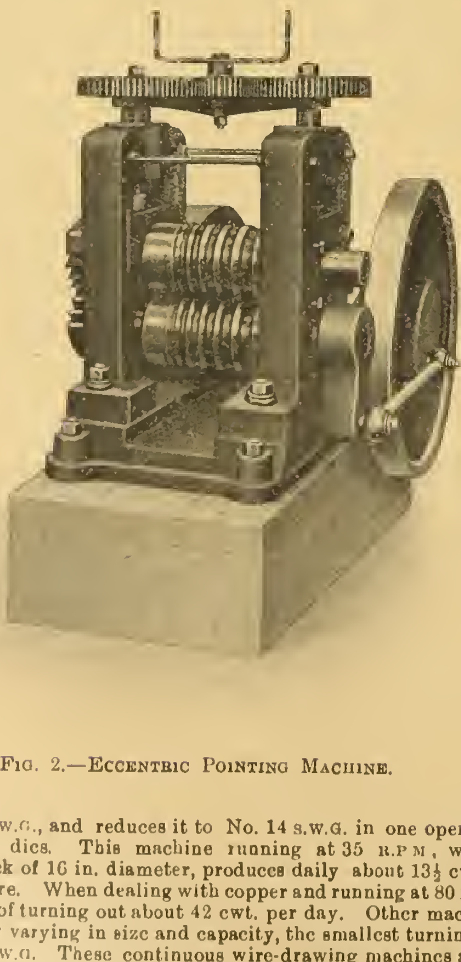
Fig. 2.—Eccentric Pointing Machine.

An automatic punch-grinding machine was also in operation grinding the ordinary round punches used in wire mills. This machine is a great advance on the hand method of grinding, whilst at the same time far more accurate and cheaper work is done, a perfect surface being obtained on the punch.

Several machines for pointing wire preparatory to drawing were shown of the grooved-roller type operated by hand or power. These take all sizes of wire and point down (cold) from No. 0000 to 20 s.w.g. With these machines hammers and files are dispensed with, and waste of wire is obviated. Larger power-driven machines are manufactured for dealing with wires and tubes varying from No. 6 s.w.g. to 1 in. (fig. 2). A "Farmer" hammer pointing machine was shown taking copper rods up to $\frac{5}{8}$ in. diameter, and steel up to $\frac{3}{8}$ in. diameter.

A machine for automatically polishing diamond dies was also shown. This machine, which was of high-class workmanship, was very interesting. The die to be polished is placed in a chuck, and a needle provided with diamond powder automatically moves in and out of the die whilst it is turning round at a high speed, and polishes the die to the required size. This machine is also used by makers of metallic-filament lamps, for cleaning and polishing diamond dies through which the filament is passed.

Mr. Ed. Brand, of 472, Moss Lane East, Manchester, is the sole selling agent for this country, and all communications relative to these machines should be addressed to him personally.

THE GERMAN ELECTRICAL INDUSTRY.

Outbreak of a War of Prices.

The depression in trade during 1907 and 1908, which can by no means be regarded as having been overcome, has, in general, less prejudicially affected German economic life than the preceding critical period at the beginning of the present century, and this observation applies particularly to the electrical industry in that country. In discussing the subject in the course of two lengthy articles, the *Frankfurter Zeitung* first compares the present situation with that which obtained in 1901. At that time the collapse of large electrical undertakings took place, and dividends rapidly declined in the case of others; and in the result there was a brushing away of financial methods which had proved to be mistaken. On the other hand, things are quite different at the present time, as no difficulties have arisen in connection with any of the large electrical groups. Strengthened outwardly as hitherto, the large electrical undertakings stand forth, and it is not at all probable that the results, in so far as they flow to the shareholders in the form of dividends, will experience large diminutions for the past year. Of course, the electrical companies have not on this occasion remained untouched by the change in the times. It can be assumed with some definiteness that, in so far as the dividends hitherto paid are maintained, it will be necessary in many cases to draw upon the "still reserves" to a considerable extent. Owing to the inadequate method in which the German electrical companies mostly announce their profit and loss accounts to the public, it is not only possible, but also probable, that the measure in which old and accumulated profits will now be brought into account will be withheld from general knowledge, so that the influence of the unfavourable course of time will be calculable either only with difficulty or not at all.

The Degree of Employment.

Although a favourable reaction is expected everywhere in German industries from a new development of the general condition of trade, it seems that the presumptions for a rapid strengthening of productive activity in the electrical industry have, so far, not manifested themselves. The two principal factors which determine profitability are the degree of employment and the level of prices. As far as the former is concerned, the situation can by no means be regarded as unfavourable. It is true that the Zurich Bank for Electrical Enterprises recently expressed an opinion that is not by any means favourable in regard to the extent of the orders and the problems in the electrical industry. The bank, which belongs to the group associated with the A.E.G., stated that there was an increasing inclination on the part of State and communal authorities to undertake the production of electricity on their own account, and thus considerably limit the scope of electrical firms. But, as compared with this position, the Frankfort newspaper points out that the private electrical firms come into consideration as contractors for such central stations, and states that dissatisfaction would by no means be expressed everywhere in such circles at playing the *rôle* of contractor without individual capital investment. Certainly, possible profits from financing are not obtained in this way; but, on the other hand, the risk and the necessity to expend considerable sums without a speedy large return are not present. In general, the prospect of remunerativeness of, for instance, an electricity works created by a private undertaking, is not very favourable. Private industry cannot calculate upon a profit of from only 4 to 5 per cent. of the invested capital. As against this, communal or provincial interests are probably able to be satisfied with a very low interest on the shares taken up in a municipal or State electricity works, as approximately the same conditions prevail in these cases as in those of secondary railways. If the latter are established by companies, the results in general are frequently very unsatisfactory, at least during the more or less lengthy period of development. But a communal or district authority, owing to the advantages which indirectly devolve upon it by reason of the railway connection, can very well be satisfied with a low rate of from 1½ to 2 per cent. Thus it has not been regarded with disfavour in electrical circles that still more central stations have arisen, and are arising, on a co-operative or joint basis of local authorities. Only a relatively few central stations of the kind are erected by the large electrical companies for their own account, and these only, generally speaking, when specially favourable conditions exist in relation to profitability.

The Conversion of Railways.

It is not to be mistaken that the expectations of the electrical industry, in so far as the problem of the conversion of State railways is concerned, have experienced a great disillusion. The German State railway authorities only approach the transformation of steam working to electric traction in a very reserved way. For instance, the orders are only now about to be placed for the first small section on a northern railway, the hesitating attitude of the authorities being due to various reasons. Above all, the general financial situation prevents the consideration of problems which, taken as a whole, would require the expenditure of millions of pounds. The question of permitting private industry to convert State lines to electric traction finds its greatest obstacle in the apprehensions of the railway authorities that it would be the means of creating dangerous competitors of the steam railways. This situation of the matter is doubtless very unpleasant for the electrical groups, as they have expended considerable sums, not only on experiments, but also in the extension of their organisation, in the hope of receiving orders for transformation of State railways. But, on the other hand, it would be incorrect to assume that the companies could have reckoned on a rapid profitability from new problems of this kind, as good things proceed slowly. If, for instance, a section is organised for electric traction, the work of completion would occupy a period of at least two years. As a matter of necessity, the State railway authorities would watch the working of the converted section for a long time in order to determine the operating expenses and cost of maintenance and compare them with steam locomotion. It would only be possible to ascertain the results after a total lapse of from four to five years from the beginning, and, if favourable, larger orders could then be counted upon, although they would not follow very quickly. But the postponement of the conversion of a main line in Germany has had other unpleasant accompaniments for the electrical industry, which is accustomed to work on a large scale for abroad. The possibility, above all, is lacking to demonstrate a large section in actual working before foreign interests, and in this connection it has to be considered that other countries, especially where cheap and large water powers are available, would, perhaps, be rather disposed to proceed with the transformation of the railways. It has also to be remembered that the German firms have to reckon with strong foreign rivalry in this branch, and that a beginning of conversion work has already been made in the United States, Italy and Switzerland.

It cannot be doubted for the rest that sufficient opportunity is offered to the German electrical industry to give practical proofs in so far as large problems are concerned. Numerous projects, particularly from abroad, have been submitted to German undertakings, from States and cities, but it has to be noted that the industry has recently shown great reserve in regard to such proposals. Shyness is manifested towards the investment of considerable sums in new undertakings without the guarantee of quick returns—and this is one of the best lessons of past times. It thus happens that many of these schemes are declined by the German companies. It has further to be considered that the firms believe that they must retain their funds for the problems to be dealt with at home, and they are also not certain that the capital for the financing of new foreign undertakings would readily be placed at their disposal in Germany.

It was hoped that the establishment of electrical trustee banks about a year ago would be of advantage in regard to employment in the electrical industry, but they have hitherto not found remunerative activity owing to special reasons. In order to provide as wide a public as possible for the obligations or bonds to be issued by these institutions, endeavours were made to fund the obligations as far as practicable. But in this way the limit was apparently exceeded which was set to the business activity of these undertakings in reference to their readiness for the placing of orders. It is perhaps possible that in times of scarcity of money at high rates, the communes, large undertakings, &c., will agree to sanction the conditions now put forward by the electrical banks for the advance of money. But this is not true in periods of an abundance of money at low offers, as in these cases the communes will procure money more easily in another way. As a consequence, the electrical banks, so long as their statutes have the present form, will not be able to reckon upon a more extensive activity except in times of dear money, although it is an open question whether the matter of revising the statutes will not be taken into consideration at a given moment. But in this event, the funding of the bank's obligations, and the obligations themselves, would naturally be judged otherwise than hitherto. If it is relatively easy for the large electrical companies to renounce many new foreign schemes, the reason lies in the circumstance that not unfavourable experience has been gained during the recent deep depression in reference to regular manufacturing employment. It has been shown, at least in so far as quantity and value of the new regular orders come into consideration, that the degree of employment was satisfactory. If this has been the case in unfavourable years, it is believed with some definiteness that the firms will be able to count upon an increase in the number of the normal orders when an improvement in the general situation takes place.

The second article of the Frankfort newspaper, which deals with price competition and price level, refers first to the enormous expenditure incurred in the extensive development of activity in the past decade. It states that until quite recently there were, after the purification brought about by the crisis at the turn of the century, three large groups—the A.E.G., the Siemens-Schuckert Works and the Felten & Guilleaume-Lahmeyer Works—which occupy a commanding position in the industry. In addition to these, there is a large number of independent firms, although these are only of less relative importance for the aggregate business, particularly abroad. Competition between the large firms exists in certain departments, but in others arrangements have been made to obviate it, as, for instance, in the incandescent lamp syndicate, the cable syndicate, and other combinations. The bonds between the large firms were so intimate as to lead to the formation of the so-called secret syndicate, which was referred to at length in the Electrical Review of October 30th, 1908, but which has undergone a considerable restriction under the pressure of public criticism. The joint working of the large firms under the arrangements just mentioned referred to the inland market, and it also extended to foreign business, in connection with which both joint transactions and joint enterprises were undertaken. Not only so, but the joint establishment of an electrical bank by the A.E.G. and the Siemens group affords proof that the antitheses between the large undertakings were more and more mitigated and partly removed.

The Struggle for Orders.

If, notwithstanding these circumstances, brisk competition has also proceeded between the firms in certain branches, this was caused by the diverging interests of the undertakings, which were constantly striving for expansion and increase of power. In addition, the activity of the smaller firms came into consideration as they endeavoured to get into the business, and were compelled to work on the basis of relatively low prices. It is, however, certain that, despite all the competition which has prevailed, a race for orders at any price has taken place recently of an extent that has hitherto seldom been observed, and which is not solely to be explained by the general economic depression. During the course of recent time a new factor has appeared, which seems to impart a fresh direction to the development of the industry, as the peculiar event is manifested that, in a period of far-advanced concentration and organisation of trade in the case of the three strong undertakings, a new enterprise has, not without success, made exertions to place itself among the ranks of large firms in regard to all branches. This is the Bergmann Electricity Works Co., which, from small beginnings and a share capital of £50,000 in 1893, has developed into an undertaking with a share capital of £1,050,000 and an obligation loan of £500,000, and has hitherto yielded the highest dividends among the companies in Germany. The Bergmann Co. was for some time outside the Glow Lamp Syndicate, but finally a friendly arrangement was made with it; and a similar observation applies to the company in regard to the Cable Makers' Syndicate, which, after a brief collapse, was renewed in May, 1909, after prices had receded to 30 per cent. below the prime costs.

The turbine branch also brought considerable differences to light. At the end of 1908, the 13 or 14 companies and firms who construct turbines met in conference with the object of restricting competition by apportioning the production among themselves, but the negotiations failed to accomplish the object in view. A very severe contest consequently occurred, and there is now a bitter struggle for the orders on the market. The general price fight has necessarily drawn all circles of the electrical industry within its scope, the only manufactures remaining untouched being those controlled by syndicates. Although the large groups which are well equipped will pass through the struggle the best, the situation is unfavourable for the undertakings which have only recently extended their organisation or are only now bringing it to completion. The Frankfort newspaper considers that the largest firms also will finally be weakened by the competitive conditions which now prevail, although it is contended that they should not diminish their power in relation to foreign competition at present. Apart from the American electrical industry, the large German firms are by no means placed on a bed of roses in other foreign countries, especially in England. The British industry has now been largely extended, and, in its endeavour to again secure the home trade, the German firms find that they are compelled to do business on much more unfavourable terms than hitherto; and similar circumstances could be proved in the case of other markets. In conclusion, the newspaper states that the interests of the community will not be served if contests are conducted which would result in the suppression of independent undertakings and pave the way towards the constitution of a trust in the manufacturing industry.

METALLIC-FILAMENT LAMP TRANSFORMERS.

Considerations Regarding their Technology and Economics.

By L. CROUCH.

(*Concluded from page* 366.)

"*No-Load*" *Losses.*—The calculation of the "no-load" current of an auto-transformer is a very important operation in its design, for the magnetising current is practically constant at all loads, and must therefore, for efficiency, be a minimum. Its calculation is simple, and gives results agreeing closely with subsequent test data. The most important function introduced is the reluctance of the magnetic circuit, and to determine this, experimental data must be relied upon.

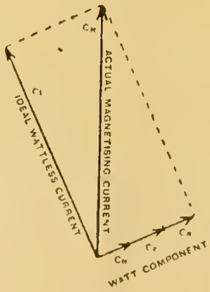

Fig. 8.

The ideal magnetising current is wattless, since all the energy stored in a magnetic field is, theoretically, restored on the collapse of that field. Denoting this current by C_L, fig. 8, it may be calculated from the equation :—

$$\text{R.M.S. } C_L = \frac{B}{\sqrt{2}} \cdot \frac{1}{\mu} \cdot \frac{10\,L}{4\pi\,T}$$

$$= \frac{1}{1{\cdot}76} \cdot \frac{B}{\mu\,T} \text{ amperes,}$$

where B = maximum induction in the iron,

μ = permeability of iron,

L = length of iron circuit,

T = number of turns in transformer winding.

To this current must be vectorially added the current required to supply the watts lost by eddy currents, hysteresis and C^2R in the iron and copper respectively. The eddy and hysteresis losses per pound of iron are experimentally determined at various induction densities (see fig. 9), and if the loss be w watts per pound at the flux density employed, then—

$$(C_H + C_E) = \left(\frac{w \times \text{weight iron in lb.}}{\text{volts}}\right) \text{amperes.}$$

C_H = hysteresis component of the magnetising current fig. 8.

C_E = eddy current ditto ditto ditto.

The current corresponding to the C^2R losses is at once known, and is, say, C_R.

By compounding C_L with $(C_H + C_E + C_R)$ at right angles (as in fig. 8) the true magnetising current can be read off, the accuracy of the method being only limited by the accuracy with which the iron employed is tested and the extent to which the iron is altered in properties by being built up into the core.

These notes will enable the magnetising current of a transformer to be calculated in any particular case, and the importance of this current has been already explained. The magnitude of the no-load current varies very considerably with the capacity of the transformer, being in some cases as high as 1·5 to 2 per cent. of the output in "simple" transformers taking up to 30 amperes, and 0·75 to 1·50 per cent. in cases where the current exceeds 30 amperes; in other instances an 800-watt simple transformer may have light losses as low as 6 watts on a 50-cycle supply and 4 watts on a 100-cycle circuit. For frequencies much below 50 ~ per second, a special winding is necessary on auto-transformers. The extent to which no-load losses can be reduced by the use of good iron has already been stated to be about 40 per cent. of the first-mentioned percentages above.

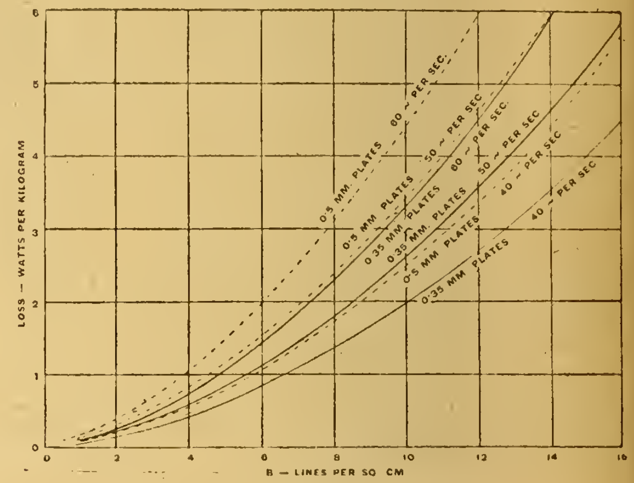

Fig. 9.

Cost of Auto-Transformers.—The success of any such apparatus as the present, depending on the ordinary householder for its chief sale, must vary largely with the price at which it can be placed on the retail market. Hence the examination of the prices of auto-transformers and the example given later of its economic value, form possibly the most important section of this article from the point of view of the non-technical reader.

The main laws governing the price of auto-transformers are that *the cost rises*—(1) As the frequency of supply falls; (2) As the primary voltage rises, the ratio of transformation being constant; (3) As the current capacity rises—factors other than those mentioned being assumed to remain constant throughout. The variation of price with the ratio of transformation is dependent on the make considered, being a direct function in some cases and an inverse function in others. The prices of similar transformers by various makers agree very closely, so that the data from which the above deductions are drawn and the curves in figs. 10-12, which illustrate them, are very valuable for general reference. The current capacities referred to in these tables and curves are the maximum currents that can be supplied by "simple" auto-transformers or dealt with as out-of-balance currents by "balanced" transformers. In the later case, the total secondary current that can be supplied may be six or seven times the current tabulated.

On increasing the frequency from 40 ~ to 100 ~ per second the price of a transformer of any stated output falls by from 15 to 20 per cent. (on the 40 ~ cost). Increasing the primary voltage from 100 to 250 volts raises the price by from 45 to 60 per cent., reckoned on the lower price, while

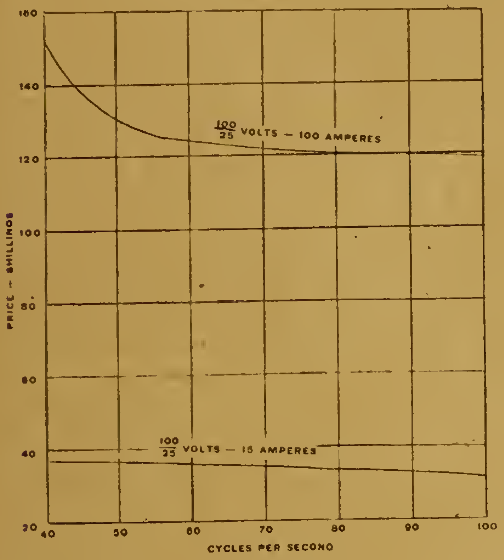

FIG. 10.

increasing the current capacity of a certain type from 5 amperes to 100 amperes (*i.e.*, in the ratio 1 : 20) increases the cost from £1 13s. to £12 8s. (*i.e.*, in the ratio 1 : 7·5). As a guide in estimating, the curves of fig. 13 may be referred to, showing the cost in shillings per kilowatt capacity of transformers for various ratios of transformation. A primary pressure of 200 volts and a frequency of 50 cycles per second are assumed. For other conditions of supply fig. 13 must be used in conjunction with figs. 10-12. The humps in the curves of fig. 13 are due to the necessity of making considerable variations in design if the current capacity is to exceed a certain limit, the latter depending somewhat on the ratio of transformation, as shown by the lateral displacement of the humps. This results in a material rise in the price per kilowatt at the limiting capacity, but the normal course of the curve is rapidly returned to as shown.

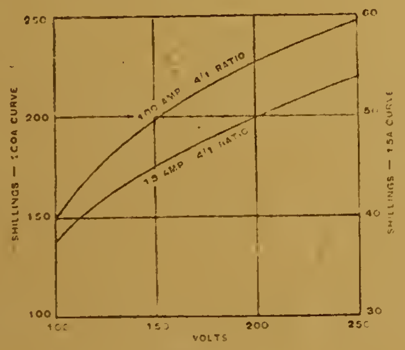

FIG. 11.

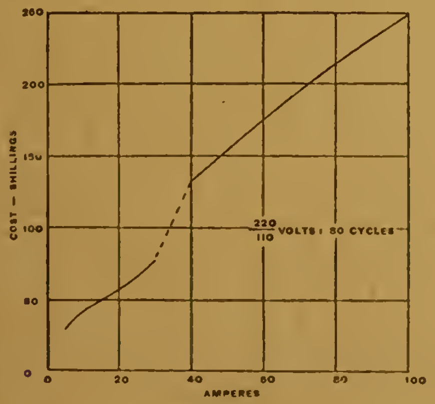

FIG. 12.

Example of the Economies Attending the Use of Metallic-Filament Lamps and Auto-Transformers.—The following example, based on a very ordinary installation and making assumptions which are clearly stated in order that the perfect legitimacy of the conclusions arrived at may be indisputable, will serve to bring home, in concrete form, the practical application and effect of the matter already given.

The capital and running costs of exactly equivalent carbon and tungsten lamps are compared. The capital cost is assumed to merely cover the cost of lamps and of the auto-transformer in the case of metallic-filament lamps. This will save confusion since, with the exception of the transformer, the cost of wiring and fitting is identical in the two cases, a simple transformer being chosen in this case to make the conditions as favourable as possible to the carbon lamps. A typical house installation of 18-16 C.P. lamps and six 8-C.P. lamps, or their equivalent, is assumed, and the running hours per annum are assumed to be equivalent to one hour's burning of *every lamp* per day (*i.e.*, a total of 365 hours per lamp per year). This assumption is found to cover the case of an ordinary household very closely. The life of a carbon lamp is assumed as 1,000 hours, and of a tungsten lamp as 1,500 hours, the latter figure being, if anything, low, for there is no longer any blackening of the bulb, and the filament of a 25-volt 16-C.P. lamp is very robust. The respective efficiencies assumed are 3·5 and 1·2 watts per candle-power, these figures being also quite authentic. The transformer is assumed to have a full load efficiency of 94·5 per cent. and the no-load current (C_L fig. 8) is assumed to flow (23 × 365) hours per annum and is calculated on a basis of a no-load loss of 6 watts—again a reliable test figure. Current is assumed at 6d., 4d., 3d., 2d., 1d. and $\frac{3}{4}$d. per B.T.U. in successive cases, and the total costs per annum in each instance are tabulated in Table II, being calculated as shown *in extenso* in Table I, where also the saving if the transformer be cut out of circuit during all but the lighting hours is shown: in the other cases the transformer is assumed to be permanently in circuit.

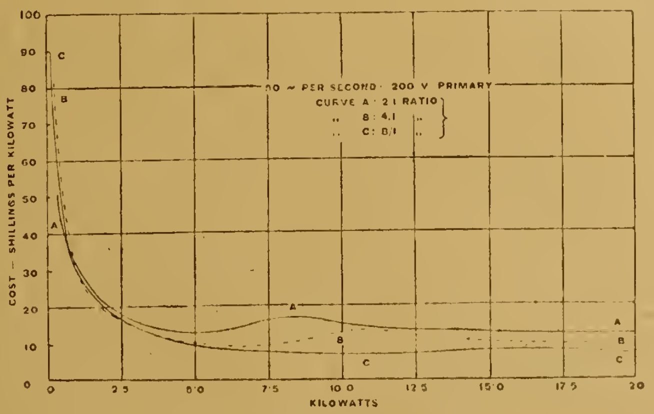

FIG. 13.

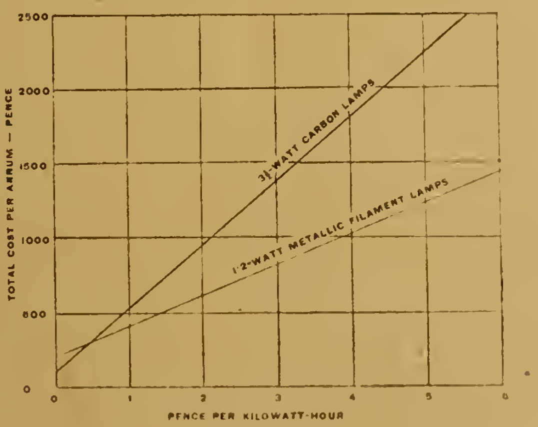

FIG. 14.

The results of Table II are plotted in fig. 14, and from the intersection of the two cost curves it will be seen that metallic-filament lamps, in spite of their higher cost per lamp and allowing for the use of an auto-transformer, are more economical than carbon lamps for all current rates down to less than ½d. per B.T.U. Though the exact figures above refer only to a particular example, the latter is thoroughly representative and fully explains the growing demand for auto-transformers. That these are playing a most important part in the economic development of electric lighting and aiding in the increasing supremacy of electricity over gas as a lighting agency cannot be doubted.

TABLE I.—Capital and Running Costs of Carbon and Metallic-Filament Lamps.

Carbon Lamps.

Capital costs.		*Running costs per annum*	
24 lamps at 10s. per dozen	£1 0 0	5 % interest on capital	£0 1 0
		Renewal of lamps (8·76 at 10d. each) ...	0 7 4
		Current at 4d. per B.T.U.	7 3 1
		Total... ...	£7 11 5

Metallic-Filament Lamps.

Capital costs.		*Running costs per annum.*	
18 16-C.P., 25 volts, and six 8-C.P., 25 volts (tungsten lamps at 2s. 3d.)...	£2 14 0	5 % interest on capital	£0 4 2
400-watt transformer (200/25 volts) ...	1 10 0	5·83 renewals	0 13 1½
		Load current	2 12 0
		"No-load" current ...	0 16 10
Total	£4 4 0	Total... ...	£4 6 1½
		Saving over carbon lamps	£3 5 3½
		If transformer be cut off during day :—	
		Total = ...	3 9 3½
		Saving over carbon lamps	4 2 1½
		Saving = 43·3 per cent. in first case, and = 54·3 per cent. in second case (on carbon lamp bill).	

TABLE II.—Total Costs of Carbon and Metallic-Filament Lamps at Various Current Rates.

Carbon lamps. Cost per annum, apart from current = 8s. 4d. (Table I).		Electrical energy per B.T.U.	Metallic-filament lamps. Cost per annum, apart from current = 17s. 3½d. (Table I).	
Current cost per annum	Total cost per annum.		Current cost per annum.	Total cost per annum.
2,574d.	2,674d.	6d.	1,239d.	1,447d.
1,717d.	1,817d.	4d.	826d.	1,034d.
1,287d.	1,387d.	3d.	620d.	827d.
858d.	958d.	2d.	413d.	621d.
429d.	529d.	1d.	207d.	414d.
322d.	422d.	¾d.	155d.	363d.
107d.	207d.	¼d.	52d.	260d.

There is little improvement possible in the mechanical and electrical design and efficiency of auto-transformers, as now on the market, but much remains to be done as regards popularising their use and extending the general knowledge of their properties and merits.

Exhaust Steam Turbine Plant at Bolckow, Vaughan's.—At the annual meeting of Bolckow, Vaughan & Co., Ltd., the chairman said that in the year's capital expenditure was included the installation of exhaust steam turbo-blowing and generating plant at the steel works. During the three months that the exhaust steam plant had been running completely it had more than come up to their expectations, and if, after further trial for some months, the installation gave the same satisfactory result, they would complete the installation of their entire steel works. The Miners' Eight Hours Act was in operation in their ironstone mines; but, judging from the Home Secretary's quick promise to introduce material alterations, he thought they might assume that the miners did not find it as satisfactory in practice as they had been led to expect. At their collieries the measure came into operation on January 1st, and until the law was altered the measure must produce trouble in the Durham Collieries.

STEAM, GAS AND OIL ENGINE BREAK-DOWNS IN 1908.

The introduction to the annual report of the chief engineer of the British Engine, Boiler and Electrical Insurance Co., Ltd., Mr. M. Longridge, M.Inst.C.E., which has just been issued, reminds us of a truth too often forgotten—that there are two kinds of things men's eyes and minds ignore: those they have never seen, and those which are always in front of their noses. The author cites this as justification for his description of incidents old as well as new; but no excuse is really needed—not only do the inexperienced require instruction from the lessons of the past, but even those who have passed through the mill are apt to forget them and may well profit by a revision.

Noting the remarkable uniformity in the rate of increase of the number of steam engines and internal-combustion engines insured, Mr. Longridge says there is no doubt that while many small steam engines have had to give place to gas engines, the latter in turn have had to make room for electromotors; but for these, the increase in the number of internal-combustion engines would have been greater. Breakdowns of steam and gas engines take place in almost identical ratio—1 in 9·4 and 1 in 9·1—gas engines, therefore, making a slightly better showing than steam. The parts most liable to breakdown are shown in the following extracts from the tables:—

Steam Engines.

	Average for previous 24 years. Per cent.	1907. Per cent.	1908. Per cent.
Valves and valve gear	21·0	28·0	34·8
Spur gearing	14·8	10·2	8·1
Air-pump motions	10·4	10·2	5·2
Air-pump buckets and valves	7·3	4·0	6·2
Columns, bed-plates, &c.	6·9	7·7	5·2
Cylinders, valve-chests and covers ...	5·2	7·2	6·2
Pistons and their attachments... ...	3·2	5·6	5·7

Gas and Oil Engines.

	Average for previous 24 years. Per cent.	1907. Per cent.	1908. Per cent.
Valves and valve gear	32·5	43·3	31·3
Cylinders and cylinder ends	16·6	13·5	19·4
Pistons	11·7	2·7	4·8
Connecting rods and their bolts ...	11·2	8·1	10·8
Main shafts	5·0	4·7	9·1
Fly-wheels and driving drums ...	4·3	4·7	5·4

No other item exceeded 5 per cent. of the total. The breakdowns due to old defects or deterioration amounted to 15 per cent. in the case of steam and 20 per cent. in the case of gas and oil engines; weakness, bad design, workmanship or material accounted for 31 and 18 per cent. respectively, and negligence for 25 and 27 per cent., the remainder being due to accident and causes unascertained. The author draws attention to the continually increasing percentage of steam-engine failures due to breakage of valves and valve-gear, and advocates more care in fitting. The reduction of spur-gear failures is ascribed to the rapid disappearance of such gearing from engine rooms, and the low percentage of main shaft breakages to the limitation of the unit stress to 8,000 lb. by the great makers of steam engines. The high percentage of valve-gear failures in gas engines naturally calls for comment; the cylinder breakages were largely due to severe frosts, and point again to the extreme importance of draining the jackets of standing engines. No reason can be given for the increased breakages of crank-shafts.

Amongst the examples of breakdown cited in detail by Mr. Longridge is one relating to the use of superheated steam with slide valves, wear of half an inch taking place in two months. The company's experience with slide valves working in superheated steam is "not encouraging"; Corliss valves are preferred, or, still better, for the highest temperatures, multiple-beat drop valves.

Under gas engines, the author discusses at considerable length the stresses imposed upon crank pins and shafts, and obtains formulæ for their diameters, with one and with two fly-wheels. He recommends a maximum stress of 9,000 lb. per sq. in. for shafts with two bearings, and 8,000 lb. with three bearings; the maximum explosion pressure per sq. in. is given as about 450 lb. for large, and 400 lb. for small engines, with town gas, and 50 lb. less with producer gas.

A case is cited where a gas engine was wrecked through the failure of the connecting-rod bolts, which, as so frequently happens, had no fillets between the head and the shank. When will designers learn that a sharp corner is the commencement of a crack?

Turning to electrical machinery, the chief engineer reports an increase as compared with 1907 of 11·4 per cent. in insurances, of 10·7 per cent. in breakdowns, and of 18·3 per cent. in cost of damage; the last value is evidently out of proportion, and is due to a rise of 84·8 per cent. in the cost of damage to dynamos, mainly owing to a few expensive breakdowns of large generators. Motors and controller breakdowns have increased at a lower rate than the number of insurances. The ratios of breakdown were as follows:—Generators, D.C., 1 in 13·7; A.C., 1 in 5·7; motors, D.C., 1 in 9·2; A.C., 1 in 11·3; starters and controllers, 1 in 24.

Most of the failures, as might be expected, occurred in connection with rotating parts carrying current; armatures and rotors, dynamos, 30 per cent., motors, 36 per cent.; commutators and slip rings, dynamos 40, motors 26 per cent.; magnet coils and stators accounted for 11 per cent. (dynamos), and 16 per cent. (motors).

The bulk of the machines insured are motors, and these are further classified: armatures and rotors caused 38 per cent. (D.C.), and 21 per cent. (A.C.) of the failures; commutators and slip rings, 29 per cent. (D.C.), and 2 per cent. (A.C.); magnet or stator coils, 11 per cent. (D.C.), and 53 per cent. (A.C.). Dirt and neglect were blamed for breakdowns about equally with age and deterioration, accounting for nearly half the troubles with all classes of electrical machinery; bad work or design comes next, with 20 per cent. of the dynamo failures, 11 and 9 per cent. of the motor and controller failures respectively. One-third of the failures were due to unascertained causes. In starting switches and controllers, the resistance coils accounted for half the breakdowns, contacts and switch arms for 10 per cent., and automatic apparatus for 13 per cent., the remainder being in connection with parts not carrying current.

It is interesting to note, in the data relating to A.C. motors, that troubles with slip rings are extremely rare, while more than half the failures of A.C. motors arise in the stator coils. There is also a considerable proportion of failures in stationary parts not carrying current, such as the frames and bearings—18 per cent., as compared with 7 per cent. in the case of D.C. motors. The relative reliability of D.C. and A.C. armatures or rotors may be gauged from the figures given above—38 and 21 per cent. of the recorded failures respectively; the A.C. rotor hardly shapes so well as it is supposed to do.

Among the examples of breakdown detailed are instances of pieces of iron being drawn into the machine, where they naturally make for the region where they can do the most damage—between armature and pole-piece; a motor driving a centrifugal pump was found to be exposed to a jet of water from a hole in the pump casing; a drain cock was opened by a touch from a belt, emptying the oil well of a motor and causing the bearing to seize; the oil well of a motor in a brewery was found so full of dirt that the ring could not revolve, and the white metal in the bearing melted; a motor commutator was turned up by the owners and set to work again without cleaning the copper dust out of the mica and removing burrs—a typical case, leading at once to breakdown; a rope—one of eight—1¾ in. in diameter, driving a dynamo by a pulley only 19 in. in diameter, broke and fouled the bearing, dragging the entire machine into the bottom of the rope race 6 ft. below. Carbon dust and oil are fruitful causes of breakdown; it is most difficult to prevent the passage of oil to the back ends of commutators, unless the latter are pressed on the shaft; when other means of fixing are employed, the old device of caulking a copper ring between the shaft and the front end of the quill is recommended. Dust generally accumulates under string binders, especially the bands that are sometimes put round the clamping rings at the ends of commutators. Another common difficulty with commutators is due to the relative motion between commutators and armatures, which is not fully prevented by the feathers, set-screws, and so on, usually employed; the core also is often not rigidly held, with the result that the conductors break off between the commutator and the armature, or the insulation is cut through by the edges of end-plates or winding drums—which, incredible as it would seem, are frequently left quite sharp instead of being well rounded off. Core plates are best held endways by a ring sprung into a groove on the shaft, as nuts are apt to slack back. Regarding brush gear, Mr. Longridge remarks that the company has had least trouble, perhaps, with brush holders consisting of a plain box holding a rectangular block of carbon, with a flexible conductor attached, and a spring to keep the carbon up to the commutator surface.

The bulk of the breakdowns are due to oil, dust and damp—especially oil, which, when it once gets out of a bearing, creeps all over, and mixing with copper or carbon dust, produces short circuits. Imperfect fitting, keying and locking of spiders and core plates, commutator bushes, &c., comes next, and careless winding and fitting of magnet coils is not uncommon. The users of electrical machinery, of course, themselves have much to answer for. The author recommends ball-bearings for motors, with regular cleaning and inspection.

Under the head of boiler insurance and inspection there are numerous examples of badly grooved and corroded boilers offered for insurance—but not accepted. One curious instance is cited where the flanges of a number of mild steel steam pipes were found to be most imperfectly welded—hardly attached at all, in fact; they had, however, been at work for five years before one of them gave way. Of the land boiler explosions reported in 1908, eight in number, none were in electrical works; there were seven fatalities, due to these, as well as 14 others due to collapses of fireboxes and flues and sundry mishaps on land. Only two deaths took place in connection with boilers insured.

In conclusion, Mr. Longridge draws attention to a fault in the design of vertical air-pumps applied to factory engines, the condenser being water-sealed, in a case observed by the author, with an effective head of no less than 50 in., with the result that a satisfactory vacuum could not be obtained. The author suggests modifications in the design which would avoid the trouble, dispensing with a foot-valve and greatly improving the vacuum obtainable.

Fatality.—While Leonard F. G. Cone, aged 19, an electrical engineer of Plumstead, was in camp at Salisbury he was struck on the nose by his horse's nosebag, and on his return home he died in Woolwich Infirmary from meningitis. Verdict, "Death from misadventure."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GERMANY (*continued*).

	Marks per 100 kg.
Steam boilers of wrought-iron, also assembled parts of the same, provided with fittings or not	5
Boilers with more than 10 similar tubes of a diameter amounting to 300 mm. or less, clear; and boilers of all kinds of non-malleable cast-iron, weighing 5,000 kg. or less per piece	8
Ditto, weighing more than 5,000 kg. per piece	6
Articles of coarse lead	6
Copper rods, sheets, plates &c.	12
Copper wire, iron wire with wire of copper or copper alloy wound round it or plated or twisted thereon	12
Copper wire rope and cable, neither lacquered, polished nor nickelled	15
Coarse wares of copper and of cast brass, not otherwise mentioned; tubes and pipes	18
Wares, other than coarse wares, of copper or cast brass; lacquered or polished; sheet-copper and sheet-brass	30
Copper, tombac, and brass wires, *verniert*, coloured, or nickelled, not being "ornamental wares"	60
Wares of copper alloys other than tombac or brass, not being "ornamental wares":—	
Fine, especially all polished, nickelled, coloured, lacquered, or *verniert* wares	60
Other than fine, neither polished, nickelled, coloured, lacquered, nor *verniert*; metal foil	30
Steam engines, steam turbines, water-power machinery (turbines, water-wheels, water-pressure engines), combustion or explosion motors, combined or not with dynamos:—	
More than 500 up to 1,000 kg.	11
More than 1,000 up to 2,500 kg.	7·50
More than 2,500 up to 5,000 kg.	6
More than 5,000 up to 50,000 kg.	5
More than 50,000 up to 100,000 kg.	4·50
Dynamos, electromotors, continuous-current transformers, also finished armatures and commutators; converters and reactance coils, weighing:—	
500 kg. or less	9
Over 500 and up to 3,000 kg.	6
Over 3,000 and up to 10,000 kg.	5
Over 10,000 kg.	4
Machines firmly attached to dynamo-generators or motors, dutiable as machinery.	
Accumulators and electrodes therefor:—	
Combined with celluloid, vulcanite, &c.	24
Other	6
Underground electric cables encased in a protective cover of metal sheet, wire or the like	8
Telegraph appliances, telephones, electrical appliances for surgical and dental purposes, galvanic and dry batteries and thermo-electric couples	60
Electric appliances for illumination, transmission of power, or electrolysis; electric measuring, counting and registering apparatus; resistances and shunts; other electrical appliances not specially mentioned, and component parts of such articles, weighing:—	
10 kg. or less	40
More than 10 kg. and up to 25 kg.	30
More than 25 kg. and up to 100 kg.	20
More than 100 kg. and up to 500 kg.	8
More than 500 kg. and up to 1,000 kg.	6
More than 1,000 kg.	4

(*To be continued.*)

A Hint to Electrical Undertakers.—The American *Electrical Record* quotes an unusual use to which electricity is being put in a New York church:—"As a means of raising money to pay off a debt this church uses electric lights as memorials to the dead after the following manner:—A huge altar electrolier includes name-plates as part of its winding vine decoration, about each of which is a cluster of 10 incandescent lamps. Subscribers desiring the prayers of the congregation for their dead pay $1,000 for each light. The name of the deceased is then inscribed on the plate above the cluster of lights, and one light is lit, to be kept burning at all services. The payment of each successive $1,000 means the lighting of another light, the maximum amount being $10,000 for each name. Eighteen of the name-plates have already been subscribed for and 30 lights purchased. The memorial is so constructed that it can be lengthened and enlarged almost endlessly, and the pastor of the church is reported to be looking forward to the day when it will reach the high vaulted ceiling and start twining its way along the sides of the chancel." This suggests a field of wonderful possibilities!

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,329. "Appliance whereby the blind can detect and trace pencil writing by means of an electrically rung bell or gong." A. M. Cox. August 23rd.

19,359. "Improvements in and relating to electric safety lamps for use in mines or other like places." J. G. Patterson. August 23rd.

19,387. "Improvements in arc lamps." S. C. Mount and Beck Flame Lamp Co., Ltd. August 23rd.

19,392. "Improvements in or relating to dynamo-electric machines." B. G. Lamme. (Date applied for under Sec. 91 of the Act, October 7th, 1908, being date of application in United States.) August 23rd. (Complete.)

19,393. "Improvements in or relating to dynamo-electric machines." F. W. Le Tall. (Westinghouse Electric and Manufacturing Co., United States.) August 23rd. (Complete.)

19,394. "Improvements relating to dynamo-electric machines." F. R. Kunkel. (Date applied for under Sec. 91 of the Act, September 8th, 1908, being date of application in United States.) August 23rd. (Complete.)

19,397. "Improvements in submarine cable telegraphy." W. Judd. August 24th.

19,424. "Improvements in electric lighting devices for life-buoys." J. F. Trentmann. August 24th. (Complete.)

19,434. "Improvements in electrical detectors or contact-makers for use in connection with railway switch points and the like." E. C. Irvino. August 24th.

19,465. "Device for varying the intensity of light of electric lamps." A. de Stefano. (Date applied for under Sec. 91 of the Act, August 26th, 1908, being date of application in Italy.) August 24th. (Complete.)

19,466. "Improvement in electric furnaces for the treatment of gases by means of flame arcs." Salpetersaure Industrie-Gesellschaft G.m.b.H. (Date applied for under Sec. 91 of the Act, August 25th, 1908, being date of application in Germany.) August 24th. (Complete.)

19,475. "Improvements relating to magneto-electric machines to be used for medical purposes." T. Morris. August 25th.

19,496. "Improvements in or relating to driving mechanism for use with electric motors." W. G. Mambridge. August 25th.

19,516. "Process and apparatus for electro-mechanical transmission to a distance of half-tone illustrations, portrait and other photographs, engravings, manuscripts, typograms, and the like." H. Carbonelle. (Application for Patent of Addition to No. 5,187, 1907.) August 25th.

19,527. "Improvements in or relating to the transmission of power by means of magnetisable pulleys, bands, and the like." A. Huguenin. (Date applied for under Sec. 91 of the Act, August 25th, 1908, being date of application in Germany.) August 25th. (Complete.)

19,565. "Improvements in or relating to electro-magnetic switches." W. H. Powell. August 26th.

19,599. "Improvements in or relating to means for cooling the rotor-windings of dynamo-electrical machinery." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G m.b.H., Germany.) August 26th. (Complete.)

19,600. "Improvements in methods of charging and discharging electric accumulators or secondary batteries." A. M. Taylor. August 26th.

19,603. "Improvements in apparatus for electric telegraphs." Siemens Bros. & Co., Ltd., and G. S. Grimston. August 26th, (Complete.)

19,615. "Improvements in alternating-current motors." A. H. Midgley and C. A. Vandervell. August 26th.

19,637. "Improvements in and relating to starting switches for electric motors." A. D. Smith. August 27th.

19,660. "New or improved coin-freed apparatus for supplying or measuring a current of electricity." J. A. Farrand. August 27th. (Complete.)

19,662. "Improvements in spring switches for electrically setting railway points and signals." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 27th. (Complete.)

19,684. "Improvements in electric signalling apparatus." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 27th. (Complete.)

19,718. "Improvements in shades for electric glow lamps." G. Davis and H. J. Simpson. August 28th.

19,719. "Improvements in casings and coverings for electric circuits." E. W. Lancaster. August 28th.

19,732. "Improved tumbler switch for electrical currents." A. E. Watkins. August 28th.

19,747. "Electric safety switch." W. J. Brooks. August 28th.

19,757. "Variocolour reflecting air-worked arc-light advertising sign." F. J. Torode. August 28th.

19,758. "Improved construction of electric arc lamp." C. Parsons and W. G. Hunt. August 28th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electrical Control of Mechanism from a Distance. G. C. Lohay. 14,396. July 7th. (Date applied for under International Convention, July 16th, 1907.)

Control of Mechanism from a Distance. G. C. Lohay. 14,420. July 8th. (Date applied for under International Convention, September 26th, 1907. Application for Patent of Addition to No. 14,396/08.)

Electric Galvanic Batteries. G. Schauli. 14,609. July 9th.

Electrically Blocking a Single-Line Railway. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,784. July 11th.

Method of and Apparatus for Compounding Alternating-Current Generators. M. Breslauer. 14,897. July 14th. (Date applied for under International Convention, July 15th, 1907.)

Electrical Typewriter operating Attachment for Message Transmission. G. A. Mavrand. 16,791. August 10th.

Electric or like Conduit Jointing. T. G. Hann. 16,863. August 11th.

Control of Dynamo Electric Machines. British Thomson-Houston Co. and F. W. Carter. 16,997. August 12th.

Electric Ignition Devices. A. S. Postans. 17,159. August 14th.

Magnetic Brakes for Tramway and other Vehicles. R. Shears. 17,211. August 15th.

Protective Devices for Electrical Installations. British Thomson-Houston Co. and E. B. Wedmore. 17,899.

Starting Switches for Electric Motors. G. H. Garside. 18,965. September 10th.

Protective Devices for Alternating Electric Current Systems. British Thomson-Houston Co. and E. B. Wedmore. 20,498. September 29th.

Trolley Poles for Trams and like Electrically-driven Vehicles. S. Bryan. 20,575. September 30th.

Depolarisers for Electric Batteries. G. Schauli. 24,355. November 12th. (Date applied for under Rule 13, July 9th, 1908.)

Depolariser for Electric Batteries. G. Schauli. 24,356. November 12th. (Date applied for under Rule 13, July 9th, 1908.)

Automatic Switching or Controlling Apparatus for the Distribution of Electricity. E. G. Bryant and R. A. Pearson. 25,134. November 23rd.

1909.

Apparatus for Controlling Electric Motors. H. E. Dey. 759. January 12th.

Control of the Current and Voltage in Dynamo-Electric Machines. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke-Ges.) 1,503. January 21st.

Regarding Mechanism for Electric-Motor Starting Switches, Valves, and like Apparatus. Siemens Bros. Dynamo Works and B. G. Payne. 4,317. February 22nd.

Automatic Regulators for Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 4,882. February 27th. (Application for Patent of Addition to No. 5,037/07.)

Alternating Electric-Current Machines. R. Moser. 6,103. March 13th (Date applied for under International Convention, March 14th, 1908.)

Electric Wire Supports. C. C. Gould. 7,610. March 30th.

Arrangement of Thermo-Piles. B. von Wysocki. 11,230. May 12th.

Electrical Fatality.—On the 1st inst. an inquest was held at Ramsbottom, Lancs., by Mr. Barlow, Deputy Coroner, on the body of John W. Garner, 5, Hulme Terrace, Ainsworth, who met his death at the electric sub-station of Messrs. Turnbull and Stockdale's works, Stubbins. Mr. R. C. Leslie and Mr. C. D. Taite represented the Lancs. Electric Power Co. It was stated that the deceased was an electrician's labourer in the employ of the Lancs. Electric Power Co., and that he had followed the occupation for three years. Dr. R. Crompton said he found the deceased lying on the ground outside the sub-station door, which is entered from the bleach works yard. He had since made a post-mortem examination, and found that there was a small wound on the bottom of the right hand between the roots of the middle and ring fingers. This was burned around and was sufficiently large to admit the point of a pencil. It was $\frac{1}{8}$ in. deep. There were also blisters at the roots of the fingers, and the skin was scarred at the back of the hand, the wrist and arm scorched to the elbow and the hair burned off. The left hand was scorched to the elbow, and the face was discoloured on the left side, and the moustache singed. On the right side between the shoulder blade and the spine was a scorched puncture of flesh corresponding with the holes in the garments, and in his opinion death was due to electrical shock as a result of the current striking the right hand of the deceased. David Ferguson, an assistant erector, said the deceased was a careful man. Witness was engaged erecting a transformer on the wall of the sub-station. Deceased had just gone out of the door, and there was a flash and report, and he then found deceased lying in front of the transformer. He was bleeding from the mouth. He thought deceased must have stumbled on to the live contacts. The switches were 6 ft. 4 in. from the ground, and there was a temporary platform 2 ft. 10 in. high. Mr. Taite said they were under the impression that the deceased attempted to climb the platform, and stumbled and put out his hands to save himself. The voltage that came into the sub-station was 10,000. They were instructed that the charged metal on the top of the yellow board was dangerous. There was no screen, and there were no rubber gloves or boots provided, though there was a rubber mat under the switchboard. J. Millar, electrical erector in charge of the job, said that deceased had instructions to enter the station only on the low-tension side of the transformer. He did not think it necessary to have a screen in front of the switchboard, and there would have been great danger to anyone putting such a screen up. He had individually cautioned the deceased. The jury returned a verdict that the deceased accidentally came to his death by electric shock, and sympathy was expressed with the deceased's relatives.

Rubber Coagulant.—It is reported that Mr. O. A. Elias, F.C.S., has discovered a chemical reagent which effectually and quickly coagulates rubber latex, without injury to the resulting product; coagulation has always been one of the most troublesome and difficult processes in the preparation of raw rubber, and the new method, if found satisfactory, will be heartily welcomed by rubber collectors and manufacturers.

British Association.—The *Times* Winnipeg correspondent reports that nearly 200 members of the British Association left Winnipeg on the evening of the 2nd inst. for a western trip over the Canadian Pacific Railway. They will be back in Winnipeg on 13th inst. ready for the return home.

THE
ELECTRICAL REVIEW.

VOL. LXV. SEPTEMBER 17, 1909. No. 1,660.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

DURHAM MINERS AND ELECTRICITY.

AT a Council meeting of the Durham Miners' Association, held at Durham City, on September 4th, a resolution was considered with regard to electricity in mines, and containing a request that electric machinery and cables be taken out of the pits, as they were considered a source of great danger. It was explained that a Select Committee had been appointed by the Government to go into the matter, and that the owners would not object to a meeting on the question, and in view of this explanation the resolution was withdrawn.

This is the outcome of the remarks upon the lamentable disaster at the West Stanley Colliery, contained in the last annual report of Mr. Wilson, M.P., Secretary of the Durham Miners' Association, to which full reference was made in the ELECTRICAL REVIEW for May 21st, 1909. Mr. Wilson therein stated that it was his own opinion that this explosion was caused by electricity, and in spite of the coroner's jury's verdict and the report of H.M. Inspectors of Mines, who both stated that the cause was not ascertained, there is a general opinion in the North of England that electricity was the secondary cause of the explosion, if not the primary. In view of such a general impression, it is useless to mince matters, and it will be better at once to admit the possibility and face the question boldly. One thing is certain, had it not been for the West Stanley explosion the above resolution of the Durham miners would never have been moved.

It may be of interest, therefore, to consider the question of electricity in mines from a miner's point of view. By miner, we mean the coal-hewer, who forms the majority of those employed in a coal mine as well as of the members of the Association; and he is absolutely ignorant of electricity or its working. His occupation is to get the coal down and fill it into tubs or wagons, which are then taken from the working place or "face" by the "putter"—who may be looked upon as the hewer's assistant—to a point, commonly termed a "flat," from whence they are removed by horse or mechanical haulage. Under these circumstances electricity in any shape or form does not enter into any phase of his work. He is paid by results, usually "per ton," the hewing price being controlled mainly by a fixed "county average" wage. In Scotland this is now a "minimum wage."

The work of "hewing" is arduous, especially in thin seams, and, provided he gets *no less* wage than he can now earn, he has no objection whatever to having this part of the work done by machinery. The present-day miner, in fact, has a very great objection to hewing proper; this is evidenced by the stringent regulations that some colliery managers have been obliged to issue, owing to the men blasting down the coal without first "kirving," a condition known by the term "shooting fast." With mechanical coal-cutting this arduous part of his work is done for him, and he has then only to get the coal down, either by "blasting," "hewing off," or "wedging," and fill the loose coal into tubs. Hence he rather welcomes than otherwise the introduction of coal-cutting machinery, and though his price per ton may be reduced, he is enabled to fill more tons, but in many cases this price is not low enough to allow any margin of profit to the owners on the capital expenditure required to install the machines.

Why, then, should he request that electricity be taken out of mines, which would be nothing more or less than a serious calamity? Simply because this cheapest of all systems of power transmission has been so misused, ill-understood, and so badly installed, that he has become *afraid* of it. *Afraid!* There is no other word to describe his objection to electricity. So many fatal accidents have occurred, due to the victim unsuspiciously coming in contact with some "live" part of a circuit, when, without any warning, he is struck down, apparently by some invisible force which cannot by any means be controlled. Men have been fatally injured, and although experts (?) have been called in to make examinations and tests, *no fault* has been found in any part of the machine or circuit. In view of such a state of things as this, the miner thinks that if the technical experts cannot control or explain this "electricity," he himself will have none of it. And now that the fear has got abroad that electricity may cause a serious explosion in a fiery mine, he asks, and we may say from his point of view justly asks, that it be taken out of the pit altogether. It is not electricity as an agent for the transmission of power that he objects to, but the unexplainable mystery attaching to many of the accidents caused by it. If a winding rope breaks, although lives may be lost, the reason why it broke can be ascertained. If a "blown-out shot" or a "broken safety lamp" causes an explosion, the cause may be ascertained, and precautions taken to prevent similar occurrences. But when a man simply touches, accidentally or otherwise, a piece of bare metal, and is at once fatally struck down, and when engineers and inspectors can trace *no cause*, is it any wonder that his uneducated mind is afraid to have it anywhere near him?

What, then, is to be done? The answer is simple: first, stop cheese-paring, and accepting the *lowest* tender; secondly, put the installations in charge of "certificated and qualified" engineers and make them absolutely responsible to the law—*not the colliery manager*; and thirdly, appoint competent mines electrical inspectors to see that they (the engineers) are fulfilling their duties and that the plant is safely installed and operated. But such inspectors will have to visit the colliery; go below ground; make insulation tests, and give instructions for alterations or make recommendations, if necessary. A single inspector for the British Isles is absurdly inadequate. We have no desire to be accused of a leaning towards increasing the number of Government officials; the mining industry is already heavily handicapped by Government Regulations, but some of these Regulations are bad, and especially those relating to the certificated colliery manager. Alter this, and prepare rules for the installation and use of electricity in mines, based upon intelligent knowledge of the conditions and actual practical experience.

We have hundreds of miles of tramways and railways all worked by electricity, carrying hundreds of millions of passengers annually, yet how often do we hear of fatal accidents to the men operating these? They are very few indeed, compared to accidents in coal mines. Yet it is the same electricity! But it is installed and operated by men who know what they are about. Every detail is carefully thought out and considered in all its phases by trained engineers who are alive to their responsibilities.

There is nothing wrong, or even mysterious or dangerous, in the application of electricity even in fiery coal mines, if only reasonable precautions are taken, seasoned with a modicum of common sense. At present, there is too much "cutting," dependence upon contractors, and a too-prevalent "that is good enough" sort of spirit, to make electricity in mines safe and efficient. Remedy these failings upon the lines we have over and over again suggested in these columns, and we shall hear no more of such resolutions as that noted at the head of this article.

In conclusion, if we might venture to offer a suggestion to the Select Committee, it would be that they should examine colliery engineers and electricians who have to install the plant and keep it running—men who are constantly in the pit, and who have acquired practical experience and a knowledge of the difficulties to be met and guarded against. Ask them also who ought to be responsible; and whether they have any voice in the selection of the plant. We have no doubt that some interesting and useful information would be forthcoming—if the witnesses were independent, and not primed, or under any fear of losing their job.

Short-Circuit Tests on a Single-Phase Railway.

An interesting set of experiments was recently carried out on the German State experimental railway at Oranienburg, and is reported in the *E.T.Z.* This line is a single-phase one, with the overhead wire supplied at 6,000 volts, 25 cycles. The object of the tests was, more especially, to investigate the effect of a break in the overhead wire.

The tests were carried out during damp weather. A wire was hung with one end over the overhead line, whilst the other end was moved in turn to various positions on the roof and sides of a passenger car. As soon as the switch was closed a short-circuit occurred immediately in most cases, although sometimes a second or two elapsed before a sufficient current passed to open the maximum cut-out at the station. This cut-out was set for 800 K.V.A.

When the short-circuit was moderated by the introduction of a water resistance sufficient to prevent the cut-out from operating, the point where the current was passing would gradually heat up and finally become ignited.

In some cases the carriage covering possessed sufficient resistance to prevent much current passing, but only in a single case was a position found where a partial short-circuit resulted, which, whilst failing to operate the cut-out, might have given rise to a fire. Usually, when the wire was lying on the roof without causing a short-circuit, a slight movement of the carriage would bring about a dead short-circuit. This would usually occur at the ventilators of the gas lamps, as these were in good metallic connection with the frame.

The experiments were varied by allowing the live wire to hang down and moving the carriage up against it. In this case the wire usually first came into contact with a plain wood projection, and yet a short-circuit occurred almost immediately in every case, owing to the dampness of the wood.

It was generally possible to follow the path of the current by eye as it passed along from the metal sheeting to the under-truck, jumping any gaps in its way.

The inside of the carriage also was tested by means of an electrostatic voltmeter, whilst the live wire was lying on the roof without producing a short circuit. No appreciable voltage could be discovered anywhere, even when the metal lamp support in the roof was touched.

On the whole, the experiments indicate that little damage is likely to result from a falling live wire, even in the absence of special earthing arrangements on the carriage roof.

ELECTRIC POWER IN THE WORKS OF MESSRS. ARMSTRONG, WHITWORTH & CO., LTD., MANCHESTER.

(Concluded from page 407.)

Any attempt at a complete summary of the purposes to which electric power is applied in the works of Messrs. Armstrong, Whitworth & Co., would be as futile as it would be bewildering, and we must, therefore, content ourselves with a description of a few of the more unusual and startling applications of electric power which have been effected. The older works at Whitworth Street are devoted principally, though not entirely, to steel manufacture, to the production of armoured plate in its various sizes and applications and the production of heavy gun armaments for military and naval purposes. Perhaps one of the most interesting applications of electric power is to be found in the armour plate erecting shop. It must be understood that after armour-plate has been treated by the various processes, the face of the plate is so extremely hard as to make ordinary drilling or other machining impossible, but when it is required to drill a bolt or other small hole, the hard face may be softened in small patches, but a little larger than the finished hole. For this purpose in the armour-plate department, an electric plate softening process has been introduced, by means of which it is possible so to soften the plate that holes as small as ¾ in. in diameter can be drilled into the metal, this softening being so local that after drilling has been completed it is found that the edges of the holes are as hard as the rest of the plate. The electric softening plant consists of a continuous-current motor driving a single-phase alternator of 40-KW. capacity. The alternator is provided with a variable field, and this with the shunt regulation of the motor is such that the voltage from the alternator is variable between zero and 300 volts. The current passes to the primary circuit of a transformer, whose secondary consists of one single turn of massive cross-section capable of carrying 32,000 amperes alternating current at a pressure of 1 to 3 volts. This circuit is interrupted by an air gap, which can be varied at will between ½ in. and 3 in., and the open ends of the secondary are fitted with massive copper ears or contacts. The whole transformer is slung from a small jib crane, so that it can be swung over the armour-plate, and the contacts brought down on the surface of the piece of armour-plate to be treated. These contacts are partially hollow, and a flexible water pipe is connected to them for the purpose of keeping them cool during operations. The distance apart of the copper shoes is varied by suitable slotted holes in them, through which bolts are passed attached to the limbs of the secondary circuit. The motor-generator is then run up and excited, and the result is that current passes across the gap through the substance of the armour-plate immediately below and between the copper shoes, bring it to bright redness in a short time. The regulation of the field of the alternator is so fine that the current can be brought down very slowly and by small stages, allowing the iron to cool slowly through a period varying from a few minutes to any time desired, and annealing the portion of armour-plate beneath to as soft a condition as is necessary for machining. This plant was specially constructed to the requirements of Messrs. Armstrong, Whitworth & Co.

Another interesting machine, which is probably unique and without a counter-part in any other engineering shop, is a machine for grinding the edges of armour plates to a true form either at right angles or at any angle of bevel with the front surface of the plate. The machine is of special construction, and consists of a transverse bed, 22 ft. long, over which a carriage is traversed by means of a screw capable of being reversed so as to give a slow reciprocating motion. On this carriage is mounted a British Westinghouse motor of 40 H.P., running at 400 R.P.M., carrying a circular stone carrier which is coupled direct. This stone carrier, which is 34 in. in external diameter, has 10 recesses in its front face, capable of carrying segmental stones of a special nature, measuring 4½ in. × 8 in. on the face. When these stones are rapidly rotating, the edge of the armoured plate is brought against them at the required bevel by means of an overhead travelling crane, which serves the machine. The rate of cutting is varied by adjusting the rate of speed of traverse, and taking out one or more pairs of stones in the wheel, and the plates and stones are kept cool by a constant stream of water. It will be seen that this is a process which can only be satisfactorily accomplished by the use of electricity, inasmuch as the introduction of shafting to operate at a high number of revolutions and power would be a matter of some difficulty, and the placing of a direct-coupled high-speed steam set on the bed would involve flexible steam piping which would be a difficult matter. At the same time it is much to the credit of the manufacturers of the motor and to the maintenance department of Messrs. Armstrong, Whitworth & Co., that in a wet grinding process of this nature, the arduous duty on the motor can be carried out satisfactorily.

Reference was made to the armour-plate rolling mill, which is probably one of the largest in the kingdom, and it is interesting to note, that although the main drive is by means of steam, the live rolls on the bed of the mill for the purpose of handling the plates easily when passing through the squeezing rolls, are driven by two 100-H.P. electric motors; this means of drive is adopted, inasmuch as quick and easy reversal of direction of the rolls is obtained by simply reversing the motor switches. There is a smaller rolling mill in another department which is entirely electrically operated by means of a 250-KW. motor running at 300 R.P.M. This motor is a 12-pole shunt motor built by Messrs. Armstrong, Whitworth at their Elswick Works, driving by means of a series of ropes on to the shafting of the rolling mill, which revolves at 95 R.P.M. The mill, which is used for rolling fine steel plates to be made into tool steel for the purpose of milling cutters, &c., is a two-high roll, 4 ft. on the face, one roll of these dimensions being used as the rolling mill, and the other for finishing. By means of a muff clutch, a third pair of rolls suitable for making bars, can be connected up if necessary. In conjunction with this plant a pair of Messrs. Craig & Donald's shears are driven by means of a compound-wound Armstrong, Whitworth motor of 10-B.H.P. capacity.

In an enclosed chamber partially sunk under ground in the armour-plate department, and suitably protected by sheets of mild steel, is a motor-driven circular saw of a very special type, and which is probably unique in the world. It consists of a plate of mild steel, 6 ft. in diameter, and ½ in. thick, with a plain edge. This disk revolves at 1,500 R.P.M., giving a peripheral speed of nearly 28,300 ft. per minute on the cutting edge. This is driven by means of a 150-B.H.P. motor, connected direct to the disk by means of a shaft running in long spherical bearings, lubricated with oil under pressure in the same way as a turbine shaft. In view of the enormous speed, and consequently high inertia of the revolving mass, the set takes a considerable time to get up to full speed, and for this purpose special starting arrangements of a slow speed nature are introduced. The starting switchboard is located behind an armour-plate screen at one end of the chamber provided with spy holes in order to watch the process of the cutting. The material to be cut is clamped to a carriage traversing at right angles to the motor by means of a screw, driven by an auxiliary electric motor at a proper rate of travel for cutting, which can be varied. This traverse is capable of dealing with plates up to 22 ft. in length, and a 6-in. plate can be cut at the rate of 1 ft. per hour, while at the time of our visit to the works, a 2-in. hard steel plate was cut at the rate of 12 in. per minute. The action of the saw is analogous to the older process carried out on a smaller scale in lead lapping by means of which steel, which is, of course, considerably harder than lead, can be cut by means of abrasive materials embedded in the surface of the softer material. Moreover, in the case of the cutting wheel, the point at which friction occurs is fixed as regards the steel-plate which is, therefore, rapidly raised to a condition of bright redness at that point, while the friction point is traversed along the cutting edge of the disk with a velocity equal to its peripheral speed, thereby keeping the friction surface of its disk cool.

In the armour-plate department there is another application of electric drive which is distinctly novel. In the process of oil hardening and tempering steel plates, the metal in the form of plates is first heated in furnaces to the required degree of temperature, and then brought by bogies under an electric crane of 75 tons capacity, and 50 ft. span. The distance between the ground level and the crane hook at its top position is 40 ft., and the function of the crane is to lower the glowing plate edgewise into a huge tank of oil. The usual weights of metal carried are up to 50 tons, and the speed of lift is about 12 ft. per minute, obtained by means of a compound-wound direct-current hoisting motor of 75 B.H.P. It is, however, necessary to drop the metal at a considerably greater speed than this, and for this reason, previous to the weight being lifted, oil is pumped into a large dashpot cylinder, the plunger of which is pressed down before the hook and weight rises. When the time comes to lower the plate into the oil bath, the hook and weight is released from the electrical gear, and the weight falls at a rate nearly equal to the natural drop against the oil dashpot, which, however, eases the strain of stopping the fall. In addition to the hoisting motor, electric drive is installed to operate the traverse, travel and oil pump of the crane.

The plate furnaces in this section of the works have bottoms for the reception of plates to be heated, constructed in the form of cars or large bogies, which are operated by means of 50-H.P. capstans having compound-wound motors giving a speed of 120 ft. per minute on the ropes. Electric capstans are used exclusively in the armour-plate department for handling the loads about the floors of the works.

For the water treatment of armour plates, Messrs. Armstrong, Whitworth & Co. have erected a very fine equipment of sprinklers which is capable of dealing with plates up to a size of 12 ft. × 20 ft. The plate is placed horizontally in its heated condition, on a number of carriers so formed that both the upper and lower surfaces of the plates are exposed to the rapid cooling action of the water-sprays playing upwards and downwards against the heated steel surfaces. The upper series of sprays is mounted on the carriage which is capable of being traversed till it is over the plate which has previously been placed in position by an overhead travelling crane. The traverse is operated by electric motive power, and water is conducted to the upper sprays by means of a flexible pipe. In connection with the water cooling plant of this description, is a water pumping plant consisting of six motors of 60 B.H.P., coupled to centrifugal pumps made by the Pulsometer Co. The motors are started through liquid resistances, and run at 500 R.P.M., driving the pumps against a head of 40 ft. provided by a water tower. Water storage is provided under the pump house of sufficient capacity to ensure that at no time shall the water used in cooling the plates and returned to the storage tank become warm. Two electric travelling cranes serve this plant. The cranes, which were made by Messrs. Craven, are of the three-motor type, capable of lifting 75 tons, and have a span of 75 ft.

The heavy hydraulic machines in the armour-plate department are worked by a central pumping plant, which is particularly interesting to electrical engineers. This consists of two duplicate sets of three-throw horizontal ram pumps, made by Messrs. Davies, and capable of delivering 60 gallons of water per minute against the hydraulic accumulator pressure of 25 cwt. per sq. in. These are driven by two 150-H.P. continuous-current motors running at 450 R.P.M. and geared by means of spur wheels and pinions to the pumps. The motors are started and stopped automatically, the running current being about 550 amperes, and the starting current rising to 760 amperes, inasmuch as the pump has to start against the full pressure on the rams. In order to cope with heavy current, the solenoid main switch is divided into three sections in parallel with one another. The first solenoid starter, on closing, immediately energises the coil of the second section, which at once closes and brings into instant action the third section. The convenience of this distribution of breaking circuit is obvious. To guard against a heavy arc on the third contact in breaking, this is furnished with carbon breaking tips. In series with these main switches is the main starter, the contacts of which are arranged in three segmental sections. This starting switch is operated by a small motor working on a toothed segment by means of a worm connected to the motor by a universal joint. The worm is lifted into contact with the toothed wheel by means of a solenoid energised by the closing of the third main switch. The action of this solenoid also closes contacts in the starter motor circuit. On the full travel of the starter having been made a pair of contacts on the starter arm short-circuit the armature of the starter motor, the current only flowing through the high resistance field coils. By this means over-running is prevented. The board, containing two sets of the above gear, is also provided with two overload circuit-breakers, one on each pole, two field break switches with discharge resistances, and two selector switches, one of which selects the motor which is to be operated, and the other provides a means for changing from automatic to hand-starting should this be required. For the latter purpose a hand-starter is provided for each motor. It is also possible by using the first selector switch, to put the two motors in parallel operation. The solenoid of the first main switch, which, it will be seen, commences the cycle of operations on the whole board, is in circuit with a knock-over switch adjacent to the hydraulic accumulator, and is thrown over by tappets or stops placed on a rope attached at its top to the ram, and kept stretched over the pulleys by a counterweight. This plant, constructed by Messrs. Armstrong, Whitworth & Co., has worked so successfully that another similar installation, operated by 250-H.P. motors against a pressure of 30 cwt. per sq. in., has been installed for use in the steel works department.

In the armour-plate machine department, a number of very fine special tools are installed. Reference can only be very cursory. For example, a line of six armour-plate cross-cutting machines are installed for cutting the ends of the plates and general parting-off processes before passing the steel through the hardening treatment. Each machine is fitted with a double tool capable of taking 40-ft. cuts. These machine tools were especially built for the service by Messrs. Armstrong, Whitworth & Co., and are each driven by a 20-B.H.P. motor. Another example of heavy machine tools is a double-headed drilling machine capable of drilling holes in plates up to $3\frac{1}{2}$ in. diameter on any part of a plate measuring up to 15 ft. × 30 ft. This is driven by a 20-H.P. motor constructed by Messrs. Armstrong, Whitworth & Co. at their Elswick works.

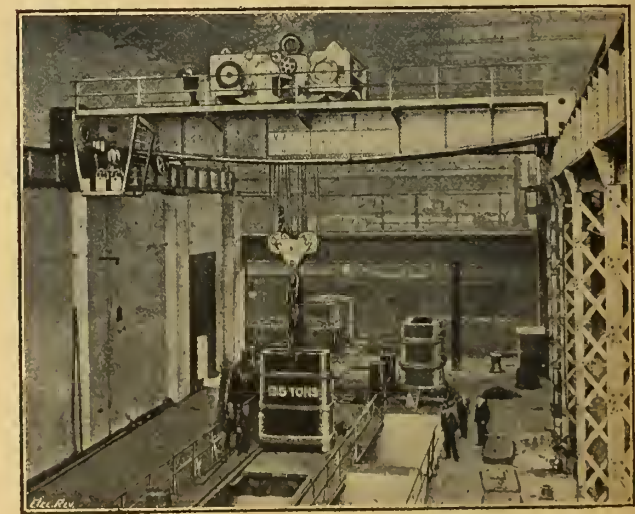


Fig. 5.—125-Ton Four-Motor Crane.

Several examples of electric cranes have already been mentioned, and it may be said that this firm has made almost universal use of electricity for this purpose. As further examples of the varying capacities may be mentioned, a 125-ton four-motor crane of 51 ft. span, constructed by Messrs. Vaughan & Sons, Ltd., and illustrated in fig. 5; two 230-ton electric cranes by Messrs. Vaughan & Son; and one 150-ton crane by Messrs. Armstrong, Whitworth & Co., each of which is driven by a three-motor equipment in the armour-plate erecting shop.

In addition to steel manufacture, which can only be incidentally mentioned here, and the armour-plate works, the equipment of which has been described in some detail, Messrs. Armstrong, Whitworth & Co. have at their Whitworth Street works an extensive heavy gun-making department devoted principally to making the 12-in. guns which form such an important part of the modern equipment of our Navy. It is served by two 30, two 50 and two 75-ton cranes, and a feature of this shop is the way in which individual electric drive is incorporated in the design of the heavy lathes, rifling machines, &c. For example, in the second bay of this shop are three large lathes for gun turning, on each of which are mounted direct on the lathe motors of 60 H.P. each, of the interpole type, capable of giving a three to one speed variation on the motor alone. This dispenses with a large amount of gearing, back gearing being done away with altogether, and the rigid fixture of the motor to the lathe gives a positive drive which is impossible in any system of belt gearing. Fig. 6 illustrates one of these gun lathes, and shows the exceedingly simple manner in which electric drive is applied. Another interesting tool in this section is that used for rifling the bore of these heavy guns. The bed of this machine is 74 ft. long, and is traversed by a tool mounted on a cutter bar, which passes up the interior of the bore to the recess for the shell immediately in front of the explosion chamber. The tool is then drawn backwards, a feed having been given to it, and at the same time is rotated slowly, so as to give a spiral cut in the interior surface of the bore. The reversing of the tool is accomplished by means of a drum type switch at the end of the bed, which changes the direction of current in the armature at the end of each stroke. The starting resistance of the motor is inserted in series with the armature at each reversal, and is cut out by a special switch, which is driven off the motor shaft. The reversing switch has also an attachment for putting resistance in series with the shunt field winding of the motor in such a manner that, on the return of the stroke, the motor runs at 900 R.P.M., whilst on the cutting stroke it only runs at from 300 R.P.M. up to any speed, not exceeding 900 R.P.M., that may be required.

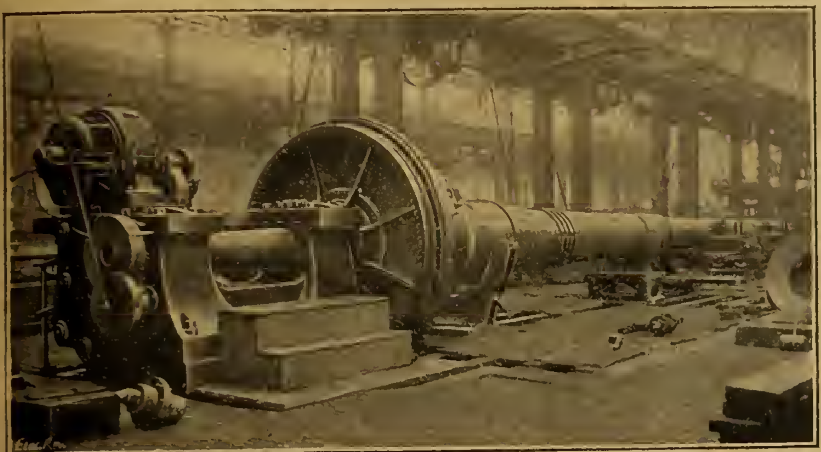


FIG. 6.—MOTOR-DRIVEN GUN LATHE.

It will be understood that in a works of this description and magnitude, the joiners' and pattern makers' department has attained considerable dimensions, and in this section the principle of group driving is largely adopted. For operating the principal machines in this department a 50-H.P. shunt-wound motor has been installed.

Messrs. Armstrong, Whitworth & Co. have designed a special motor starter, an example of which is to be found in this department, and which may fittingly be described here. Fig. 8 illustrates the way in which it is applied to one of the line shaft drives. This starting controller, made at the Manchester section of Messrs. Armstrong, Whitworth & Co., has been designed with regard to the required conditions for the starting and protection of the motor, and also for the protection of the mains supplying the motor. It presents no particular difficulty in operating, hence it can be operated by any person without doing any damage. The upper portion of the switch consists of an adjustable overload circuit-breaker on the positive pole, and a no-volt circuit-breaker and an enclosed fuse on the negative pole. Below this apparatus is the starting switch itself, which consists of a number of copper blocks, to which the resistance connections are made. Traversing over these blocks is a laminated copper contact, suitably insulated and fastened to an iron block. The iron block is threaded, and is controlled by a screw, extending the length of the copper blocks and supported by a framing at each end. The screw is operated by a hand-wheel fixed on the end of the spindle. There is also an interlocking device on the negative circuit-breaker, which renders it impossible to close this circuit-breaker unless the sliding block be in the starting position. All the above apparatus is fixed on a slate slab mounted on an iron frame. The resistance is placed underneath the apparatus, and is made up of asbestos-woven net resistance plates. It is designed so as to give a suitable starting current on the first resistance block, and a regulated increase of current on each of the remaining blocks. The connections necessary are all made at the back of the controller. The whole of the controller is enclosed in an iron case, with movable glass front, the handles for the operation of the circuit breakers, and the starting switch, being the only parts of the controller projecting through the iron case. This type of controller has been installed in various departments of the works, and has given general satisfaction.

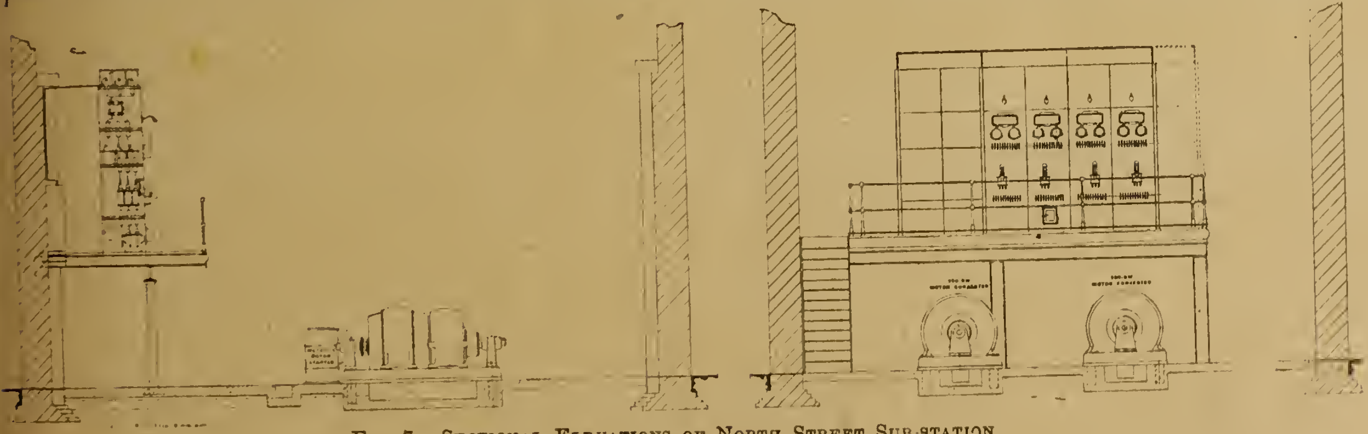


FIG. 7.—SECTIONAL ELEVATIONS OF NORTH STREET SUB-STATION.

An item worthy of special mention is a 50-B.H.P. shunt-wound motor, situate in the armour-plate department, which proves to be interesting as having run for several years on an exceptional duty. On being started after August Bank Holiday, it is never shut down again until Christmas Eve, and it has stood up to this work, with similar long runs between holidays, without giving any trouble for 10 years.

Within the last two years the increasing operations of the firm have necessitated still further extensions, and a new and extensive works at North Street has recently been erected in order to deal with light gun manufacture. The two works are joined by means of a full-gauge railway line which runs through the by-streets near to the works and across the main thoroughfare known as Ashton Old Road. This is used for the transport of raw and finished materials between the two works. The power requirements are met entirely by municipal electricity, a Corporation sub-station for the purpose being installed closely adjacent to North Street, the general lay-out of which is shown in fig. 7. Supply is given by means of three-phase current at 6,500 volts, 50 cycles, to a similar high-tension board to that installed at Whitworth Street. The energy is transformed by means of Bruce Peebles-La Cour converters of 250 KW. capacity to continuous current at 500 volts. A three-wire low-tension network is carried throughout the works, and power is obtained from the outers, while lighting is drawn from either outer and the middle wire. Up to the present four motors of 50 B.H.P. drive the shafting in the new light gun shops, while two motors of 20 B.H.P. each drive mills for the buildings department. The motors in the gun shops are mounted at the centre of each bay. The works are lit by 50 enclosed arc lamps, run two in series across the 250-volt supply. There are four bays in this new shop devoted to machining, and one to erecting; the last-named bay is dominated by a 3-ton motor travelling crane built by Messrs. Vaughan & Son. The whole of the motors used in this part of the works were constructed by Messrs. Armstrong, Whitworth & Co., Ltd., at their Elswick Works, and it may also be mentioned that the low-tension board in the sub-station is of their own manufacture, having been constructed at their Openshaw Works.

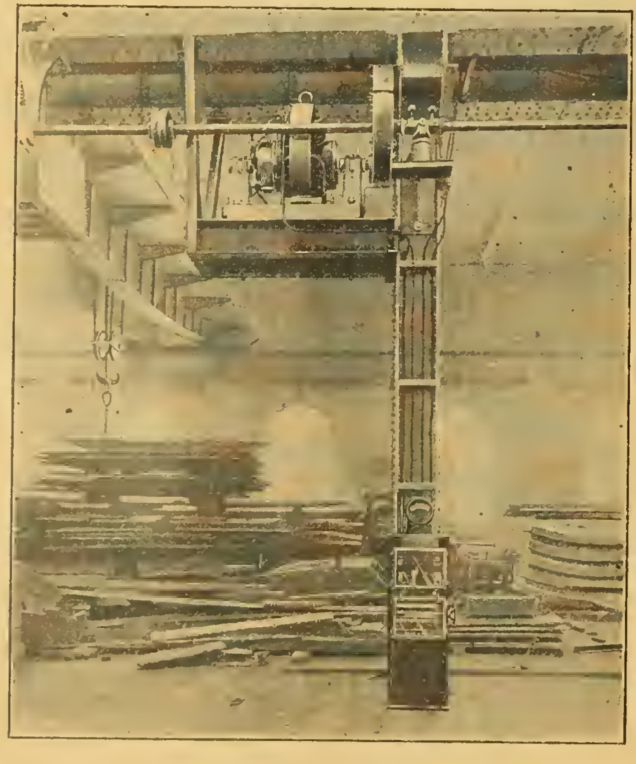


Fig. 8.—Line-Shaft Motor and Controller.

Part of the ground area at North Street is taken up by the stockyard of the firm, and in order to handle the steel ingots and other material, a large Goliath crane of 75 tons lifting capacity has been installed. This crane runs on rails 500 ft. long, and having centres of 52 ft., the height from crane to rails of the traversing carriage being 25 ft. The main hoist is operated by a 40-B.H.P. motor capable of lifting the load of 75 tons at a speed of 5 ft. per minute, while the traverse of the carriage is driven by a motor of 15 B.H.P. at the rate of 40 to 50 ft. per minute. In order to cause the crane to travel along its rails, a motor is installed at the bottom of each leg, of 11 B.H.P. capacity. It has been frequently noticed in cranes of this description that there is considerable danger, where independent drive on each leg is used, for one leg to get ahead of the other, and to produce a joggling action on the crane, which not only causes severe racking stresses on the construction, and a considerable amount of useless friction on the rails, but also tends to oscillate the load on the hook in an unpleasant and dangerous manner. This action is more pronounced if at the time of starting the load is not slung symmetrically as regards the span of the crane. In order to overcome this difficulty Messrs. Armstrong, Whitworth & Co. have cross-connected the motors, which are series wound, so that the field of the motor at the bottom of one leg is connected in series with the armature of the motor on the other side. By this means an undue rush of current in one armature strengthens the field, and, therefore, the torque on the other motor, equalising the turning moments, and by this means an equal starting impulse on the two motors is given and maintained at all times of travel with perfect success. This system is considerably better than the practice of placing a travel motor at the centre of the span and connecting it to the driving wheels by means of cumbersome and inefficient bevel gearing. The current is brought to the circuits of this Goliath crane by means of overhead wires mounted on insulators and brackets attached to poles, spaced 25 ft. apart; a double-pole collector is placed on the crane to make contact with these wires. As the whole of the work is out of doors and subject to the severe weather conditions to be found in Manchester, it is evident that the satisfactory performance of this equipment is an evidence of the good quality of Messrs. Armstrong, Whitworth & Co.'s electrical manufacture.

The maintenance of an electrical plant and distribution system of this description calls for a considerable staff. It is probably the largest private plant and power distribution system to be found in the United Kingdom, and the supervision and upkeep in good running order of the electrical equipment reqnires four inspectors of plant, two inspectors of mains and a staff of 90 men, including such persons as arc lamp trimmers. These men form a self-contained department for the maintenance of the electrical work, and such constructional work as can conveniently be carried out on site.

In concluding this article, we have to put on record our appreciation of the courtesy of Mr. Gledhill, the manager of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., at Manchester, for allowing us to prepare this description of the electrical equipment of these works, and also that of Mr. D. McCormack, the electrical engineer, for giving us a considerable amount of technical assistance in collecting data concerning the electrical apparatus which we inspected during our visit.

THE SINGLE-PHASE MOTOR.

By A. O. BUCKINGHAM.

Prior to 1900 most of the alternating-current generating stations were single-phase, and a lighting load had been the only load anticipated, but the great development in the use of power brought about by the direct-current motor for industrial purposes was not without its effect on the managers of single-phase stations, who, together with the direct-current station managers, were beginning to find it imperatively necessary to improve the load factors of their stations.

The only single-phase motors in practical existence at this time were of the simple series and repulsion types, both with badly sparking commutators and little better than academic toys, and single-phase induction motors of very low starting torque and requiring enormous starting currents, which, in combination with small, and often badly regulating transformers, failed to start at all, until assisted by hand. These offered but a poor outlook for the single-phase station in the direction of a power load; hence it came about, and not unnaturally, that a large amount of single-phase plant was relegated to the scrap heap, to be replaced by polyphase.

These radical changes, as might have been expected, were not carried into effect without leaving an unfortunate bias in the minds of engineers against the single-phase motor.

A few weeks ago the writer arrived in England after being abroad for some years, during which he had personal experience with a single-phase undertaking of considerable magnitude, which during the past three or four years has developed a growing power load of some 1,500 KW., made up of all sizes and types of single-phase motors, which are almost without exception giving complete satisfaction to the consumers. Thus it was with considerable astonishment that he learned the adverse opinions expressed by engineers in this country as to the single-phase motor.

While prepared to admit that the starting torque of the single-phase induction motor, especially that with a squirrel-cage rotor, is inferior to that of the polyphase motor, the writer has rarely found this to be any real drawback; as power for industrial purposes is usually applied by belts to single apparatus or to countershafting, in each case equipped with fast and loose pulleys, the objection to low starting torque disappears. The writer would here point out that the fast and loose pulley system is not without some advantages of its own, especially when frequent stops are required, and the time of starting up and stopping is a consideration. Moreover, when small power is used, say up to 2 H.P. or 3 H.P., the single-phase induction motor has a peculiar advantage of its own, namely, that of running in whichever direction it is given an impulse, and for small apparatus requiring to be reversed at intervals, this fact has been fully utilised, thus dispensing with all starting apparatus, such as reactances, resistances, and phase-splitting switches; a simple D.P. switch is all that is required, the necessary impulse being given by hand.

Single-phase induction motors giving 50 per cent. of full-load torque at starting, without taking excessive current, are not uncommon.

When a large starting torque is required, the commutator type of induction motor, starting as a repulsion motor, and when up to speed automatically raising the brushes and running on as an induction motor, leaves nothing to be desired. Its characteristic is not unlike that of the series direct-current motor. It will give twice full-load torque with twice full-load current, without any other starting device than a double-pole switch. In fact, at the moment of starting, it develops the same torque per ampere as when running. The commutator is subjected to no wear, except at the short period of starting, which it does practically without any sparking. Motors of four years' continuous service show scarcely any signs of wear, and give no trouble at all.

Starting and stopping can be effected at a distance, as in the case of isolated pumping plants, and in the event of an interruption to the supply, the motor automatically arranges itself in the starting position, with brushes on the commutator; and if without an attendant, the switch being closed, it starts up automatically with the renewal of supply, resuming its normal running condition. This performance is not equalled by the ordinary D.C. motor, as the no-voltage release either opens the circuit or reintroduces starting resistance, and if without an attendant, the motor remains stopped, or in the latter case there is a danger of burning out the rheostat with the switching-on of the supply.

The absence of any need of attention, and the automaticity of starting up again in the event of interruption to the supply, especially when it is required to run all night, has frequently been a determining factor when in competition with other forms of power. Further, the single-phase commutator induction motor, in conjunction with an auto-transformer with taps, is capable of large and economical speed regulation, such as is often required by printing machinery.

As a matter of fact, it appears to the writer that there is nothing which the D.C. or the polyphase motor can do, that this type of motor cannot do equally well from the consumer's point of view. It has a high power factor, and its electrical efficiency is certainly not more than 2 per cent. below that of its D.C. or polyphase rivals.

Single-phase central station managers cannot be too careful in their selection of transformers for single-phase motors. The writer has come across transformers of 50 KW. capacity, which, when supplying full secondary current load at 70 per cent. power factor, had an inductive drop of 12 per cent., to say nothing of C^2R losses, and he is firmly convinced that many of the troubles experienced with motors failing to run up to rated output, and bad starting, are directly due to this cause.

As the undertaking with which he was engaged boasted a connected motor load of some 2,500 KW., and included all sizes of motor up to 80 KW., exclusively supplying power to 60 or 70 different trades in the area supplied, and giving every satisfaction while so doing, the writer fails to understand the *raison d'être* for the apparent backwardness of the single-phase motor in British power supply work.

HOW WE GOT THE ORDER.

By BEN FRANK.

"A small white coffee and a box of dominoes, Miss."

Just as Tom gave this order, Dick entered the café. "Not a very satisfying meal for a 12-stone man," he exclaimed. "It reminds me of the tale of the spotted boy of Peru, whose father, it was said, had once upon a time swallowed a box of dominoes. What are you going to do with them, anyway?"

"Now, don't be a silly ass." Tom was evidently in a bad humour. "I suppose I *can* play solo dominoes, if I like; but, as a matter of fact, I am just waiting for Harry—and here he comes."

A glance at Harry's face, as he wormed his way between the tables to where Tom and Dick were sitting, showed that he was on good terms with himself. He was all smiles.

"What ho!" was his cheery greeting, as at length he came alongside. Tom shuffled the dominoes in glum silence. "How do," returned Dick, "had a stroke of luck, or what? You look as pleased as though you had found a sixpence."

"Ah, ha! my boy, What ho!" Harry's vocabulary was distinctly limited, but there was no mistaking his good spirits.

"I suppose Tom has told you that we have just taken the order for what's his name's big motor installation?"

"Never a word. So that's what has put you off your feed, is it Tom? I wondered what had upset you."

"It's a mug's game anyhow," Tom muttered.

"What is?" queried Harry.

"Why, doing work for nothing; it's no good to you or to anyone else. We were pretty slack or we should not have put in such a cut price as we did. We made sure of getting the job, and your firm were the last people we should have expected to be below us."

"Dash it all, you need not be quite so down hearted about it, old chap. Buck up, you'll get the next big contract."

"He seems to take it rather badly," remarked Dick, after Tom had left them.

"Yes, he does seem rather cut up about it; you see, it is not so much for the sake of the job itself, although that is well worth having, but the fact of being able to say we are doing Carmine's works means a great deal. People in their trade follow each other like sheep."

"From what Tom says, you won't make anything out of it."

"You bet we will though. If you won't say a word, I'll tell you how we got the contract."

"Right, fire ahead."

"Well, I made out the estimate and filled in all the schedules of prices. The consulting engineer is a decent sort, but a regular demon for schedules. There is a complete bill of quantities made out, and a schedule of every yard of cable, every motor, bedplate, switch, gear, belt, and goodness knows what all, so that at the end of the job it can all be measured up and charged accordingly. Of course, the tenderer has to fill in his lump sum price in the 'form of contract' for the whole of the quantities specified and agree to additions or deductions being made at schedule prices.

"Very well; I made the total come to £5,625, and this was carefully checked by one of my chaps, and I sent the estimate in to the governor for approval. When it came back the figure 6 was struck out, and a 4 put in its place, making the total £5,425. 'Look here, young fellow,' I said to Sharpe, 'I thought you checked this.' 'So I did,' says he. 'Then how is it there is a mistake of £200?'

You see, I did not dream of doubting the governor's addition. He's a real genius at figures. I never knew a man who could sum up a long money column like he can. Two figures at a time all the way up a foolscap sheet as quick as lightning; and never a mistake! So the estimate went in, and in due course the order came. 'Just run your eye down those columns again,' I said to Sharpe, 'and see where you made that mistake of £200.' But there was *no* mistake. The two of us went over it together, over and over again, and at last I had to own that the governor, for once, was wrong. So I went down to him and said that I was afraid he had made a mistake in altering my figures, and that we should be £200 to the bad if we accepted the contract.

"'Let me see the form of contract,' he said, and when he had run his eye over it he added, 'Oh, that's all right, the work is all to be measured up and charged according to schedule. If your scheduled prices are all right, it does not matter what total you fill in the form, it won't count for anything at the end of the job!'

"'You wily old bounder!' I thought to myself. That had never occurred to me before. You see, the contract is settled on the lump sum price; but once the job is started, there will be no end of alterations, and only the schedule will count."

Dick raised his eyebrows and whistled softly. "Very smart, to put the mildest construction on it. Tom *would* feel pleased if he knew, wouldn't he?"

"Don't breathe a word to him, for Heaven's sake! Of course, it was a clerical error on the governor's part, but he made the best of it." Harry was clearly trying to dissemble.

"Of course, of course; but if that consulting engineer is as clever as you say, he's sure to spot it."

"Well, what if he does, he can't do anything, the schedule's the thing."

"I know what I should do, if I were he."

"What?"

"Oh! Never mind."

THE MEASUREMENT OF THE INSULATION OF A LIVE THREE-WIRE SYSTEM.

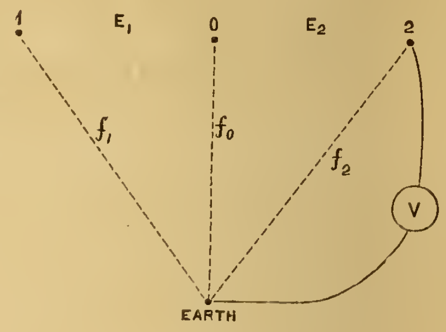
By STUART A. RUSSELL.

THE interesting paper on the above subject, communicated by Dr. Kapp and Dr. Coales to the Institution of Electrical Engineers, and published in abstract in the ELECTRICAL REVIEW of the 20th ult., describes two methods of finding the joint fault resistance of a live three-wire system with the middle wire earthed; and it further shows how, by a variation of the voltage on the two sides of the three-wire system, this joint resistance can be separated into its three components.

The credit of first working out a method of determining the three separate fault resistances by varying the voltage on the two sides of a three-wire system is due, the writer believes, to Prof. Rousseau, of Brussels University, as he proposed it to the writer in 1894 as an extension of the voltmeter test then in use for testing the cable system in connection with the Brussels Municipal electric light station. This method was described, and the proof given, in an article by the present writer which was published in the ELECTRICAL REVIEW of February 25th, 1898; but it may be of interest to again briefly describe the method employed, as it is one that was regularly in use at Brussels in 1894.

The apparatus required consists of an electrostatic or high-resistance voltmeter, a resistance of known value, and one or more switches; and the test is made by first determining the joint fault resistance of the system, which is done by connecting any one of the three wires to earth through the voltmeter and noting the reading V, and then connecting the same wire to earth through the resistance S and noting the reading V^1. The joint fault resistance is $F = S\dfrac{V - V^1}{V^1}$, provided an electrostatic voltmeter is used, or a voltmeter whose resistance is very high compared with the values of F and S. It will be noted that if the resistance S is adjustable, and is regulated so that $V^1 = \dfrac{V}{2}$, the apparatus becomes direct reading, as $F = S$. This method can be applied at any point of the system, and it is not necessary to interrupt the earthing connection when making the test. At the same time it must be remembered that, whatever method is employed, great accuracy cannot be obtained if the resistance of the earth connection is low compared with the fault resistances of the several wires.

Prof. Rousseau's method of obtaining the separate values of the three components is as follows:—After obtaining the value of F as described above, the voltage E_1 on one side is raised, and the voltage E_2 on the other side of the system is lowered, so as to make the ratio $\dfrac{E_1}{E_2} = K$ as large as is conveniently possible, and the reading V of the voltmeter when connected between one wire and earth is noted. The voltage is then again changed so as to make the ratio $\dfrac{e_1}{e_2} = k$ as small as possible, and the reading v of the voltmeter is noted. Referring to the diagram, in which 1, 0 and 2 are the three wires, f_1, f_0 and f_2 the fault resistances, and V the voltmeter conneeting the wire 2 to earth, we have—



$$\frac{V}{F} - \frac{E_2}{f_0} - \frac{E_1 + E_2}{f_1} = 0, \qquad (1)$$

or—

$$\frac{V}{E_2 F} - \frac{1}{f_0} - \frac{1 + K}{f_1} = 0. \qquad (2)$$

Similarly, when the voltages are e_1 and e_2, and the voltmeter reading is v, we have—

$$\frac{v}{e_2 F} - \frac{1}{f_0} - \frac{1 + k}{f_1} = 0. \qquad (3)$$

From (2) and (3) we get—

$$\frac{1}{F}\left(\frac{V}{E_2} - \frac{v}{e_2}\right) - \frac{K - k}{f_1} = 0,$$

giving—

$$f_1 = \frac{F\,E_2\,e_2\,(K - k)}{e_2\,V - E_2\,v}. \qquad (4)$$

We can now get the value of f_0 by filling in the value of f_1, in equation (1), and when f_1 and f_0 are known, the value of f_2 can be found from the equation—

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_0} + \frac{1}{f_2}.$$

The measurements of E_1, E_2, e_1 and e_2 can be made with the same voltmeter that is used for measuring the voltage to earth, but it is more convenient to use a separate voltmeter connected through a double-pole change-over switch.

Name-plates.—We have received from the GLOBE NAME-PLATE CO., LTD., of 20, High Holborn, W.C., specimens of their chemically-engraved name-plates, such as they are supplying to prominent electrical manufacturing firms.

AN IMPROVED FORM OF CONDENSER FOR POWER WORK.

The undoubted opening which exists for a cheap and reliable condenser in alternating-current distribution work has not hitherto been satisfactorily met, chiefly because of the difficulty of obtaining a suitable dielectric and of building the condensers in a safe and mechanical manner.

For low voltages, such as occur in telegraph and telephone work, the recently-introduced paraffin-paper condensers, made up by winding plain paper and tin-coated paper from continuous rolls, are thoroughly satisfactory, whilst for high-tension work at 10,000 or more volts the Moscicki glass-tube condensers have given good results. For moderate voltages glass is unsuitable, as it cannot be obtained in thicknesses sufficiently small from the electrical standpoint, whilst retaining sufficient mechanical strength.

Paper is eminently suitable for the purpose, but its hygroscopic nature must be combated by some more stable and heat-resisting material than paraffin, and with this object various resinous substances have been tried from time to time. The condensers were, however, usually unsatisfactory, because they were made up by hand with alternate sheets of tinfoil and dielectric, and the insufficient protection of the edges and the presence of air bubbles gave trouble.

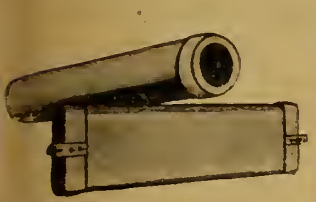


Fig. 1.

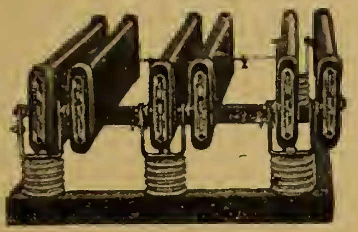


Fig. 2.

Messrs. Meirowsky & Co. some years ago patented a machine for forming insulation tubes out of treated paper, and they have recently applied the same apparatus to the production of a reliable form of condenser. The process of forming the insulation tubes was as follows:—The prepared paper, retarded by a brake, was drawn over hot plates and wound on a maudrel working under heavy pressure from two rollers, kept at a temperature only slightly below the melting point of tin. In this way both dampness and air bubbles were effectively avoided, and the resulting tube, after cooling, was drawn off the mandrel with an extremely dense and firm texture, and in a condition to be worked like wood. The material was known as Pertinax, and was found very reliable both in air and in oil. If required, the tubes could be flattened out into plates.

When using this process for the production of condensers, it is only necessary to lay suitable sheets of smooth tinfoil on the paper as it leaves the drum and passes over the hot plates, and to wind this tinfoil in with the paper. In the direction of motion the sheets of tinfoil are made of the right length to reach just once round the periphery, and the breadth of the tinfoil is made somewhat less than that of the paper, according to the voltage on which the condenser is to be used. Projecting lugs, alternately to right and left, are provided on the tinfoil sheets.

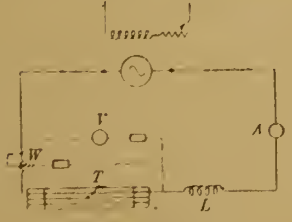


Fig. 3.

In this way, after removal from the mandrel and the joining of the lugs, a thoroughly satisfactory tube-shaped condenser is obtained without air bubbles, with every trace of moisture removed and with the edges completely closed down round each piece of tinfoil. The tube can, if desired, be pressed into a flat shape, as shown in fig. 1, although this is at the expense of the internal cooling surface. A battery of such plate-shaped condensers is shown in fig. 2. The condensers can be readily arranged to suit any voltage by simply varying the number of layers of plain paper wound on between every two tinfoil sheets.

Dr. K. Fischer, in the *E.T.Z.* for July 1st, 1909, describes some tests carried out on condensers of this type. A battery of four condensers, suitable for 1,000 volts, was made up, each element having a capacity (measured with direct current) of from 1·72 to 2·28 microfarads (total, 8·25 mfd.), a weight of 3,840 to 4,490 grammes (total weight, 16,500 grammes), and a size of 75 cm. × 14·8 to 16 cm. × 2·5 to 2·75 cm. (total volume, 10,902 cb. cm.). They were of the flat shape, and were laid one on top of the other, and the temperature during the test was taken in between the two central ones at T (fig. 3).

As no 1,000-volt supply was available, the test was carried out by arranging a resonance circuit as in fig. 3, using a transformer for the choking coil L, and adjusting it until the voltage V was about 1,000. The wattmeter W was of the dynamometer torsion-head type; the voltmeter was a Weston dynamometer, and the ammeter a hot-wire instrument. The condenser was run for 5½ hours at a voltage varying between 990 and 1,160, the supply voltage being about 300, and the frequency varying from 87 at the start to 69 at the end. The power absorbed by the condenser was about 50 watts, and the power factor varied from ·09 at the start to ·12 at the end. The capacity, calculated from the alternating measurements by the ordinary formula, was 8·7 mfd. at the start, and 9·3 mfd. at the end. The temperature rise at T at the end of the run was 19½° C., and was practically steady at that.

After this test the condensers were connected to a H.T. transformer, and the voltage was gradually raised. At about 2,000 volts the noise of a slight discharge was noticed. This increased with the voltage, and breakdown of one element occurred at 5,500 volts. An examination of the inside of the condenser showed the presence of a blackened cavity.

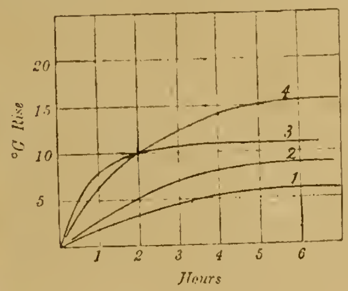


Fig. 4.

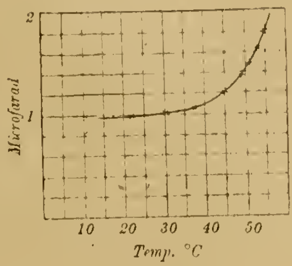


Fig. 5.

The insulation resistance of these transformers was practically infinity when cold, and even after lying for some hours in water, although the resistance fell, they stood the full voltage satisfactorily.

Various transformers for higher voltages up to 10,000 were also tested, and all showed a power factor of about ·1 at 50 cycles. Fig. 4 shows the temperature rise curves for some of these. Curve 1 is for a 10,000-volt ·022 mfd. condenser; curve 2 for a 5,500-volt ·082 mfd. one, curve 3 for a 3,000-volt ·22 mfd. one, and curve 4 a 2,000-volt ·56 mfd. one.

The temperature rise has a somewhat marked effect on the capacity, especially at the higher values, as is shown in fig. 5. Within the ordinary range of temperature, however, this variation is not appreciable.

ELECTRICAL DEVICES FOR HANDLING MATERIAL AT GARY.

One of the most prominent features of the equipment at the Gary plant of the Indiana Steel Co. is the apparatus provided for handling the raw material. Along the slip where the ore is received in vessels, there are five monster ore unloaders and an equal number of bridges. Each unloader is of the grab-bucket type rated at 10 tons per lift, while each bridge is rated at 13 tons and is of the cantilever type. The former is equipped with six motors, having a total rating of 435 H.P., while the latter has 14 motors, the aggregate rating of which is 618 H.P. The object of the bridges is to convey the ore to the point of use from a large concrete trough to which it is carried by the unloaders.

The master controller for operating the six motors on each unloader is mounted in a motorman's compartment arranged within the leg of the unloader immediately above the bucket; thus the operator is able at all times to view the performance of the machine from the most advantageous position. No power other than that derived from electricity is used with the unloaders, all hydraulic cylinders, &c., having been dispensed with. Lifting magnets have proved particularly advantageous for handling both the raw material and the finished product at Gary. In the open-hearth stockyards, the cranes used for unloading pig-iron and scrap from railroad cars are equipped with magnets provided with a controller so arranged as to cause the load to be released with great promptness. Current in a reversed direction is sent through the magnet winding when it is desired to release the load. It is said that the load is released in 0·6 second, while when this arrangement is not used 12 seconds are required for releasing the load. Skull-cracker cranes equipped with lifting magnets are in use at the open hearth and adjacent to the pig-casting machine for breaking up defective castings and the skulls of chilled metal which accumulate on the linings of ladles used in handling molten metal. The cranes are mounted upon runways of exceptional height. Steel balls weighing approximately 12,000 lb. are used for breaking up the scrap and skulls. The material to be broken is unloaded from cars and placed on the ground by means of the magnet. A ball is then lifted by the magnet and hoisted to a suitable height, and merely throwing the magnet controller to the "off" position releases the ball, which does the work of breaking the material. The broken metal is then gathered up by the magnet and loaded into boxes for charging into the open-hearth furnaces.

There has recently been put into operation at Gary a pair of lifting magnets for handling the output of the rail mill. The shipping yard of the rail mill is spanned by two special electric cranes, each equipped with double hoisting drums. Fig. 1 illustrates a pair of magnets suspended from one of these cranes lifting 30,000 lb. of rails 60 ft. in length; the same pair of magnets are capable of lifting a double-locked or nested layer of rails 30 ft. in length, 23 rails being handled at each lift. In other words, 10 or 12 tons of rails are handled per lift, depending upon the section of the rail. With these magnets an ordinary car of rails can readily be loaded in from two to three minutes. In addition to the saving in time and labour which is introduced by these rail-handling magnets, a further advantage is gained in that owing to the wide spacing of the magnets the rails are not strained, and there is no danger of giving them a permanent set in the process of handling.

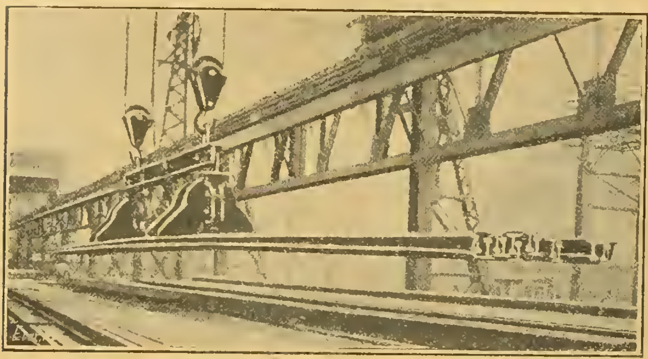


Fig. 1.—Electromagnets Lifting a Layer of 60-ft. Rails.

For controlling the motors on the above-mentioned cranes, as well as those on the ladle cranes, charging cranes, soaking-pit cranes, stripper cranes, &c., use is made of ventilated grid controllers of the type devised by Mr. A. C. Dinkey when superintendent of the electrical department of the Homestead Steel Works. The controller is operated by a lever having a straight forward and backward motion. When properly connected, the motion of the lever indicates to the operator the direction in which the motor will run. For instance, in the case of a trolley on a crane, when the operator moves the lever from him the trolley moves across the bridge away from him, and when the lever moves toward the operator the trolley moves toward him. This agreement is found to be very valuable, particularly in cases where one operator must operate a number of controllers, and where confusion on the part of the operator might result in serious damage.

The above-described controlling devices and lifting magnets were designed and built by the Electrical Controller & Manufacturing Co., Cleveland, Ohio.—*Electrical World.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Storekeeping for an Electricity Works.

May I briefly reply to the letter by "E. W. R.," which appeared in your issue of September 3rd? I will take the notes one at a time:—

1. I much prefer a book for the requisition of goods to the loose leaves torn from a carbon copy book.

2. The only difference suggested here is a hand-ruled book in place of one with the headings printed.

3. "E. W. R." hardly makes his meaning clear in this paragraph. I do not see any reason why the storekeeper should not keep the stores cards. A card is used for each article, or batch of like articles, because experience proves that to be necessary. There are storekeepers and storekeepers, and their knowledge of electrical material may vary in proportion to their positions and salaries. In an electricity works the storekeeper has to deal with scores of other goods than electrical material.

4. The cash columns in the stores book (received) are not there for use by the storekeeper. The cash columns serve a particular purpose peculiar to an undertaking where the borough accountant handles the financial part of the business. I do not agree that the storekeeper should be responsible for *all* goods passed by him. The engineer is the man who knows what he requires.

5. The £ s. d. columns in the issued book are there for the benefit of the cost clerk. "E. W. R." says here "for the same reason as No. 4." No reason appears in "No. 4," only a question.

The few books and cards described really form part of a complete system of cost keeping. Perhaps this should have been mentioned; the presence then of any superfluous matter might have been understood, where the use was not apparent. With regard to the remarks about a difficulty being experienced with such a large number of books, practice says otherwise.

Interested.

The New Theory of Electricity.

Your correspondent Mr. Walker will, I think, find it a great advantage in understanding the new theories of matter and electricity if he becomes a Berkeleyan out and out. Clerk Maxwell, as we all know, wrote:—"Bishop Berkeley let us d—n him with faint praise," but I doubt greatly if his successor at Cambridge, Sir O. Lodge, and others, would have the temerity to do so.

Meanwhile people like the writer live in a medium 2,000 million times denser than lead, where masses are not acted upon by gravitation, and of which the only point in its favour, is the childlike simplicity of the mathematics compared with earlier times. Mathematical physicists nowadays calculate densities of ether, &c., as easily as Hudibras spouted Greek. If it does not look quite right the theory soon straightens things.

"All mass is mass of the ether, all momentum momentum of the ether, all kinetic energy kinetic energy of the ether," so writes Sir J. J. Thomson in "Electricity and Matter," a book I recommend together with "the little Berkeley," to Mr. Walker.

"We are all waves" writes another scientist, and "molecules are individuals;" having got so far, it is but a step to do as the writer has done, and believe with good Bishop Berkeley that everything is merely "an apparition of the mind."

Anyone who wishes to appreciate the modern theory of Thomson, Drude, &c., as regards matter, or rather its absence, would be well advised to study Berkeley first.

Meanwhile the grand simplicity of the corpuscular mathematics is, like the Bellman's chart in the "Hunting of the Snark," something to be thankful for. Previously it was about as bad as the good Bishop's "brandy and salt" cure for all ailments; and when one turns oneself inside out, so to speak, the regions spoken of by Sir O. Lodge recently become apparent. Places—

"Where entity, and quiddity,
The ghost of defunct bodies fly."

Physics now is much more exciting reading than anything Wells or Marie Corelli can produce.

M. F. H. W.

I beg to thank you for your courteous reply to my letter on the above subject, which appears in the current issue. I am also interested to learn that you champion the new theory. May I ask you to carry the matter a little farther, and to state the experimental proof of the claim made by Sir Joseph Thomson, and endorsed by yourself, that the whole of the mass of the corpuscle arises from its charge?

My complaint in this matter is that Sir Joseph Thomson, and those who think with him, have jumped an important gap in the chain of evidence. Taking the report of Sir Joseph's address, given in your own columns, I note the following:—

> The study of gases exposed to Röntgen rays has revealed in such gases the presence of particles charged with electricity; some of these particles are charged with positive, others with negative, electricity.
>
> The properties of these particles have been investigated; we know the charge they carry, the speed with which they move under an electric force, the rate at which the oppositely charged ones recombine, and these investigations have thrown a new light, not only on electricity, but also on the structure of matter.
>
> We know from these investigations that electricity, like matter, is molecular in structure, that just as a quantity of hydrogen is a collection of an immense number of small particles called molecules, so a charge of electricity is made up of a great number of small charges, each of a perfectly definite and known amount.

With practically all of the above I should be in agreement, except that I should look for proof of the claim that the investigations have thrown a new light on the structure of matter. Later on in the address, however, I find the following :—

> We have already made considerable progress in the task of discovering what the structure of electricity is. We know that negative electricity is made up of units, all of which are of the same kind; that these units are exceedingly small compared with even the smallest atom, for the mass of the unit is only $\frac{1}{1700}$ part of the mass of an atom of hydrogen; that its radius is only 10^{-13} centimetre, and that these units, "corpuscles" as they have been called, can be obtained from all substances. The size of these corpuscles is on an altogether different scale from that of atoms; the volume of a corpuscle bears to that of the atom about the same relation as that of a speck of dust to the volume of this room. Under suitable conditions they move at enormous speeds which approach in some instances the velocity of light. The whole of the mass of the corpuscle arises from its charge.

In the whole of the last quotation from the address, which I take it gives the substance upon which you endorse the President's claim, it will be noted that there is no proof of the claims made. The President makes very large claims, I think it will be acknowledged, and I ask, where is the proof of the claims?

Suppose we analyse the claim you quote. Newton's definition of mass, it will be remembered, is volume into density. How does the volume or density of the corpuscle arise out of the charge which it carries? The point which I wish to make is that, so far as anything which has yet appeared shows, Sir Joseph Thomson, and those who think with him, have assumed, without proof, that the charged corpuscle is the charge. I ask for proof of it.

Assuming that the charge controls the volume and density of the corpuscle, surely that is different to the corpuscle owing its existence to the charge. Many substances owe their volume and density to their possession of a certain quantity of heat, yet I presume it will not be argued that heat is, for instance, steam.

Sydney F. Walker.

Bath, *September 13th*, 1909.

[It is not usual, when recording conclusions, to recapitulate the whole of the evidence upon which they are based; the limitations of time and space preclude any such attempt. Our correspondent will find the details of the experiments recorded in the proceedings of the scientific societies and other publications. He appears to have heard of them now for the first time, and seemingly has not kept himself in touch with the investigations which have been in progress in this connection during the past decade.—Eds. E.R.]

What is an Electrician?

In reply to "Alpha," what constitutes an electrician, I would like to say that up till a year or two back I was always under the impression that an "Electrician" was one versed in electricity, not necessarily a lathe and vice man nor even a mechanic, but one who had a good technical knowledge of the subject and was able to direct the installing and erection of electrical plant only. On the other hand, an electrical engineer was one who had passed right through the works and was capable of erecting and running a complete plant, including boilers and prime movers, being a thoroughly practical man, with good technical and a fair commercial knowledge of both steam and electrical machinery. However, like "Alpha," my ideas were shattered a year or two back after reading an advertisement in your paper, which no doubt many of my electrical friends will remember. It read after this style :—

"Wanted, an electrical engineer to take charge of the electric light plant on a gentleman's estate; one who could do horse-shoeing preferred; must be a married man, with a wife able to milk. Salary, 22s. per week, with cottage, coals, and potatoes." What O! the potatoes.

Some little time later another one appeared, viz. :—

"Wanted, an electrical engineer, married, for private estate in the Isle of Bute, to take charge of the electric light installation, run electric launch on lake, also a steam launch between island and mainland, one with a knowledge of motor-cars preferred."

Now, being an all-round man, I answered this, and after a week's delay, I received the following reply. "I am instructed by the Hon. So-and-So to state that your experience being that of the man we require, we shall be glad to know if you could commence duties on 26th inst. The salary will be 27s. per week, with house, garden, and coals."

However, I was so nervous of the salary, I did not accept it.

I often wonder if our dear old Editor inserts these adverts. for the enjoyment of his readers, or whether he's really in earnest. But, when all's said and done, I suppose we mustn't grumble, because who knows but that some day one of the above jobs, combined with the Old Age Pension, may keep one of us out of the workhouse.

C. W. Wardle.

Newcastle-on-Tyne, *Sept. 13th*, 1909.

[We hardly need point out that we are in no way responsible for the announcements that appear in our advertisement pages.—Eds. E.R.]

The opinions of "Alpha" upon this question have been perused with interest. The term "electrician" is quite authentic. If we look in the dictionary, we see that an electrician is one versed in the science of electricity. Now, the trouble is that not everyone who styles himself an electrician is versed in the science of electricity. Let us take two extremes.

There is, say, the local plumber and gasfitter, who has no technical knowledge of, or practical experience in, electrical work proper, but who will fix an electric bell for you, and is not above attempting electric light wiring (despite the resultant low insulation test, &c.). He is an "electrician." Then we peruse a syllabus from that eminent gentleman, Prof. Andrew Jamieson, and find that he is "consulting engineer and electrician."

Thus we have the two extremes enclosing Messrs. Nobody, Anybody, and Everybody. No one can call himself "Doctor" unless he possesses the necessary qualifications for such distinction. Anybody can term himself "electrician," whether he possess the necessary qualifications or not. The qualifications which an electrician should have are a good combined practical and technical knowledge of the branch of electrical work to which he devotes his efforts.

An electrical engineer is, of course, one who has a thorough all-round knowledge of electrical work. Having passed the recognised examinations of the City and Guilds of London Institute (either for wiremen and electricians, or for electrical engineers) should be recognised as adequate technical qualification for those who have been unable to take a day course at one or other of the technical institutions.

In regard to wiremen, arc lamp trimmers, motor attendants, &c., they are all necessary adjuncts to the efficient working of an electrical concern where they are employed, otherwise they would not be there, and there are many amongst these who can quite correctly style themselves electricians, whilst as regards those who do style themselves electricians and electrical engineers, and are not entitled to do so, well, we cannot, under the present conditions, prevent them from doing so; therefore, it is only left for us to quietly smile (or frown) at the presumptuousness of such individuals.

R. W. J.

Electric Miners' Lamps.

Mr. Jones's criticism of my letter in your last issue has caused me to go more fully into the case for electric miners' lamps, with the result that I am myself surprised to discover how good and strong a case it is.

Referring to Mr. Jones's letter, however, I should like to say it is news to me that the Joicey Collieries and the Lambton Collieries are under joint control; I am, therefore, corrected in this matter.

With regard to the Ediswan bulbs, my information is from the very best source, but as I have not the permission of the colliery proprietors to publish their figures, I cannot do so; but Mr. Jones can rest assured that these lamps have proved the most satisfactory, in spite of many tests with other lamps for quite a number of years.

With regard to how many collieries can take 2,000 miners' lamps, I may say that, without an effort, I can think of at least a dozen, and although I do not profess to be a mining engineer, I think there must be many others of quite as large a capacity.

Mr. Jones, I think, leaves out of consideration in his estimate of costs several items.

1. The parts he mentions, and for which he allows 1d. per lamp per week, are practically eliminated from my battery, and the broken glasses are paid for in many collieries, by the miners, &c., themselves. For instance, I eliminate battery plates, flexible connectors, either worn-out or broken lugs, ebonite cases, charges for distilled water and lead rivets, and reduce the consumption of sulphuric acid to the very lowest.

2. The bulbs have a life of 1,000 hours, and cost little more than half the figure that Mr. Jones quotes.

3. With regard to plant required, I would point out that electricity is now generated at most of the large collieries throughout the kingdom at a very low cost, or else it is obtainable from the district electricity supply at not more than 1d. per unit.

4. I cannot see how 2,000 lamps, charged in three batches, and requiring 1¼ watts each (even assuming that the maximum current is being used during the whole six days) can possibly consume more than 120 B.T.U. (not 400 B.T.U.) per week, and certainly a generating plant of 5 KW. would be just about five times as large as would be required to charge 666 lamps per time, and leave a margin for charging another 100 lamps.

By my improved design of lamp and system of working, the existing lamp cabin and staff can, in most cases, be utilised for the electric lamps, and I claim that my cost for repairs and up-keep is *less* than with the oil lamp owing to the elimination of working parts, reduction of inspection and insurance expenses, not to mention the absence of fire risk, the use of metal-filament lamps, hermetically sealed cases, and interchangeable parts, most of which can be bought by the million in the open market.

Although the first and running costs of my lamp are much below that of any other electric lamp I happen to know about, my reason for writing to your journal was, as stated in my first letter, more to point out that any satisfactory electric hand lamp offers important advantages to colliery managers and men quite apart from lamp cabin economies. The advantages are precisely :—

Absence of fire risks through defective, overheated or damaged gauzes and broken glasses or unlocked Davy lamps.

Decreased expenditure for inspection and supervision. (If the time of 10 men at £2 per week is diverted to other functions in the colliery, £20 per week should be written off the lamp account.)

Cleaner coal, owing to a whiter light.

Better atmospheric conditions for the hewers.

Moreover, I am possessed of definite knowledge that in the case of one colliery using electric hand lamps, the accounts show an appreciable balance in favour of running electric lamps as against Davy lamps, while if the decreased insurance rate is considered, our (the electrical engineers') position is impregnable. One gas catastrophe averted would financially outweigh the first and maintenance costs of many electric lamps for many years to come.

I am somewhat surprised and disappointed that Mr. Jones has not supported us more in his arguments than he has done.

Fred. J. Turquand.

London, W.C., *September 13th*, 1909.

Tramway Power Tariffs.

Are you aware that in your leader in this week's issue you have perpetrated an extraordinary blunder in comparing tramway power station *works costs* with combined lighting and power station *works costs plus capital charges?*

Arguing on this false basis you point out the disadvantage of those tramway authorities who purchase current instead of generating it themselves. It is difficult to understand how such an extraordinary blunder could have got into your paper as it has, but you can quite appreciate the uncomfortable time that a good few borough electrical engineers will experience who are selling current to a tramway undertaking.

You are using the very argument which is used by many tramway managers and tramway committeemen, who *will not* realise the difference between works costs and total costs.

A. H. Seabrook,
General Manager.

Marylebone Electricity Supply.

[Mr. Seabrook has evidently not read the article in question throughout, or he would have noticed that after giving the *average works cost* (which includes distribution, repairs, &c.) of 12 tramway power plants, viz., 0·402d. per unit, and similarly the *average purchase price* paid in the case of 10 combined undertakings, viz., 1·147d. per unit, we stated, "It is true, these figures are not directly comparable. . . . . The higher figure includes in many cases transforming and feeder losses, as well as the interest and sinking fund charges on the capital cost of the power house, substations where necessary, and feeders."

We then go on to show that allowing for financial charges at 6 per cent. on £55 per KW., in addition to the tramways station works cost, there is still a balance in favour of the self-contained systems, amounting to no less than £160,000.

The concluding paragraphs of the article dealt with the Glasgow and Manchester undertakings particularly. Can our resourceful correspondent explain away the 1909 published data of the Glasgow undertaking, viz , 27,741,755 KW.-hours "issued from power station to sub-stations.;" load factor, 39·8 per cent. ; power expenses, interest and sinking fund, ·757d. per unit, or allowing for conversion and transmission losses, to meet Manchester conditions, ·82d per unit? In the case of Manchester, the 1909 figures show 29,675,249 units sold to the tramways department at 1·04d. per unit, and we have Mr. Pearce's statement at the M.E.A. last June, that the Manchester traction load factor is 32 per cent.

While it may be argued that these cases are not strictly comparable, we submit that they are sufficiently so to allow one to form an opinion in favour of the tramway plant, even allowing an addition for depreciation in the Glasgow case at the same rate as may be included in the Manchester figures.

We quite appreciate the troubles of the borough electrical engineer who runs up against a tramway committeeman, particularly if the latter should interpret the proper proportion of capital charges to be included in his price per unit, as the proportion of the capital charge incurred in giving the supply in his particular case—a definition with which Mr. Seabrook will certainly agree.—Eds. E.R.]

The ascertainment of cost of traction supply in a combined undertaking is admittedly complicated by reason of load and diversity factors and other causes, and is a matter which cannot profitably be discussed in the columns of a newspaper.

Fortunately, however, this point is not at issue, the only matters really calling for attention being, on the one hand, the prices *charged* for traction supplies in cases of combined undertakings, and, on the other hand, the costs in cases where separate plants are owned and worked by tramways undertakings.

Two such cases will illustrate the unmistakable errors made in your leader, and what is true here will, no doubt, apply to the other towns named by you. The cases can be supported with a wealth of detail, but so as not to encroach unduly on your space, the facts are given as briefly as possible. For the year 1908 you quote Manchester's charge for traction as 1·14d. per unit. This is quite correct, but note should be taken that the units charged are measured at the distributing stations, and not at the generating stations. Glasgow's cost is, however, not £37,365, or ·35d. per unit, as you state, but is, according to page 21 of the accounts issued by the Glasgow tramways department, £136,145 in all, or 1·19d. per unit, and this, be it noted, is for units measured at the generating station. As Glasgow furnishes on the same page the total units at distributing stations, it is possible to correctly place the figures on something like equality with Manchester. The total then, as issued for traction load from sub-station direct-current bus-bars, is 23,103,603 units, which divided into the £136,145 above named, represents 1·41d. per unit, a vastly different figure from the ·35d. previously mentioned.

Your leader partly explains the discrepancy by referring to the omission of interest and sinking fund charges, but there are other omissions, such as provision for renewals, rates, taxes, management expenses, &c., all of which are included in Glasgow's own statement.

The other case is that of Sheffield, where the figures published require considerable adjustment before they are comparable with those for Manchester. For instance, Sheffield's cost of ·668d. per unit makes no allowance whatever for units used in the generating station, nor for the excess of transmission losses in Sheffield as compared with Manchester, nor for rates and taxes. From figures supplied by Sheffield, it appears these increase the cost to ·81d. per unit, and even then there is no provision for renewals, as is the case in both Glasgow and Manchester. Further, the costs in the Glasgow area, and in that part of the Manchester area worked from the Stuart Street station, are for high-tension supplies converted at and distributed through sub-stations. Consequently they are not comparable with Sheffield's cost, which is for a low-tension supply furnished direct from the generating station, the true comparison here being with that part of Manchester's supply given from Bloom Street station, where the cost is practically the same as in Sheffield.

Perhaps the best comment on these comparisons of Manchester's dual system with Glasgow and Sheffield, is to mention that they have been critically tested and accepted by the Manchester Tramways Authorities within the last few months, and there is no doubt existing in Manchester as to the wisdom of the combined supplies. Whatever may be said of other towns, it is certainly not true that dissatisfaction exists in Manchester.

It is alleged that Tramways Committees, when comparing the prices charged to them for traction with those charged to large power consumers, are not convinced that the difference in conditions warrants the difference in prices. Be that as it may, the differences in conditions of supply are incontestable, and the economics of electric supply are nowadays sufficiently well understood to render argument as to the justice of lowering prices for better load factors unnecessary. The only proof needed is that the better load factors exist, and on that point electric undertakings may be trusted to look after their own interests.

As far as the municipalities are concerned, I submit that this question should be looked at not from the tramways manager's standpoint or the electrical engineer's standpoint, but from that of the broader viewpoint, viz., which course is best for the municipality as a whole?

Referring again to the case of Glasgow, the most important undertaking cited in support of the separate generating station system, what is the position to-day? The electricity and tramway power stations are linked up by mains, enabling the two departments to exchange to the extent of 4,000 KW. In at least one other of the towns named, the question of giving a supply for the tramway extensions from the lighting station has been under serious consideration of late. I am unable to appreciate the difference between the linking up of tramway and lighting stations and a combined station to commence with; the principle involved is the same in each case, and I submit these examples afford very fair proof of the correctness of Mr. Wordingham's advice and Manchester's attitude on this question some ten years ago.

The writer of your leader has not, I think, closely gone into the question of the economics of power production at combined stations, otherwise he would never have penned the words in the last paragraph. The effect of calculating the tramway rates with reference to the annual charges on the whole capital expenditure of an undertaking in which bulk supplies of power form a large percentage, is favourable indeed to the tramways departments, so much so that we have in Manchester agreed upon a rate for the next three years which shall be calculated on that part of the undertaking which directly concerns the tramway power supply. It is here where the tramway departments who take their supply from combined stations have the pull, they may reasonably expect the prices paid for their energy to fall, due to the influence which the large power supplies have on the capital charges incidental to the combined undertaking. But in the case of separate tramway stations working on a more or less fully developed system, the power costs are only influenced by economies in running expenses—the capital charges will remain practically constant.

S. L. Pearce.

Manchester Corporation Electricity Works,
September 14th, 1909.

[Mr. Pearce omits to mention that the £136,145, power expenses at Glasgow in 1908, included £47,547 for depreciation; deducting this—as it has no counterpart at Manchester—we have £88,600 net power cost, which, spread over 25,200,000 units, issued from sub-stations, *used in car works, depots, &c.*, gives a total cost of ·84d. per unit, as compared with 1·14d.—say 1d. per unit, if we allow a proportion for renewals in the Manchester figure for 1908. As regards the advantage of linking up, the Glasgow tramways department only purchased 13,557 units from the lighting department in 1909. If so much benefit is derived at Manchester—which is in a distinctly superior position to the majority of towns—from the influence of the large power supplies on the capital charges as a whole, how is it that the Manchester tramway charges so much exceed those of Glasgow, and are, in fact, calculated directly on the plant used for tramway supply?—Eds. E.R.]

Ignition Magnetos.

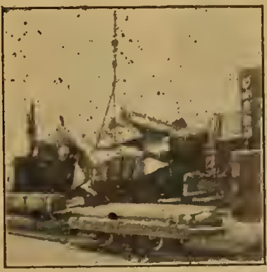
As a reader of your valuable paper I should like you to enlighten me as to the reason why no British firm can manufacture a magneto machine that will approach any of the foreign makes in efficiency. I have been assured that it is so. Surely it is not that we have not the ability. Various motor-car builders state that they cannot obtain a satisfactory magneto, no matter what price is paid for them. It is very humiliating to be told that we have not the brains in England.

Harry Owen.

Widnes, *September 13th*, 1909.

Packing for Shipment.

In a recent issue of your journal you referred to the rough usage to which cases of machinery, &c., are subjected in foreign parts, and the consequent need for the most careful packing. In this connection, the enclosed photograph, which shows cases containing electrical machinery, switchboard panels, &c., just deposited on the quay, at a port which shall be nameless, may be of interest. Incidentally, it confirms your remarks as to the uselessness of "This side up" and similar labels.



T.

Curious Lamp Failure.

Replying to "N. B.'s" letter and photograph of a glow lamp failure. Although he states, on breaking the lamp, the filament was intact, he omits to say whether the lamp in the ordinary term was burnt out, *i.e.*, would not light when applied to the current. Was it devoid of vacuum? If it had been examined for this, in all probability it would have been found to be the case, also minus vacuum, and still the filament intact. The dinting of the bulb is easily explained. It is caused by burning lamps in confined spaces, so that when it is alight the temperature rises enough to bring the thin glass of the bulb to a soft state, allowing the atmospheric pressure to dint the glass, as in the photograph. If the lamp had been minutely examined it would have been seen that the glass of the bulb had touched the filament, which, being incandescent, quickly burns a hole in the glass, then away goes the vacuum, which accounts for the deposit of soot. The excessive current caused to flow, through the loss of the vacuum, being enough to fuse the connection of the lamp to the bayonet top before the filament burnt through.

I have had many instances of the denting phenomenon of lamp bulbs. Ordinary 50 C.P. carbon-filament glow lamps employed for street lighting purposes, which were enclosed in 7-in. spherical globes, after burning a month or so used to become hot enough to allow the atmospheric pressure to press in the glass bulb until it touched the filament, which immediately burnt a hole, as I have already stated; so it is quite feasible for this to have happened to a lamp burning in the vicinity of an engine, where the temperature of the atmosphere is considerably higher than in the open air.

Another peculiar phenomenon that has come under my notice, which I should like to see explained, is:—Osram lamps burnt in the same kind of globes, the neck of which just allows them to pass in, on burning out cannot be extracted from the globe without first breaking either the globe or the lamp, the bulb of the lamp having apparently swelled. I have seen four separate instances of this.

H. R. G. F.

Carbon Brushes.

A very large number of your readers must be interested in, and have considerable experience of, the behaviour of carbon brushes on dynamos and motors, and yet they remain a puzzling problem to those whose business it is to satisfy the caprices of the machines on which the brushes have to work. Every maker could, I think, quote instances both of conspicuous successes and of abject failures with identically similar brushes on different types of machines of equal merit as far as regards design.

There can be little doubt that an ideal brush should collect sparklessly with the lightest possible pressure at all loads, for this must result in a minimum of wear and tear of both commutator and brush.

An instance has recently come to my notice where a set of four brushes were put upon a 25-H.P. motor driving a shop averaging about seven hours' work a day.

Preliminary tests of friction gave definite indications of the difference of pressure necessary to collect at full load compared with those brushes previously used, but the results were even more remarkable. The brushes were taken out after rather more than five years' regular work, and were found to have worn down just 10 mm., or 2 mm. per year. The old type of brush used to last from seven to eight months. At the same rate of wear the new brushes would have a life of from 10 to 15 years!

It would be interesting to know if similar instances can be quoted by any of your readers. The armature had never been out of the machine during the five years, and the brushes were only taken out in order to make further comparative tests.

The vagaries of carbon brushes must be an interesting study to those who have to look after them, and, perhaps, some of your readers can from their experience throw some interesting light on the subject.

W. Stepney Rawson.

London, W., *September 11th*, 1909.

PROCEEDINGS OF INSTITUTIONS.

Hydro-Electric Power in Canada.

By Cecil B. Smith, M.Am.Soc.C.E.

(*Abstract of paper read before the* American Society of Civil Engineers, *September* [illegible], 1909.)

The population of Canada is familiarly spoken of as agricultural in character, but this is only relatively true, as large and important industries flourish throughout the Eastern Provinces, and even in this young and sparsely populated country the increase in population is almost entirely urban in character, except on the great wheat plains of the Middle West.

Coal is available on the extreme east and west, but for 2,000 miles, covering most of the most populous and fertile centre of the country, it is necessary to import coal from the United States for heat and power. From a hydraulic point of view, however, the country has been peculiarly favoured, as a glance at the map will show.

The Hudson Sea is deep set into the heart of the country, and the height of land between the waters flowing to this sea and to the St. Lawrence drainage system is from 1,200 to 1,500 miles long, and, what is of more importance, it is only from 1,000 to 2,000 ft. above the sea, and is not of a mountainous character, but is a perfect network of lakes, swamps, rock, and forest, and affords a good reservoir and regulator for hundreds of large rivers, which, as they reach the parent St Lawrence, descend over precipitous Laurentian rapids, admirable as sources of hydraulic power. This condition obtains all over Canada as far west as Eastern Manitoba, and, as the rainfall averages from 25 to 40 in. per year, with no marked tendency to drought, and as the long winters store up so much moisture that the low-water period often merges into the period of autumn rains, the pinch of low water is not in many cases a serious menace, except in the March of severe winters. On the great western plains the topography and climate both militate against hydraulic values.

Until 20 years ago, hydraulic power often formed the basis of growing industries and determined frequently the location of the centres of population, but the larger centres of trade were developed by rail and water transportation and in many cases were quite distant from such sources of power.

With the advent of electric power transmission, however, these cities offered a favourable market for the sale of light and power from distant sources, and private companies, and in some cases municipalities, have invested large sums in hydro-electric constructions and transmission systems to serve the adjoining districts.

On the Atlantic seaboard, in the presence of extensive coal measures and coal mining, the incentive to hydro-electric development has been lacking; indeed, a recent installation of steam-electric equipment having a capacity of 500 KW. at the pit mouth, from which electric energy is transmitted at 11,000 volts to Amherst, N.S. (distant 6·5 miles), may be but the pioneer of much more extensive installations of a similar character in other parts of America.

Farther westward in New Brunswick, there exists the condition more usual in Canada, namely, rivers having large drainage areas, and having their sources in swamp, forest, lake and mu-keg, in which snow and frost linger late in April, or even until May, and feed these rivers throughout the dry months of August and September; indeed, it is usual in Canada to find the extreme low-water period in March, before the frost has ceased to hold the moisture from flowing. The Miramichi, Restigouche and St. John are great rivers, and extensive hydraulic constructions may be expected for grinding pulp alone, in addition to serving near-by towns and cities by transmitted electricity.

A most interesting and extensive development has been commenced at Grand Falls, N.B., by the Grand Falls Power Co., where the St. John River, with its sources in hundreds of lakes of Northern Maine, falls abruptly 115 ft. over a slate barrier.

For these hydro-electric works the type of construction which has been selected is that of vertical 10,000-H.P. three-phase 25-cycle 11,000-volt units, operating under a head of 130 ft., and the designs, under which contracts for the construction of the works are about to be let, provide for a hydraulic capacity of 80,000 H.P., with a present machinery installation of 40,000 H.P., which will generate current for ferro-manganese smelting, pulp grinding, and for transmission to the cities of Woodstock (70 miles), Fredericton (125 miles), and St. John (165 miles). An interesting feature of the design is that the generators are to be placed in the wheel pit immediately above the turbines, with a provision for the proper ventilation of this subterranean chamber, as well as careful water-proofing to ensure satisfactory electrical conditions. The tunnel tail-race will be placed entirely below the level of the tail-race water, and the draft tubes from each unit, therefore, will be brought into the top of the tunnel from one side of the wheel pit; this, it will be noted, is a variant on the methods adopted by the Toronto and Niagara Power Co. in its works at Niagara Falls, Ont.

On the Pacific Coast, the hydraulic conditions are very different from those in other parts of Canada, for the great mountain ranges are not good reservoirs, and, although the glaciers feed the rivers until late in the summer, yet at other seasons, owing to the light rainfalls east of the coast range, the rivers become very much reduced in volume; thus the excessive floods of the Fraser River, for instance, make it unsuitable for hydraulic development for power purposes. Near the coast, however, the rainfall is excessive, and the existence of small lakes has facilitated the construction of several interesting developments, serving Vancouver and the adjoining territory.

The works of the Stave Lake Power Co., now under construction, are 35 miles east of Vancouver, on Stave River, where a head of 90 ft. is to be utilised. The equipment will consist of five units, each of 5,000 H.P., and it is considered that the electrical output from this installation has a good prospective market in Vancouver and Westminster, to which the current is to be transmitted at an ultimate voltage of 60,000.

The Vancouver Power Co., Ltd., has a most interesting development at Buntzen Lake, 18 miles from Vancouver. This has been made possible by diverting the water of Coquitlam River at Lake Coquitlam into Buntzen Lake by a 2½-mile tunnel having a section of [illegible] ft. At Buntzen Lake the water is taken from the head works by steel pipes to a power house, 1,[illegible]00 ft. distant, and located at [illegible], 400 ft. lower.

The generating equipment is typical of the Pacific Coast, being originally composed of four units, each of 3,000 H.P.; two Pelton wheels for each unit driving a 3,000-H.P. 2,300-volt generator at 200 R.P.M., in addition to [illegible] the [illegible] recent installation of a 10,000-H.P. generator driven by four Pelton wheels, thus making an equipment having a total generating capacity of 22,000 H.P.

The electric current from this station is stepped up to 33,000 volts and transmitted to Vancouver, New Westminster, Burnaby, Lulu Island and elsewhere, and is used for operating electric railways, salmon canneries, car shops, saw mills, and for general municipal and industrial purposes, thus serving the requirements of an urban population of about [illegible].

The transmission line consists of double towers each carrying two circuits of three phase, No. 2 B. & S. copper cable, and crosses navigable water at one place, where there is a span of 2,750 ft. suspended 150 ft. above the water.

The total single three-phase circuit length of lines is 135 miles, and the transformer capacity at present in service is 14,650 KW. at the generating station and 10,400 KW. at the various sub-stations; all these transformers are air cooled, and are of different sizes up to a maximum of 2,500 KW. per phase.

The only interesting hydro-electric plant is that of the West Kootenay Power Co., built to serve the mines and smelters at Rossland, Trail, and in the boundary district. It is located at Bonnington Falls, on the Kootenay River, 9 miles west of Nelson, B.C.

The hydraulic head varies from 65 to 55 ft., being least at high water, and the minimum capacity of the river is estimated at about 6,000 cb. ft. per sec., being the run-off from a mountainous drainage area of nearly 10,000 sq. miles, which, owing to the glacial sources of the river, gives a low-water period in winter and a high water period in summer. The station is a very interesting example of complete concrete construction, including even the intake channels and draft-tubes of the turbines, and is constructed for an equipment of four units, each of 6,000 H.P., nominal rating, with the turbines of 30 per cent. overload capacity. At present, two units are installed and a third has [illegible], in addition to which the whole system has an equipment of 2,700 KW., and, when required, serves Rossland and Trail over a 31-mile, cedar-pole line at 20,000 volts on two No. 0 B. and S. three-phase circuits.

The step up transforming station supplies 60,000-volt current for the new cedar-pole transmission circuits to Phoenix Mines and Grand Forks Smelters, and to Greenwood Mines, distant 79, 69 and 83 miles respectively; and its present equipment consists of six single-phase water-cooled transformers each of 1,850 KW. nominal rating, each three-phase bank being in a fire-proof compartment; there is also a bank of three single-phase 1,250-KW. transformers held in reserve for the Rossland and Trail Districts at 20,000 volts in the event of a breakdown of the older station. The total transforming capacity in seven sub-stations is 31,000 KW., and the active connected load is 21,000 H.P.

The adjoining zinc and lead smelters at Nelson, B.C., will be supplied by these works or by the municipal hydro-electric works of the city of Nelson, on the other side of the river from the large power station just mentioned. This municipal power station has an equipment of 1,000 H.P., which is about to be increased to 2,500 H.P. by the installation of a second vertical unit.

The Saskatchewan River, of 125,000 sq. miles drainage area, rising on the eastern slope of the Rocky Mountains by many sources, fed from glaciers, and descending to the plains through many mountain gorges, offers, near its sources, reasonable opportunities for hydraulic development.

At a point on this river immediately before it enters Lake Winnipeg, at Grand Rapids, the change in level is 112 ft. in a few miles, and there is thus afforded the opportunity for a development of at least 300,000 H.P. whenever the demand arises for a power development at that point.

The Winnipeg branch of the Nelson River drains an area of approximately 55,000 sq. miles in the State of Minnesota and in the Provinces of Ontario and Manitoba, and, from its peculiar topographical features, affords one of the most favourable locations for the development of hydraulic power in Canada, excelled, perhaps, only by the Niagara and the St. Lawrence, and superior in some respects to the Ottawa River.

The more extensive water power locations of this river are rated by the Hydro-Electric Power Commission of Ontario at a total of 1[illegible],000 H.P., minimum dry-weather flow, 24-hour service, and it may be considered that the [illegible] capacity is at least 200,000 H.P., under ordinary conditions. It is contended that the requirements of railway operation, flour milling, pulp and paper mill work, and possibly smelting, will demand a careful study of the specific value of these powers in the near future, as soon as the trans-Continental railway is in operation. The Koochiching Falls, at Fort Frances, is being developed on a basis of 14,[illegible] H.P., for which the dam construction is now completed and power construction is under way.

The Winnipeg River proper commences at Kenora, where the river leaves the Lake of the Woods, and from this point to the mouth of the river there is a chain of falls and chutes which, as sources of economical power, [illegible] to [illegible] or equal. The two conditions worthy of comment are that at each power location the rocky [illegible] the fall is [illegible] a foundation for a dam, thus combining [illegible] head [illegible], and at the same time creating considerable [illegible] to meet daily peak-load requirements. Also, the [illegible] lake storages very much reduce the flood [illegible] and [illegible].

Table I is a [illegible] of the power sites on the Winnipeg River proper, between Kenora and the mouth at Fort Alexander.

Of the sites mentioned in Table I, Island Falls, Point du Bois, Slave Falls, Upper Seven Portages, and Grand Bonnet afford excellent construction opportunities. All but the first two in Table I are within easy transmission distance of the City of Winnipeg, and all are within short distances of two trans Continental railway systems.

TABLE I.—POWER SITES ON THE WINNIPEG RIVER.

Location.	Available head, in feet.	Minimum electric horse-power, 24 hour rating.	Average electric horse-power, 24 hour rating.	Remarks.
Kenora	18	21,000	42,000	5,500 H.P. installed
Island Falls	45	56,400	112,800	
Point du Bois ...	46	83 600	209,000	20,000 H.P. being installed
Slave Falls ...	30[*]	54 500	136 200	
Upper Seven Portages	30[*]	54,500	136,200	18,700 H.P. installed at Lee Channel
Lower Seven Portages	22	40,000	100 000	
McArthurs Falls	12	22 300	55 750	
Grand Bonnet	30	56,000	140,000	
Little Bonnet	10	18,500	46,200	
White Mud Falls ...	15	28,000	70,000	
Silver Falls	21	39,100	97,800	
Pine Portage Falls ...	12½	23 300	58,300	
Totals...	—	497,200	1,204,250	

[*] Including raising the water level by head works.

The situation at Kenora illustrates the great value of water-power as applied to flour-milling. The town has little else to recommend it as an industrial centre, not being at a competing railway point, nor at a bulk breaking point; neither is there any surrounding population or any fertile areas; but, in spite of these apparently unfavourable conditions, three large flour mills are located there, and use about 4,000 H.P., with a capacity of 10,000 bbl. per day. Two of these plants operate privately-owned hydraulic equipments, and the third purchases 1,000 E.H.P. at a flat rate of $10 per E.H.P.-year, from the municipal power station. The latter has been built recently at the eastern outlet of the Lake of the Woods, with dimensions to receive machinery having a capacity of 4,000 E.H.P., one-half of which has already been installed.

At the main or western outlet of the Lake of the Woods, at Kenora, there has also been built for some years, a stone dam from which water could be drawn to develop approximately 18,000 E.H.P. at low water, but no further constructions have been commenced.

At Point du Bois the city of Winnipeg (population 120,000) has commenced the construction of a large generating station involving a 75-mile transmission line to the city, and the designs contain some interesting features. A short (1,200 ft.) head canal, concrete overflow walls, and a rock-filled dam in the main river will raise the water 15 ft., creating a total head of 46 ft. and forming a lake 5 sq. miles in area, thus producing uniform and quiet hydraulic conditions. The dimensions of all control works, dams, &c., provide for an ultimate equipment of 60,000 H.P. The remainder of the work is to be a solid reinforced concrete structure involving an enclosed forebay room, power house, and transformer station equipped primarily with five 5,300-E.H.P. units, which will consist of horizontal, double-runner turbines (draft chests only) in reinforced concrete wheel-pits and directly connected through a breast wall to three-phase, 60-cycle, 6,600-volt generators making 164 R.P.M.

The transformation will be to 77,000 volts, by water-cooled, oil-insulated transformers having a capacity of 3,750 KW. per phase. Similar transformation at Winnipeg will be from 72,000 volts down to 11,000 volts in a main terminal station, from which 11,000-volt feeders will distribute to three or more sub-stations for local distribution at suitable voltages; the transformers at the terminal station, however, are to be oil-circulating, and oil-cooled. The system of remote control will be fully applied at both stations.

The transmission lines, of No. 000 copper, or aluminium equivalent, will be carried on double-circuit steel towers spaced 600 ft. apart, each alternate tower being of elastic type, with two legs only. All tower foundations are to be on concrete.

The city utilities are already numerous, and include artesian water supply, pumped electrically; and the desire to be able to offer cheap power to industries, present and prospective, which would otherwise labour under a great disadvantage in a city which cannot offer bituminous coal of a good quality for less than $6·50 per ton, while anthracite coal is $10·50 per ton retail, appears to be ample justification for this ambitious project for a city of 120,000 inhabitants.

(To be continued.)

Magnetic Clutches.—Messrs. C. E. LUGARD & Co., of Middlesbrough, have received an order for an electromagnetic clutch to transmit 1,000 H.P. at 75 R.P.M. This clutch will weigh about 7 tons, and is believed to be the largest in the world. Electromagnetic clutches transmitting 1,200 H.P. at 350 R.P.M., 800 H.P. at 215 R.P.M. and 600 H.P. at 375 R.P.M. have been installed on the Continent for driving wire rod or small section mills.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Vickers" One-Lock Adjustable Reamer.

To meet the demand imposed by modern methods for a satisfactory adjustable reamer for accurate work, Messrs. Vickers, Sons and Maxim, Ltd., of 32, Victoria Street, S.W., have introduced the neat device illustrated in fig. 1. In this reamer the shell is made in one piece, with a parallel or Morse taper shank, and is bored and slotted to receive the cam bolt and blades. Fig. 2 shows the end view with these parts in position, and it will be seen that the blades can be gradually forced outwards by rotating the cam bolt, the surface of which is formed somewhat like a ratchet. A scale and gauge point on the end of the shell and bolt provide means for preserving the setting. The side view, fig. 3, shows how the blades are locked into close contact with the cam bolt. All the blades are adjusted simultaneously, and the cutting edges are backed off to give radial clearance. A nut on the end of the cam bolt serves to lock the blades after adjustment; this nut lies in a recess in the shell, and cannot be accidentally disturbed. The front end of the reamer is free from obstructions, so that a blind hole can be reamed to the bottom. The parts are, of course, interchangeable, and the reamers are made in sizes from $\frac{3}{8}$ in. to $6\frac{3}{16}$ in. in diameter, the smallest having 6 blades and the largest 14 blades.

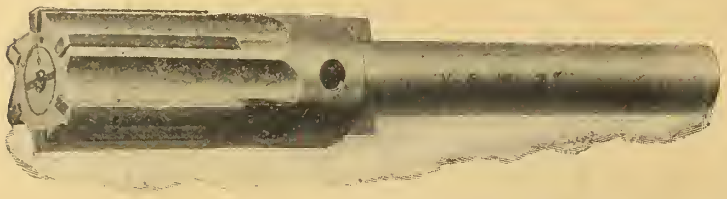


Fig. 1.—"Vickers" One-Lock Adjustable Reamer.

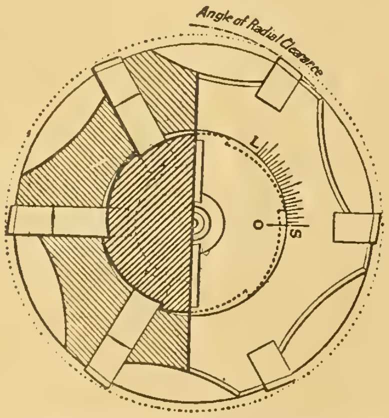


Fig. 2.—Front Elevation and Section of Reamer.

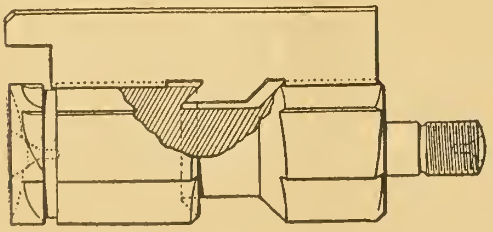


Fig. 3.—Mode of Securing Blades to Bolt.

Telephone Recorder.

The accompanying illustration, fig. 4, represents a neat and handy instrument which is being put on the market by the Telephone Recorder Co., of 11, Adam Street, Strand, W.C. It is made to stand on a table or to be fixed on a wall, and carries two rolls of paper—one to tear off at the right-hand edge, with the message duplicated on it, and the other to be rolled up inside, bearing the original written record of the message received. The carbon paper used for obtaining the duplicate is always in position, and the filed record is easily referred to when necessary. With one of these recorders at hand, the usual hunt for a scrap of paper to take down a message, and the ensuing hunt for the memorandum next day, will become things of the past.

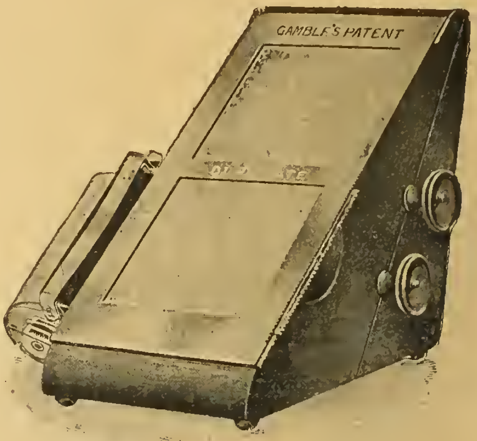


Fig. 4.—Telephone Recorder.

"Aron" Maximum-Demand Indicator.

The Aron Electricity Meter, Ltd., of 80a, Salusbury Road, Kilburn, have devised a simple attachment to their clock meter for the purpose of recording the maximum demand over a predetermined period. As shown in fig. 5, a pin *a* is fixed on the arbor of the pointer, which indicates the maximum demand on a dial. An arm *b*, which engages the pin, is attached to the indicator wheel *g*, which is controlled by a hair spring. At suitable intervals—generally 20 minutes—the change-over gear of the Aron meter, connected to wheel *c*, lifts the double lever *d*, and thus disengages the wheel *e*, which is driven by the counting train, from the indicator wheel *g*; the latter therefore is carried back by the spring to its original position against the stop *f*, leaving the pointer behind on the dial. After a few seconds the lever *d* drops again, bringing the wheel *e* once more into gear with wheel *g*, and restarting the indicator. The principle of the device is based on the fact that the change-over gear acts at regular intervals, and the number of revolutions of the counting train during each of these intervals is exactly proportional to the consumption during that time; thus the indicator records the energy used during a given short period, or the average demand during that period, and the pointer only moves when that value exceeds the maximum previously attained. The size of the meter is not increased; the action is purely mechanical, and the accuracy is equal to that of the meter itself. The device is applicable to all systems of electrical circuits, D.C. and A.C., and is easily reset.

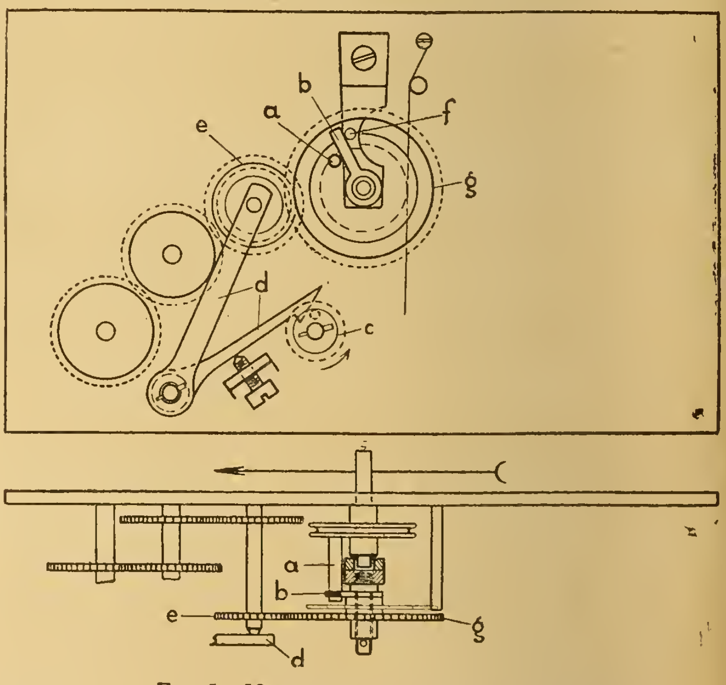


Fig. 5.—Mechanism of "Aron" M.D. Indicator.

Economical Turn-down Lamps.

Messrs. Geipel & Co., of St. Thomas Street, S.E., who have been supplying turn-down lamps for a considerable time, have sent us particulars of their latest types. The "Pull-String" type has two filaments, one an ordinary 8 or 16 c.p., the other a 1-c.p. filament. The switch is contained in the lamp cap for switching one or the other filament into circuit.

These are supplied in all voltages from 50 to 250, and of either 8 and 1 or 16 and 1 c.p. The 8 and 16-c.p. filaments take 4 watts per c.p., and the 1-c.p. filament takes 8 watts for the 1 c.p.

The "Hylo" long cord type, which is here illustrated, is a new lamp which Messrs. Geipel are supplying, with cords 3, 6, 10 and 15 ft. long. The switch has a rotary action with a flexible chain.

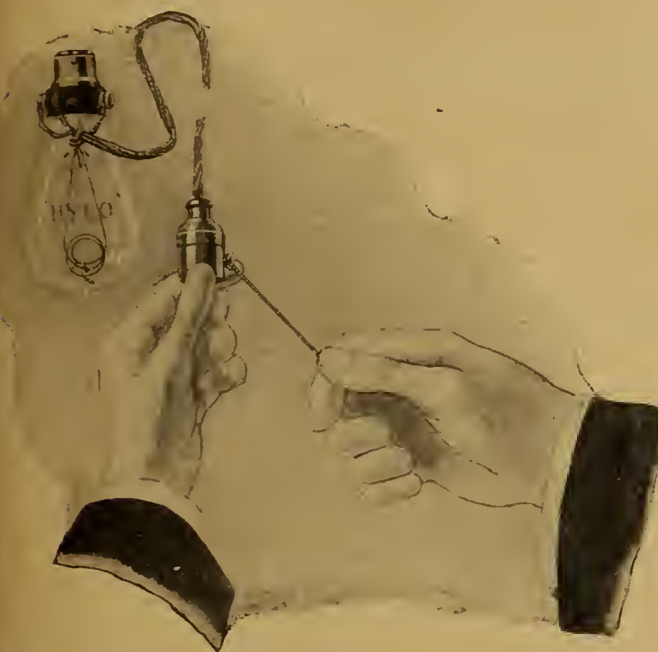


Fig. 6.—"Hylo" Long Cord Turn-Down Lamp.

The first pull turns the lamp on to its full power (8 or 16 c.p.), the next pull reduces it to 1 c.p., the third pull turns the light out. This action can then be repeated. Messrs. Geipel supply to dealers, for showroom purposes, a machine worked by electricity, with hands which pull the string, constantly changing the light from high to low and from low to high.

BUSINESS NOTES.

Book Notices.—*Annuaire International de l'Acetylène.* By R. Granjon and P. Rosemberg. 1909. Paris: Office of *l'Acetylène.* Price 2 fr. 50.—In addition to a mass of general information regarding carbide of calcium and acetylene, and apparatus used in conjunction therewith, this annual, now in its second year, gives a quantity of statistics relating to the manufacture and uses of these substances. It appears that there are 74 carbide works in existence, of which this country possesses no more than two; it happens that the United States has the same number, but the latter aggregate 40,000 h.p. to our 3,100 h.p. Thornhill, in Yorkshire, and Collooney, in Ireland, are the sites of the British plants. Our annual consumption is 12,000 tons, of which we import five-sixths; Germany consumes 40,000 tons, a far greater amount than any other country, necessitating the importation of 30,000 tons. Other European countries produce more than they require for their own use, particularly Norway and Sweden, which together export 45,000 tons. The total output of the world is put at 240,400 tons, with plant of 333,800 h.p. The "towns"—most of them really villages of one to two thousand inhabitants—lighted with acetylene are said to number at least 836, probably more like 1,000; 16 of these are British.

The Aero Manual. London: Temple Press. Price 1s. 6d. net.—This handbook has been compiled by the staff of "The Motor," and gives a concise review of the history, principles and practice of mechanically propelled human flight, with numerous illustrations. It is unfortunately true that up to the present electricity has played only an insignificant part in the development of this art, and until a new battery, primary or secondary, is devised, representing a very great advance over those at present available, there is no great likelihood of its becoming more extensively employed in the air. But progress in this branch of engineering has been extraordinarily rapid since the petrol motor was evolved, and if, as enthusiasts declare, aerial locomotion becomes a popular means of transport, it is quite conceivable that the trans-Atlantic liner of the future will be equipped with turbo-generators and motor-driven propellers. In any event, the subject is one of absorbing interest, and we have found this admirable book to be full of information on human flight, gliders, aeroplanes, dirigibles, aerial motors, and details of design. We can strongly recommend its perusal to engineers, and can promise them that, unless they are already familiar with the subject, they will learn some facts with regard to the behaviour of planes moving in air which will surprise them.

"*Journal* of the I.E.E.," Vol. 43, No. 196.—The part recently issued contains the following papers:—"The Use of Large Gas Engines for Generating Electric Power," by L. Andrews and R. Porter; "The Dielectric Strength of Compressed Air," by E. A. Watson; "The Kapp-Hopkinson Test on a Single Direct-Current Machine," by Dr. W. Lulofs; "Fly-wheel Load Equalisers," by J. S. Peck; "Notes on Safety of Working Electrical Plants in Coal-mines," by S. A. Simon; and an original communication on "The Dimensions of Transformers," by A. R. Low.

"*Transactions* of the Institution of Civil Engineers of Ireland." Session 1908-9. Dublin: John Falconer. 1909.

The *Faraday House Journal* for September contains an interesting account of the career of the late Principal, Mr. Hugh Erat Harrison, and of that of his successor, Dr. Alexander Russell, each accompanied by a portrait of the subject of the article.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXVI, No. 2. April, 1909. From the Club.

"Syllabuses Applicable to Technical Schools, &c., in England and Wales." Issued by the Board of Education. London: Wyman and Sons. Price 4d.

"*Journal* of the American Society of Mechanical Engineers," September, 1909. Vol. XXXI, No. 7. Baltimore, Md.: From the Society.

"Continuous-Current Dynamos and Motors." By W. R. Kelsey. Second Edition. London: Technical Publishing Co., Ltd. 1909. Price 7s. 6d.

A new edition of "The Dynamo: Its Theory, Design and Manufacture," by C. C. Hawkins and F. Wallis, will be published immediately by Whittaker & Co., this well-known work having been thoroughly revised and considerably enlarged.

Gold Mirrors for Searchlight Projectors.—We have on previous occasions mentioned Mr. Cowper-Coles's invention of glass mirrors coated with gold instead of the usual silver deposit; the resulting beam of light is composed of red, yellow and green rays only. At the same time its range or penetrative power is not reduced, and by the elimination of the violet rays, the dazzling effect is greatly diminished. It is interesting to note that in the recent R.A.C. tests the only three motor-car lamps fitted with gold reflectors secured the first three places for maximum distance from lamp without dazzle. For naval projector work it is found that a torpedo-boat on a foggy or rainy night can be more clearly seen with a gold than with a silver mirror projector; the objects illuminated stand out more prominently and there is truer colour rendering. The gold mirrors are supplied by the Reflector Syndicate, Ltd., of 82, Victoria Street, Westminster, S.W., who hold the patents for the process.

Meldrum Destructor Results.—We have received a detailed statement of the daily consumption of output of the refuse destructor supplied to the Prahran Municipality, Victoria, by Messrs. Meldrum Bros., Ltd. During the month of July the refuse burnt amounted to a weight of 661 tons 2 cwt., and the electricity generated to 27,870 units; the units generated per ton of refuse (average) were 42 6, and the revenue for the month, at ½d. per unit, was £58 1s. 3d.

Consular Notes.—Poland.—The British Consul at Warsaw reports that telephonic communication in that town is growing rapidly in favour. The number of subscribers has risen from 2,372 in 1901 to 14,817 in 1908. The service is open day and night. The subscription at present stands at £7 5s. 4d. per annum for business houses and £6 6s. 8d. for private residences, with an unlimited number of calls. Warsaw is now connected by telephone, through Lodz, with Kalisz, on the German frontier, but at present through connection with Germany has been prevented by the action of the censor. The line from Lodz to Kalisz runs through Lask, Zdunska-Wola and Sieradz, and is 68 miles in length. It was constructed by private enterprise at a cost of £45,000. From Lodz to Warsaw the line is Government property. Three minutes' conversation between Warsaw and Kalisz costs 2s. 6d. The Lodz-Warsaw and Lodz-Kalisz rates are 1s. 6d. and 1s. respectively. Thanks to the severe measures adopted by the Governor of Lodz, the former interruptions of communication, caused by the thefts of wire by the inhabitants of the suburbs of that town, has been stopped. A line between Warsaw and Lublin is practically completed. A plan, supported by those merchants who desire to develop trade with Austria-Hungary, has been proposed by the Director of Posts and Telegraphs at Lemberg, for constructing a line between Warsaw and Cracow. If this plan should be carried out, Warsaw will be in direct communication with Vienna. At the usual telephone rates, three minutes' conversation between the two towns will cost about 2s. 10d. As stated in the report for the year 1907, the opening of the electric tramways of Warsaw was postponed until 1908. Operations were started in March, and at the close of the year 15 of the 22 completed lines were in use. The number of cars is 200. The system is the overhead wire and the service has been good. The cars are of the central corridor class and give seating accommodation to 24 people on cross benches. On both the front and the rear platform eight persons are allowed to stand. The fares for 2 versts, *i.e.*, 1·326 miles, are first-class, 1¾d., second class 1¼d. The system, which is a municipal undertaking, was built by a Belgian company, electrified by a German firm, and let for operation and management to a Polish syndicate. The cars are well patronised, and are stated to be making £2 per car per day more than was anticipated. Since the introduction of the tramways the number of horse cabs has diminished by 50 per cent. Though there are plans for extending the tramways in the town to various neighbouring villages, there is not much prospect of the proposal being carried out. The so-called first and second class streets in Warsaw are now lighted by electricity. The suburb of Mokotow has built its own station, which supplies 150 lamps of 50 C.P. each to the adjacent streets. Private orders for electric light installation have been so numerous that a new set of plant is required for this suburb. Lodz is installing the electric light. The towns of Z[illegible] and Ozorkow are also completing similar works.

Later in his report the Consul states that the ill-feeling created by the action of the German Government in passing the Polish Expropriation Bills has excited the whole Polish population against Germany and anything German, and has opened the door to British goods of every description. There is an opportunity now for British manufacturers and merchants to break the monopoly of trade which has hitherto been enjoyed by their German competitors. [This new position was fully discussed in the ELECTRICAL REVIEW last year—August 2[illegible], 19[illegible].] It is no exaggeration to say that there is no branch of commerce for which a good opening does not exist. A successful venture, however, depends on a study of the local requirements and conditions, and an endeavour to establish a reciprocal trade, without the intervention of the German middleman, who at present is in supreme control. Attention should especially be paid to the Jewish section of the mercantile community, as 80 per cent. of the total trade passes through their control. This is a survival from the times when no Pole would engage in trade; but, even in spite of the large increase of Jews, owing to the emigration from other portions of the empire, the Pole is gradually asserting himself and emancipating himself from the necessity of Jewish assistance in his business. Endeavours are being made in Warsaw to form a local section of the Russo-British Chamber of Commerce at St. Petersburg, but at present nothing is definitely settled. It would be useful if British merchants, who already have established agencies in the district, would communicate the name of their agent to the Consulate at Warsaw, as often, from want of knowledge as to where British articles can be obtained on the spot, local merchants cross the frontier and obtain the same thing of German make. A few of the catalogues received at the Consulate have French or German translations. German is generally understood by all business houses, but a Russian text would be useful in the district now being dealt with, and also throughout Russia.

Note for Shippers to Mexico.—Shippers to Mexico will be interested to learn that the disability of not being able to consign on through bill of lading to interior points in the Republic has been removed, and these documents can now be obtained from all the steamship companies serving Mexican ports. Information regarding this and other matters relating to Mexico will be gladly given on application to Mr. E. J. Bray, the General European Agent of the National Railways of Mexico, at Dashwood House, 9, New Broad Street, London, E.C. This office has been specially inaugurated by the Government lines to protect their interests in Europe, and with the further object of putting at the disposal of shippers, and all who are interested in Mexico, information concerning the country.

Impulse Turbines.—We are informed that MESSRS. WILLANS & ROBINSON, LTD., after prolonged experiments, are placing on the market a steam turbine of the Impulse type, intended to meet those cases in which a speed of as high as 3 000 R.P.M. is admissible. This will provide for a capacity up to 1,500 KW. The turbine has been designed with a view to efficiency, as well as simplicity. The rotating element consists of two wheels only, but, it is stated, the economy realised compares favourably with that of any other turbine. In future, therefore, Messrs. Willans & Robinson, Ltd., will be in a position to supply turbines either of the Parsons or of the Impulse type, and they are prepared to put forward the type most suitable for the conditions to be met.

Bankruptcy Proceedings.—HERBERT JOHN PURDETT, electrical engineer and contractor, 16, Regent Street, Rugby, and 32, Earl Street, Coventry.—The summary of debtor's statement of affairs issued by the Official Receiver (Mr. C. J. Band, Coventry) shows gross liabilities £1,214, of which £1,154 is expected to rank for dividend. The assets are estimated to produce £303, against which there are preferential creditors for £28, leaving £3[illegible]4 and a deficiency of £819. The causes of failure, as alleged by debtor, are "trade depression in Rugby, competition, bad debts, illness and heavy rental." From the Official Receiver's observations, it appears that debtor commenced business with a capital of £150 in February, 1902. The principal electrical trade creditors are:—

General Electric Co.	[illegible]4	[illegible] Co.	£8
Marsh, Son & Co.	[illegible]	[illegible]	
Robinson & Hand[illegible]	[illegible]	[illegible] Co.	[illegible]
British Thomson-Houston Co. .	[illegible]	Enterprise Electric Co. .	12
Electrical Co.	26	[illegible]	11
G. Braulik	[illegible]3	[illegible] ..	11
Siemens Bros. Dynamo Works .	[illegible]	[illegible]	10
Hawkins & Co.	19		

The first meeting is to be held on September [illegible], and the public examination on October 11th.

J. W. SYDENHAM.—The public examination was held [illegible] before Mr. Registrar Giffard, at the London Bankruptcy Court, of John William Sydenham, sales manager, [illegible], Connaught Street, Marble Arch, who failed in July with [illegible] £[illegible]. In the course of his evidence, the debtor [illegible] past [illegible] years he had been employed in the [illegible] trade on the commercial side, latterly at a salary of £[illegible] per annum. In April, 19[illegible], with £[illegible]0 capital, he commenced to speculate for differences on the Edinburgh Stock Exchange, mostly in [illegible] and American rails, and although he won at first, he eventually made a loss of £395. On June 10th last judgment for £211 was obtained against him, and being unable to satisfy it, he was made bankrupt. Witness attributed his failure and insolvency entirely to those losses. The examination was concluded.

P. E. B[illegible].—The first meeting of creditors was held on Tuesday before Mr. W. P. Bowyer, Assistant Official Receiver, at the London Bankruptcy Court, under the failure of P. E. B[illegible], described as late of 8, Hill Street, Knightsbridge. The debtor, who returns liabilities £1,471, against assets £7 10s., states that, since 1899, he has had no occupation beyond acting as director of various companies, in which he invested and lost between £2[illegible],000 and £30,000. In 1903 he financed the Electric Light Renovating Co., Ltd., to the extent of between £[illegible] and £9,000, of which about £5,000 or £[illegible],000 was his own money. In [illegible] 1906 the debenture-holders foreclosed and sold the whole of the company's property. The debtor had made himself liable for the lease of the works in Britannia Street, [illegible]ditch, and the landlord obtained judgment against him in respect of an outstanding balance of £2[illegible]0. The failure was attributed by the debtor to losses in connection with the various companies he had financed. He made no proposal and the creditors left the estate in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy, the debtor's public examination being fixed for October 27th.

HERBERT SHUTTLEWORTH, Cross Court, Briggate, Leeds, electrical engineer.—The debtor appeared for his public examination at Leeds on the 14th inst. He said he resided with his parents and was unmarried. He had carried on business as an electrical engineer at the above address since February, 1906 having had nine years' previous experience of the business. He had no capital, borrowing £20 from his father, afterwards obtaining other loans from him. The amount now owing to his father was £357, including £197 amount of bank overdraft guaranteed by him. His total liabilities, according to his statement of affairs, were £465, and he estimated that his assets, including £50 good book debts, would realise £74 11s., leaving a deficiency of £391. He alleged his insolvency to be due to bad trade and competition. He had principally done wiring, and prices were cut very much in that line. His net profit, shown by his deficiency account, was only £[illegible]5 19s. 7d. since February 1st, 1906, but he found, on making up his cash-book, that the amount should be £114. At the same time, he admitted that his living and personal expenses during the same period were £276, so that he had been living considerably in excess of his income. His business had not been successful, and in July he executed a deed of assignment, offering 5s. in the £, which was refused by the principal creditors. He had never been greatly pressed by creditors, and he alleged that, apart from the amount due to his father, he was not insolvent at the time of the petition, if the business could have been sold as a going concern. He admitted, however, that this must be taken into consideration, and, including his father's debt, he was aware of his insolvency about three years ago, and all his trade debts had been contracted with that knowledge. He hoped, however, for better trade. He had kept day-book, bought and sold ledgers and cash-book, but the cash-book was not posted up at the time of the petition. There was a difference required to balance the cash-book of £243 3s. 10d., which he accounted for as being travelling and personal expenses which he had not entered. He had taken stock, but had only roughly ascertained his financial position. The examination was closed.

ERNEST FENWICK JONES, plumber and electrical engineer, York Road, West Hartlepool.—A receiving order was made at Sunderland, on September 11th, on a creditor's petition.

D.P. Battery Contracts.—The D.P. BATTERY CO.'s contracts received during the past week include orders for the supply and erection at Howrah of a storage battery having a capacity of 800 KW.-hours, for the East Indian Railway Co., and another for New South Wales. In the home trade the company have secured contracts for 13 batteries for country house lighting installations, for the purpose of Government tests, and metal depositing work, as well as sundry renewal orders.

Factory Acts Prosecution.—At Dartmouth Police Court on Tuesday, last week, the Urban Electric Supply Co., Ltd., were summoned for an offence under the Factory Acts, it being contended that a lad named Owen Gurowich, 16 years of age, had on August 20th been employed in the generating station at Dartmouth at 8.30 p.m. during prohibited hours.—Defendants pleaded guilty, and were fined 1[illegible]. and costs.

Catalogues and Lists.—MESSRS. MANN, EGERTON AND CO., LTD., Norwich. Small eight-page pamphlet entitled "[illegible] Light in the Country," giving illustrations of country residences where they have put down small electric lighting plants, and [illegible] together with prices of same.

[illegible] Co., Exchange Buildings, Briggate, Leeds.—Small [illegible] illustrations, brief [illegible] and prices, of a [illegible] dry and medical batteries, massage vibrators, [illegible] lamps, &c., for the current season.

MESSRS. W. N. BRUNTON & SON, Wire Mills, Musselburgh.—[illegible] pamphlet just issued, of high-class steel wires both in [illegible]. The firm have endeavoured to bring together [illegible] all the special wires that are used. Sizes and [illegible] arranged in tabular form.

[illegible] UNITED ELECTRIC LIGHT CO., LTD., have [illegible] for contractors and others to [illegible] their premises, letting the world know that 'Royal [illegible] Lamps' are 'British made,'" and that they save [illegible] per cent. [illegible]. The pictorial feature consists of several [illegible] the British [illegible] whose services are enlisted to give force to the above [illegible]. Copies of the show-card, which measures some [illegible] in. high × 15 in. wide, can be obtained by sending trade card to the company's publicity department at Queen Street, E.C.

Messrs. L. Dens & Co., Place de Meir, 21, Antwerp.—This is a 40-page illustrated catalogue of the vitrified clay conduits of the H.B. Camp Co., of Pittsburgh, for whom Messrs. Dens are general agents for the Continent. Notes on underground conduit construction are followed with particulars of the Camp conduits, dowel holes and pins, [illegible] and their use, repairs with split conduit, the suitability of the Camp conduits for high tension service, manholes and their construction, &c. A table of lengths and sizes of duct is given, also a list of some of the more important installations on this system in the United States and other foreign countries.

Messrs. Veritys, Ltd., London and Manchester.—A neat and compact radiator pamphlet of 32 pages has been issued for the current season. It is of pocket size, and contains small pictures (quite large enough to show the character of the different designs) of "Aston" luminous and non-luminous types of radiators. Several new designs are included, among them being the new pattern non-luminous radiator as used on H.M. battleships and cruisers. Prices and code-words are given, and an asterisk indicates whether the goods are held in stock. The list should be very handy for contractors and supply engineers.

The Electrical Co., Ltd., Charing Cross Road, W.C.—Several new publications, being sections of their catalogue, prepared in uniform size and style. Each contains brief descriptive material, and a good deal of tabulated data, including prices. The lists relate respectively to three, two and single-phase induction motors up to 6 [illegible], lift controllers, and motor starters for continuous-current motors.

The Worthington Pump Co., Ltd., 153, Queen Victoria Street, London, E.C.—New catalogue of 44 pages, fresh from the press, in which descriptive matter, accompanied with a number of interesting sectional and exterior half tone views, appears of the Worthington condensing apparatus—counter-current jet condensing plants with separate water and air pumps; Conejector condenser, without air pump, and with or without water pump; semi counter current jet condenser and wet air pump; Multiflow surface condensers; exhaust oil separators, exhaust heads, exhaust relief valves; tubular heaters. A brief cable code is given at the end. The catalogue is produced in very fine style, and neither money nor pains has been spared in producing the excellent pictures. Power station engineers and other interested readers can secure a copy of the catalogue by writing to the above address.

Messrs. Pirelli, Ltd., 45, Basinghall Street, London, E.C.—New catalogue of cables and wires just issued, every article included in which are made by the well-known firm of Pirelli. The contents range from large-armoured cables to instrument wires, and they comprise paper-insulated lead-covered cables for light and power; air-space telephone and telegraph cables; and all types of rubber and gutta-percha cables, wires, and flexibles for every class of electrical service. Several types of telephone cables for indoor and outdoor work, cotton and silk-covered bell and instrument wires, also numerous accessories, such as tapes, ebonite sheets and tubing, &c., are detailed. In addition to the foregoing, Pirelli's make to any practicable specification. Attention may be directed to some special extra-high-tension cables, which are shown, together with particulars of exceptionally severe tests to which they were subjected. The catalogue is arranged in a businesslike way, and where prices are given they are very plainly printed. Copies of the catalogue (32 pages) will be forwarded to any wholesale trade house upon application.

Messrs. W. Gripel & Co., Vulcan Works, 72a, St. Thomas' Street, S.E.—Price list and samples of Okonite and Manson insulating tapes, of which the former is offered as a substitute for rubber strip at a greatly reduced price.

National Electric Lamp Association (Engineering Department), 4411, Hough Avenue, Cleveland, Ohio, U.S.A.—Bulletins No. [illegible]a, dealing with tungsten miniature and low-voltage lamps for a variety of purposes; and No. 9, on the conservation of natural resources through the use of high-efficiency lamps.

The Electric and Ordnance Accessories Co., Ltd., Aston, Birmingham.—Catalogue (20 pages) dealing with the "Eclipse" electric cooking and heating apparatus. Notes on the advantages of the system, the general construction of the apparatus, heat regulation, and cost, are given, also pictures and prices of a number of electric kettles, hot water jugs and glue pots, hot plates, plate warmers, flat irons, Eclipse electric heaters, and other articles. Flexible wire and cable and wall plug and plug adaptor devices are not overlooked, and a page of figures appear stating the cost of operation of the different apparatus included in the list. In the Eclipse system the units consist of a special resistance material insulated with mica and enclosed in a thin metal casing. We are given to understand that this resistance material is quite able to withstand a temperature of 2,5[illegible] F. without risk of breakdown. We are informed that a number of heaters were placed in circuit for periods varying from [illegible] to 1,2[illegible] hours, and at the end of these periods not one of the units had broken down nor were they the worse for wear to any appreciable extent. Most of the apparatus listed in the catalogue is capable of being adjusted to give from one to four different heats by a slight manipulation of the plugs. In addition to the apparatus listed the company are shortly bringing out a series of apparatus for cooking by incandescent heat, such as grillers, ovens, toast racks, &c. In these the units will consist of resistance material prepared specially for the Electric and Ordnance Company and capable of being run at red heat for a considerable period. The company have been testing some units made up from this material, and they inform us that up to date they have run for 1,[illegible] hours without showing signs of giving out. In addition to being simply run in circuit, quantities of water and grease have from time to time been poured on these so as to realise as far as possible actual working conditions. The result of this pouring on of water and grease is merely to cool down the units temporarily until the foreign matter has evaporated, and it is stated to have no injurious effect whatever. Copies of the catalogue can be obtained on application.

Messrs. Bruce Peebles Co., Ltd., Edinburgh.—Pamphlet (No. 20A) of 20 pages, devoted to the Peebles motor converters (La Cour Patents). The principle of these machines is described, together with design and construction notes and explanatory diagrams. Motor converters for either lighting or traction service, or both, are mentioned, as is also the inverted converter. A number of half-tone views show the machines in Manchester and other places. A tabular comparison appears of motor-converters with rotaries and motor-generators, and a list of important contracts is also given, these amounting to over 100,000 kw.

Mr. Chas. W. Richardson, 159, Worsley Road, Patricroft, near Manchester.—Four page circular describing the Richardson series adapter, and giving hints for fixing and a list of prices of accessories for same.

The J.L. Manufacturing Co., Ltd., Johnson-Lundell Works, Southall, Middlesex.—Catalogue in expanding binder cover allowing for addition of later lists, in which many fine illustrations of the patent laminated-field J.L. dynamos and motors and their parts are contained. Accompanying them are priced sheets of standard protected type motors for 230, 440 and 500 volts continuous current and compound-wound dynamos for 110 volts. Among the views is a large one of the interior of the company's works (machine shop), a low-voltage dynamo direct coupled to a high-speed oil engine, an adjustable-speed portable motor and switch equipment, and a 10-H.P. totally enclosed slow-speed motor driving a cold saw cutting H-iron beams. Copies of the catalogue can be obtained from those interested in this class of manufactures.

The Witton-Kramer Electric Tool and Hoist Co., Witton, Birmingham.—New leaflets describing their specialities. Leaflet K6 describes and illustrates electric polishing machines. Leaflet K7 describes the firm's standard type of electric winches, which are manufactured in all sizes from 1 H.P. to 50 H.P. Leaflet K8 shows two types of electric grinders, one for use in the tool rest of a lathe or milling machine, the other fitted with "long snout" and longitudinal feed for general work or for internal grinding. It has also been used for grinding commutators of large machines whilst the armature is still in the frame, but for this purpose it is usually fitted with a cross-traverse movement in addition to the longitudinal movement. Leaflet K12 describes "Witton-Kramer" flexible shafts, and gives prices of same, for transmitting power at awkward angles and for operating tools from portable motors in places where there is no line of shafting. Information as to the construction of the shafts, and regarding possible applications, is given. The company will shortly be publishing a list giving full particulars of a complete line of electro-lifting magnets that they are now designing.

Sydney Contract Deposits.—An Australian paper says:—"The Sydney City Council overruled the advice of its chief electrical engineer, and is calling for fresh tenders for turbine sets. Apart from the danger of overruling the advice of a highly-paid expert, the question of the deposits is worth more than passing notice. Tenderers for the turbines had to lodge a deposit of £1,000, and on acceptance a further deposit of £5,000, as a guarantee. The want of any finality in acceptance of the tenders practically locks up some £6,000 of each of the firms tendering. This is a point that should urge City Councillors, in all fairness, to waste no time in bringing the matter to a conclusion."

Trade Announcements.—Messrs. Isenthal & Co., of 85, Mortimer Street, Cavendish Square, W., announce that owing to the rapidly-increasing demand for the Moscicki high-tension condenser and the electric valve, they have taken additional premises at the same address in order to carry on the manufacture of these patents in England, and so to give quicker deliveries. They have at present in hand some very large Government and other contracts for Moscicki condensers, the former for wireless telegraphy, and the latter for the protection of overhead lines.

The Electrical League has removed its offices to Bank Buildings, Kingsway, London, W.C.

Messrs. Francis Reade & Co., electrical engineers and contractors, have removed to larger premises specially erected for them, at The Broadway, Church End, Finchley, N., where they have now opened a show-room for electric light fittings, shades, lamps, accessories, &c.

Dissolutions and Liquidations.—Under the compulsory winding-up order made last June against the Uxbridge and District Electric Supply Co., Ltd., Waterloo Road, Uxbridge, Mr. H. E. Burgess, Official Receiver, has now issued his report to the creditors and shareholders. The statement of affairs showed unsecured debts, £6,62[illegible]; preferential claims, £[illegible]; loans on first debenture bonds, £[illegible]5,000; on second debentures, £15,000, and interest, £2,579, making a total indebtedness of £59,291. The assets are valued at £75,039, or sufficient to yield, subject to realisation, a surplus of £15,748 after discharging the whole of the liabilities. They (the assets) consist of the following items, viz.: Cash in hand, £56; stock of coal, &c., £73; machinery, £15,454; mains, £25,204; transformers, motors, &c., £[illegible]4,417; switchboards and instruments, £661; meters, £1,234; freehold site of generating station, £1,780, buildings, £8,277; trade fixtures, fittings, &c., £100; general stores and other property, £1,02[illegible]; goodwill, £12,000; investments in shares, &c., £284, good book debts, £1,473; and bad debts, £387. The account with the contributories, however, discloses a deficiency of £10,527, which is accounted for as follows: Expenses of carrying on business from January 1st, 1906, to date of winding-up order, including interest on debentures, £8,505—£11,560. Losses and depreciation from January 1st, 1906, written off in company's books, viz., bad debts, £142; preliminary expenses, £150. Losses and depreciation now written off, viz., loss, wiring department, £202; depreciation of undertaking, £20,694; less estimated value of goodwill, £12,000 = £8,694. Bad debts, £245; preliminary expenses, £893; discount on issue of £19,000 debentures, £1,900—total, £23,787. Less excess of assets over capital and liabilities on December 31st, 1905, £1,742; gross profit arising from carrying on business from January 1st, 1906, £11,517; transfer fees, £13,260—deficiency as per statement of affairs, £10,527.

The following is the text of the Official Receiver's report, viz.:—The winding-up order was made June 29th, 1909, on the petition of a creditor presented to the Court on June 17th. On the date of the winding-up order, Mr. John Conacher, general manager of the company and of the Metropolitan Electric Supply Co., Ltd., was appointed special manager for the Official Receiver. The company was promoted by Arthur Locke Radford, John Finnis Stilwell and William Frederick Thomas, assisted by Walter Avery Bird, the first secretary of the company, and was registered on June 24th, 1899, as the Uxbridge and District Development Syndicate, Ltd., with a nominal capital of £1,000 in shares of £5 each, the intention being to apply for a provisional order granting a monopoly for the supply of electricity in Uxbridge and the adjoining districts. The first directors were Radford, Stilwell and Thomas, and they, with Admiral Lord John Hay, Frank Bailey, James Carr Saunders and the Hon. J. B. Lubbock, who represent the Metropolitan Electric Supply Co., Ltd., constituted the board at the date of the winding-up order. Other directors have been William Potter, Harold W. Couzens, M. Binswanger-Byng, J. O. Callender, W. H. Cripps and F. Leverton Harris, who have resigned, and Col. W. G. Renton (deceased). The nominal capital was eventually increased to £75,000, divided into 10,000 ordinary and 5,000 6 per cent. cumulative preference shares of £5 each. 5,255 ordinary shares, representing £26, 275 have been allotted, the whole having been subscribed for in cash except 45 shares issued as fully paid. No preference shares have been issued. A provisional order, which was confirmed by the Electric Lighting Orders Confirmation (No. 12) Act, 1900, was granted to the company under which it received power to supply electricity in Uxbridge and the immediate neighbourhood. The area of supply was afterwards extended by further orders. The company's name was changed in April, 1901, to the "Uxbridge and District Electric Supply Co., Ltd." A prospectus was issued on May 30th, 1901, offering 2,650 £5 shares for public subscription, but only a small number (128) were applied for. The original shareholders received £1,000 for waiving the right they claimed to convert their holdings into founders' shares, and the money was applied by them in taking up 200 further shares in the company. Under an agreement dated March 26th, 1901, the General Electric Co. (1900), Ltd., agreed to make advances from time to time to the company not to exceed a total of £20,000, on the security of debentures. The agreement provided that orders for the plant and works necessary for the company's undertaking should be placed with the General Electric Co. at rates equal to 10 per cent. above competition prices. In May, 1901, the company acquired a freehold site at Uxbridge, and a generating station was built and equipped, and the laying of electric mains proceeded with. The approximate length laid is high tension 37½ miles, and low tension 11½ miles. The public supply of electricity commenced in May, 1902. The General Electric Co. by September, 1904, had subscribed for a total of £20,000 of debentures, and a further £3,900 were taken up by directors and the public. The debentures carried interest at a minimum rate of 4 per cent., and were exchanged in September, 1904, for others bearing interest at 5 per cent. The company at the same time issued debentures for £3,000 to Callender's Cable and Construction Co., Ltd., in payment of a debt. In May, 1905, the General Electric Co. held debentures for £21,500, and also 320 shares (£1,600), and Callenders held debentures for £3,000 and 730 shares (£3,650). By an agreement of May 8th, 1905, in consideration of the company withdrawing its opposition to a Bill in Parliament, the Metropolitan Electric Supply Co., Ltd., agreed, in the event of the Bill receiving the Royal Assent, to acquire the interests of the General Electric Co. and Callenders, and to take up an additional 500 shares in the company. The Metropolitan Co. were also to have a right to nominate directors up to four in number. This arrangement was duly carried out in December, 1905, and the Metropolitan Co has since taken up further debentures for £19,000, viz., first debentures £4,000, and second debentures £15,000, which were issued to them at a discount of 10 per cent. The total debentures issued by the company amount to £50,000, of which £43,500 are held by the Metropolitan Co., and £6,500 by the directors and the public. The total capital expenditure of the company in connection with its undertaking, according to the accounts for the year 1908, was £81,358 10s. 8d., being £7,183 10s. 8d. in excess of the share and debenture capital subscribed. The result of the company's trading (before charging interest on debentures and bills) has been as follows:—

1901	Profit £15
1902	Loss 90
1903	Profit 687
1904	do. 1,467
1905	do. 987
1906	do. 1,531
1907	do. 2,818
1908	do. 2,903

No dividends have been paid. The company was unable to pay the interest due on debentures for the half-year ending December, 1908, or to meet its other liabilities. Upon the presentation of the petition to wind-up, the Metropolitan Co. commenced an action, and on July 20th, 1909, the Court appointed the Official Receiver as receiver for the debenture-holders. The assets of the company, apart from the unexpired term of the provisional orders (but including the cost of the provisional order) are valued in the statement of affairs at £63,038 16s. 2d. The goodwill, including the unexpired term, is included by Radford & Hitchens at £12,000, but James Carr Saunders, who concurs in the statement of affairs, values the goodwill at £5,000. Unsecured creditors, returned at £6,622 4s. 5d., are in respect of electric cable supplied, £5,860; bank overdraft paid off by directors, £558; goods sold and work done, £182; insurance, £22—total, £6,622. Preferential creditors returned at £89 8s. 6d. are for rates, salaries and wages. The failure of the company is attributed by the directors to want of working capital, and to loss of business caused by the closing down of customers' works.

As a result of the statutory first meetings of creditors and contributories, held on July 29th, 1909, the Official Receiver remains the liquidator of the company with a committee of inspection.

CYLANTHA PUBLISHING CO., LTD.—This company is winding up voluntarily, as it cannot by reason of its liabilities continue the business, with Messrs. A. G. Wright and J. Strahan Smith, 165, Queen Victoria Street, E.C., as liquidators.

POOLE AND DISTRICT ELECTRIC TRACTION CO., LTD.—A meeting is to be held at Electrical Federation Offices, Kingsway, W.C., on October 11th, to hear an account of the winding up from the liquidators, Messrs. E. Garcke and W. F. Cox.

INTERNATIONAL TELESCRIPTOR SYNDICATE, LTD.—A meeting is to be held at Norfolk House, Strand, W.C., on October 14th, to hear an account of the winding up from the liquidator, Mr. R. H. Hoare.

Premier Accumulators.—THE PREMIER ACCUMULATOR CO., have recently completed an extension to their works to cope with increasing business. They have recently secured orders for 56 lighting type cells for Lord Rosebery, 55 lighting type cells for Lord Fitzwilliam, a lighting battery of 56 cells for Melbourne, and another lighting type battery for India, together with 264 cells in lead-lined wood boxes and automatic reversible booster and switchgear for the Wallasey U.D.C. with 10 years' maintenance.

Bravo, Callender!—The two following interesting items of Continental information have reached us this week:—"There was keen international competition for the contract for the supply and laying of the mains required in connection with the electric lighting and power installation at the Harbour at Ostend, tenders being received from British, German and Belgian concerns. The contract was divided into two lots. For one of them the CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., of London, succeeded in submitting the lowest offer; for the second lot their quotation was slightly higher than that of the Land und See Kabelwerke Gesellschaft, of Cologne."

"A dozen firms submitted tenders to the Société Nationale des Chemins de Fer Vicinaux for the supply and installation of the underground continuous-current feeders required for the Brussels-Dilhock electric railway. No fewer than nine German concerns, one Austrian, one Belgian, and one British, competed for the contract, the lowest offer being that of Callender's Cable and Construction Co., Ltd., London."

LIGHTING and POWER NOTES.

Aberdeen.—Legal action has been taken by the Electrical Contractors' Association of Great Britain under the Electric Lighting Act of 1905 in regard to the new works at the City Hospital. The Association complain of the Corporation executing work on the consumer's side of the meter. The point will shortly come before the Courts.

Accrington.—At the T.C. meeting last week Ald. Higham, chairman of the Electricity Committee, referred to the success which had attended the electrical exhibition in the Town Hall. Some 13,250 persons had paid for admission up to Saturday, and the total receipts amounted to £110. No doubt it would mean some loss to the Corporation, but the increased use of electrical energy would repay them for their trouble and expense.

Acton.—The Council decided in May last that the price of electricity for lighting should be 7d. per unit to consumers on free wiring installations, and 6d. per unit to all other consumers. Last week a meeting of the Council was held to consider applications from shopkeepers to be supplied at a special rate. Of the 581,809 units consumed last year, it was mentioned that 145,138 units were consumed by shopkeepers, factories, and places of worship. Finally it was resolved, by four votes to three, that after October 1st, shopkeepers (including factories), should be charged on a flat rate of 5d. per unit.

Amble.—At a meeting of the U.D.C. on the 8th inst. the question of lighting the town by electricity was further considered. A vote of ratepayers had been taken, and the result was that nearly two to one voted in favour of electricity. It was decided to employ an expert to examine and report on the scheme, and then a further vote will be taken.

Barrow-in-Furness. — The report of the electrical engineer for the year ending 1909 shows that 1,057,330 units were sold, an increase of 10,000 units on the previous 12 months, and that the maximum load fell somewhat to 884 KW. The equivalent of 78,119 8-C.P. lamps was connected, and this included 152 motors of 1,004 H.P., the apparatus on hire including 14 motors, 29 radiators, 52 irons, 9 water heaters, 23 kettles, and 5 arc lamps. Although there was a considerably reduced output for both lighting and tramways, the new connections in lamps, or their equivalent, were much above the average.

Bexhill.—The L.G.B. has sanctioned the Council's application for a loan of £2,120 for condensing plant, cooling tower, &c., so far as it relates to borrowing £1,990, to be repaid within 21 years. The board has deducted sums amounting to £130 in respect of outstanding work.

Another application is to be made for a loan of £197 for small extensions.

Bray.—At the meeting of the Urban Council last week, a report from the Electric Lighting Committee was read, from which it appeared that the Committee asked for leave to formally apply for a loan of £1,000, sanction to substitute a 50-H.P. Diesel oil engine for the gas engine, and instructions to the engineer to prepare specifications, &c. Mr. Bradshaw explained that the £1,000 was not an extra loan. It had been already granted, but they wanted to utilise it in a more beneficial way, and it was necessary to get the formal sanction of the L.G.B. The report was adopted.

Canada.—The fight between the electrical interests and the Hydro-Electric Commission, has reached almost a final stage, Major J. A. Murray, of Toronto, having issued a writ which is based on the original rights of the Ontario Power Co, and the Ontario Government, as regards the use of Niagara water. Major Murray seeks an injunction to prevent the expenditure of money on the scheme, and the pledging of the credit of the province of Ontario and Toronto municipal corporation in carrying out the contract to purchase electrical energy developed from the Niagara River, on the ground that the water is within the exclusive control and jurisdiction of the Dominion Government; that its use by the Ontario Power Co. is without sanction of the Government, and therefore illegal, and that, therefore, the Hydro-Electric Commission, in carrying out a contract with the company, is illegally spending money and pledging public credit. It is suggested that as the Dominion Government rights are involved, the Solicitor-General may take action.

Carlisle.—The Electricity Committee of the T.C. has agreed to supply steam to the Baths Committee at 1s. 0¾d. per 1,000 gallons. It has also been agreed to run an aerial transmission (estimated to cost £800) to Holme Head, to supply Messrs. Ferguson Bros.' new works, and to lay a feeder from the power station (estimated to cost £1,750) to Messrs. Cowans, Sheldon and Co.'s works.

Cowdenbeath (Fife).—At a meeting of the T.C. a letter was read from the Fife Electric Power Co., asking the consent of the Council to the inclusion of the burgh in the district for which the company intends making application for a provisional order. The Corporation means to promote its own order, and therefore agreed not to meet the company.

Darlington.—The T.C. has received from the L.G.B. sanction to a loan of £2,187 for the provision of a 500-KW. generating set.

Edinburgh.—The Marine Gardens have recently been brought up to date by the outlining of the various buildings with electric lamps. Over 10,000 lamps are now in use, 8,000 additional ones having been installed during the past few weeks.

Hayti.—It is stated that negotiations are proceeding with a Belgian group, which, with the participation of a leading German electricity company, proposes to establish electric supply works for the cities of Port-au-Prince and Cape Haytien, in the West Indies. The Government of Hayti has promised to support the scheme.

India.—The Government of Bengal has approved of the agreement entered into between the Maharaja of Mourhbauj and the British Westinghouse Co. for the establishment of a plant to utilise the water-power of the River Barabolang in the Mourhhanj State in the generation of electrical energy for lighting and power purposes.

Lanarkshire.—A new cement manufactory of the Coltness Iron Co., Ltd., at Newmains, has recently been started for making cement from waste furnace slag. A travelling electric crane takes an 8-ton ladle of molten slag from the furnace to a "tipler," worked by an electric motor. An aerial electrically-operated railway conveys the material to the clinker-house; thereafter all the processes in the mills are operated by electricity. A 1,750-H.P. gas engine generates energy for the mills at 2,500 volts, and utilises the waste gas from the blast furnaces. Each pair of mills in the cement works has a separate motor of 350 E.H.P.; and a motor of 150 E.H.P. drives all the conveyors, elevators, &c. The aerial ropeway is driven by a turbo-generator worked by exhaust steam. The feature of this cement factory is that the whole of the installation is derived from the waste product of the blast furnace, viz., the slag which is converted into Portland cement, and the power for driving the machinery which is obtained from waste gases and exhaust steam.

London.—Bethnal Green.—A special meeting of the Council is to be convened for the 30th inst., to consider in committee the matter of the supply of electricity in the borough. Quotations have been sent in from adjoining authorities and companies, and it was recommended by the committee that negotiations be opened up with Hackney, but this recommendation was not agreed to by the Council at the meeting on July 15th.

An electrical exhibition which is being promoted by the Shoreditch, Hackney and Stepney B.Cs. is to be held at the Pitfield Street Baths, Shoreditch, from October 18th to 30th.

Long Eaton.—At a meeting of the U.D.C. on Monday night the engineer reported an increase of 36,285 units, or 47 per cent. generated. It was recommended that the discount on the quarterly accounts for payment within one month from date of demand be increased as follows:—5 per cent. on accounts under £25; 7½ per cent. on £25 and under £50; £10 per cent. on £50 and under £75; 12½ per cent. on £75 and under £100; and 15 per cent. on £100 and upwards. After some discussion this was agreed to.

Melbourne.—The P.C. has accepted the tender of the Midland Machine Trust Co., Ltd., for current for 26 tantalum lamps at 15s. each for the lighting season, and for arc lamps at £4 each.

Newcastle (Co. Down).—At the monthly meeting of the Urban Council, held on the 6th inst., Messrs. J. W. Fraser and Co., Lewisham, gave notice that they were applying to the B. of T. for a provisional order for electric lighting. The Council decided to ask for further particulars as to the proposals.

Peterborough.—The T.C. has offered to supply energy to the cable company which contemplates having works at Woodstone, at $1\frac{1}{10}$d. per unit up to 750,000 units per annum, and 1d. per unit beyond. The company undertakes to consume at least 500,000 units per quarter, and it is estimated that the cost of additional plant, &c., to cope with the supply will be £13,875.

Stretford.—The Electricity and Tramway Committee having failed to come to an agreement with the Manchester Corporation as to the price of electricity supply for increased tramway service, consequent on the opening of the United's football ground, the Committee has decided to place the matter before the L.G.B., with a request that an arbitrator should be appointed. Instead of going to the heavy cost of extending its own electricity works for the purpose of providing the necessary energy for the increased traffic, the Stretford authority desires to obtain the power from the Manchester Corporation, which has fixed the price at 1d. per unit for traction consumption, subject to an adjustment in respect of the price of coal, this arrangement to remain in force until March 31st, 1912.

Uruguay.—The municipal authorities of Carmelo and Villa del Rosario have recently decided on the establishment of central electric lighting stations in their respective towns.

Watford.—Relying on the passing of the E.L. Amendments Act in Parliament, the U.D.C. has decided to delete from its Bill, Clause 36, which seeks to give the Council power to supply fittings, &c.

Worcester.—The T.C. has decided to replace 78 gas lamps and three small lamps, giving from 3,000 to 3,500 C.P., in Barbourne, London, and Bath Roads, with 12 arc lamps and 57 Osram lamps, giving 13,530 C.P., at a cost of £250 per annum, against £229 4s. 6d. for gas.

It is proposed to apply to the L.G.B. for sanction to a loan of £656 for coal storage and handling plant at the Hylton Road electricity works. It was agreed, however, to repay the amount out of revenue in five years.

Worthing.—The L.G.B. having deducted £337 in respect of meters from a loan applied for, the T.C. has asked that the present application be acceded to as, owing to previous loans for meters having been obtained, money has been expended on account. The Council has made arrangements to meet the cost of meters out of revenue account in future. The other part of the loan applied for, £2,300 for mains and £1,250 for house services, has been sanctioned.

Yarmouth.—At a meeting of the T.C. on Tuesday, a letter was read from the L.G.B. with reference to the application of the Council for sanction to borrow £2,000 in respect to the alteration of the system of public lighting in the borough from gas to electricity in certain streets, stating it was not the practice of the Board to sanction loans for undefined expenditure in public lighting, and it was not satisfied that the substitution of electricity for gas would result in any economy or improved lighting.

TRAMWAY and RAILWAY NOTES.

Argentine.—It was recently announced that the firm of Th. Bracht & Co., of Antwerp and Buenos Ayres, had applied to Congress for a concession for the construction of an underground electric railway in Buenos Ayres. It is now stated in this connection that the firm in question is acting in conjunction with the

Banque de Reports, de Depôts et Fonds Publics of Antwerp, and the Union Anversoise de Tramways et Enterprises Electriques. A similar offer had previously been made by the Western Railway, and now Ricardo R. Lédola is seeking for a concession on behalf of the contractors for the Paris Metropolitan Railway. It is said that the city of Buenos Ayres appears to desire to arrive at a speedy solution of the question mainly in consequence of the large amount of traffic.

Ayr.—Mr. Wm. Grant, the general manager, in the course of his annual report on the working of the Ayr Corporation Tramways states that the total revenue for the year was £15,081, compared with £15 322 in the preceding 12 months. The traffic receipts amounted to £14 444—a decrease of £[illegible]. The receipts per car-mile worked out at 8 87d., as compared with 9·13d. for last year. The number of passengers carried was 3 6[illegible]0,537, a decrease of 49 501. Of the receipts 29 49 per cent. were from ½d. fares, 17 27 from 1d. fares, and 24 41 from 2d. fares. The surplus for the year, £62, was carried to the burgh general assessment. The capital expenditure now stands at £82,169, the depreciation and renewals fund amounts to £13,110, and in addition, there is a reserve fund of £5,000.

Brentford.—At the last meeting of the Guardians it was reported that the bill of costs of the London United Tramways Co. with regard to its appeal against the assessment of its property in the Union was £6,099. This had been reduced on taxation to £3,832, and the Guardians made an order for the payment of this sum.

Continental Notes.—Spain.—A concession for the construction and working of an electric tramway in the city of Vigo and suburbs has been applied for. The Direccion General de Obras Publicas, Madrid, invites tenders until November 3rd, for the construction and working of an electric tramway to run from Calle de Villanova to Calle de Wad-Ras, in Barcelona. An application respecting this concession has already been submitted by the Sociedad Anonima Tranvias de Barcelona á San Andrés y Extensiones, who have certain preferential rights in the competition. Don Carlos E. Montañés has been granted a concession for the construction and working of the Metropolitan Electric Railway at Valvidrera. It appears that the work will involve the boring of a tunnel. Two years are allowed for the completion of the work, excluding tunnel operations.—*Board of Trade Journal.*

Austria-Hungary.—The district authorities of Hohenfurt have arranged to construct as soon as possible an electric railway from Zartlesdorf to Lippnerschwebe. The cost of construction is assessed at 3,000 000 kronen (£125,000), to cover two-thirds of which it is proposed to issue a loan.

Russia (St. Petersburg).—A further stage has been reached in connection with the tramway question in the Russian capital, inasmuch as a St. Petersburg correspondent states that according to the scheme placed before the Municipal Council by the Tramway Committee, it seems almost impossible that the Council will entertain the offers made by private companies to construct and work the lines of second-class of a total length of 64 versts. The total cost of construction is estimated at £4,200 000, the annual receipts at £1,430,000 and the working expenses at £830,000. The interest service of the proposed loan, including redemption, would require £268,700, and the renewal fund would need £84,000, so that the profit surplus of £600 000 would be reduced to £227,300 per annum, which, in the opinion of the Committee, would allow of the payment of a dividend at the rate of 4½ per cent. on the ordinary capital expenditure.

Bavaria.—The Bavarian State Railway authorities have decided to convert the railway between Salzburg, Reichenhall and Berchtgesgaden to electric traction. In connection with the scheme, a large electric power generating station is to be established at Ribling.

France.—The railways radiating from Paris to Versailles, St. Germain, and Argenteuil are to be electrified at a cost of £6 000,000. The work is to be completed in 10 years.

Germany.—The Prussian State railway authorities have placed a new order for the delivery of [illegible] storage battery motor coaches for use on various sections of the railways, which are already equipped with 62 accumulator cars. It was stated that as a result of the practical working of the latter they have been found free from objection, and that passengers give a preference to travelling in them. In addition to this type of self-contained coach, the railway authorities have in operation some steam motor coaches of a special kind, as well as a petrol-electric coach. If the latter two classes should prove to be reliable, they would probably only be extended where the storage battery cars are not applicable on account of the limited distance which they can alone cover without the necessity of re-charging the batteries.

Glasgow.—The Tramways Committee recently recommended that an experimental direct service of cars should be given between Townhead and the West-end of the city for four months. In the course of the discussion in the T.C. it was pointed out that several new cross routes were working at a loss, six of them accounting for a deficit of £17,[illegible]. In the end the recommendation was disapproved.

Immingham.—The Grimsby R.D.C. has passed the plans of a light railway, to be worked by electricity, between the new deep-water dock at Immingham and Grimsby. The scheme will be completed in January next.

London.—Lt.-Col. Druitt's report, on behalf of the B. of T. in connection with the collision which occurred at Moorgate Street Metropolitan Station on August 5th, which was recently issued, shows that the accident was due to the failure of an automatic signal to return to the danger position, behind a train which occupied the track section in the station. The Johnson All-electric Automatic system has recently been installed, and Mr. H. G. Brown, chief engineer to the Signal Co., suggests, in his evidence, that the probable cause of the signal remaining in the clear position was an accumulation of sediment in the oil, which caused the release valve (in the operating oil cylinder on the signal) to stick, and so prevented the signal going to danger when the magnet controlling the release valve was de-energised by the track circuit being interrupted. The release valve is to be re-designed.

The L.C.C. tramway route from Holborn to Hampstead, *via* Camden Town, was opened throughout for traffic on Friday last.

The Willesden U.D.C. has decided to oppose the joint scheme of the L.C.C. and Middlesex C.C. for a tramway from Marble Arch to Cricklewood unless certain road-widening is agreed to.

Pudsey.—On Wednesday last week, owing to the failure of the brakes on a car which was running round a curve, the car jumped the track and ran into some shop fronts; one passenger was injured.

South Africa.—The East London T.C. (Cape Colony) has resolved to lay a new tramway at an estimated cost of £8,500.—*Commercial Intelligence.*

South Shields.—The Tramways Committee suggests making an experiment with regard to the fares on the market place and seaside line, which is regarded as the most unremunerative part of the system. There are no halfpenny fares in the town, but the Committee proposes to introduce a system of penny return tickets on the section named during a trial period of 12 months.

Wolverhampton.—The Lea Road section of the Corporation tramways was completed at the beginning of last week, a trial run took place on Wednesday, and the line was opened for traffic on Friday afternoon, and has since been well patronised. Provisional permission was given by the Board of Trade to open the line prior to the official inspection on condition that the Corporation took all risks; the insurance company interested also gave their sanction to running the cars for traffic, and the Tramway Committee decided, therefore, to commence operations at once. This section completes the whole of the lines now proposed to be laid down by the Corporation, though another tramway is very much needed in the direction of Stafford New Village and Fallings Park Garden City, which are becoming densely populated. The contractor for the Lea Road line, it may be mentioned, was Mr. Trentham, of Handsworth and Smethwick, and he has done his work well.

TELEGRAPH and TELEPHONE NOTES.

Argentine Cables.—It is understood that the River Plate Telegraph Co. has made an offer to the Argentine Government to lay free of cost a cable between Buenos Ayres and Europe *via* Tristan da Cunha. The Western Telegraph Co. and its associates appear to be determined to meet any possible opposition or competition by the German cable scheme in a workmanlike and effective manner. An American contemporary states that the Western Telegraph Co.'s contract with the Argentine Government for the laying of a cable between Buenos Ayres and Ascension provides that if within a period of 25 years from the date of the completion of the agreement any company should make proposals to the Government, which would appear advantageous to the latter, for the laying of a new submarine cable between the Argentine Republic and another country, preference will be given under the same conditions to the Western Co. The agreement provides for a monopoly in official messages and all unrouted traffic collected by the Government telegraph offices. The agreement also accords freedom from all import duties and taxes for 25 years. The company in return for these privileges reduces rates on messages *via* Brazil by 15 centavos per word.

Cable Interruptions and Repairs:—

	Interrupted.	Repaired.
Tangier Cadiz	May 19, 1909	
Tourane Amoy	June 17, 1909	
Assab Perim	July 8, 1909	
Gibraltar Tangier	Aug. 7, 1909	September 10
Dakar-Conakry	Aug. 20, 1909	
Balikpapan-Kwandang	Sept. 2, 1909	

The German Cable to Brazil.—The section of the cable between Emden-Borkum and Teneriffe, as previously announced, was recently completed and was opened for traffic on August 26th. It belongs to the German South American Telegraph Co., of Cologne, which was formed in August, 1908, to establish a connection with Brazil. The laying of the land cable was commenced in the following month, and the length to Borkum was completed at the end of November. The marine cable to the end of the canal at Emden was finished in June of the present year, whilst the cable to Teneriffe, of a length of 1,698 miles, was started on July 26th by the cable steamer *Stephan*, the work having been carried out by the Norddeutsche Seekabelwerke, of Nordenham. The station at Teneriffe is located at Santa Cruz and the staff is composed of Germans. It is probable that the continuation of the cable to Brazil will not take place before the beginning of next year.

It has not yet been decided whether the direct route to Pernambuco will be chosen or whether an intermediate landing will be effected at Monrovia in Liberia, the latter way being about 1,000 nautical miles longer and consequently necessitating a greater expenditure. But as in any case a connection is to be established with West Africa the latter route will, perhaps, be given the preference. In this event a branch cable would be laid to the German colonies of Togo, the Cameroons and South-West Africa, by means of which German communication with Africa would be completely independent of British cables. It is also calculated that Portugal and the State of Congo would utilise the cable as they have, it is said, manifested great interest in an improvement of the present cable connections. By means of a direct cable between Emden and Pernambuco, it will be possible to reduce the charge by 6d. per word. Efforts are already being made in Brazil to extend the cable from Pernambuco to Buenos Ayres, which prolongation is deemed to be necessary in German interests. The subsidy granted by Germany has been so arranged that interest on the working capital will not only be paid but the capital will also be redeemed. The completion of the Teneriffe cable has increased the total length of German transmarine cables to about 17,9[illegible]0 miles.

Glasgow.—A new central telephone exchange is being constructed at the Waterloo Street branch of the Post Office on the common-battery system. This exchange will have provision for 10,000 subscribers, and is expected to be ready about the end of this year.

High-Speed Wireless Telegraphy.—On Saturday and Monday last an interesting demonstration of the Poulsen system of wireless telegraphy took place at the Cullercoats station. As our readers are aware, this station was erected by the Amalgamated Radio-Telegraphic Co. to test on a working scale the Poulsen system of telegraphing with undamped waves, the corresponding stations being at Esbjerg and Lyngby, in Denmark; the latter station was in communication with Cullercoats last week-end, over a distance of 600 miles, the sending power being 3 or 4 KW. We gave a description of the ordinary Poulsen equipment of the Cullercoats station in our issue of July 9th last, in the form of an abstract of a paper read before the Institution of Electrical Engineers at Newcastle by the engineer in charge of the station, Mr. A. S. M. Sorensen. The Poulsen arc takes from 7 to 10 amperes at 340 volts from the town mains, and generates oscillations having a frequency of nearly 200 000 cycles per second, the current to the antenna being about 9 amperes, and the wave length about 1 800 metres. The antenna is coupled direct to the sending circuit, and the transmission is effected by short-circuiting a few turns of inductance in the circuit, thus changing the wave length slightly, the sparking at the key being insignificant and almost noiseless. Signalling over a distance of 400 miles has been accomplished with as little as 200 watts. Receiving is effected in ordinary working with a telephone connected to the Poulsen "ticker," which allows the waves to accumulate by resonance in the secondary circuit, and intermittently discharges the stored energy through the telephone, no coherer or detector being required and very loose coupling being employed, so that the tuning is very exact. For the high-speed transmission an automatic sender is used, with punched tape as in the Wheatstone system; the only example of this sender as yet in use is set up at Lyngby. The receiver consists of a photographic recorder embodying the Edelmann string galvanometer and a crystal rectifier, consisting of particles of galena and tellurium in contact, which permit the waves to pass in one direction only. This is in series with the string galvanometer and the receiving circuit. A shadow of the "string"—an excessively thin gold wire stretched in a strong magnetic field—is projected by a Nernst lamp and lenses on a slit in front of a sensitised paper tape, which passes from the slit through developing and fixing baths, the apparatus being driven by a small motor provided with an eddy-current brake to ensure steady running. The vibrations of the "string" cause its shadow, projected on the paper, to produce a trace resembling somewhat the record of a siphon recorder, extremely clear and easy to read. With this apparatus signals were received at speeds of 50 and 100 words per minute with satisfactory results. The power employed was 7 or 8 KW. at Lyngby. It is anticipated that when the trans-Atlantic stations are completed—one of which is partly erected in Ireland—it will be possible to send 50 words a minute and to record the messages received, with a sending power of 100 H.P. The speed from Lyngby has reached 125 words per minute, or five times the speed claimed for land-operated wireless transmission up to the present.

For ordinary commercial messages to ships the De Forest spark system is used at Cullercoats, with the electrolytic detector, and a wave-length of 600 metres. A new experimental wireless station has recently been erected at the Armstrong College, Newcastle-on-Tyne, and equipped with the Poulsen apparatus, so that communication can be carried on with the Cullercoats station; the Poulsen system is particularly well adapted for wireless telephony, and experimental work in this and other directions will be carried on between the two Tyneside installations.

Norway.—The telegraphic system in 1907-8 increased over the previous year by [illegible] km. of line, and 727 km of wire, to 10,[illegible] and [illegible] km. respectively; while the increase of the telephone system was 845 km. of line, and 3,327 km. of wire, to 5,[illegible] and 9[illegible] km. respectively. In the above year there were [illegible] offices in Norway, an increase of 53 on the previous year; and the telephone subscribers increased from 17,453 to 18,602, but the majority of these were located in Christiania. The service was worked by 1,387 permanent employés, while 3,318 temporary employés were also engaged. The telegraphic traffic was 2,819,657 messages, an increase of 5·1 per cent. on the year 1906-7. Only 529 complaints of errors in transmission were made. The number of telephonic conversations increased from 49,086,660 to 52,476,527, and the total telegraphic and telephonic receipts amounted to 5,679,3[illegible]6 fr. The expenses of both systems amounted to 3,495,158 fr.—*Journal Télégraphique.*

Pacific Cable.—The report of the Cable Board for the year ending March 31st last shows that the traffic receipts for the year were £114,82[illegible], less the Atlantic Companies' charges, £3 763 the net receipts amounted to £11[illegible]. Deducting the expenditure a balance of £16 6[illegible]7 was left, which was applied to the reduction of the amount (£77,544) due for interest and sinking fund, leaving £60,8[illegible]8 to be subscribed by the Governments concerned, as compared with £62,562 for the previous year. The traffic receipts showed an increase of £1 4[illegible]5, and the total receipts an increase of £2 933, while the expenditure increased by £1,458, due to the normal increase of salaries and to the fact that almost all the staff became entitled to long leave. The renewal fund stood at £192,595; with interest on investments (£7,000) and appropriation from revenue (£30,000), the fund is growing at the rate of £37,000 a year. Serious interruptions occurred on the Canadian landlines and one of the Australian landlines. The speed of the duplex transmission on the Bamfield-Fanning section has been increased to 90-97 letters a minute, whereas it was originally anticipated that the practical working speed would not exceed 65 letters; as this is the slowest section, the capacity of the whole system is correspondingly improved. The cable has given no trouble. The messages last year numbered 232,304 ordinary, 9,086 Government, and 2,532 Press messages, the total being 243,922, as against 249,590 in the preceding year. The total capital expenditure was increased by less than £500 during the year, to £1,999,100.

South Africa.—NATAL.—The annual report for the past year of the Natal Telegraph Department has just been issued, and shows that the telegraph receipts for the year ended June 30th, 1908, amounted to £42,404, as compared with £45,623 for the previous year, being a decrease of £3,219. During the year ended December 31st, 1908, the number of telegrams passed over the department's lines were 1,518,148, as compared with 1,579,061 for the previous year. Three additional offices were opened during the year, the total now being 212. The telephone receipts totalled £9,587, as compared with £8,682 for the previous year; the trunk revenue shows a steady increase, accounted for in great measure by the adoption of the 1s. 6d. uniform rate for three minutes' conversation.

TRANSVAAL.—A heavy snowfall on August 17th did much damage to telegraph lines. Natal was cut off from Johannesburg, and one of the Cape lines, through Kimberley, *via* Bloemfontein, had to be used for communication with Natal.

Switzerland.—A new telephone line to the summit of Mont Rosa was inaugurated last week. It places the Observatory, at a height of about 15,000 ft., in communication with the telephonic exchanges in the Aosta Valley.

Underground Wires.—The Postmaster-General, says the *Times*, has decided to proceed at once with the work of placing the Post Office telegraph wires underground between Chatham and Dover. The telegraph wires between Chatham and London are already underground.

United States.—It is reported by a correspondent of the *Financial News* that the American Telephone and Telegraph Co. is negotiating to purchase the control of the Western Union Telegraph Co., which has hitherto worked in conjunction with the Anglo-American Telegraph Co. If the deal is effected, it is suggested, the Western Union traffic will be diverted to the Commercial Cable Co., both of these being Mackay companies, and the Anglo-American Co.'s traffic will be confined to New York.

Wireless Telegraphy.—It is reported that the German Colonial Office authorities are negotiating with the Telefunken Gesellschaft with a view to the establishment of means of communication by wireless telegraphy between Berlin and German colonies. It is proposed in the first place, to raise the height of the Nauen station by about 160 ft., and experiments are to be made this year between this station and a ship proceeding to the Cameroons. If it is found possible to effect a connection between Nauen and the coast of the Cameroons, it is intended to link together the remaining German colonies in Africa so that they will be able to communicate with the Fatherland by way of the Cameroons.

An official from Marconi's Wireless Marine Communication Co. is in Durban with the object of making experiments with a view to the establishment of a wireless telegraphic service between South Africa and this country. According to the *Standard*, this is part of a scheme which the company are endeavouring to execute as quickly as possible—that of establishing wireless telegraph stations between the Home country and all her colonies. The idea is to establish stations at distances of about 2,000 miles apart, for the purpose of transmission. The total cost of linking up the Empire by wireless, involving the erection of 24 stations, will be about £1,3[illegible]0,000. Each station will cost £55,000 in outlay, and £10,000 yearly for upkeep. The estimated income per station per year is £22,500, or a total of £540,000 yearly, which provides for a handsome profit.

A wireless telegraph station is being erected close to the sea at Simon's Town.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Telegraph and telephone material for the P.M.G., Melbourne. See "Official Notices" September 10th.

Common battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Sydney.—The Australian Postmaster-General has ordered cables and wires to be obtained by tender to the value of over £17,500, within the current financial year.—*Commercial Intelligence.*

Belgium.—September 28th. La Société Nationale des Chemins de Fer Vicinaux of Brussels (14 Rue de la Science) are inviting tenders for the supply and erection of the overhead equipment for the Anderlues-Lobbes section of the Carnieres-Thuin electric railway.

November 6th. The municipal authorities of the town of Tongres are inviting tenders for the extension of the central electric lighting station. Plans and specifications can be obtained from the Hotel de Ville on payment of 8 francs.

Bristol.—September 21st. E.L. installation at Alexandra Park Schools, Fishponds, for the T.C. (deposit £2 2s.); Rodway and Dening, architects, Gaunt House, Orchard Street, Bristol.

Burnley.—September 20th. The Guardians are inviting tenders for electrical supplies to the workhouse. Particulars from the Clerk, to whom tenders must be sent by the 20th inst.

Canada.—Toronto.—October 14th. A New York Exchange says that the city of Toronto is inviting tenders for four 1,500-h.p. synchronous motors, two 1,500-h.p. induction motors, four 500-h.p. induction motors and two 225-h.p. synchronous motors, with exciters, switchboards and connections; also for a number of large-sized turbine pumps, piping, valves, &c.

Corea.—It is reported that the Japanese authorities have decided to construct new telephone lines in Corea to the length of 500 miles, at a cost of 70,000 yen (about £7,150).—*B. of T. Journal.*

Dudley.—September 28th. Electrical fittings for six months, for the B.G. C. W. Coster, clerk, Union Offices, Dudley.

Epsom.—September 25th. 850 tons washed nuts for the U.D.C. electricity works. Engineer, Mr. A. C. Gilling.

Fulham.—September 22nd. 150 electricity meters for the Corporation. See "Official Notices" September 10th.

Glasgow.—One electric passenger lift and three electric hook lifts for the new Mitchell Library. Specifications and forms of tender from Mr. W. B. Whitie, 219, St. Vincent Street.

Isle of Thanet.—Stores for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 3rd.

London.—L.C.C.—September 21st. Two 500-kw. and 150-kw. motor-generators, also high and low-tension switchgear, for sub-stations; steam and other piping, valves, &c., for Greenwich generating station. See "Official Notices" August 27th.

Manchester.—September 21st. Steel girder tramway rails, for the T.C. (deposit, £1 1s.). J. M. M'Elroy, general manager of the tramways, 55, Piccadilly.

Oulton Broad.—The U.D.C. invites applications from those willing to carry out its E.L. order. See "Official Notices" September 10th.

Walthamstow.—September 24th. 695 yd. of feeder cable for the U.D.C. See "Official Notices" to-day.

Yarmouth.—The T.C. has instructed its electrical engineer to advertise for 2,000 tons of Derbyshire fine slack coal for the mechanical stokers. He was also authorised to order a quantity not exceeding 700 tons of Scotch anthracite nut coal at 9s. 3d. per ton from Messrs. W. Cory & Son, Ltd.

York.—September 24th. Traction switchboard for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Admiralty.—We are informed that the British Electric Calibrated Fuse Co., of Harpenden, have received the Admiralty contract for all fuses, from 3 to 30 amps., required up to December 31st, 1911.

Australia.—According to a contemporary the P.M.G. has ordered telegraphic materials, &c., costing £983, from Messrs. Johnson & Phillips Ltd.

Belgium.—Five concerns submitted tenders for the supply and installation of the overhead equipment of the Trazegnies-Anderlues section of the new electric railway which is being built by the Société Nationale des Chemins de Fer Vicinaux, of Brussels. The lowest was that of Messrs. R. Henin & Co., of La Louviere.

La Société des Houilleres Unies, of Charleroi, has just placed a contract with a native concern for the installation of four electric winding engines at its collieries.

Bexhill.—The Corporation has accepted the tender of Mr. F. A. Greene, for £293, for pipework and valves for new condensing plant at the electric light works.

Bradford.—The T.C. has accepted the tender of Messrs. G. A. Steinthal & Boydell, Ltd., for motors for the conditioning house, at £209.

Burslem.—The Education Committee has accepted the tender of Messrs. Evans & Sons, Burslem, for installing the E.L. at Middleport Schools, at £86 15s.

Cheltenham.—The T.C. has accepted the tender of Messrs. Heenan & Froude for duplicating the refuse destructor, at £5,796.

Edmonton.—The order for 49 a.c. porthole fans for the Infirmary has been placed with Messrs. Hogan & Wardrop, of London, for their E.M.I. fans.

Portsmouth.—The Corporation Telephone Committee has accepted the tender of W. T. Henley's Telegraph Works Co., 1,500 yd. 24-pair cable, at £54. Other tenders were:—B. I. and H. Cables, Ltd., £56; Electrical Co., Ltd., £72; Western Electric Co., £76.

The E.L. Committee has accepted the tender of the British Wettinghouse Co. for six feeder panels, at £168. The firm of Siemens Bros quoted the same figure, and the other tenders were:—B.T.-H. Co., £341; Dick, Kerr & Co., Ltd., £342. The tender of the B. I. & H. Cables, Ltd., for two feeder pillars, at £59, was also accepted.

Stockport.—The Governors of the Infirmary have accepted the tender of Messrs. Turner & Atherton, of Stockport, for the erection of an electric hoist, and the fitting up of an X-rays equipment.

South America.—Messrs. James Gordon & Co. have received an order, from South America, for 1,200-h.p. water turbines with governors, and other accessories.

Swansea.—The E.L. Committee has accepted the following tenders:—

Arc lamps.—Veritys, Ltd.
Cables.—Callender's Cable and Construction Co.
Arc lamps, pillars, brackets, and raising and lowering gear.—The London Electric Firm, from £383 to £386, according to the type of raising gear best suited for use in conjunction with the arc lamps recommended.
Switch pillars and joint boxes.—Lucy & Co., Ltd.

Worthing.—The T.C. has accepted the tender of the Beck Flame Lamp Co., for Beck lamps, at £638.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, September 25th. At 3 p.m. Visit to the Imperial International Exhibition, Shepherd's Bush.

Municipal Tramways Association.—Wednesday, September 22nd, to Friday, September 24th. Annual Conference at the County Hall, Spring Gardens, London, S.W. See Elec. Rev., September 10th, page 425, for titles of papers.

The Electrical Propulsion of Ships.—Mr. W. P. Durtnall, whose proposals for the electrical propulsion of steamships are familiar to our readers, has issued a circular letter protesting against a letter published in the *Times* Engineering Supplement of September 8th, in which a leading member of the electrical profession deprecates the "extravagant claims made for electric propulsion." Mr. Durtnall's zeal and enthusiasm in the advocacy of this are well known, and no doubt, like all enthusiasts, he may paint too rosy a picture at times; but, still, it must not be supposed that his propaganda is not well founded. The writer of the *Times* letter himself—Mr. H. A. Mavor—is the inventor of a special system of electrical propulsion, which, we infer from his letter, is being applied to a ship of over 1,000 h.p., and he is a strong advocate of electrical driving.

In this connection it is interesting to note that the Institute of Marine Engineers has just awarded Mr. Durtnall the Denny Gold Medal for his paper on "The Generation and Electrical Transmission of Power for Main Marine Propulsion and Speed Regulation," read on July 18th, 1908, which was considered the best of the papers submitted in competition for the medal during the session 1908-9.

Will.—Estate valued at £10,331, with net personalty £3,253, was, according to the *Times*, left by the late Mr. G. Ellis, a director of the South London Electric Supply Corporation, Ltd.

NOTES.

The Science of Plant Management.—It has been an ften repeated experience on the part of engineers connected with lectricity supply undertakings that on approaching a possible conumer on the question of power he is confronted with the fact that he consumer has very little idea of the pros and cons of the question of private *versus* public supply, considered from an conomic point of view. He is, for example, only too apt to put down a negligible amount for depreciation, and to ignore management and operating costs in running the plant. A comparison between station prices and private supply prices, therefore, becomes unfavourable to the former, and it requires a huge amount of persuasion to make the consumer see that such items are not ictitious values in the account. A development in the extension eaching course of the Columbia University, of New York, indicates, o a large extent, the line upon which such faulty reasoning will be best corrected, owing to the education of operating engineers, building superintendents, engineers' assistants and others, who have o much to say with regard to the plant requirements of any particular factory. A course has been arranged upon the subject of plant management, and is intended for engineers of the above description who already have a good knowledge of arithmetic and elementary physics. By the courtesy of the Columbia University, we are enabled to indicate the practical standpoint from which the problems of plant management are studied. Starting, first of all, with the problem of machinery selection, the layout and installation of plant is discussed. Schedules for the identification and operation of plant are then elaborated, and the common units for measuring plant economy, together with the instruments and methods of measurement, are treated.

A considerable section of the course is devoted to the subject of engine-room accounting. In this section it is shown how to construct records of operation and to compute results from the operating data. The systems for filing records for daily comparison and reference are explained, while the course includes the question of purchase of coal and supplies, payment of labour, store and tool room management, computation of total operating costs per unit output, the question of plant depreciation, interest, depreciation annuities, computation of actual cost per unit output, arrangement of expense and plant efficiency reports to owners.

The third important section of the course deals with cost analysis and expense control. In this the method of determining standard unit costs and the distribution of expense to the various systems operated is discussed, together with leakages and direct expenses in operation and machinery. The relation between plant efficiency and the actual cost per unit is also explained. An important, and perhaps novel, feature on this side of the Atlantic, is the section devoted to industrial betterment methods. There is no doubt that this, however, forms a very real factor in the efficient working of such plants. The training and handling of men, apprenticeship and bonus systems for power plants are examined, while the means and methods to be taken against accident including fire, underwriters' regulations and liability insurance, are discussed. The course finishes with fire protection and appliances, and fire fighting organisation for individual buildings.

The course extends over 40 lessons, taken twice a week for a period of 1½ hours each, and it will be seen that students who successfully graduate in a course of this description will have attained an intelligent idea, not only of the actual management of plant, but of the economic reasons which underlie the best methods of power plant management. It would be a distinct boon if such a course could be initiated on practical lines by colleges in this country for the benefit of those who do not yet understand the essential problems underlying the choice and management of power.

The Industrial Exhibition at Nancy.—Nancy is the centre of the great industrial region of France lying along the Belgian and German frontiers. The exhibition has been promoted by the financial and industrial interests of this district, whose products are fully represented; these form the greater part of the exhibits, but interesting examples are not wanting from the ends of France and from Germany and Switzerland.

The Metallurgical Hall is one of the most interesting, and impresses on the visitor that French iron and coal are important factors in European industry. There are reproductions of galleries in the ore mines, with examples of timbering and specimens of ore, castings, forgings and rolled products.

Passing through a 24-ft. stator (by the Société Alsacienne de Constructions Mecaniques), one reaches the engine room, where are installed three large low-speed reciprocating sets of 600 to 1,000 H.P., 90-100 R.P.M., showing many points of interest in the valve-gear, &c. The large stator referred to above is for 1,900 KW., three-phase, 550 volts, 50 cycles, 94 R P M. Turbine practice is represented by two turbo-generators of 750 KW. by the Cie. Générale Electrique, of Nancy, and by the Société Alsacienne; the latter (a Zoelly turbine) runs at 3,000 R P.M., 50 cycles, generates at 5,000-5,500 volts, and is connected through a step-down transformer in parallel with the low-speed sets to a system of aluminium mains by the Société Electro-Métallurgique Française. The engine room is served by a battery of boilers of the Mathot Stoft and Garbe types.

There are further exhibits of turbines by Schneider, of the famous Creusot works (Brown-Boveri-Parsons type) and by the Rateau Co.

One of the most interesting exhibits in this section is a pair of compound engines with superheating arrangements between boiler and H.P. cylinder, and between H.P. and L.P. cylinder. The superheat can be arranged so that the steam is dry at the end of each expansion without excessive superheating between boiler and H.P. cylinder. These engines are installed by Heinrich Lanz & Co., of Mannheim, and are on the Lentz system.

There is not a single exhibit of the high-speed reciprocating type so much favoured in this country.

In the electrical section the exhibit of the Société Alsacienne makes the best display. A repulsion motor (50 H.P., 350 volts, 25 cycles, 500 R.P.M.), one of 80 for the Railways of the "Sud," may be contrasted with a D.C. traction motor of the same output. The repulsion motor is 40 per cent. larger than the D.C. machine.

A vertical booster by the same company occupies about half the floor space required for a horizontal position. A green glass insulator by a firm whose speciality is champagne bottles attracts notice by the high voltage—100,000 volts—it is designed for. Fabius Henrion, of Nancy, shows an extensive range of electrical machinery, and there are many interesting examples of standard apparatus by various firms, which cannot here be described in detail, but which well merit examination. In the textile section is exhibited a single-phase commutator motor of variable speed for cotton machinery by Messrs. Brown, Boveri. The textile department itself is large and important.

Mention, at least, must be made of the fine exhibit of rolling stock and locomotives, one of the latter with a water-tube boiler. There is the usual array of lighter attractions and dissipations. The whole of the exhibits are housed in graceful white buildings. The Exhibition closes next month.

Electricity in Mines: Questions in the House.—In the House of Commons, on September 15th, Mr. Markham asked the Secretary of State for the Home Department what was the definition of a completely-enclosed motor in the Home Office rules relating to electricity in mines, and whether a flame-proof motor not totally enclosed was covered by the definition completely enclosed? Mr. Gladstone replied: I am advised that the enclosed required by Special Rule 37 is total enclosure, and this, I understand, is the view generally taken in the industry. The case of a "flame-proof motor not totally enclosed" would not, therefore, be a compliance with the rule; but the point has been noticed for reference to the committee on the rules which I am about to appoint. Mr. Markham: Is the right hon. gentleman aware that a member of the committee which drew up these rules stated that "completely enclosed" meant nothing to the mind of the Commissioners more than "totally enclosed"? Mr. W. E. Harvey: In view of the loss of life which has occurred recently in mines, and which is attributed to electricity, I wish to know if the Government are prepared to undertake some experiments with regard to electricity in mines. Mr. Gladstone: As I have already stated, I am about to appoint a committee, and it is extremely probable that the committee will extend its inquiries to this question.

Alleged Nuisance from a L.C.C. Sub-station.—Sir William Collins, in the Parliamentary Papers, last Friday, asked the President of the Board of Trade whether his attention had been directed to complaints made of nuisance arising by noise and otherwise from the working of an electric sub-station of the L.C.C. in Arlington Road, St. Pancras; whether the station had been inspected on behalf of the Board of Trade; whether the working of the station was in accordance with the Board of Trade regulations; and whether the Board had suggested, or would suggest, any action with a view to abating the nuisance complained of. In reply, Mr. Churchill says:—The sub-station in question has not been inspected on behalf of the Board of Trade, and is not liable to such inspection, nor is its working subject to the Board of Trade regulations. He has, however, asked the L.C.C. for their observations on the nuisance stated to exist and will communicate their reply to his hon. friend.

Strange Fatality.—It is reported from Gillingham, Dorset, that a boy named Harry Andrews, aged 9, met with his death from paralysis set up by a current of electricity from a toy magnetic battery. The instrument, which is about the size of a matchbox, and is sold for about 2s., belonged to another lad who, while bathing, left it with his clothes on the river bank. Andrews took hold of the battery and received a shock, which he told his father later "seemed to shift all the bones in his body." Symptoms of paralysis set in, and a doctor was called, but the lad gradually got worse and died. Dr. Walker was of opinion that the current set up neuritis, which gradually spread to the spinal cord and brain. Deceased was not a robust boy.—The jury found that death was caused by paralysis produced by the electric current from the battery which deceased handled by misadventure.

Westminster Electric Swimming Club.—The members of the above Club held their ½-mile championship race at Thames Ditton on Saturday last, September 11th. The event was somewhat marred by the exceptional coldness of the water, but the conditions overhead were perfect. The race ended in a victory for S. G. Taylor (mains department), W. Llewhellin (drawing office) being second, and the others finishing in the following order:—3, A. E. Watson; 4, R. Litt; 5, S. A. Crowe; 6, F. Dodd; 7, E. L. Stern. Three competitors, F. R. Crump, W. Hurman and A. Collingwood were overcome by the coldness of the water, and had to give up, the last-named being only a few yards from home. Tea was afterwards partaken of at the Albany Hotel, and the afternoon sport was voted a great success.

Life in China.—We have received an inquiry as to the cost of living in Shanghai. While we have published articles on the cost of living in many foreign countries, we have not dealt with China, and we should be glad to hear from any readers who have had experience of life in this country.

Electrical Contracts for the Navy.—On Tuesday, in the House of Commons, Mr. Renwick asked the First Lord of the Admiralty whether, in the case of contracts which have recently been placed for the electric light installations and searchlights in British warships now building, the contractors for such installations, &c., being British branches of German firms, it was made a condition of the contract that only British-made cables, machinery, and fittings should be used, and only British subjects employed in the superintendence and fitting of same on board the vessels; and whether precautions had been taken to prevent the necessary plans of the ship supplied to the contractors being sent abroad or shown to foreigners. Mr. McKenna, in reply, said that in a contract of the kind it was made a condition that only British made cables, machinery, and fittings should be used, and only British subjects employed in the superintendence and fitting of them on board the ships. With regard to the last part of the question, the following provision had been embodied in recent contracts:—"This contract involves an obligation of secrecy within the meaning of Sec. 2 of the Official Secrets Act, 1889. The contractors shall at their own expense take all such measures and precautions to ensure secrecy in connection with the design, construction, equipment, and completion of the said vessel as may be necessary, including therein all such measures and precautions as may be regarded as necessary by the Commissioners, and the contractors shall if so required at any time by the Commissioners, afford to them such evidence as the Commissioners may consider satisfactory that all such measures and precautions have been, are being, and will be taken." In reply to a further question, Mr. McKenna said that the conditions were strictly carried out.

Copper.—In its issue of September 3rd the *Financier* has an article, in which it is anticipated that the current year will be close on 1906 in total copper deliveries, indicating a considerable revival in consumption. While taking into account the fact that consumers have been waiting for the market while stocks have been accumulating, there seem indications of a trade revival in this country, which, coinciding with that in the States, must result in a large demand.

Educational Notes.—University of London.—An "Appointments Board" has been constituted by the University of London, to assist graduates and students of the University in obtaining employment, and to assist employers to find, in the University ranks, suitable men for vacancies. Those who know of vacant appointments suitable for University men are invited to communicate with the Secretary of the Board.

Polytechnic School of Engineering, Regent Street, W.—The new session commences on the 27th inst. We have received the syllabuses of the engineering courses, which include, besides the usual subjects, motor-car and "aero" engineering. Mr. W. Hibbert is the head of the electrical and physics department. A special course of lectures on medical electricity will commence early in October.

International Correspondence Schools.—To-morrow (Saturday) a reception is to be held at the headquarters of the "I.C.S.," Kingsway, to which all British students of the schools are invited by the directorate, and in the evening there will be a banquet at the Hotel Cecil, at which the Rt. Hon. Lord Montagu of Beaulieu will preside, supported by representatives of several of the engineering societies and other eminent personages. Besides the 50 branches of the I.C.S. in the United Kingdom there are branches in all the British Colonies and Dependencies, from which representatives have been invited, and it is anticipated that the function will mark an epoch in the history of the I.C.S.

Appointments Vacant.—Assistant engineer and car-shed foreman for the Sunderland District Electric Tramways, Ltd. (£2). Instructor in electrical and mechanical engineering for the Limerick Municipal Technical School (£130). See our advertisement pages for particulars.

Institution and Lecture Notes.—Institute of Metals.—At the Autumn meeting which will be held at Manchester on October 14th and 15th, it is expected that the following papers will be presented:—

J. H. Andrew, M.Sc., and C. A. Edwards, on "The Constitution and Properties of the Ternary Alloys Aluminium-Copper-Tin."

C. O. Bannister, Assoc.R.S.M., and H. [illegible], on "[illegible] Appearance of Solders."

H. W. Greenwood, on "The Technical Assay of Zinc."

J. S. Glen Primrose, on "Notes on the Production of Pure Spelter."

E. L. Rhead, on "[illegible] Causes of the Corrosion of Copper and Brass."

Prof. C. A. Smith, M.Sc., on "The [illegible] of Ductile Materials."

Prof. T. Turner, M.Sc., and M. T. Murray, M.Sc., on "The Copper-Zinc Alloys: a Study of [illegible]."

[illegible]

[illegible] Consulting Engineers," has been awarded to Mr. C. Allan [illegible], M.C.M.I.E.E., who will read his essay at the meeting to be held on October 4th at 7.30 p.m. at Caxton Hall, Westminster.

Developments of the Thury D.C. System.—We are informed that the well-known series direct-current transmission line from Moutiers to Lyons, which has been in operation since 1905, has proved such a remarkable success that very important developments are to be carried out on the same lines.

The generating station itself is situated near Moutiers (Savoy), and takes its power from the River Isere; it was fully described in our issue of August 10th, 1906. The total power of the D.C. high-pressure plant at present is 6,400 H.P.; energy is transmitted at a pressure of 57,600 volts to Lyons, a distance of 180 kilometres, by means of two conductors of 9 mm. diameter. Parallel to the D.C. line is a three-phase line going to the same point. At Lyons the D.C. energy is utilised in driving a number of motor-generators.

The series system has not only demonstrated its elasticity, but has proved to be so reliable and easy to operate that the companies concerned have decided immediately to carry out extensions on a large scale.

A generating station is to be erected at La Bridoire (Savoy), in which three high-pressure D.C. sets will be installed, each of 2,000 H.P. at 28 R.P.M.; they will generate a current of 150 amperes at a pressure of 8,000-9,125 volts.

A second generating station on the Roziers at Bogel (Savoy) will contain two generating groups, each consisting of two double machines driven by the same turbine and capable of giving an output of 3,500-4,000 H.P. at 428 R.P.M., and delivering a current of 150 amperes at 16,000-18,250 volts. A corresponding amount of D.C. motor-generator plant will be placed in the Vaulx-en-Velin sub-station.

The total capacity of the direct current high pressure generating plant, when the extensions are complete, will be 15,000 KW., and the three generating stations connected in series will deliver 150 amperes at 100,000 volts. This will be a noteworthy development, as for the first time in Europe an operating voltage of 100,000 volts will be reached, and it is claimed that this pressure is not the limit which can be achieved on this system.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Weymouth T.C. has increased the salary of Mr. J. H. Bolam, electrical engineer, to £2[illegible] per annum as from March 31st last, rising by £25 a year to £[illegible].

The L[illegible] T.C. has increased the salary of Mr. W. H. Cooke, electrical engineer, from £350 to £400 per annum.

The Llandilo T.C. has appointed Mr. Bowen, of Llandilo, as electrical engineer.

We understand that Mr. Barnard, the electrical engineer of Walsall, who has been ill for over a month, is now making satisfactory progress towards recovery.

The Bristol Electrical Committee has recommended the appointment of Mr. A. E. Wilson, the present distributing superintendent, as deputy city electrical engineer, at a salary of £300 per annum, rising by £25 a year to £400.

Mr. W. B. Morgan, station superintendent at Avonbank, Bristol, has resigned, and is proceeding to take up an appointment at Dawson City.

Tramway Officials.—The staff and employés of the Huddersfield Tramways have presented a Sheraton inlaid timepiece to Mr. Frank Smith, station engineer, on his marriage.

General.—Prof. S. P. Thompson, D.Sc., F.R.S., has consented to become the first president of the Illuminating Engineering Society.

Mr. J. H. R[illegible], who wrote the interesting "Notes on Life in Western Australia" which appeared in our last issue, and which were based upon his 1[illegible] years' experience of that part of the world—4½ years being spent as electrical engineer on the Lake View Consols—is now staying in London for a short time. He will go abroad again as soon as he has fixed up an appointment.

In July last a complimentary smoking concert was held at Wellington, New Zealand, in honour of Mr. J. K. Logan, I.S.O., to congratulate him upon the honour conferred upon him by His Majesty the King, in appointing him a Companion of the Imperial Service Order, nearly 150 officers of the Telegraph and Postal Service being present, with Mr. Hutton, the chief Postmaster, in the chair. The toast, "Our Guest" was proposed by Mr. T. Buckley, Electrician, who referred to Mr. Logan's experiences in the early days of New Zealand telegraphy, and his guidance in keeping the Department up-to-date as telegraphic science advanced. Mr. Logan has had to do with almost every extension of the telegraph lines in the Dominion, and for 17 years he has filled the office of Superintendent of Electric Lines. In responding, Mr. Logan said that he was connected with the Department in the early days, having arrived in Dunedin in 1864, and he proceeded to relate some very interesting reminiscences of his connection with telegraph and telephone construction and development in New Zealand from that date down to last year, when there were 1,763 offices—295 telegraph and 1,468 telephone—in operation. He regarded the distinction now conferred upon him as a compliment to the Post and Telegraph Department.

NEW COMPANIES REGISTERED.

National Electric Signs Co., Ltd. (7,267).—This company was registered in Edinburgh on September [illegible], with a capital of £[illegible]00 in £1 shares, to acquire the rights to erect and use in Great Britain the German invention "Universal Licht-Reklame," and to carry on in the United Kingdom or elsewhere the business of general advertisers and contractors. The subscribers (with 25 shares each) are:—F. Lead, 73, Robertson Street, Glasgow, iron merchant; J. Barr, 67, [illegible] Street, Glasgow, [illegible] expert; D. Graham, 1[illegible], Hope Street, Glasgow, house factor; J. Mackenzie, 67, West End Park Street, Glasgow, electrical engineer; J. Stewart, 67, Cadder Street, Pollokshields, engineer; A. Braithwaite, 67, Hope Street, Glasgow, clerk; J. P. [illegible], 118, Bath Street, Glasgow, writer. The number of directors is not to be less than three or more than five; the first are F. Lead, J. Barr and D. Graham; qualification, £25; remuneration as fixed by the company. Registered office, 112, Bath Street, Glasgow.

International Filaments, Ltd. (104,923).—This company was registered on September 11th, with a capital of £[illegible] in £1 shares, to acquire from Sir John W. Ott[illegible], C. F. Call, H. Reynolds, J. Metcalfe, W. Stewart and M. Gregory, foreign and colonial rights and secret processes and inventions relating to the manufacture of metal filament and electric incandescent lamps, and to carry on the business of electric, telegraph, telephone, mechanical and consulting engineers, manufacturers of and dealers in electric incandescent lamps and filaments, &c. The subscribers (with one share each) are:—A. C. Vincent, 34-6, Gresham Street, E.C., incorporated accountant; R. C. J. Goodrich, 34-6, Gresham Street, E.C., chartered accountant; C. S. Eaton, 34-6, Gresham Street, E.C., clerk; A. J. Needham, 8, Midland Terrace, Cricklewood, N.W., clerk. Private company. The number of directors is not to be less than two or more than five: the first are W. Stewart and J. Metcalfe; qualification, 100 shares; remuneration as fixed by the company. Registered office, 34-6, Gresham Street, E.C.

Electrical Trolley Head Co., Ltd. (104,886).—This company was registered on September [illegible], with a capital of £6,000 in £1 shares, to adopt an agreement with J. T. Cherry and E. H. Clive for the acquisition of certain patents, and to carry on the business of electrical engineers, manufacturers of, and dealers in electrical trolley heads, &c. The subscribers are:—L. James, 7, Argaum Villas, Devonport, accountant, 10 shares; S. J. M. Hocking, 103, Fore Street, Devonport, confectioner, 1 share; S. J. Harris, 4, Alma Place, Plymouth, jeweller, 1 share; S. G. Pearce, 28, Caroline Place, Stonehouse, Devon, engineer, [illegible] shares; S. Sampson, Waterloo Street, Plymouth, grocer, 1 share; E. Browning, North Hill Pharmacy, Plymouth, chemist, 1 share; T. Lloyd, Westbury House, Beacon Road, Emsworth, Hants., 1 share. Minimum cash subscription 1,000 shares. The number of directors is not to be less than two or more than seven; the first are S. J. Harris and J. Griffin; qualification, 10 ordinary shares.

Dioptric Sign Co., Ltd. (104,860).—This company was registered on September 6th, with a capital of £1,000 in £1 shares ([illegible] cumulative preferred, 5[illegible]0 ordinary, 250 deferred), to acquire from E. L. Warren the benefit of certain existing inventions relating to an improved sign, to develop and turn to account the same, and to carry on the business of electrical engineers, metal workers, shop fitters, gas fitters, &c. The subscribers are:—A. H. Chalmers, 5, Fenwick Street, Liverpool, chartered accountant, 25 shares; A. G. Bigley, 54, Ferndale Road, Sefton Park, Liverpool, book keeper, 10 shares; J. W. Towers, Widnes, Lancs., chemical manufacturer, 50 shares; J. O. Rhodes, 139, Duke Street, Liverpool, electrical engineer, 15 shares; Turner & Dunnett, 10, Fenwick Street, Liverpool, printers and stationers, 150 shares. Private company. The first directors are not named. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

R. Lascelles & Co., Ltd. (104,853).—This company was registered on September 4th, with a capital of £1,000 in £1 shares, to adopt an agreement with R. Lascelles and to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in electric, magnetic, [illegible] and other apparatus, &c. The subscribers (with one share each) are:—T. F[illegible]g, South [illegible], [illegible], engineer; A. F. Kemp, 7, [illegible] Street, Oxford Street, W., engineer; A. H. [illegible], Harlow, Essex, engineer; R. Lascelles, 55, [illegible] Road, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are R. Lascelles and T. F[illegible]g; qualification, one share; remuneration as fixed by the company. Registered by S[illegible], Ca[illegible] & Co., 9, Southampton Street, Bloomsbury Square, W.C.

OFFICIAL OF RETURNS ELECTRICAL COMPANIES.

Underground Electric Railways Co. of London, Ltd. (7[illegible]6).—Particulars of £1,000,000 [illegible] created August [illegible], 1909, and [illegible] filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, [illegible]. Property charged: Generating station at [illegible], [illegible] certain [illegible], &c. Trustees: J. Tr[illegible], H. Coc[illegible] and J. A. D[illegible].

"Z" Electric Lamp Manufacturing Co., Ltd. ([illegible]794).—Particulars of £[illegible] debentures created August 1[illegible], 1909, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, [illegible]. Property charged: [illegible] undertaking and property, present and future, [illegible] capital. No trustees.

Lenel Wireless Syndicate, Ltd. (101,[illegible]).—Charge dated August [illegible], 1909, to secure £[illegible], [illegible] on [illegible] [illegible]. Holders: [illegible].

Electrolytic Alkali Co., Ltd. (64,3[illegible]).—Issue on August 16th [illegible].

Lodge-Muirhead Wireless and General Telegraphing Syndicate, Ltd. [illegible].

Church Stretton Electric Supply Co., Ltd. ([illegible]857).—Charge dated [illegible], 1909, [illegible]. Property charged: [illegible], London.

British Aluminium Co., Ltd. (4[illegible]).—[illegible] dated August [illegible], 1909, to secure £[illegible] [illegible] dated June 17th, 1909. Property charged: [illegible] undertaking and property, present and future, including uncalled capital. Holders: [illegible], Bell & Co., 1, London Wall Buildings, E.C.; and W. Morrison, H. Morrison and J. A. Morrison, 53, Coleman Street, E.C.

Regent Electric Co., Ltd. (100,189).—Particulars of £100 debentures created August 20th, 1909, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £75. Property charged: The company's property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Dumbarton Burgh and County Tramways.

At the annual meeting, Major Heaton Ellis, in moving the adoption of the report (see Electrical Review, September 3rd, page 390), pointed out that this was the first complete year of the company's operations, and that the total revenue amounted to £19,495. This was particularly gratifying in view of the fact that during a considerable part of the year the weather was very disappointing. The proceeds of the issue of the debenture stock had been sufficient to meet the balance of the construction contract, and the whole capital expenditure had not exceeded what the directors originally estimated for; in fact, there was a balance in capital account to their credit. Turning to the trade conditions, he said they could hardly expect to experience a more depressed state than that which prevailed during the past year, but he hoped, and was led to believe, that the depression which had been so marked during the last year was gradually lifting, and that the trade on the Clyde, and in the district served by the tramways, appeared to be improving. Their system would, of course, benefit substantially with improved trade and the consequent development of the route. Meantime it was a matter of satisfaction to know that in a period when trade was stagnant and weather conditions were unfavourable they were able, after providing for interest on debenture stock and the full dividend on the preference shares, to carry forward the substantial sum of £3,000. The report was adopted.

Poole and District Electric Traction Co., Ltd.

The report of the liquidators states (according to the *Financier*) that the liquidation of the company was commenced in July, 1905, but owing to the delay occasioned by the litigation with the Bournemouth Corporation, full particulars of which have been from time to time given to the shareholders, the liquidators have been unable until this date to convene the final meeting. The total proceeds from the realisation of the assets amount to £137,880, and the disbursements to £136,000, which latter amount makes, with the final distribution of £3 3s. per share, a total return to the shareholders of £19 3s. in respect of each £10 share held by them. The balance, amounting to £1,280, has been retained by the Board of Trade. Of this amount, £30 is to meet outstanding dividend warrants, and £1,250 is reserved as remuneration of the liquidators, including office accommodation and services provided by the British Electric Traction Co. during the four years over which the liquidation has extended, and also a contingent claim of £158 for legal costs. Resolutions will be submitted at the meeting to authorise the payment of £1,250 to the liquidators, and to authorise the liquidators to hand the books and papers of the company to the British Electric Traction Co. to be dealt with as that company in its discretion may decide.

British Thomson-Houston Co., Ltd.

The fourteenth ordinary general meeting of the shareholders of the above company was held on Tuesday at the offices, 83, Cannon Street, Mr. G. Franklin presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, September 10th, page 427), said that the directors had taken the somewhat unusual course in industrial companies in making their report a pretty full one, dealing with the various branches of the company's business, and the accounts showed the results which had been arrived at by the year's trading. He therefore did not propose to enlarge upon the report or accounts, unless any shareholder desired to ask for any information.

Mr. H. C. Levis seconded the motion, and the report was adopted without discussion.

Continental.—Russia.—The Russische Gesellschaft Schuckert & Co., of St. Petersburg, reports a net profit of 102,742 roubles for the last financial year. A dividend of 3 per cent. is being declared, the same as for the preceding 12 months.

Belgium.—A new company has recently been formed in Brussels with a capital of £11,[illegible]00 and the title La Société Industrielle [illegible] Belge.

La Société Belge des Lampes Électriques, of Ixelles, is increasing its capital to £[illegible]0,400.

James Keith & Blackman Co., Ltd.—A dividend of 5 per cent. (1s. 1[illegible]d. per share), on the preference shares is announced for the year, with £2,[illegible]01 carried forward.

Shawinigan Water and Power Co.—A dividend of 1 per cent. for the quarter to 30th inst. is announced.

MARKET QUOTATIONS.

Wednesday, September 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon	„	£12	..
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	1/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
„ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £136	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	¼d. dec.
c „ Tube (brazed)	„	8d.	⅛d. dec.
c „ „ (solid drawn)	„	7d.	⅛d dec.
c „ Wire, basis	„	6½d.	¼d. dec.
c Copper Tubes (brazed)	„	8⅝d.	⅛d. dec.
c „ „ (solid drawn	„	8⅝d.	⅛d. dec.
g „ Bars (best selected)	per ton	£71	£1 dec.
g „ Sheet	„	£71	£1 dec.
g „ Rod	„	£71	£1 dec.
e „ (Electrolytic) Bars	„	£60 10	£1 dec.
e „ „ Sheets	„	£77	£1 dec.
e „ „ Rod	„	£65 10	10/- dec.
e „ „ H.C. Wire	per lb.	7⅞d.	⅛d. dec.
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	8/5	3d. inc.
j Iron Pig (Cleveland warrants)	per ton	51/-	4½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 to £13 2 6	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 7 6	2/6 inc.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1½	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	105/-	variable.
e Silicium Bronze Wire	per lb.	9d.	¼d. dec.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£134 10 to £135 10	£2 10 dec.
n „ Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals:—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare,
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Dundee and Broughty Ferry Tramway Co., Ltd.—At the annual meeting of this company, ex-Provost Brownlee, in moving the adoption of the report, said the drawings had increased by £170, and the working expenses were £70 down. Their line was very much a fair-weather line, and it was some consolation to know that last year was not a very favourable one for their business. While the directors had resolved to pay the usual dividend on the preference shares, they did not see their way clear to pay a dividend on the ordinary shares. When the time came, they must be prepared to reconstruct the permanent way out of revenue. The report was adopted.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the past half-year.

Winnipeg Electric Railway Co.—A dividend of 2½ per cent. for the quarter ending 30th inst is announced.

STOCKS AND SHARES.

Tuesday Afternoon,

The process of revivifying business is always a slow affair, and it must be confessed that the present September has lived up to its usual reputation in this respect. High-class securities are just a trifle scared by the prospect of money becoming slightly dearer as the autumn advances, and the crop requirements of the world require to be financed. There is, however, no danger of money getting dear for some time to come.

The death of the well-known American railroad magnate, Mr. P. H. Harriman, which caused a mild sensation in financial circles, has acted upon electrical markets only to the extent of strengthening some of the cable companies' shares.

There are intermittent sparkles of activity in the Home Railway market, but they seldom last for more than an hour at a time—if for so long as that. The Board of Trade Returns for August indicate that the recovery in trade continues, but this factor goes for little in the Railway department, when prices are, as Lord Rosebery might truly say, in the melting-pot. Central Londons are amongst the firmest of the electrical issues. Great Northern, Piccadilly and Brompton Preference rose to 8¼ the other day—a movement all the more noticeable on that occasion from being the only exception to a dismal list of declines in other Home Rails.

Baker Street and Waterloo can no longer be bought at par. Charing Cross, Euston and Hampstead Debenture has primed up to 95, and Great Northern Debenture is steady at 97.

Underground Electric Railway of London descriptions are moving rather irregularly. Business in the Income bonds was marked at 36 the other day. The 5 per cent. prior lien bonds are 103; the 4½ per cents. at 89, with three months' interest accrued, can be picked up to pay a trifle over 5 per cent. on the money.

News from Mexico is of a conflicting character, and it is very difficult to sift the contradictory evidence, to understand whether the country is really prospering or whether it is but the hot-bed of revolutionary reaction whose early outbreak is inevitable. Prices of the Mexican traction and power varieties are, however, well maintained on the whole, moving within narrower margins than the market has of late been accustomed to. Mexico Trams are nearly 130, and the Power Company's Common shares stand about 72. Monterey Debenture holds its improvement at 90. Of the others in the same group, but outside Mexico, business in Rio Trams is being done on the basis of 90½ to 92½, while Sao Paulo's keep about 148½. There is not much change in the Anglo-Argentine Tramways or the British Columbia Electric Railway issues. There was an eager rush of proprietors in the latter concern to secure the new stocks just offered.

British Electric Traction Ordinary shares, it is of interest to notice, marked 13s. 9d. at the end of last week, and on the same day London United Preference changed hands at 50s. More London United shares could doubtless be bought at the same price.

The traffic accruing to the Anglo-American Cable Companies is declared to be the heaviest which those undertakings have enjoyed for several years, and the various stocks and shares are in demand. Of these, the 6 per cent. Preferred stock of the Anglo-American Telegraph Company looks reasonably attractive at 104¼. Dividends are payable quarterly; there is one due at the end of this month. Barring unexpected accidents, the full dividend looks safe for, at any rate, a year or two; and with the Deferred in the ranks of the popular gambling-counters at the present time, the Preferred might easily improve several points.

Eastern and Western Telegraph stocks and shares are firm. The Globe Company has declared its usual quarterly interim dividends.

Marconi shares gained another small fraction upon consideration of the Government being about to take over ship-to-shore stations. United River Plate Telephones are firm, but Monte Video Telephones can be bought at 15s. National Telephone Deferred is changing hands fairly freely in the neighbourhood of 122.

Electric Lighting shares are steady as featureless. Manufacturing issues are decidedly firm, and those of the armament companies have advanced substantially. The little rubber market has fresh prospectuses thrust upon it several days a week, and, in spite of all the criticisms directed at the prospects when competition shall have reduced the price of rubber to more normal values, quotations of the better-known shares are mostly strong.

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from September 17th to 30th, 1909, (both days inclusive) for preparation of warrants for interest at the rate of 4½ per cent. per annum, payable October 1st, 1909, for the half-year ended that date.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Sept. 7th.	Closing Quotations Sept. 14th.	Business done week ended Sept. 14th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —146	145 —147	..	..	..	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	60½ — 62½	61 — 63	..	..	+ ⅛	5 2 8
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	103¾—104¾	104 —106	104½	103¾	+ ½	5 14 9
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	20⅜ — 20⅞	21¼ — 21½	21 9/16	20⅞	+ ⅜	1 17 3
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103½—105½	101 —103	..	..	—2½	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	91¼	..	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼ — 9	8½ — 9¼	..	..	+ ¼	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅜	3 — 3½	..	..	+ ⅛	5 11 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ — 8⅞	8⅛ — 8⅝	..	..	— ⅛	5 15 11
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	2 4 3
60,710*l*	Direct United States Cable	20	4¼%	4⅜%	4¼%	4¼%	13 — 13½	13 — 13½	13⅛	13	..	6 5 11
48,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	128 —131	129 —132	130½	129½	..	5 6 10
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	81½ — 86½	84½ — 86½	86¼	83¼	..	4 0 0
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	105¾	105	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ — 12¼	11¾ — 12¼	12⅛	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	103 —104	..	..	..	3 16 11
900,000*l*	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ — 10¾	10¼ — 10¾	10½	10 7/16	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾ — 14¼	13¾ — 14¼	14	..	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	..	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	53	52½	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	83 — 86	84 — 86	..	..	..	4 13 0
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 78	..	..	..	5 2 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	23/32 — 27/32	¾ — ⅞	16/6	16/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16 — 15/16	⅝ — ⅞	12/6	..	— ⅛	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — ⅞	⅝ — ⅞	..	..	— ⅛	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 —107½	107¼	106¾	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121½—123½	121 —123	122	121⅜	— ½	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛ — 10⅞	10⅛ — 10⅞	10 9/16	10½	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ — 10⅞	10⅛ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 7/16 — 5 11/16	..	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	99½	98½	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ — 1½	1 13/32 — 1 15/32	..	..	+ 1/32	5 6 1
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1 5/32 — 1 9/32	..	..	+ 1/32	4 15 3
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	86¾	86⅝	..	4 11 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839*l*	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7¾ — 8¼	..	..	+ ⅛	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —133	131	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6¾ — 7	7	6¾	— ⅛	5 14 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1 3/16 — 1 7/16	1¼ — 1½	28/1½	..	+ ⅛	4 8 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	101 —103	100 —102	..	..	..	3 17 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	...	13¼ — 13¾	13¼ — 13¾	..	..	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	9/16 — 11/16	⅝ — ¾	13/9	11/3	+ 1/16	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 — 8½	8⅜ — 8⅞	8½	8 9/16	+ ⅜	6 15 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000*l*	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Sept. 7th.	Closing Quotations Sept. 14th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝ — 4⅞	4⅝ — 4⅞	96/3	94/4½	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 9/16 — 4 13/16	4 9/16 — 4 13/16	92/6	..	..	5 3 11
978,250	Do. 4 % Deb. Stock	..	..	..	..	4 %	92½ — 93½	92½ — 93½	93¼	92¾	..	4 6 6
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅜ — 4½	4⅝ — 4¾	9 /3	90/-	+ ¼	4 4 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼ — ¾	¼ — ¾	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅝ — 2⅛	1¾ — 2¼	..	..	+ ⅛	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 — 98	96 — 99	..	..	+1	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	147 —152	142 —147	146	143	—5	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	117 —122	114 —119	116¾	114	—3	5 0 1
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	105 —109	108	106	—3½	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	104	..	..	4 5 9
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	9/16 — 15/16	9/16 — 15/16	13/9	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2 — 2½	2 — 2½	..	..	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	85 — 88	84 — 87	86½	85½	—1	5 14 11
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7½ — 7⅞	7¼ — 7⅝	7 9/16	..	— ¼	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6½	6⅛ — 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
304,940*l*	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15
125,000*l*	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅜ — 5	4¾ — 5¼	5⅛	5 1/16	+ ⅛	4 5 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	..	..	..	5 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜ — 11⅛	10⅜ — 11⅛	10⅞	10⅝	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5¾	5⅜ — 5¾	5¼	5⅜	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 — 2⅛	..	..	..	5 17 8
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —108	105 —108	..	..	..	3 14 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3¼%	62 — 64	62 — 64	..	..	..	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	85½	85	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,4[illegible],000	City and South London Railway	Stock	1¾%	2⅛%	2⅛%	1½%	81½ — 82½	81 — 82	..	..	— ½	4 18 9
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	⅝ — 1⅛	⅝ — 1⅛	..	..	..	13 6 8
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

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* Unless otherwise stated, all shares are fully paid. ‡ A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sept. 7th.	Closing Quotations Sept. 14th.	Business done week ended Sept. 14th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅛ — 1 5/16	1⅛ — 1 5/16	..	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1 5/32 — 1 9/32	24/9	..	+ 1/32	4 14 1
271,030	Do. dc. 4½ % Deh. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Duhlin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅜%	4⅜%	2½%	1¼%	⅛ — ⅜	3/16 — 5/16	..	..	..	24 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4⅜%	4⅜%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1 1/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cnm. Pref. ..	10	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cnm. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13¼	12⅝ — 13⅜	..	..	+ ⅛	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	5 5/16	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	105½ —107½	..	..	..	4 3 4
50,000	India-Rnhher, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14¾ — 15½	14¾ — 15½	15¼	..	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅞ — 15/16	¾ — ⅞	..	..	— 3/32	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4¼ — 4¾	..	..	— ⅛	10 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
399,930	Do. do. 50,008 to 100,000	10	8 %	8 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cnm. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅛ — 2⅝	2⅛ — 2⅝	50/-	47/6	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	67 — 70	...	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38 — 38½	37¾ — 38¼	38⅜	37¾	— ¼	1 6 2
2,640,914	Do. Surplns Lands	100	2⅝%	2¾%	2¾%	2¾%	65 —67	65 — 67	65½	65⅜	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	16 — 16½	16 1/16	15⅞	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	..	..	..	..
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	9d.	..	..	Nil
500,000	Do. do. 5 % Cnm. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	15/-	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94 — 96	94 — 96	..	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	128 —131	125 —128	129¼	126¼	—3	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93½ — 95½	90 — 92	94⅞	91½	—3½	5 8 8
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35⅛	34⅞	..	5 0 0
140,000l	Do. 4 % Deh. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Undergronnd Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½ —103½	102½ —103½	103	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	89 — 91	88 — 90	..	..	—1	5 0 0
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	37 — 39	36 — 38	37	36	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Sept. 7th.	Closing Quotations Sept. 14th.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7⅜ — 7⅞	7⅜ — 7⅞	..	..	..	6 7 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ — 8	7½ — 8	..	..	..	4 7 6
336,376	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3⅞ — 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3½ — 4	..	..	— ⅛	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	10½	..	..	5 9 1
40,000	Do. 6 % Com. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2¾ — 3¼	1½ — 2	..	..	—1¼	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10 27/32	10⅝	..	5 9 1
400,000l	Do. do. 4½ % Deh. Stock ..	..	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deh. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84 — 86	84 — 86	..	..	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	98 —101	..	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6½ — 7	6½ — 7	..	..	..	5 14 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5 — 5¼	5 — 5¼	5 1/16	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	94½	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛ — 4⅝	4⅛ — 4⅝	85/-	..	..	5 7 6
76,121	Do. 4½ % Cnm. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000l	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 8 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	83 — 85	80 — 82	82	81	—3	6 1 11
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	8½%	71 — 75	66 — 70	72¾	68	—5	5 0 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	106 —110	100 —104	107	104	—6	6 14 7
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85½ — 87½	82 — 84	86¾	82½	—3½	5 19 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	96 — 99	85/-	..	+1	4 10 4
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4½ — 5	4¾ — 5¼	..	..	+ ¼	4 15 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Rcd.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¾ — 12¾	12 — 13	12¼	12	+ ¼	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	31/32 — 1 3/32	1 — 1⅛	..	..	+ 1/32	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	..	..	..	7 2 10
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	..	..	..	Nil
35,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	57/6	55/-	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	5 16 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	103	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2	1½ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	77 — 81	..	..	..	5 11 1
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	27/32 — 29/32	27/32 — 29/32	..	..	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8½ — 9	8½ — 9	8 17/32	..	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

THE LIGHTING OF A LARGE EXHIBITION HALL.

The accompanying photograph indicates the scheme of electric illumination adopted in connection with the recently completed public exhibition hall in Frankfort. The only hall which approaches this one as regards floor space is the Paris "Grand Palais," and there is room for some improvement in the lighting of the latter, especially in its central portion. The Frankfort hall is 365 ft. long, 220 ft. wide and about 90 ft. high to the cupola. Æsthetic and architectural considerations did not very well permit of arc lamps being suspended by long supports from the roof, and yet, owing to the great height, the use of arc lamps was essential. It was decided, therefore, to suspend a number of powerful lamps near the roof. The number of such lamps was practically fixed by the nature of the roof construction, as each junction in the ironwork formed a convenient natural suspension point, and the lamps thus placed would help to emphasise the main lines of the building.

Twenty flame arcs of about 4,000 C.P. each were, therefore, suspended from the high central elliptical ring, whilst the remaining 96 junction points received enclosed arcs of about 1,600 C.P. each. These arcs give an ample general illumination in the hall, but for use on special occasions something additional, in the nature of an ornamental illumination, was desired, and for this purpose an outline illumination by means of a large number of miniature incandescent lamps was decided upon. Some 20,000 2-C.P. lamps, spaced 5 in. apart, were therefore fixed along the centres of all the main girders, and also along the balustrades of the two galleries, whilst along the lower edges of the galleries rows of ordinary incandescent lamps, with a somewhat greater spacing, were fixed, to help in illuminating the spaces below the galleries.

Electrical Illumination at the Frankfort Exhibition Hall.

The total candle-power of all the lamps installed amounts to about 400,000, and the power used is about 360 KW. For the sake of greater reliability, the arc lamps are supplied from a direct-current central station in the town, whilst the incandescent lamps are connected to the Frankfort alternating supply, generated in a separate station in another quarter of the town.

The trimming of the arcs is carried out from galleries in the roof, the arcs being suspended on arms turning on vertical axes, and thus being readily drawn over the galleries when desired.

The general effect of the combined illumination can be seen from the view, but the pleasing blending of the various colours, which gave rise to many favourable comments, cannot, of course, be reproduced.—*A.E.G. Zeitung*, July, 1909.

SPECIFICATIONS FOR TRUCK PARTS.

We abstract below some of the standard specifications which have been adopted by the Brooklyn Rapid Transit Co. with a view to securing the safest and most suitable equipment, and in order that the policy of complete standardisation may be carried out to the utmost.

Reference should be made to the *Electric Railway Journal* of July 24th for the complete specifications and for drawings of certain parts.

Steel Tires.—The steel tires are of open-hearth or crucible steel, and in general conform to the standards outlined in Bulletin No. 14 of the American Society for Testing Materials. The chemical composition is limited as follows:—Manganese, not to exceed 0·80 per cent.; silicon, not less than 0·25 per cent.; phosphorus, not to exceed 0·05 per cent.; and sulphur, not to exceed 0·05 per cent. All tires must have a tensile strength of not less than 110,000 lb. per square inch, and their elongation in 2 in. must not be less than 10 per cent. All tires must be free from cracks, flaws or other injurious defects, and conform to dimensions ordered.

The steel tires covered by the foregoing are $2\frac{7}{8}$ in. thick. The wheels used under the elevated cars are 36 in. diameter, and carry 9,000 lb. when the car is light. The elevated cars are operated up to a maximum speed of 40 M.P.H. The wheels used for the electric locomotive are 37 in. diameter, carry 14,250 lb., and are run at speeds up to 40 M.P.H.

Steel Castings.—The open-hearth or crucible-steel castings are to conform in general to the standards laid down in Bulletin No. 16, American Society for Testing Materials. In their chemical composition these castings must not have over 0·05 per cent. of phosphorus or over 0·05 per cent. of sulphur. Such castings must have a tensile strength of not less than 60,000 lb. per square inch, an elastic limit of not less than 27,000 lb. per square inch, an elongation of not less than 22 per cent. in 2 in., and a reduction in area of not less than 30 per cent. All castings must be annealed by heating uniformly to about 850° C., or 1,560° F. No castings must be shipped until it is certain that the proper crystallisation has been obtained. This is characterised by a fine granular section, a sample of which must be furnished upon request. Castings must be true to patterns and free from slag, blow-holes, shrinkage cracks and sand. Bearing surfaces must be solid, and no porosity is allowed in positions where the resistance and value of the casting for the purpose intended will be seriously affected.

Wrought-Iron.—The wrought-iron must be free from steel scrap. The physical requirements for both rectangular and round sections are:—Tensile strength per square inch not less than 48,000 lb. rectangular, or 50,000 lb. round; elastic limit per square inch not less than 25,000 lb. rectangular, or 25,000 lb. round; elongation in 8 in. not less than 20 per cent. rectangular, or 25 per cent. round. A reduction of 1,000 lb. per square inch in tensile strength is allowed below the above figures when it is necessary to machine test pieces. Bars are required to bend cold, without signs of fracture or cracking, through 90° to a curve whose radius equals the thickness of the piece. At least one sample in three must bend through 180° without cracking. Bars when nicked evenly and bent back by light blows must show a generally fibrous fracture, free from steel or coarse crystalline spots. Not over 15 per cent. of the fractured surface must be granular. Two test pieces, 20 in. long, are taken for test from each 200 bars or less. All bars must be practically straight, smooth, free from cinder spots, blisters, cracks, slivers, injurious flaws and imperfect edges. Round iron must conform to the limit gauges adopted by the Master Mechanics' Association, and rectangular iron must not vary more than ·03 in. from the size ordered.

Steel Forgings for Driving and Trailer Truck Axles and Armature Shafts.—The specifications for steel forgings for truck axles and armature shafts conform to those of the American Railway Master Mechanics' Association and the American Society for Testing Materials. The material is open-hearth steel with the following chemical limitations:—Phosphorus, not to exceed 0·05 per cent.; sulphur, not to exceed 0·05 per cent.; and manganese, not to exceed 0·60 per cent. The tensile strength must not be less than 80,000 lb. per square inch, the elongation not less than 20 per cent. in 2 in., and the reduction in area not less than 25 per cent.

Composition Castings.—Five different alloys are used for composition castings, as follows:—Journal bearings, check plates and various other bearings are of bearing metal, No. 1 composition; car trimmings, trolley wheels and various power-house castings are of bronze, No. 2 composition; signal bells are of bell metal, No. 3 composition; steam fittings, valves and cocks are of steam metal, No. 4 composition; and miscellaneous castings, motor and control parts are of yellow brass, No. 5 composition.

The analyses of the five compositions are given in Table I:—

Table I.

Composition.	Copper. Per cent.	Tin. Per cent.	Lead. Per cent.	Zinc. Per cent.	Maximum impurities. Per cent
No. 1, Bearing metal ...	77·00	8·00	15·00	—	1·0
No. 2, Bronze	88·40	5·50	2·80	3·30	1·5
No. 3, Bell metal ...	82·00	18·00	—	—	1·5
No. 4, Steam metal ...	85·00	5·00	5·00	5·00	1·0
No. 5, Common brass ...	67·00	—	—	33·00	1·5

Note.—A variation of 10 per cent. is allowed from the specified amounts of tin, lead and zinc.

Mixtures with scrap of the percentages indicated are permitted as shown in Table II:—

Table II.

Composition.	Copper. Per cent.	Tin. Per cent.	Lead. Per cent.	Zinc. Per cent.	Maximum scrap. Per cent.
No. 1, Bearing metal ...	38·50	4·00	7·50	—	50
No. 2, Bronze	62·00	3·80	1·90	2·30	30
No. 3, Bell metal ...	82·00	18·00	—	—	—
No. 4, Steam metal ...	59·50	3·50	3·50	3·50	30
No. 5, Common brass ...	—	—	—	—	100

Note.—All scrap must be of the same composition as the metal for which it is used, and where the amount of scrap, as shown above, cannot be obtained, new metals must be used in proportion.

Inspection must show that the castings are free from segregation, oxidation, dirt, sand, cavities and any other injurious defects.

Cast-steel Gears.—Cast-steel gears are of open-hearth or crucible steel, and must not contain more than 0·05 per cent. of phosphorus or more than 0·05 per cent. of sulphur. The tensile strength must be not less than 70,000 lb. per square inch, the elastic limit not less than 35,000 lb., the elongation in 2 in. not less than 16 per cent. and the reduction in area not less than 25 per cent. All gear castings must be annealed by heating uniformly to about 850° C., or 1,560° F. No castings must be shipped until it is certain that the proper crystallisation has been obtained, this being characterised by a fine grain. The gears must be true to patterns and free from slag, blow-holes or shrinkage cracks. The finished surfaces must be solid, and no porosity will be allowed in the teeth.

Steel Pinions.—All steel pinions are of open-hearth steel of individual billets hammered to size for each pinion. The principal difference from the gear metal is in the use of manganese, which must not exceed 0·6 per cent.; phosphorus and sulphur must not exceed 0·04 per cent. each. The tensile strength of the pinion material must be not less than 80,000 lb. per square inch, the elastic limit per square inch not less than 40,000 lb. per square inch, the elongation in 2 in. not less than 22 per cent. and the reduction in area not less than 35 per cent.

All pinions must be free from seams, cracks or other defects, and must be finished to the exact sizes shown on the plans accompanying the order. The bore must be accurately and smoothly reamed.

Elliptic and Semi-elliptic Springs.—Car springs, whether of the elliptic or semi-elliptic type, are of crucible or open-hearth steel containing the following ingredients:—Carbon, 0·90 to 1·10 per cent.; manganese, 0·25 to 0·50 per cent.; silicon, 0·15 to 0·25 per cent.; phosphorus, not to exceed 0·05 per cent.; and sulphur, not to exceed 0·05 per cent. At least 25 per cent. of each lot of springs is subject to test. The trial consists in applying $1\frac{1}{2}$ times the maximum specified load with the ends of the semi-elliptic springs supported on swinging or roller bearings. When released from $1\frac{1}{2}$ times the maximum specified load, the springs must not be more than $\frac{3}{16}$ in. higher nor more than $\frac{3}{16}$ in. lower than the specified height, and must not take a permanent set when free. The plates must fit closely together at all times, and deflect uniformly under the test loads. The plate must be free from lamination and other defects, and must not vary more than ·03 in. in width nor more than ·02 in. in thickness. The bands must not vary more than $\frac{1}{4}$ in. in length, $\frac{1}{16}$ in. in width or $\frac{1}{32}$ in. in thickness. The distance, centre to centre, must not vary more than $\frac{1}{4}$ in. from drawings.

REVIEWS.

The Law Affecting Engineers. By W. Valentine Ball, M.A. (Cantab.), Barrister-at-Law. London: Constable and Co., Ltd. Price 10s. 6d. net.

This book primarily appeals to practising consulting engineers and the responsible engineering officials of the many large purchasing authorities. It deals with their powers and duties, both as between their employers and contractors, and in the rarer cases where they are called in to act either as expert witnesses or as arbitrators in disputed cases. As an exposition of the law regarding the interpretation of engineering contracts, it should also prove of service to the engineering officials of contracting and manufacturing companies.

The volume may be divided into four sections, namely, Chapters I to V, which deal with the duties, powers and responsibilities of the engineer; Chapters VI to XIX, which are concerned with various aspects of engineering contracts; Chapter XX, which is devoted to arbitration procedure; and the Appendix, which consists of several model forms of general conditions, forms of tender, and sample agreements. Amongst these are the "Model General Conditions" prepared and issued by the Institution of Electrical Engineers, which receive the author's hearty commendation.

In the first section the question who is a consulting engineer calls forth the answer that the term includes all who in an advisory capacity act as the engineering representatives of purchasers of engineering plant or materials. The necessity for a high standard of professional conduct is pointed out, and the suggestions made by the Institution of Civil Engineers in 1902 are detailed. The difficulty of enforcing any such suggestions without the legal powers which are vested in the governing bodies of other learned professions is mentioned.

The question of fees is then considered, and the importance urged of having a clear understanding on the following points—namely, their amount and the times of payment, whether extras are to be considered separately, and what would be the effect on the amount of a total or partial abandonment of the scheme after the plans and specifications had been prepared.

It is urged that all service agreements for periods exceeding one year should be committed to writing and stamped, and, if with a local authority, sealed, otherwise they will be held invalid in the Courts. It is suggested that a solicitor be consulted before such agreements are signed, as there are many points needing careful expression, particularly in regard to date of payments, length of notice to be given or accepted, restrictive covenants binding an employé after leaving an employer's service, and other equally important details.

The question how an engineer should act when summoned as an expert witness is then discussed. The importance is insisted on of making himself perfectly acquainted with the points at issue and of cultivating a clear, distinct manner in the witness box, so as to withstand, without aggression, the cross-examination of the opposing counsel, and to impress the judge with the correctness of his views.

The fact is noted that he is not bound to give a "yes or no" answer when qualifying expressions are necessary.

The fees chargeable for such work are then fully considered.

With regard to liability, it is pointed out that, while he cannot be held liable for losses incurred through his erroneous opinions or errors of judgment, he must display a "reasonable degree of skill" and must be careful to carry out effectually the work of supervision, or he may be held responsible for the consequences. Several instances are mentioned where considerable sums have thus been recovered.

The next section—Chapters VI to XIX—deals with engineering contracts. The need for care in their preparation is insisted on, and the difficulty of rectifying even palpable mistakes after the contracts have been signed is shown. Instances are given where applications to alter "£18 per cwt." to "18s. per cwt.," and "30s. per cwt." to "30s. per ton" have been refused.

A contractor is warned that he must satisfy himself that a scheme for which tenders are invited is practicable, and that he has no redress if events prove that the methods proposed in the specification are unsuitable, and the work has to be carried out in a more expensive manner. He should also be very careful of the use of the words "whole" or "complete" without being sure that all liabilities are covered in the price.

One chapter deals with tenders. That these should be in writing goes without question, verbal tenders being inadmissible in the Courts. The importance of care in choosing the phrasing is insisted on, and it is pointed out that a contractor cannot shield himself from its binding nature by calling it an estimate.

The right of withdrawal is discussed, and the illegality of tenders offering to accept a certain sum less than any competitor is proved from actual cases.

Reference is made to the Public Health Act of 1875, which enacts that not only must a public authority advertise for tenders, but also it must have specifications prepared for works carried out by them. It is shown to be legal for competitors to agree either to refrain altogether from tendering or for one selected party to make a firm offer, the others being knowingly considerably higher.

The duties of a quantity surveyor and the liabilities of his employer are then considered. The custom of the trade in making the builder pay his fees is mentioned, and it is stated that in law a contract holds, although based on erroneous bills of quantities issued with the specification, unless it can be proved that there was an evident intention to defraud.

The next chapter deals with the important question of specifications, and re-states their binding nature after acceptance by the contractor. It is a fundamental principle in law that the contractor fully acquaints himself with all risks, whether mentioned in a specification or not. The author, however, points out that though a specification is not a warranty that work carried out in accordance with its provisions will be satisfactory, it implies that ordinary care has been exercised in its preparation, and gives as an illustration some harbour works, where the plans issued with the specification showed a sunken wall which could be made use of. This did not exist, and heavy expenses were in consequence incurred. The engineer and his employer, not the contractor, were held responsible.

Plans and drawings when referred to in a specification form part of the contract. The need for care in approving contractors' drawings is referred to, and the responsibility of the contractor to complete in accordance with them is insisted upon, as well as the necessity for an engineer to be specially authorised before permitting variations from an approved drawing. Reference is then made to the legal ownership of plans of completed works.

The next chapter relates to extras and alterations. The need for these to be expressly authorised before being carried out is insisted upon. Those who have had any experience with the consideration of the extras claimed at the end of a long contract, know how important it is that orders for extras should be definite both as regards what is to be done, and its amount. It appears that the law is very clear upon the liability of a contractor to complete work he has contracted to do, and it places the onus of obtaining sufficient orders for extra work, as well as of satisfying himself that the engineer has power to authorise it, upon the contractor.

The author then deals with the question of time of completion, the powers of an engineer to grant extensions, and the effect which extra work has upon the original contract date of completion. Engineers' certificates, payments, bonuses and penalties next claim attention. The difference between progress and final certificates is explained, and the legal effect of the issue of the final certificate is discussed; the engineer is reminded that as in issuing this final certificate he is acting in a semi-judicial capacity, he is bound not merely to be very careful how the certificate is worded, but also to hold the scales equally as between employer and contractor.

The author considers it advisable that all decisions of the engineer, including the final certificate, should be open to arbitration.

The prevalent idea that a penalty clause cannot be enforced unless accompanied by a possible bonus clause does not appear to be borne out in law. Indeed, it is pointed out that the Public Health Act of 1875 expressly enacts that "every contract made by Local Authorities must specify the pecuniary penalty to be paid in case the terms of the contract are not fully performed," and it has been decided in the Courts that this provision is mandatory. Here no question of corresponding bonus is mentioned. It is, however, pointed out by the author that the amount of a penalty must have some fair relation to the damage sustained, and he recommends that the description "agreed and liquidated damages" be used instead of the word "penalty."

As an illustration of penalties inflicted for departure from specification, the author cites a case where a penalty of £1,000 was inflicted by the Admiralty because a certain gunboat exceeded the specified weight by a few tons. When, later on, it was found that this was the only satisfactory boat of its class, the money was returned to the contractor as "an act of grace," not as a necessity of law.

Contractors will be specially interested in the next two chapters, which deal with maintenance and sub-contracting. The several forms of maintenance clauses, in some of which the contractor makes himself responsible for all accidents, and even the consequential damages resulting therefrom, while in others he is only responsible for defects due to defective design or workmanship, are discussed, and the contractor is advised to be careful in regard to what he accepts.

The engineer is urged to reserve to himself the power of approving the names of sub-contractors, while it is stated that such approval does not in law release the main contractor from any of his liabilities. Several questions as to the rights of the sub-contractor are discussed by the author, notably, to whom he must look for payment in the event of bankruptcy or insolvency of the main contractor after delivery of the goods, and to what extent he is liable in case of delay on his part to deliver a small but essential part of a large contract.

The functions and powers of an assistant engineer next claim attention, and it is made clear that it is not possible for an engineer to delegate the entire responsibility of supervision to an assistant, however competent.

The last chapter in this section is of particular interest to electrical contractors, as in it questions arising out of the supply of electrical energy and of electrical plant are discussed. For instance, if a supplier contracts to sell power, it must be suitable for the purpose for which it is to be used, if that purpose was known to the supplier when the contract was made, in the absence of special limitations as to what would actually be supplied.

Whether a cut-out and shunt resistance form integral parts of a "complete installation," or whether they can be charged for as extras, and whether "the actual cost of generating electric light" includes any allowance for depreciation of plant, and what are contractors' liabilities in reference to accidents through fire or electric shocks to third persons, are questions which are answered by references to actual legal decisions.

The third section consists of one chapter, in which arbitration procedure is fully treated. It points out the different classes of references, considers the phrasing of the arbitration clause usually inserted in engineering contracts, and gives much useful advice to an engineer chosen to act as arbitrator. It urges care in drafting the award to see that it covers, but does not exceed, the terms of reference, and suggests the advisability of taking legal opinion upon the phrasing used. The conditions upon which a Court of Law will revoke an award are considered, also the question of permissible fees, and the right of the arbitrator to have a lien on his award until the fees are paid.

There are two questions relating to engineering contracts not considered in the present volume, which might with benefit be fully treated in a future edition. One is the effect which beneficial use of part of a plant has upon its acceptance by the purchaser and the completion of the contract, and the other the question of tests, and the liability of a purchaser to take over plant which only in degree—that is, as regards performance guarantees—falls short of specification requirements.

The book deals with a number of subjects of daily interest to engineers and contractors, and while in some points the conclusions arrived at differ from those commonly held and acted on in everyday commercial life, there is no doubt that it will prove a very useful addition to the modern business library.

The Theory and Practice of Electric Wiring. By W. S. Ibbetson, B.Sc., A.M.I.E.E. London: E. and F. N. Spon. Price 5s. net.

The volume before us comprises 366 pp., is divided into 15 chapters, and has an Appendix of tables dealing with conduits and conductors. There are also about 16 pages devoted to City and Guilds' examination questions in wireman's work, 1903-1908, and a fairly comprehensive index to the whole book.

The author puts forward as one of the reasons for this essay into the field of technical literature that "the period has arrived when a wireman should be an electrician, and no doubt in a few years' time there will be few who do not possess certificates of competency, not simply in the jointing of cables but in electrical work generally. It is to further this end that the book has been written." It has also "been the author's aim to make as clear and concise as possible the facts necessary to wiremen, in order to perform their work intelligently and efficiently."

It has often occurred to us that the writing of a preface should be handed over by an author to a competent and friendly reviewer—"It wad frae mony a blunder free us." The result too often is quite out of harmony with the author's expressed aim, and we fear this volume is a case in point. The author of a text-book simply cannot be too careful in the choice of words to express his thoughts so as to render it unnecessary to read any paragraph twice over in order to grasp its meaning. Such lucidity is absent in this case, and this sometimes leads to humorous results.

The book opens with general principles in Chapter I, and these are fairly well treated; the statements made regarding current, pressure or voltage and resistance cannot be called definitions in any sense of the term, but may be sufficient for a wireman's use.

Chapters II, III and IV deal with resistance, measurement of resistance and Ohm's law respectively. This portion is nicely dealt with, and a number of numerical examples are worked out.

Chapter V is given over to the consideration of filament lamps, and is probably the haziest in the book. The fourth line of the chapter, page 63, is marred by an interpolated "and," making the paragraph unintelligible. There are quite a number of slipshod statements in this portion of the book, and only a few instances can be quoted.

On page 65, "their life"—carbon-filament lamps—"is about 1,000 hours, and the efficiency drops 20 per cent. *at the end of this time*"; page 67, dealing with the decrease in resistance of a carbon filament with increasing temperature, we are told that "this makes the lamp very *sensible* to a rise of a few volts pressure when hot." On the same page we learn that high-efficiency (metallised) carbon filaments are obtained "by special treatment in the electric *arc!*" Page 71, tungsten filaments are obtained by "reducing the mass to the *constituency* of putty." Passing over others we find this on page 77: describing the "iron ballast resistance . . . enclosed in a small glass tube" used in the Nernst lamp, we are told that "the tube, *instead of being a vacuum*, is filled with hydrogen gas." Two pages further on, however, the following description may be of interest to the electrical trade: "Tubolite lamps are the ordinary filament lamps encased in long tubes, the sizes being from 1 ft. to 8 ft. 6 in. long. They have reflectors fitted to the back of them . . . ." An ordinary filament lamp 8 ft. 6 in. long is surely an achievement.

Arc lamps form the subject-matter of the succeeding chapter, and its value may be judged from the following: "It is very difficult by aid of diagrams to give a clear conception of the mechanism of arc lamps, but no doubt the reader will have ample opportunity of observing a lamp and should trace the path of the current through one and notice the actions which take place when the lamp is burning." Hence there are no diagrams or illustrations of arc lamp mechanism, and the descriptive paragraphs are often very confused and involved. The last paragraph on p. 92 has no apparent reference to the context, and ought to appear on p. 88.

Page 97—"The golden flame of the flame arc is due to vapours of the calcium fluoride or other calcium salts mixed in the carbons during manufacture to the extent of about 10 per cent., and *which are produced by the heat of the arc.*" There are apparently more things mixed than flame carbons.

In Chapter VII we come to distribution of power, and here there are some good diagrams, but the treatment is far too scrappy, the whole subject being disposed of inside 16 pages. The same remark applies to the following section, where instruments are illustrated and described. The chapter is quite inadequate for a text-book of this nature.

Chapter IX deals with fuses, cut-outs and switches. The relative advantages and disadvantages of lead, tin and copper for fuses are gone into, and a table is given showing the usual length of break allowed for various currents and pressures. Switches are similarly dealt with, and, generally speaking, this section is much better. There are many points, however, which might be improved.

Forty-eight pages forming Chapter X are devoted to systems of wiring, and casing, conduit, B.I.W. twin-wire, and "C.C." concentric systems, are illustrated and described in a fairly satisfactory manner. Regarding the latter system, the author seems to think that the making of the joints is a matter involving a great deal of time, and it may interest him to know that the writer has repeatedly made three-way 7/21½ junctions complete in from 5 to 7 minutes—much less time than is required for an ordinary joint in insulated wire.

The next two chapters dealing with joints, soldering, &c., and insulators and cables, respectively, are quite satisfactory, but in the thirteenth chapter the author is again unlucky. Here he deals with batteries and bells, and adds three or four pages on electric motor connections. Now what connection has a motor with a bell, or what fellowship has a starting switch with a bell-push? We are told that "it is rather difficult to show how motors can be intelligently fitted up without giving a chapter on motor construction." Then why not give such a chapter?

Testing for faults in cables in the next chapter is all ht, but the author describes one highly dangerous way of ng a fault. He suggests earthing the live main, so urn out the earth fault on the other main. In an man's hands this would result not only in burning lt but also all the adjoining neighbourhood.

The final chapter is made up of descriptions and diagrams of the wiring for Lundberg's special switches, electric flashing signs, &c., and is useful enough to the average wireman, who cannot always obtain a catalogue showing such connections.

As far as we are aware, this is the author's first effort in technical literature, and it is because *experientia docet* that we have devoted more space to a criticism of this book than the subject deserves. A reviewer is only human, and it is in no captious fault-finding spirit that we conclude by remarking that practically throughout the volume the author's thoughts seem to have been in a condition similar to that of some wires behind a distribution board, which he graphically describes on page 133 as "being crossed and recrossed in a perfect *mêlée*."

"Further, by these be admonished; of the making of books there is no end, and much study [of them] is a weariness to the flesh."

J. D. M.

THE ENCLOSED ARC, OR THE METAL-FILAMENT LAMP?

By "PAM."

It must often be noticed that although all kinds of apparatus are described and discussed in the electrical Press, arc lamps seem to be quite ignored, and in view of the remarkable improvements which have recently been made, this is all the more surprising.

Perhaps they are most in evidence in "Situations Vacant"—for travellers to sell on commission, &c.

No doubt this is a reflection of the difficulties which manufacturers have in disposing of their goods, and it is a fact that arc lamps want a great deal more selling than the usual run of things; this is especially noticeable in comparison with the business as "played" seven to ten years ago. Then it was a "bed of roses," now—"thorns," and long ones, too.

The chief cause of this is, of course, that good old price leveller—competition—but Osram and its fellow lamps have given arcs a very nasty shock.

Now, what I cannot understand is the apathy of manufacturers and those interested in arc lamps generally. They have enough fighting material at hand to swamp all the adherents of other artificial illuminants, if they could only muster enough energy and intelligence to put things plainly before the general (electrical) public. I am sure that anyone thinking of illuminating must have noticed the claims of metal-filament lamps, high-pressure gas, &c., which are advertised and pushed in such a manner that it is not a matter of looking for information, but rather trying to get away from it. On the other hand, notice the advertisements which generally appear for arc lamps. It is the general rule that nothing is shown but a few illustrations of external appearance of lamps, which convey no meaning at all to the average reader, and I have come across scores of people who think that arc lamps are not as efficient as metal-filament lamps. This is a direct result of the unintelligent advertisements displayed. If the arc lamp people would only give a few details as to what they actually can do as regards candle-power for carbon and watt consumption, as the incandescent lamp people do (both electric and gas), they would be shaping better and doing themselves some good by advertising.

Speaking of the usual lack of figures, I should like to state a case which I came across some time ago. A certain firm sent inquiries to several dealers for flame lamps for shop lighting. The current was specified as 10 amperes, the voltage 200, and the lamps were to run four in series; and tenderers were requested to state the mean hemispherical candle-power of the lamps offered. Now one firm actually gave this as 1,000, and another as 3,000. This, mark you, for an expenditure of only 500 watts, which shows 8 c.p. per watt.

Such ridiculous figures as these are certain to do a lot of harm to everyone concerned, but not least to the firm giving them, as such things are sure to be gone into, if only on account of their sensationalism.

The latest advertisements for metal-filament lamps are stating that these are more economical than enclosed arc lamps, but these claims cannot be substantiated, as will be seen from the figures given below.

Take the case of an ordinary shop, using four lights for either inside or outside lighting, and assume that each lamp is desired to give about 600 C.P., the voltage is 200, current is charged at 5d. per unit, and the lamps will be in use each day from dusk until 9 o'clock, or about 1,000 hours per annum.

If enclosed arc lamps are to be used, a good make can be obtained for £2 10s. each, and I have estimated that 20 per cent. depreciation is generous. As regards trimming, this would only have to be done 10 times per year, and if there is no one on the job who can do it, the local electrician would willingly take this on at, say, 4s. per visit (one hour's work).

In the case of metal-filament lamps, a life of 1,000 hours has been allowed, although 700 to 800 would be nearer the average. The lamps installed would be a good make listed as 700 Hefner C.P. (630 British) consuming 800 watts.

ENCLOSED ARC LAMPS.

	Cost per annum.		
Four lamps complete at £2 10s. each = £10; 20 per cent.	£2	0	0
Trimming and carbon, 10 visits at 4s.	2	0	0
Energy, 600 watts × 1,000 hours × 5d. per B.T.U. ...	12	10	0
	£16	10	0

METAL-FILAMENT LAMPS.

Four lamps, depreciation on lanterns, &c., say, 25s. each	£5	0	0
Energy, 800 watts × 1,000 hours × 5d. per B.T.U. ...	16	13	4
	£21	13	4

This shows a saving of £5 3s. 4d. in favour of enclosed lamps, and the estimates are all generously inclined to the other lamp, and no mention has been made of the possibility of little boys with stones or other unforeseen things occurring, which might ruin a metal-filament lamp in its youth.

Of course, no one needs to be told that flame lamps give five times the light for the same current as an enclosed arc lamp, and that the high cost of carbons is accordingly covered in a few weeks.

The object of the above deductions, besides calling the attention of all interested in lighting to the great misconceptions which are prevalent regarding the humble enclosed arc lamp, is to rouse the vendors from the awful state of lethargy which they seem to be in, in the hope that they will muster their forces of advertisement and argument, to oust the metal-filament and other lamps from the false position which they have attained.

BRITISH TRADE WITH CHINA.

[COMMUNICATED.]

In giving this small collection of words the above title, I would say that nearly all that follows refers to trade with China, but a great many of my remarks might equally apply to British trade with other countries.

I am afraid it is rather an ambitious task for a novice of the pen to try and convince the English engineer and financier that it is high time to drop the policy of "masterly inactivity" of which they seem so proud, and to set to and try to hold the position of commercial superiority which has been ours for so long; that position is slipping from us, or we are slipping from it, at an alarming speed. If once we lose it, we shall never regain it, for there is no real reason why London should be the world's commercial centre.

Before I took up my residence abroad, England to me was the pivot on which the globe revolved; her financial and her technical men, also her merchantmen, were the last words in brightness and energy, and were full of enterprise—I have of course always appreciated that there were other people on the earth, but poor people, and how sorry I was for them because they were not born on our blessed isle.

On my return to London after several years away, I received a horrid shock, and I cannot describe what my feelings were when I found this country labouring under the spell of the most virulent disease that can possibly attack a nation, firm, or man, and which is best described as "swollen head." The swelling was maintained by a false sense of superiority, which once we could fairly claim, but unfortunately for us that day is past, and if I could only impress upon the people of this country that they must give up trying to make extra profit just because they are English, and because the article they are selling has been made or designed by their own fair hands, I should feel I had not lived in vain.

Now take the home manufacturer dealing with an inquiry from abroad—will he give a c.i.f. quotation? No, he will not, unless you are his agent, or you have done business with him before, and as it is impossible at the other side of the globe to obtain freight rates from England, the poor engineer man has to guess the rates, and if he makes a mistake, the loss is his. I will tell you without fear of contradiction that the manufacturer will sometimes give a quotation "*ex* works" or f.o.r. Now, how on earth can a firm, say in China or Japan, or some other far-away spot, guess the freights from a works, say in Birmingham?

If home firms do not want to trade with distant lands, they should state in their advertisements and catalogues "No export trade done," because owing to these absurd methods, the poor people at the other side of the globe often get left, and the business goes elsewhere, generally to Germany or America.

To one just home it is beyond understanding to hear some of the remarks and sentiments expressed by some of the larger engineering manufacturers.

I brought home with me some most valuable details as regards prices, all conveniently tabulated, and the only thanks I got was: "Oh, yes, I see we are much higher, but we do not try to compete with foreign manufacturers." For Heaven's sake, why not? In no country in the world is skilled labour so cheap and efficient, there is no country in the world with such shipping facilities, and iron and coal is here in abundance, and yet it is impossible to compete! It is no earthly use telling a Chinaman or a Japanese that he must pay more money for a certain machine, because it was made in England, and that the firm which made it is a hundred years old. The day for that sort of thing has gone by, because when we could say it, our competitors were in their manufacturing infancy, and had not the capability of competing with us, but now, after assiduously studying our methods and improving on them, they are at least our equals, and in several ways they get ahead of us. They do this, first, because they can obtain financial assistance more easily than we can, and they in their turn assist their foreign agents; secondly, because their Consular services are far superior to our own.

In mentioning the Consular service, I would particularly ask you to note that I do not decry the very able and courteous body of men in that service, but I condemn the present system. I think it would be little short of suicidal if we did not have men of birth and education at the head of the service, but where I think the system is wrong is here. As is well known, at Embassies and Legations in any country there is a Commercial Attaché. It is his duty to look after commercial enterprise for his country, but if anyone expects one man to efficiently guard the interests of his country in an empire the size of China, he had better be put in an asylum. In China we have a commercial Attaché of great capability and energy, and one who, if an English firm applies for information, gives all that is asked for, and sometimes even more—the gentleman I refer to is Sir Alexander Hosie. Now I would suggest that the commercial branch of the Consular Service should be improved somehow on the following lines. We should appoint one commercial Attaché as at present, but give him a large staff of assistants, placing one at each Consulate, these assistants to be taken from business life, not from college just after passing their examinations; let them be engaged from the service of firms in the country they are to work in, so as to be certain of their knowing local conditions.

I can think of nothing more foolish than sending out a youngster who is fresh from college, and who has no commercial experience, to get in touch with the people and conditions and to report on possible business.

Since I have been home I have preached often and volubly against the deadly apathy or sleeping sickness which hangs over us, and I am glad to see letters in the *Times*, leaders in the *Observer*, and occasional notes in the *Pall Mall Gazette*, all in the same tone, pointing to lack of interest shown in this country as to the vast importance of the China trade.

On Saturday, August 28th, the *Times* said: "British commercial preponderancy is still an asset of immense value which deserves the support of more consistent and determined policy than this country has of late years maintained in China."

The *Observer*, of August 29th, growls because the Americans insisted on participating in the Hankow-Canton railway loan, and infers that they are poaching on our preserves. To get at the truth of this matter, I do not think we have to look further than H. E. Tong Shao-Yi's visit to Washington this year to thank the U.S.A. for returning the Boxer Indemnity, and it is my firm belief that this move was suggested then. When one looks over the history of the relations of the last two years between China and the U.S.A., one will see very good reasons why China should turn to America for support.

We must take many things into consideration, one of the most important being the encouragement given by the U.S.A. to China to send students over to the American Colleges. *We give no special facilities.* The return of the Boxer Indemnity, the two visits of such an important man as Mr. Taft, one with Miss Roosevelt, and one at the eve of his election as President of the U.S.A., were far-sighted moves. We have sent no man of special fame or importance! Last, but in no way least, the vapourings of the American Press about raising the Legations at Peking to rank of Embassies, and wild suggestions of an American-Chinese Alliance, have to be remembered. These last two points, though not being looked upon with any interest by the intelligent reader or student of International affairs, would be contemplated by the Chinese with great pride and pleasure.

In what I am about to say I do not wish to appear to run down the Chinese in any way, but how could China rank as a recognised power yet, and what could she give America in return for an alliance? I am fully convinced that the United States is at present in far higher favour in Chinese eyes than any other nation.

To conclude, I would say that if our manufacturers wish to continue to do business in the Far East, they must give more support to the people who act for them, or they will find that the Englishman abroad will turn aside and take up dealing with foreign firms; that would be quite an easy thing for him to do.

I suppose my firm receives 50 letters from the Continent and America to one from England suggesting business relations.

Our firms must give c.i.f. quotations when asked for; they must improve their catalogues; they must not say, when approached to reduce their price to get business, "that it is their standard machine, with their name on it," and "it is the best on the market, and they have made it for 50 years, and have always had the price asked, and if the prospective purchaser does not like it, he need not buy it," as to have such things written and said to one, makes one just a bit annoyed.

The next point I take does not apply so much to the electrical branch of the engineering trade as to the mechanical.

On the question of quality I wish to impress upon Britishers that it is not necessary to quote us in the East for material made to comply with the B. of T. or to the British Standard specifications; these do not come into force at all unless specially asked for.

We in the East want good, but not extravagant, stuff; we want to be able to rely on it, and be certain of the wheels turning round, but we do not want it to last 1,000 years. I will give the best instance I can. In early June this year I received an invitation to be present at the opening of a new railway near Canton, which had been built and financed entirely by Chinese. Well, I went, and found the rails too light, the rolling stock of a cheap and nasty variety, and the locomotives remindful of an asthmatical pug with iron wheels. On being asked by the chief engineer my opinion of the line, I told him he had got the most beautiful collection of mechanical trash that I had ever seen. His reply was, that he knew that quite well, but as he was not absolutely certain of the commercial success of the venture, he thought it better to start by being cheap, and improving as he made money.

That is entirely illustrative of the Chinese methods, and if you want the Chinaman's business, you have got to accept some of his ideas.

NOTES ON TRADE ABROAD.

(*Continued from page* 411.)

China.

In the article commencing on the page that precedes this we are enabled to publish some spirited observations regarding the British position in, and attitude toward, the Chinese market. The reader will note the bearing of these criticisms—from one who is on quite familiar ground when expressing them—on the whole of our trade relations with that part of the world. Electrically, as we have already said in these pages, the actual demand in China is small at present; but it is a more than thrice-told tale that those who are "in" at the beginning of a particular development stand a better chance than others, one reason being that they have an important influence in creating, or deciding the character of, the demand that will come later. "Once used, always used," may apply to a popular commodity, but the clause conveys an idea of the kind of thing that happens in a field where the electrical demand, which is sure to come before very many years have passed, will be decided largely by the local circumstances, and partly by the attitude of the Chinese mind after having digested what it has observed in more advanced civilisations, but probably more largely by the electrical engineers and exploiters and traders of England, America or Germany, who make available manufactures which, broadly considered, fit the case as far as it is reasonably possible to foresee it.

Patience and Capital Must Combine.

Those who are anxious to do business in this coming field must understand that if there is any foreign market in which patience is required it is China. There has to be a preparing of soil, a seed-sowing, and a period of waiting, before a harvest of profitable business can be obtained. Here and there a concession may be secured or an order or two booked, but, generally speaking, it is first necessary both to get to know the Chinese character and to get yourself well known. "Preparing the soil" and getting to "know the Chinese character" involve an intimate knowledge of human nature, and of certain weaknesses which are recognised to exist in the Celestial Empire far more generally than they obtain in the United Kingdom. Patience such as we have referred to naturally means that in order to hold on one must have substantial capital at one's back. It is useless to think one can become rooted in China without it.

There is a vast hoarded wealth in China which the owners thereof are not averse to turning over if they have brought to their notice a form of enterprise and investment out of which they are convinced they can make a good thing. Assume, for instance, that it is desired to construct a railway: first, a small section would be laid out on the cheapest possible lines, producing a good profit because of the small capital outlay involved. In this way you have convinced your Chinaman that you have a scheme which will pay handsomely, and then he will enter warmly into it, and you can construct a larger and more substantial undertaking. It is very much the same sort of procedure as happened in our own towns and cities when the electric tramway came along. A municipality put down a short section of trolley system, the public hailed it as a boon, the traffic receipts were most gratifying, and very soon many more miles of track were felt to be an absolute necessity.

In Touch with the People.

An American Consular official at Tsingfau, alluding recently to the depression of trade throughout China, remarked that the number of travelling salesmen was gradually decreasing. "Thus American exporters of some lines of goods who covered this territory regularly a year ago, now have no men in the field at all." An amusing illustration of the enlightenment that is coming over the Chinese people as the white population becomes larger is found in their attitude toward patent medicines. It used to be the common method to relieve one pain by causing another, but this practice of the natives has lost its hold in many circles as American and other foreign firms have extensively advertised their patent medicines throughout the Empire with display posters. The paper of the latter is in gaudy colours, gives a picture of the medicine as placed on the market, and, furthermore, has Chinese reading matter. Quite a big and regular business is being done. There is little in common—we will not say nothing—between patent medicines and electrical goods, but the case is worth noting as indicating that prejudice does not prevent the Chinese from embracing a foreign article if they think they are going to gain thereby. We are not sure whether electric body belts and shocking coils have been brought to the relief of the Chinaman. The time may come—who knows?—when some of these artistic metal-filament lamp posters, upon which our firms spend so much ingenuity and striking colour, may, with Chinese inscriptions, adorn the streets of Chinese cities, and by energetic work in an unlimited field sweep out such cobwebby and antiquated household illuminating devices as are now in fashion, and bring in a new era for the lamp-maker at home and the British-equipped (?) central station.

Recognising a Need and Meeting it Early.

Another American Consul reports upon the methods adopted by an American gramaphone firm in catering for Chinese trade and pandering to the peoples' eccentricities. An energetic and experienced representative went out in the summer of 1907, after the agency for his goods had been excellently worked by one of the largest musical goods houses in China. He co-operated with this firm in enlarging the field of operations and they now have agencies in almost every treaty port in China. "The head agency at Shanghai has eight or ten Chinese salesmen continually in the field, and every detail of the trade is being carefully watched. For instance, it was found that the black horn, which was suitable for the home trade, did not appeal to the Chinese eye. The company have now placed bright red and yellow horns on their machines, and they are very popular."

Here again we are not actually on electrical ground, but we see how thoroughly other exporting countries are getting close into touch with some of the needs or fancies of the people. With electrical goods the case may be different, and consequently will call for a variation of the treatment. We may not yet find it worth while to go and sell switches and lamps and electric fans and so on to the millions in China,—either with or without an agreement with the Contractors' Association—seeing that they have not the electric supply at their doors; but there are such things as isolated electric lighting plants, petrol-electric sets perhaps, and equipments and other such lines, that the better classes of Chinese might now be induced to "cotton on to" if we were to lay out the proper organisation to reach them. Perhaps we are looking a little too far ahead, but it is no good overlooking possibilities altogether because we have not yet got evidence that the demand is being catered for.

How a German Electrical Company Succeeded.

Let us see how a Continental electrical firm have succeeded in their efforts to become known in China. An American Consul (W. T. Gracey, of Tsingtan), in reporting on electric light plants in cities there, states that a certain German firm had considerable success during a few months early this year in securing contracts. This firm, whose headquarters are in Berlin, has a branch house in Shanghai, and others in Tsingtan, Hankow, Tientsin and the other large ports of the Far East. A full supply of electric lighting supplies, sample plants, &c., is kept at each branch house, so that intending purchasers are able to see the entire plant in working condition. "This undoubtedly," he says, "is the best way to secure orders for this class of goods, and the success of the method of pushing trade by personal representatives and goods on the spot is shown by this company's recent success."

The light plant installed in Kirin recently was put up and successfully started by this German firm. The plant consists of two boilers by Borsig, supplying steam at 150 lb. pressure to two high-speed compound engines built by W. H. Allen & Sons, Bedford. The engines are coupled direct to 165-KW. alternators supplying three-phase current at 5,000 volts with a periodicity of 50, which is transformed down to 220 volts for consumers, the alternators having been manufactured by the German firm mentioned.

In February the same company also inaugurated the electric light in Soochow, a city of 40,000 inhabitants, and this station is now regularly supplying current to consumers. In this plant there are three Krupp Lancashire boilers, two open-type Schickau engines running at a speed of 250 revolutions, arranged with a jet condenser and air pump worked from the low-pressure crosshead. The engines are coupled direct to German 175-KW. alternators, generating three-phase current at 2,200 volts, the area of distribution being less than in Kirin. Current is transformed down for consumers to 220 volts. The number of lamps being connected is increasing daily. The same German company has also secured the contract for lighting Mukden, Manchuria, a city of 180,000 people, and the initial installation will consist of one 250-B.H.P. Belliss engine and one 350-KW. dynamo.

Future Power of American Finance.

American banking authorities are greatly impressed with the opportunity that exists for industrial growth and expansion in China, and they are, by the establishment of the American Bank in Peking, endeavouring to show that the financial strength and power of the United States is such as to render it unnecessary to look to Europe for capital as they have done up to the present. Mr. Willard D. Straight, the representative of the Bank named, when in this country recently, spoke enthusiastically of the United States becoming regarded as a World Power in financial and other matters in the Far East in railway work, coal and copper mine development, the creation of a mercantile marine, and so on. In efforts of this nature the Government authorities in Washington are lending valuable co-operation. An American Consul, in discussing the ability of the British and Chinese Corporation to handle in an intelligent way commercial matters of any magnitude, and its influence on future railroad construction, remarked: "British capitalists, manufacturers and commercial houses realise that the business of the future in China can best be secured by present efforts and that such efforts should be made here, not with a view to immediate profits so much as with a view to securing a foothold for the future. American manufacturers will work at a disadvantage in their efforts to meet competition in the China trade until American money invested in Chinese enterprises, and American representatives promoting American interests, bear a more equal ratio to the English and German capital and agents engaged in the trade of China."

It is interesting to read such views by our trans-Atlantic friends regarding the strength of the British position, but comforting as it may be, it has to be recognised that in the future we have got to meet a keener competition than has been experienced so far, and weak places in the armour, such as are pointed out on another page by our special contributor, call urgently for our attention.

Railroad Possibilities.

For many years to come, no doubt, the great bulk of the engineering operations in China will be connected with railroad construction and equipment, and American firms interested in these lines are being urged to see to it that American goods are represented by American agents. The Chinese are themselves making progress in the manufacture of railway materials, rolling-stock, &c.; indeed, for some years past rails have been supplied by the rolling mills at Han-yang, and the T'ongshan shops are building passenger and freight cars and other supplies. Railways are contemplated throughout all parts of the empire, connecting the interior with the ports. Chinese merchants subscribed the capital for 134 miles of line from Honan Fu to Tung Kuan at a cost of £1,300,000, and the work is to occupy three years. This line will eventually proceed to Hsian Fu with its population of 1,000,000, which total extension of 800 miles will still leave the terminus less than halfway from Tientsin to the western frontier of the empire. Some idea of the nature of the work involved may be gained from the fact that the principal of three mountain chains *en route* reaches a height of 20,000 ft., and is covered with vast glaciers. The cart road from Hsian to Lanchau is said to cross the range at an elevation of 10,000 ft. The Ministry of Posts and Communications recently memorialised the Chinese throne, proposing great railway extensions in the north-west section, urging that they should be pushed and planned for with all energy, and the memorial has been approved of by the Government, which apparently is fully alive to the enormous importance of establishing communication. The American Minister at Peking states that, besides four or five Government schools now teaching railway engineering, another is to be established at Tientsin. "A rail-making plant is to be erected at T'ai-Yuan-Fu, and every department and district touching the north-west railway is directed to plant 30,000 elm trees, in order to provide ties for the future."

There is little doubt that the Chinese will not be dependent upon the "foreigner" any longer than he can help. Even British and American missionaries report that no sooner have they succeeded in establishing a church than the Chinese, though grateful enough for their pioneering and Western education facilities, are anxious to be left to their own resources and to manage their own affairs. This characteristic will, beyond shadow of a doubt, develop, as time goes on, in other matters, but we hope that there may be many years in which to do a profitable electrical trade before the foreigner can be dispensed with in this department. Chinese students study electrical and other engineering subjects in American colleges, and study American electrical text-books. They occasionally come to colleges in this country and study our text-books. The extent to which they do this kind of thing may go far to affect the kind of electrical system and material employed in China. The point is one to brood over.

We might indulge in all sorts of romancing concerning the multitudinous other developments that follow "in the train" of the railway, but it is a little too superficial for us to enter into a story of what has happened here and in every other country since the railway opened up communication and made a thousand and one kinds of development possible that were not dreamt of before. No doubt, with local variations, history will repeat itself in China.

American Weaknesses in the Chinese Field.

A comparison of American business methods in China with those of European parties is made by American Consul Williams of Chefoo. He says that a great weakness in American trade methods is the custom of placing the business of a large number of trade agencies in the hands of one firm handling everything from seeds to locomotives, the business being carried on in one or two small rooms. "American manufacturers should understand that China has passed the pioneer stage of doing business in the old-time country grocery style. American firms have combined on a machinery agency, and this combination ought to be not only instrumental in giving new life in this line of products, but it may be the possible solution of the best method of selling other American products in China. In this connection the suggestion is offered that while, as a rule, merchants should be willing to receive suggestions from a foreign agent, it is always best that the agent should be a man of tact and patience, who knows how to put himself behind rather than in front in all his dealings with Chinese traders."

Another Consul (in Nagasaki, Japan) reprimands American exporters to the Far East for the injury that they are doing to that trade by bad packing and lack of courtesy. A case is cited of a consignment of articles which arrived in damaged condition owing to their being badly packed. The local business house complained, and for their pains received a rather curt letter, saying that the exporting firm "believed its men knew how to pack goods." Other consignments continued to arrive in the same condition, until ultimately the orders were transferred to a foreign house which was prepared to guarantee the condition of shipments. It is fair to say that some Chinese business has been transferred to London for the same reason. This Consul quotes an article from a Far Eastern paper, in which the following comments appeared :—

> The complaint as to packing is very general against American firms, as is the one that they show little or no interest as to local demands and local requirements in foreign markets. As is a well-known fact, there are varying conditions in all foreign markets, fixed by the consumer, and experience is showing that the man who meets those conditions to a greater extent than his competitors, gets the business. American manufacturers have as a rule shown a fine contempt for this condition, and in many places they have, for no other reason, been nosed out of the business. These are among the reasons that make us welcome the forthcoming visit to the Orient of a large party of American business men. They have much to learn about trade conditions in the Orient, and the best way to do it is to go over the ground personally.

Some idea of the transport difficulties that may have to be met with in certain parts of the great Chinese "continent," owing to the comparative absence of railway communication, may be conjured up by remembering that all materials for the 800-ft. bridge over the Yellow River at Lanchowfu, Province of Kansu, which is nearing completion, had to be conveyed nearly 1,000 miles in carts.

From the Errors of Others let us Profit !

Yet another Consul has been driving it home to the American about his remissness in the Far East. Really, if we read much more, our trans-Atlantic cousins will fall from grace in our estimation of them as exporters. A commercial traveller who has spent 20 years selling American goods in China, the Straits Settlements, Burma and India, after comparing the immediate possibilities in China and India to the advantage of the latter, said that the main trouble in the way of American-made goods was the manufacturers themselves. They did not take a personal interest in finding out what was required, nor did they look carefully after filling orders and packing the goods.

> In other words, the American manufacturer has had too much to do at home to pay much attention to the details and requirements of the Far Eastern and Oriental trade. The result has been that goods have been sent to China and India that ought never to have been sent, and packed in a way to discredit the American exporter and to make it impossible in many cases to get a second order. Add to this the uncertainty of delivery, and a rather discouraging situation is presented. He thought that the United States should have a line of steamships, run on a regular schedule, to India and to points in China, say once in two months. This would ensure certainty of delivery, and at the same time accustom the eastern peoples to the American flag, and keep before them the opportunities of trade with the United States.
>
> He also thought that an exposition warehouse in the large port cities of India would be excellent for the display of American goods suited to the requirements of the country, to be in charge of a capable and trustworthy man with the necessary assistants to "talk" the goods and to take orders. In connection with this continuous exposition would be an advertising bureau, which could keep before merchants and others the American goods on display and the advantages offered to would-be buyers. This plan is not new. In fact, much said by this experienced commercial salesman has been repeatedly set forth in reports, not only from this Consulate but from others. It all goes to emphasise the need of adopting suggestions that proceed from the experience of persons who have occupied this field for years and know what they are talking about.

What an American Consul is Doing to Help.

The American Consul at Amoy has, with commendable enterprise, prepared a printed catalogue of American trade catalogues, business directories and trade journals received at that Consulate in China. He has sent a copy of this index catalogue to each importing firm in that district, together with the following letter, which we print, to support the views expressed on another page concerning the insufficiency of the present British Consular trade representation in China. With American Consuls so active in trade matters in all parts of the Empire, there is a pressing demand for some more far-reaching British trade agent service such as our contributor advocates.

> I beg to inform you that all trade catalogues, business directories and trade journals received at this Consulate from American manufacturers and dealers are properly catalogued and placed in the commercial library of this office. I take the liberty to send you enclosed herewith a complete catalogue of all trade publications at present on file in this library, and cordially to invite you to call at any time during the office hours of this Consulate to consult any of the publications therein enumerated. I shall be pleased indeed

to be of any possible assistance to you in placing you in touch with American manufacturers and dealers, and respectfully request that when such assistance is desired you favour me by availing yourself of my services.

This Amoy Consul (Julean Arnold) has set aside a certain space in the Consulate for the library of American trade publications, and has provided tables and writing materials for the use of those who wish to consult the library.

Traders should Protect Themselves.

Early in the present year a case was before the Mixed Court in Shanghai in which a Chinese shopkeeper was fined for selling a European imitation of an American article which had been sold in China for 20 years. The European article was of inferior quality, and bore the trade mark and boxing of exact pattern and size, with one or two minor changes, so that it was possible only after minute examination to discover the difference. The Chinese who was fined for handling the goods had to give security that he would not sell the bogus brand in future, and all the articles in his possession were confiscated by the police. An American Consul, in reporting the matter for the benefit of traders at home, mentioned it as an illustration of the necessity of having trade marks lawfully registered in all the principal countries in the Far East. "The Court had, of course, no jurisdiction over the European company which manufactured the imitation, but if the American merchant had had his trade-mark registered abroad, he could, no doubt, secure full satisfaction for the infringement, and in all probability the foreign manufacturer would not have attempted to use the trade-mark in this fraudulent manner." The interest in this case is not by any means limited to America, and British firms anxious to secure such protection as the Courts in China are able to afford will profit from the incident and its lesson.

Some Present-day Development.

The manager of a leading American steel company returned to the States last month from a 13 months' trip round the world. The *Wall Street Journal* published a most interesting interview with him, and in the article more space was devoted to China and its wonderful possibilities than to all other parts that he had visited. The Hanyang Iron and Steel Works at Hankow have been manufacturing steel since 1894, and they have a well-equipped works—parts are now undergoing remodelling—producing high-quality steel, and employing 20,000 people. Common able-bodied labourers receive about 7 cents per day, and women about 5 cents per day; boiler-makers earn $7·50 to $10 per month. As was pointed out in the interview, "such prices as these for skilled labour, and a maximum of about 45 cents a week for common labourers at the mines, place the production of steel out of competition with a like product in the States, and it is only a question of time when China will be a large producer of iron and steel." This cheap-labour question is likely to be a deciding factor in handling foreign competition in other departments of industry too—the "Heathen Chinee" has a long way to go in Western Civilization before he will arrive at our Trade Union rates of wages! The Yangtse engineering works now about completing at Hankow commence with 1,000 men and they will build engines, boilers, ships and general machinery. But these new works that have sprung up are only a small beginning. Electrical installations will be needed for the equipment on modern lines of the innumerable works and undertakings that will be started in the next decade or two, and British electrical prestige in that market must not be allowed to suffer. Americans claim that they are so much nearer to the Orient that their goods can arrive there within three weeks, and they urge manufacturers and merchants in the States to take advantage of a splendid opportunity to get into the field early, as "it will be much more difficult to get trade after others have thoroughly established themselves, and the British, French and Germans are not slow to take advantage of such conditions." All such information as this is worthy of study by the Britisher—not to influence him to keep "hands off," because he may imagine that others are so favourably placed that he does not stand a chance, but to guide him as to the importance of a policy of immediate aggression.

It may be thought that we have gone rather more fully into the trade prospects in China than the immediate electrical requirements, as at present understood, justify. It is our belief, however, after what we have heard from the lips of visitors to the Electrical Review offices, and from what we have read on the matter, that those interested in British electrical trade abroad should look closely into the case of China, and we hope that some of them, at any rate, will in some way or other profit from what we have written.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GERMANY (*concluded*).

	Marks per 100 kg.
Insulating coils, bells, and buttons, bobbins, keys, switches, and similar parts of electrical fittings, of earthenware, porcelain, or glass, not combined with other materials, and not admitted as "parts of electro-technical appliances imported in sections":	
White	10
Coloured	20
Insulating appliances (bobbins, safety boxes, tubes, disks, rings, and the like) of asbestos, asbestos paste, mica or micanite, for electro-technical purposes ...	15
Arc lamps	40
Complete cases for arc lamps in combination with glass globes covered with network or not; reflectors, search-lights	20
Electric incandescent lamps	80
Vehicles intended to run on rails:	
In combination with motive machinery, except steam locomotives	10
Without motive machinery:	
Passenger carriages without leather work or upholstery	7·50
Passenger carriages with leather work or upholstery; tramcars for passengers; cars of all kinds for mono-rails	12

In addition to the ordinary tariff rates quoted above, a new law of July 15th, 1909, imposes, as from October 1st, 1909, an internal tax on certain lamps and materials for lighting purposes (so far as they are destined for use in Germany) at the rates shown in the subjoined statement. These duties are applicable both to German made and to imported goods, and, as regards the latter, are leviable in addition to the import duty:—

	Rate of internal tax.
A. Electric incandescent lamps and burners therefor:	Pfennig.
(*a*) Carbon-filament lamps—	Each.
Up to 15 watts	5
Over 15 up to 25 watts	10
" 25 " 60 "	20
" 60 " 100 "	30
" 100 " 200 "	50
And for each 100 watts in excess of 200	25
(*b*) Metal-filament lamps, Nernst lamp burners and other incandescent lamps—	
Up to 15 watts	10
Over 15 up to 25 watts	20
" 25 " 60 "	40
" 60 " 100 "	60
" 100 " 200 "	100
And for each 100 watts in excess of 200	40
B. Mantles for incandescent gas and similar lamps ...	10
C. Carbons (*Brennstifte*) for electric arc lamps—	Per kg.
(1) Of pure carbon	60
(2) Of carbon combined with other materials (*mit Leuchtzusätzen*) and all other carbons	100
D. Burners for mercury-vapour and similar lamps—	Each.
Up to 100 watts	100
Over 100 watts, for each 100 watts in excess	100

The tax is to be paid by the producer of the articles by affixing tax stamps to the packages before the completely packed articles are removed from the factory, &c., where they are made. In the case of imported articles, the tax is to be paid by the importer at the time of clearance through the Customs house.

Articles and materials for lighting which are liable to taxation under the present law may not be removed from the place of manufacture in Germany or imported into Germany from foreign countries, otherwise than in completely closed packages which cannot be opened without leaving recognisable traces. The kind of packing and the permissible size of each package is to be prescribed by the Bundesrat. Particulars of the contents are to be marked on each package—*i.e.*, in the case of electric incandescent lamps, burners therefor, and mercury-vapour and similar lamps, the number and watt-consumption; in the case of mantles, the number; and in the case of carbons for arc lamps, the net weight. In addition, each package must bear an indication of the tariff class under which it is liable to duty, and the designation of the contents (trade mark).

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,826. "Improvements in electric switches." Einar Lundsteen und Aktieselskabet International Elektrisk Trappeautomat. August 30th. (Complete.)

19,834. "Improvements in or connected with telegraph or telephone insulators and the like." H. Lavy. August 30th.

19,914. "Improvements in or connected with electric batteries." G. Fuller. August 31st. (Complete.)

19,974. "Improvements in controllers for electric motors." G. E. Edwards and H. Rogers. September 1st.

20,003. "Improvements in adjustable transformers for polyphase electric alternating currents." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 1st. (Complete.)

20,004. "Improvements in the driving arrangements of looms." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke, G.m.b.H., Germany.) September 1st. (Complete.)

20,005 "Improvements in the regulation of alternating current commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 1st. (Complete.)

20,008. "Improvements in conduits for electric light, telephone and telegraph cables or conductors and the like." A. Watkins. September 1st.

20,010. "Improvements in the manufacture of filaments for incandescence electric lamps." G. T. B. Cobbett, R. de Fazi and F. Grill-Claussen. September 1st.

20,035. "Improvements in and relating to electrical connectors." B. F. Sobotka. September 1st.

20,055. "Improvements in or relating to regulators for storage batteries." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 1st. (Complete.)

20,057. "Improvements in apparatus for electro-plating." S. O. Cowper-Coles. September 1st.

20,105. "Improvements in filling electric joint boxes." C. J. Beaver and E. A. Claremont. September 2nd.

20,106. "Improvements in electric joints." C. J. Beaver and E. A. Claremont. September 2nd.

20,115. "Improvements in and connected with current collectors for electric traction systems." S. P. (Suchostawer Patents) Syndicate, Ltd., and H. M. Sayers. September 2nd. (Complete.)

20,129. "Improvements in and means for the production of long continuous electric arcs." J. Y. Johnson. (Badische Anilin and Soda Fabric, Germany.) September 2nd.

20,175. "Improvements in and connected with the control of series-wound dynamo-electric machines." J. G. P. Thomas. September 3rd.

20,192. "Improvements in processes and apparatus for the electrolytic production of salt solutions." T. Girtin. September 3rd. (Complete.)

20,211. "Improvements relating to telephone transmitters." E. A. Graham. September 3rd. (Complete.)

20,218. "Improvements in electro-magnetic switch mechanism." Otis Elevator Co., Ltd. (Otis Elevator Co., United States.) September 3rd.

20,229. "Improvements in transmitting apparatus for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. September 3rd.

20,230. "Improvements in wireless telegraph transmitters and receivers." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. September 3rd.

20,241. "Improvements in electrical ignition mechanism for internal combustion engines." A. Giraud. (Date applied for under Sec. 91 of the Act, September 3rd, 1908, being date of application in France.) September 3rd. (Complete.)

20,246. "Improvements in and relating to the control of electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 3rd. (Complete.)

20,272. "Azimuth and steering rings for reduced diameter card, magnetic or ships' compasses." H. Brown. September 4th.

20,286. "Elastic electromagnet power-transmitting device, particularly for use with automobiles, locomotives and the like." W. Dmitriew. September 4th. (Complete.)

20,311. "Improvements in arc lamps." A. G. Bloxman. (Gebruder Siemens and Co., Germany.) September 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electrolytic Meters. W. B. Thorpe. 865. January 14th. (Post-dated July 14th, 1908.)

Electrolytic Galvanic Process. C. Bianco. 15,031. July 15th.

Electric Conductors. R. K. Gray. 17,283. August 17th.

Electrical Switches. H. W. Cox. 17,315. August 18th.

Composition Applicable for Use in Electrical Resistances, Fireproof Bodies, and Constructional Work. W. A. Phillips and F. R. Bacon. 17,340. August 18th.

Apparatus for Wireless Telegraphy. G. Marconi and Marconi's Wireless Telegraph Co. 17,505. August 20th.

Electric Heating Apparatus. R. G. Pheysey. 17,687. August 22nd.

Electroliers. R. S. Woods. 19,183. September 12th.

Electrodeposition of Metals. J. J. N. Brachmann. 23,193. October 30th.

Winding and Disposing of the Secondary Circuits of Induction Coils Used with Telephone Apparatus. R. R. Harper. 23,739. November 6th.

Electrodes for Use in Electrolysis. C. C. Connor, J. W. Stubbs and Electrolytic Alkali Co. 23,930. November 9th.

Process of Electroplating Articles of Electrically Non-conductive Material. A. Gerbing. 24,139. November 16th.

Electric Batteries. H. de Martis. 26,285. December 4th. (Post-dated August 17th, 1908.)

Telephone Instruments. D. B. Clarke. 26,315. December 5th.

Electric Ignition Apparatus for Internal-Combustion Engines. A. W. Bird and Thomson Bennett, Ltd. 26,894. December 11th.

Magneto-Electric Ignition Devices for Internal-Combustion and like Engines. R. Wattles. 28,843. December 29th.

Process for Manufacturing Flat Incandescent Filaments for Metallic-Filament Electric Lamps. W. Schaffer. 28,554. December 31st. (Date applied for under International Convention, January 2nd, 1908.)

1909.

Induction Coils for Ignition and other Purposes. E. C. R. Marks. (Chicago Coil Co., United States.) 318. January 6th.

Lampholders for Electric Incandescent Lamps. T. Birchall. 1,673. January 23rd.

Wireless Electric Signalling Devices for Indicating the Relative Positions of Ships. R. Degener-Böning. 2,845. February 4th.

Storage Batteries. C. H. Montgomery, J. B. Young, R. E. Hellyer and R. J. E. Baker. 9,692. April 23rd.

Signalling Apparatus Operated from a Distance. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,240. June 15th.

Bearings of Electricity Meters. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 16,538. July 15th.

Electro-Chemical Industry in Switzerland.—The Electro-chemical industry of Switzerland is making marvellous progress; there are at the present time 22 works established and others under construction, whilst the power utilised is calculated to be 100,000 H.P. During the last year electro-chemical products were exported to the value of £310,000, and the whole of the requirements for home consumption were also manufactured. Nearly £80,000 worth of aluminium was exported, and the other principal items were the nitrates and artificial manures produced in the electrical furnaces which have been built.

The Efficiency of Illuminating Agents.—From a report presented to the German Imperial Cabinet in reference to a proposed tax on electrical energy and gas, the following figures are taken, showing the illuminating value of the different types of electric lamps and gas burners.

In electric lamps one KW.-hour produces—

	Candle-hours.
Ordinary incandescent	330
High-efficiency incandescent	500
Nernst	500
Osram, tungsten, &c.	700 to 1,000
Arc lamps, alternating	800
" " continuous	1,000
" " flame	2,000
Mercury vapour...	1,600
" and quartz tube	3,000

For gas lighting one cubic metre gives—

	Candle-hours.
Incandescent upright	560
" inverted	1,000
High-pressure gas	1,000

Electrical Haulage at the Friedrichshall Potash Mines.—Some detailed information as to the working of these mines is published in *E. K. & B.* for July 24th. The haulage plant is large enough to develop 250 H.P. on the rope, and can lift 75 tons per hour from a depth of 900 metres. At present the working depth is only 500 metres, and the quantity dealt with is far less than the maximum, but, as the following figures show, even under these circumstances some very creditable results have been attained:—

Length of test in hours	12	16	8
Average No. of lifts per hour	9·5	7	18
Total weight raised in tons	219·8	211·4	351·56
Depth (metres)	500	500	500
Average H.P. on the rope	34	24·5	81·5
Average H.P. as a percentage of full load (250 H.P.)	13·6	9·8	32 6
Total KW.-hours used	590	546	818
KW.-hours for H.P.-hours on rope ...	1·45	1·4	1·26
Steam consumption per KW.-hour (lb.)	20·5	20 7	20·0
Steam consumption per H.P.-hour on the rope (lb.)	29 7	29	25

It will be seen that even with a load of only about 10 per cent. of the maximum the consumption is as low as 29 lb. of steam per effective H.P.-hour, and this is but little more than the consumption at one-third load. This point is of special importance in connection with potash mines because of the great variations in output. Even when the actual consumption over a long period is considered, including the non-productive traffic for inspection, &c., the results are only slightly worse, as is shown by the following figures extending over a period of a quarter of a year:—

Total tons raised	24,149
Total working hours	1,431
Average H.P. on the rope	31·2
Average H.P. as a percentage of full load (250 H.P.) ...	12·3
Total KW.-hours used	67,898
Steam consumption per rope H.P.-hour at 20·7 lb. per KW.-hour (lb.)	31·5

THE
ELECTRICAL REVIEW.

Vol. LXV. SEPTEMBER 24, 1909. No. 1,661.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E C.

MUNICIPAL TRACTION.

THE Municipal Tramways Association, which has just held its eighth annual conference in London, may fairly claim to rank as the leading representative body in the British tramway world; and Mr. A. L. C. Fell, as its new President, holding also the important post of chief officer of the L.C.C. Tramways, necessarily speaks with unimpeachable authority on questions relating to tramway problems of the present, while his views on "Tramway Problems of the Future"—the subject of his presidential address—cannot fail to be of interest. That such problems are both numerous and weighty may be readily inferred from the copy of the address before us, though a captious critic would perhaps suggest that the words Past and Present should have been included in the title as well as Future.

The remarkable cessation of activity which descended upon tramway development in the United Kingdom last year calls for comment at the outset of Mr. Fell's address. He regards it as indicating that the rush of construction is over, apparently for good; but is it the fact that we have approached the limit of the possibilities of electric tramway development in this country? When we compare the extent of our systems with those of the United States, for instance, a remarkable contrast is found. The city of Boston alone has a network of tracks of greater aggregate length than those of Glasgow, Manchester and Liverpool combined—our three largest systems outside London—yet the population of Boston is only some 700,000, while that of the three British cities is about two millions. What is the reason of this remarkable difference? Is it due to the fact that the average receipts per passenger in Boston—2½d.—provide a sufficient revenue to cover all outgoings with a good margin, while our standard penny fare—to which the average closely approximates—being less than half the former, keeps the undertakings always within a very narrow margin of profit or loss, and with difficulty provides sufficient allowance for depreciation and renewals? The average dividends on tramway investments have steadily dwindled during the past five years from 4½ to less than 3 per cent., and the average return on the ordinary capital is under 1¾. The falling-off is certainly due in part to the depression in trade, but we strongly suspect that it is in no small degree the result also of excessive lowering of fares or lengthening of stages.

Mr. Fell complains of the burden of cost of paving that is laid upon the tramway authorities, from which their competitors are free. He goes so far, in fact, as to allege that the ratepayers really give a subsidy to omnibus companies so that they may compete with the tramway undertaking, "which, if owned by the municipality, would relieve the rates." We are not aware that the L.C.C. tramways, since they have been taken out of the hands of the companies formerly owning or leasing them, have ever paid a penny to the relief of the rates; nor do we agree that it is the proper aim of municipal undertakings to do so. Apart from this, however, we see no reason why omnibuses and other public carriages should be specially called upon to contribute to the upkeep of the public thoroughfares, while private vehicles go free. The omnibuses are there because the ratepayers still want them, and it will hardly be maintained that they are less entitled to the use of the roads than the private carts and lorries, which constitute the principal factor in the congestion of our roads. Where the tramway traffic is very heavy, the tramway authority establishes a practical monopoly of the portion of the roadway which it has to pave, and intensifies the wheeled traffic upon the rest of the thoroughfare; in such a case it may be argued that the tramway should contribute to the cost of paving. But the tramcars do not wear the paving, and it is difficult to find any justification for the imposition of the paving charges on tramways where the traffic is light or only moderately heavy.

Mr. Fell deplores the not too friendly relations existing between railway and tramway authorities, and advocates friendly co-operation instead of antagonistic competition—a suggestion which is likely to call forth sardonic comments on the part of the railway authorities. "Our motto," he says, "as far as railways are concerned, should be co-operation not competition." Alas! that we should fall so very far short of our ideal! It is significant, however, that the President expressly excludes the London tube railways from his definition of railway companies. He recommends the latter to devote their attention to the long-distance suburban passenger, and to leave the local traffic to the tramways, which on the average give a journey of nearly 2 miles for 1d.—too cheap, as we have said before.

Amongst other matters touched upon by Mr. Fell were rail-less trolley systems, regarding the value of which he was somewhat dubious; the reports of the Special Committees on Brakes, which, through their want of co-ordination, have had no material outcome; the concessions secured by the Income-tax Sub-Committee; the forthcoming incorporation of the Association; the value of standardisation, in connection with which he advocated the use of the "seat-mile" instead of car-mile in comparisons; through running; trailer cars, which Mr. Fell approves of, and is about to adopt experimentally; conditions of labour, which are complicated in London by the heavy drop of traffic during the middle of the day; conciliation boards, which have been organised in connection with the L.C.C. undertakings; steel-tired wheels, which have been almost universally adopted since Mr. Fell, in 1902, urged their use, in the face of strong opposition; and halfpenny fares. Regarding the last, Mr. Fell unreservedly condemns the system in connection with small tramways, but considers halfpenny fares justifiable in large cities, provided that the stages are kept short.

In conclusion, the President predicts that 20 years hence motor-omnibuses will only be found in museums; all local traffic will be in the hands of the tramways, and the railways will deal only with long-distance traffic; corrugation and other present troubles may be things of the past, but a fresh crop of troubles will have arisen for the Association to overcome.

Buying Coal for what it is Worth.

The Electrical Review has called attention from time to time to the desirability of purchasing steam coal by the B.TH.U., and the practice seems to be growing both here and in the United States, although not much information on this and on other equally interesting subjects is made public by our rather secretive engineers. The *Electric Railway Journal*, of July 31st, contained a long article composed of the specification and conditions of contract issued by a large railway.

Several of the more important electric railways have adopted this scientific method of buying coal, and during the present year the United States Government will buy over half-a-million tons on the B.TH.U. basis. The dearer coals from thick seams have a fairly constant heat value, but the more commonly used thin-seam slacks and coals have no such definite value, and it is to level down the variations of these coals to a common basis that heat value specifications are drawn.

The presence of sulphur in excess is likely to cause heavy clinkering, and damage to the boiler plates or tubes, so the United States Government sets a limit to the sulphur contents, and may reject any delivery in which this limit is exceeded.

For anthracite this limit is 1 per cent., and for bituminous from 1·5 to 3 per cent. Other buyers prefer to exact penalties, which increase at a higher rate than the increase of sulphur. On the other hand, it is not usual to offer premiums for sulphur contents below the maximum.

The percentage of ash is of the utmost importance to the buyer, as it affects directly the thermal efficiency of the coal and boiler. The United States standard for small anthracite is 18 per cent. ash, and an excess of 21 per cent. may cause rejection. Penalties increase at a higher rate than the percentage of ash, but premiums are given at a constant rate.

The percentage of ash in bituminous coal is not an approximate index of the heating value as it is with anthracite, and in the U.S. Government specifications the percentage of ash is used, together with the heat unit content, in comparing tenders. For instance, a coal containing 14,400 B.TH.U. and 8·5 per cent. ash is offered at $4·95 per ton, and a coal containing 14,150 B.TH.U. and 14 per cent. ash is quoted at $4·60.; 2 cents is added to the price of the coal for each 1 per cent. of ash, which, in the example, would increase the cost of the second coal to $4·71. The two coals are now compared on the basis of cost per million units by the formula

$$\frac{1{,}000{,}000 \times \text{price per ton}}{2{,}240 \times \text{B.TH.U.}}.$$

This works out for the first coal at $0·1534, and for the second at $0·1451, thus proving the inferior grade coal the cheapest, so long as it can be fired economically.

It is necessary also to limit the moisture contained in coal, although in some supply stations in Great Britain it is considered wise to damp the coal before firing it. The Third Avenue Railway Co. deducts from the railway scale weights an amount due to all moisture in excess of 1 per cent. with bituminous coal, and 3 per cent. with anthracite, but uses a dry sample for determining the heating value and percentages of ash and sulphur.

In New York, where there are stringent smoke laws, the railway companies set a limit on the volatile constituents of bituminous and anthracite coals, perhaps an easier and cheaper way than buying boilers which will burn the volatile products smokelessly.

Further information on this subject can be gathered from the *Electric Railway Journal* of July 10th, which reported a paper by the general manager of the Eastern Wisconsin Railway and Light Co.

THE MURRAY PHOTO-PRINTING SYSTEM.

This system has been designed to print in Roman type direct from line, using Wheatstone transmitting apparatus and the Morse alphabet.

One of the chief difficulties met with in designing such a system is the extremely short time available for the printing movement. To illustrate this, consider fig. 1, which shows the line currents concerned in sending the two letters A T. At a speed of 100 words per minute, the values of the time intervals are as marked on the diagram. The time intervals are calculated by taking six letters to a word and four dots to a letter.

Consider the spacing interval, equal to three dots, between the two letters. The printing mechanism must not be operated until at least half this interval has expired, since otherwise the apparatus could not distinguish the spaces between the elements of a letter from those between separate letters. Thus only about $\frac{1}{80}$th second is available for the printing movement, and this is far too short to permit any ordinary form of typewriter to be used. It follows that, for high-speed working, some other means of printing must be adopted.

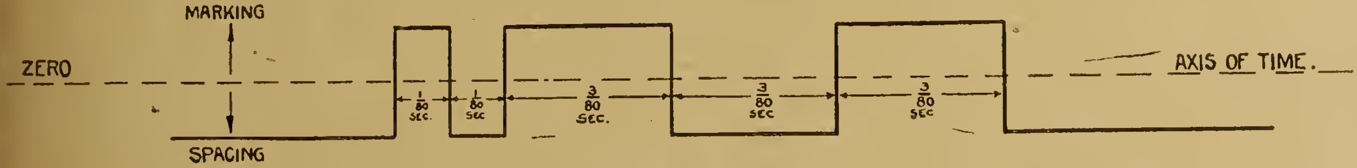

Fig. 1.

In the Murray photo-printer, optical images of the various letters and signs composing a message are successively projected on to a strip of photographic paper, which is afterwards developed and fixed in the usual manner.

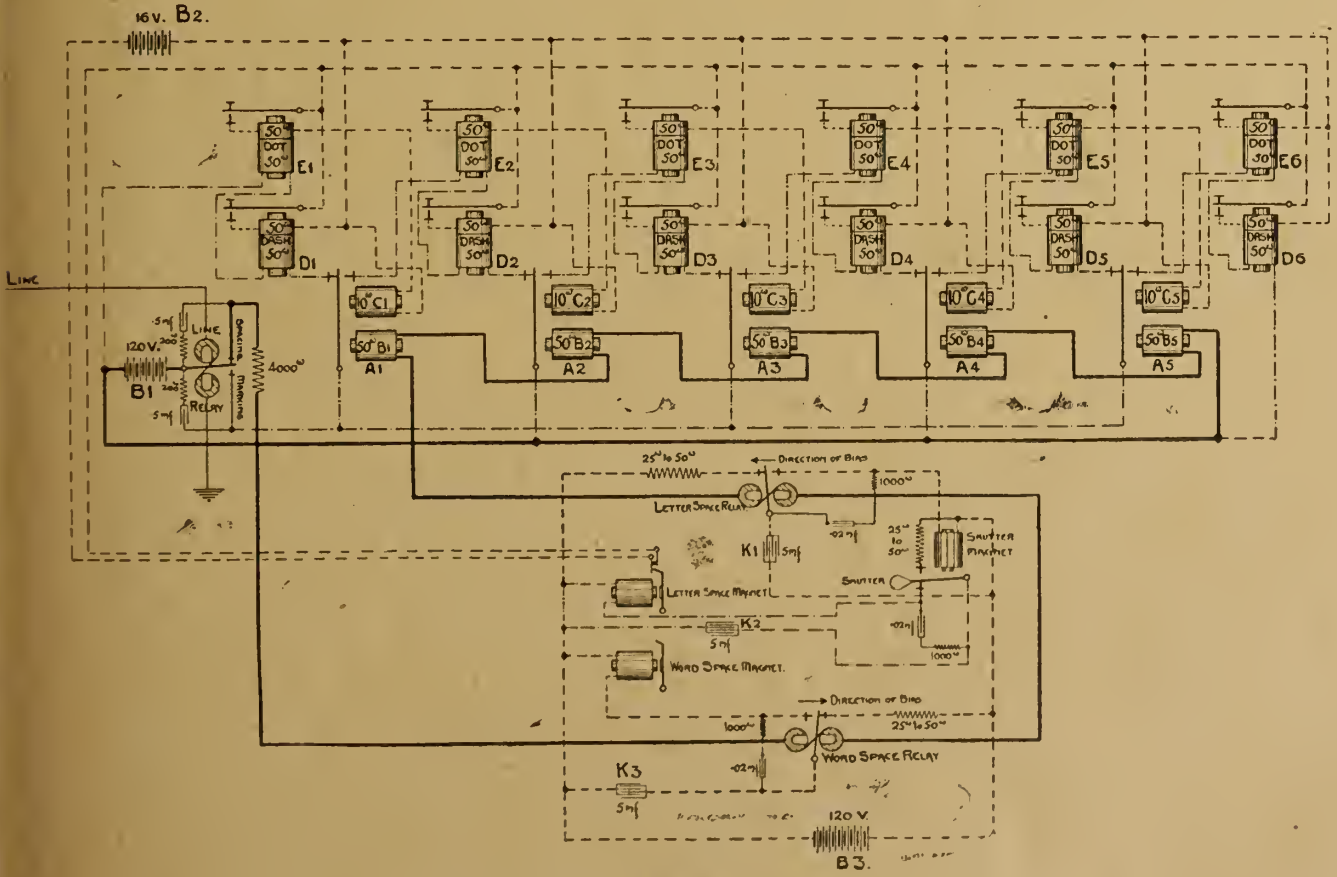

Fig. 2.

The mechanism required to effect the necessary operations is capable of rapid action, and consequently a much higher speed of reception is attainable than would be possible if a receiving instrument with moving parts of considerable mass, such as an ordinary typewriter, were employed.

The electrical portion of the receiving apparatus is shown in fig. 2.

The six relays D_1-D_6, known as the "dash" relays, are so biased that they are not affected by currents of the duration of a dot. Dash currents, however, last long enough to allow these relays to respond.

The six relays E_1-E_6, known as the "dot" relays, are adjusted to respond at once when a current passes through them.

To illustrate the action, suppose the letter "R" to be received. The first dot causes the tongue of the line relay to move over to the marking contact. This allows a current to flow for the "dot" period from the battery B_1 along the tongue and back contact of relay A_1 and through the lower coils on relays D_1 and E_1 back to the battery. Relay E_1, the "dot" relay, is at once actuated, but relay D_1, the "dash" relay, is not affected. The closing of the contacts of relay E_1 allows a current to flow from battery B_2, through coil C_1 of relay A_1, the upper coil of relay E_1, and back to the battery through the contact points associated with the letter space magnet. The current in the upper coil of relay E_1 locks its armature in position.

It will be seen that when the armature of relay A_1 is attracted, the circuit through the lower coils of relays D_1 and E_1 is broken. The magnet C_1 of relay A_1 is energised directly the dot relay E_1 is actuated. If now relay A_1 were actuated directly the dot relay contacts were closed, a dash signal could not be recorded, since the circuit through the dash relay would be broken before its armature had been attracted. To avoid this, relay A_1 is so adjusted that both its magnets must be energised before the armature is attracted, and the second magnet, B_1, is only energised when the line relay tongue has returned to its spacing contact at the conclusion of the signal. When, however, the armature of relay A_1 has been pulled over, the coil C_1 is sufficient to retain it in position.

At the conclusion of the dot signal which we are considering, the line relay tongue returns to its spacing contact, and relay A_1 is actuated. The armatures of relays E_1 and A_1 are both locked in their attracted positions. When the line relay tongue moves over to the marking contact under the influence of the next signal, a dash, a current flows from the battery B_1, along the tongue and front contact of relay A_1, through the lower coils of relays E_2 and D_2, and through the back contact and tongue of relay A_2 back to the battery. Relay E_2 responds at once, and, when the signal has lasted sufficiently long, relay D_2 is also actuated.

The closing of the contacts of relay E_2 causes a current to flow from battery B_2 through coil C_2 of relay A_2, the upper coil of relay E_2, and back to the battery through the contact points of the letter-space magnet. Relay E_2 is thus locked. At the same time a current from battery B_2 flows through the locking coil of relay D_2, the armature of which is, therefore, also retained in its attracted position.

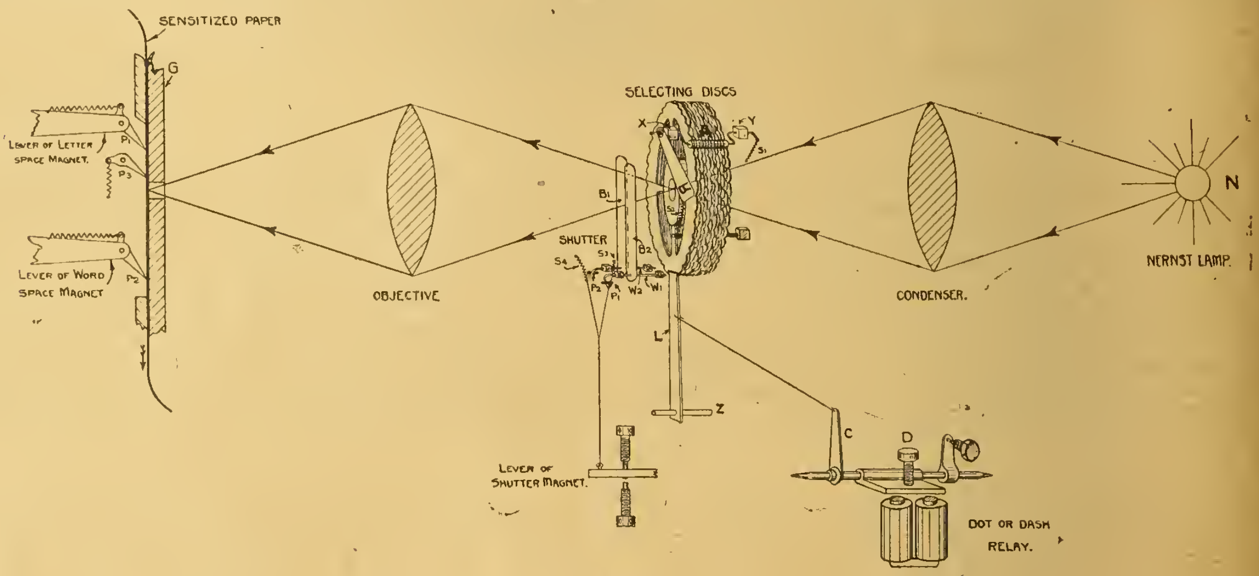

Fig. 3.

At the conclusion of the signal the line relay tongue returns to its spacing contact, and allows a current to flow from battery B_1 through coil B_2 of relay A_2. Both magnets of this relay being now actuated, its armature is attracted, and is locked in position by the current in coil C_2.

The next signal, a dot, will cause relay E_3 to be actuated, and at the conclusion of the signal the armatures of relays E_3 and A_3 will be locked in the attracted position, in the same manner as has already been described for the first two pairs of relays.

In the case of the letter R this completes the selecting process. The selecting process for any other letter or sign with more than three elements in its Morse equivalent is simply a continuation of the same actions. Since no letter or sign in the Morse alphabet consists of more than six elements, either dots or dashes, it follows that the six dot relays E_1—E_6 and the six dash relays D_1—D_6 meet all requirements. These twelve relays are in connection with the printing mechanism, which is so arranged that when the dot and dash relays corresponding to the letter or sign required have been actuated as described, a small diaphragm bearing that particular letter or sign is placed in position, like a lantern slide, in front of a source of light, so that its image can be projected by suitable lenses on to the photographic paper. A shutter is, however, interposed. As soon as the letter has been transmitted, and the selecting mechanism set, as described, the shutter is actuated and the sensitised paper exposed, and immediately afterwards the paper slip is moved forward in readiness for the next letter.

These last two actions are controlled by the "letter-space" relay. It will be seen from the diagram that when the line relay tongue is on its spacing stop, the current which is flowing from battery B_1 through the lower coils of relays A_1—A_6 also passes through two P.O. standard relays, known as the "letter-space" and "word-space" relays respectively. The letter-space relay is so adjusted, by increasing the play of the tongue between the contact screws, and also increasing the bias, that it will not close its local circuit under the influence of the short current sent through it during the dot spaces between the elements of a letter, but will respond to a current flowing for a period equal to about two dots. The spacing current between letters flows for a period equal to three dots, and thus at the end of a letter the letter-space relay is actuated.

While no current is flowing through this relay the battery B_3 is joined through the tongue and spacing contact to the condenser K_1, which is thus kept charged. When the letter-space relay is actuated, condenser K_1 discharges through the coils of the shutter magnet.

The armature of this magnet is attracted during the short time that the discharge current lasts. While it is attracted the shutter is opened, and the image of the letter which has been previously selected is projected on to the sensitised paper.

The armature of the shutter magnet, when attracted, joins the battery B_3 to the condenser K_2. Although the armature only remains attracted for a very short period, it is long enough to allow this condenser to be charged. When the armature returns to its back stop, condenser K_2 discharges through the coils of the letter-space magnet. The armature of this magnet, when attracted, moves the paper forward one letter space, and also opens the two contacts shown associated with it. The current which is locking the various relays in position, passes through these two contacts, so that when they are opened all the relay armatures are released and return to their normal position. Everything is now in readiness to receive the next letter.

If the letter, of which the reception has been traced, had been the final letter of a word, the space between it and the first letter of the next word would have been equal to five dots.

The "word-space" relay is adjusted so as not to respond to a "letter-space" current of three dots duration, but to respond to a current between three and five dots in length. Consequently at the conclusion of a word, after the actuation of the letter-space relay (which moves the slip forward one letter space), the word-space relay is actuated. This allows the condenser K_3, which while the word-space relay is in its normal position is kept charged by the battery B_3, to discharge through the word-space magnet, and thus the slip is moved forward another letter space.

Resistances are inserted in the charging circuits of condensers K_1, K_2 and K_3, to prevent the welding of the relay contacts which would otherwise result from the excessive rush of current when the charging battery is first joined up.

The resistances and condensers joined across the contact points of the letter and word space relays and of the shutter magnet are to prevent sparking at these points.

The arrangement by means of which the actuation of the dot and dash relays corresponding to any particular letter causes that letter to be placed in position in readiness for projection on to the sensitised paper, is shown in fig. 3.

The selecting disks consist of 11 wheels made of thin sheet-brass mounted on a tubular axle. The periphery of each of these wheels is cut into a series of open V-shaped notches with rounded edges. The object of these notches will be explained shortly.

Round the circumference of these disks, and lying across their edges, is placed a series of rollers, one roller being provided for each letter or sign which the instrument is arranged to print. One of these rollers is shown at A.

Each roller consists of 11 small steel disks threaded on a wire shaped as shown, which is supported at the points X Y in holes made through the edges of two brass disks fixed concentrically with the selecting disks. To one end of this wire a light spring, S_1, is attached, the other end of which is fastened to a pin fixed in the face of the brass disk which provides the bearing Y. The other end of the wire carries a mica vane carrying a letter or sign, as shown in the figure. This letter is formed of clear mica on an opaque ground. The method of printing the letter on the mica vane will be described later.

It will be seen that the spring S_1 tends to make the roller move inwards towards the centre of the disks, and thus to swing the letter into the axis of the tubular axle. Normally, however, the edges of the brass selecting disks prevent this movement from taking place. If, however, the disks be so moved relatively to one another that in each disk a V notch comes below the particular roller under consideration, the spring S_1 can pull the roller down, and the corresponding letter is then placed in position on the axis. The selecting wheels are so arranged that, when the apparatus is at rest, the notches coincide under the roller corresponding to the letter E, which is consequently depressed. The displacement of any disk causes the continuity of the groove formed by the notches across the edges of the disks at the E position to be broken. The edge of the notch in the displaced disk forces up the roller, and so removes the letter E from the printing position.

The movement of the selecting disks is effected by the dot and dash relays, each disk being controlled by one relay. The first dot relay is not, however, connected to a disk, because, as already mentioned, the letter E is normally in position for projection on the paper. As shown in the sketch, the pivot of the dot or dash relay carries an upright arm, which is attached by a fine wire to a lever L, pivoted at Z.

The upper end of the lever L rests in a notch cut in the selecting disk. The V notches in the various disks are so arranged that, when the dot and dash relays which make up the Morse equivalent of any letter are actuated, a continuous groove is formed under the roller corresponding to that letter. The roller is consequently depressed, and the mica vane bearing the letter is moved into the printing position on the axis. At the same time, the mica vane bearing the letter E is moved away from the axis, as already explained.

After the exposure, when the selecting magnets are released, each disk is returned to its normal position by the action of a spring, which has one end attached to a spoke of the disk and the other fixed to a pin inserted in the framework of the instrument. The spring controlling the left-hand disk is shown at S_2 in the sketch.

When a disk is thus drawn back to its normal position, the armature of the corresponding selecting relay is lifted up and banks against the screw D.

In addition to these springs the armature of each dash relay is provided with a second antagonistic spring. These latter springs are all joined by silk threads to a long axle which can be turned by a milled head. When the axle is rotated the silk threads are wound up, and thus the bias of all the dash relays is simultaneously varied.

The shutter, which allows the image of the letter to fall on the sensitive paper, consists of two blackened mica vanes, B_1 and B_2, which are normally held in a vertical position slightly overlapping one another. These vanes are fixed to two wire axles, W_1 and W_2, shaped as shown. The springs S_3 and S_4 normally hold the wires W_1 and W_2 up against the stop-pins P_1 and P_2.

When the shutter magnet armature is attracted, the ends of the axles W_1 and W_2 are drawn towards each other. This moves the tops of the mica vanes apart, thus allowing the light from the lamp N to pass and the letter to be registered. The condenser and objective fulfil the usual functions of these lenses in an optical lantern. The condenser is a Watson's "Micro-Illuminator," designed as a con- for microscope work. The objective may be any good lens.

The source of light which has been used is a one-ampere, single-filament, Nernst lamp.

The sensitised paper is contained in a light-tight box. The paper feed arrangement is shown on the left of fig. 3. The slip passes down behind the glass plate G, against which it is held by the three pawls P_1, P_2 and P_3. A small square hole is cut through the glass where shown, to allow the light to fall directly on the paper.

The pawl P_1 is carried on the end of the letter-space lever. Pawl P_2 is similarly carried on the word-space lever. Pawl P_3, fixed on the framework of the instrument, prevents the paper slip from running back.

(*To be concluded.*)

THE ENGINEERING SECTION OF THE BRITISH ASSOCIATION AT WINNIPEG.—I.

[BY OUR SPECIAL COMMISSIONER.]

The Section had a particularly busy meeting, a large part of the time being occupied with what is the main question of the country—the production and transport of grain, and the improvement of communications. Sir William White's presidential address was a review of the commercial position of Canada from the point of view of trade communications, and formed a very appropriate introduction to the closely-connected group of papers on the same general subject which followed it. We intend to return to this topic and deal with it more fully in a subsequent article.

Of the rest of the proceedings the most important paper was contributed by Col. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission, on the "Engineering Works of the Panama Canal." The paper, which was very long and profusely illustrated by photographs and copies of official surveys and plans, was summarised by Lieut. Goethals, who is engaged under his father on the Canal works, in a lecture of an hour and a half. The Panama Canal is, of course, an extraordinarily interesting piece of work, alike from its history, from the effect it will produce on commerce and politics, on which we can at present only speculate, from the mere engineering interest, and from the economic and hygienic questions which have proved to be the key to its successful construction. Col. Goethals, in a striking passage, closing his paper, says that there have been no new engineering problems, that all the difficulties are administrative. In a sense that is true, but it is only true from the point of view of an administrator.

As regards the canal itself, it will be sufficient to recall here that it will be 50 miles long, with a rise to the summit level of 85 ft. in three locks on each side, and that the tide range is about 2 ft. on the Atlantic and 21 ft. on the Pacific side. The locks have a usable length of 1,000 ft., are 110 ft. wide, and have a depth of 41 ft. over the sills, and that depth of water is maintained throughout the canal. All the locks are twin, allowing two vessels to pass up or down at once, and each lock of 1,000 ft. is divided by a central pair of gates into two sections usable by vessels of 350 ft. and 550 ft. respectively, so that small or moderate vessels can pass the locks with the loss of less water from the summit level than if the whole 1,000 ft. locks were employed. It was said that 95 per cent. of present ocean-going ships are less than 600 ft. length. The excavation for the Gatun locks, three twin pairs in flight, on the Atlantic side, seems to be completed, and the machinery for building the concrete work erected. This is on a very large scale, and the detail has been closely thought out, so that the materials are brought to the site, and the charges of rock, sand and cement, properly proportioned, mixed, and poured with the utmost rapidity and ease. The whole site is commanded by ropeways carried by movable steel towers and operated electrically. Constructional work of this kind lends itself to description better than excavation or dam building, and the operations were fully illustrated by photographs and by working plans. They are, however, on too large a scale to be easily realised.

Much consideration has been given to precautions against ships breaking down the lock gates by accident. The most important gates are the upper and lower gates of the locks next to the summit level on each side, since the destruction of one of these may cause a flood. These, in all cases, will be in duplicate, and in addition emergency dams are provided above the locks; but the most effective precaution would seem to be the practice of bringing every ship to alongside a quay wall in line with one side of the lock before she is allowed to enter, and then warping her through by electric capstans without using her own engines. This should save any chance of such an accident as occurred earlier in the year at the Soo, when a ship moving under her own steam charged the lower gate of a lock on the Canadian side when the upper gate was still open. The cause in that case, we believe, was with the engine-room telegraphs.

The main problems of the Panama Canal were the provision for the excessively heavy and sudden floods of the Chagres River on the Atlantic side of the divide, and of the smaller Cocoli River on the Pacific side; the provision of sufficient storage of water to work the locks and provide for losses if a locked canal were used; or, in the alternative, the enormous and difficult excavation required for the Culebra ridge, and, indeed, of the whole route, if a sea level canal were preferred.

The American engineers, having the previous experience of the French to go on, have dealt with these questions by designing the great Gatun dam, forming a lake 163 square miles in area at the summit level of the canal. This lake can receive the violent floods of the Chagres and other mountain streams without any risk of damage to the canal works, and is itself controlled by weirs, built in a natural hill forming part of the Gatun dam, which discharge into the present Chagres bed, and away from the canal, into the Caribbean Sea. It also provides ample storage water for the dry season for lockage and waste. A smaller lake, Miraflores, lying below the upper and above the two lower locks on the Pacific side, provides in the same way for the floods of the Cocoli. The excavation of the Culebra cut, which, on the proposal of a sea level canal, would have been enormously heavy, is reduced by the plan of the summit lake to manageable though still vast dimensions. The figures of these excavations may be given, though they are hardly realisable.

The total excavation at the summit level will be 150 million yards. The French removed 40 millions; the Americans have removed another 50 millions since 1906, and 60 millions remained last June still to be excavated. Electricity is used to operate the ropeways and concrete machinery at the Gatun flight of locks on the Atlantic side, and will be used similarly at the locks on the Pacific side when their construction begins. Two large generating stations are designed to provide the power for working the locks, and working the vessels through, as well as for lighting and other purposes connected with the operation of the canal. It is reckoned that the canal will pass 80 million tons of shipping per annum, or four times the present tonnage of the Suez Canal.

In electrical papers the Section was somewhat weak. Mr. Ormond Higman contributed an historical account of the work of the International Electrotechnical Commission, and a group of three papers on subjects connected with three-phase distribution lines were read by Prof. Marchant, Prof. Thornton and Mr. E. A. Watson. Prof. Thornton's was an account of an experimental investigation of the electrostatic field between three wires by Hele-Shaw's method of drawing stream lines. It was a good example of the use of the method, but as the author observed, there is no useful present application of the results. Dr. Marchant gave formulæ for the capacity of a three-phase aerial line, useful as giving the value of the capacity currents. Mr. E. A. Watson gave an account of experiments on the critical pressures at which leakage by aerial discharge begins, and the effect of the condition of the wires. In Canada, as no doubt in the United States, the greater part of the work of electrical installations falls to the civil engineers and the manufacturers, and the independent electrical engineer, as such, would generally find employment only on special points. There are large water powers all over the country, often of very moderate heads, and there seems to be no limit to the use that may be made of them. Sir William White, in his presidential address, mentioned that the water powers in the Province of Quebec alone were estimated at 13 million H.P., and it is said that the Georgian Bay Canal will make 1 million H.P. available. Civil engineers with experience of the utilisation of such falls, and manufacturers of electrical and turbine machinery should find much employment in the near future. A visit to a large hydro-electric plant now being constructed for supplying Winnipeg was arranged for members of the Association, and we shall allude further to this plant next week.

Prof. Foster, of McGill University, Montreal, gave some account of an investigation now being made for the Dominion Government of the properties and qualities of the coals found in Canada. Canada possesses coalfields on the extreme east in Nova Scotia and New Brunswick, and on the extreme west in the Rockies, and nearer the Pacific Coast; but excepting deposits of lignite in Manitoba, there is no coal between. The central regions of Canada, and the steamers plying on the great lakes, draw their coal supplies from the Pennsylvania fields through Cleveland, on Lake Erie; and this trade has an important bearing on the general traffic problem which will be dealt with later. The coals from Eastern Canada are bituminous, but in the Cordilleran region every variety of coal is found between lignite and fine anthracite. The examination of all these coals is being very thoroughly carried out. They are tested on a working scale, in raising steam in full sized boilers and in gas producers; and their coking qualities are tested in actual operative coke ovens. Large samples of each kind are handled, hundreds of tons being taken if required. The value to the Dominion of this work when completed should be very great.

Another paper that requires notice here was contributed by Col. Ruttan, the city engineer, on a plant recently completed for supplying Winnipeg with water at high-pressure for fire purposes. The water of the Red and Assiniboine rivers, at whose junction Winnipeg stands, is so heavily charged with silt that it is quite unfit for domestic purposes until thoroughly filtered, and is not satisfactory then. It was used until 1899 when the first artesian well was made, and now a supply sufficient for domestic purposes (and more than sufficient for medicinal purposes) is given at 100 lb. pressure from that and other wells sunk since. The supply was not, however, nearly sufficient for fire purposes, and fires are so frequent and destructive in Winnipeg that an additional supply was imperatively required. Indeed, the fire insurance rates that obtained there would shock an English house owner. The present system was accordingly established to pump water at high pressure into the city from the Red River. The plant consists of six gas engines, two of 250 B.H.P., and four of 500 B.H.P., driving pumps having a duty of 9,000 gallons per minute at 300 lb. pressure; a very complete plant of Crossley gas producers and a gas holder; the whole connected to an extensive system of high-pressure mains, with a liberal equipment of hydrants. To meet the condition made by the insurance underwriters, that there should be two sources of power, the city gas supply is connected to the gas-holder, and also directly to the engines, and ample provision is made by duplication of parts to prevent an interruption of the service by accidental breakdown.

A fire, which completely burnt out a large building two nights before Col. Ruttan read his paper, showed how rapidly fire takes hold of the inflammable structures common in Winnipeg, and at the same time how thoroughly it was controlled after the high-pressure hydrants had been started.

Other papers of interest were by Prof. Coker on a method of exhibiting strains in two dimensions by circularly polarised light, and by Mr. C. E. Larard on torsion tests on steel, the results of an elaborate investigation.

Mr. Dugald Clerk contributed a paper on the work of the Gas Explosions Committee, of which he and Prof. B. Hopkinson are secretaries, and a long report of the committee was circulated. The committee was recommended for reappointment with a grant of £75.

THE MANUFACTURE OF ELECTRIC CONDENSERS.

The number of uses to which alternating currents of high frequency and low amperage are nowadays being put in commercial practice, such as their application to induction coils for high frequency medical treatment, post office line practice, and wireless work of all descriptions, has brought the question of economical manufacture of the condenser once again into a very prominent position. The days are long since passed when the interleaving of tinfoil with sheets of paper in a built-up pile was considered a suitable method of constructing a condenser. Such an arrangement was not only much too cumbersome when built to afford anything like portability, but it was also slow and expensive to make. One principle upon which modern condensers are made is that evolved by Mr. G. F. Mansbridge, in which cartridges or rolls are made up of plain paper and electrically-conducting foiled paper covered with powdered or finely divided tin, rolled together into a cylindrical form. This form of construction produces a very efficient and compact condenser arrangement, the conducting films acting as the electrodes of the condenser, the insulation being provided by means of the plain paper and the backing on which the film is mounted.

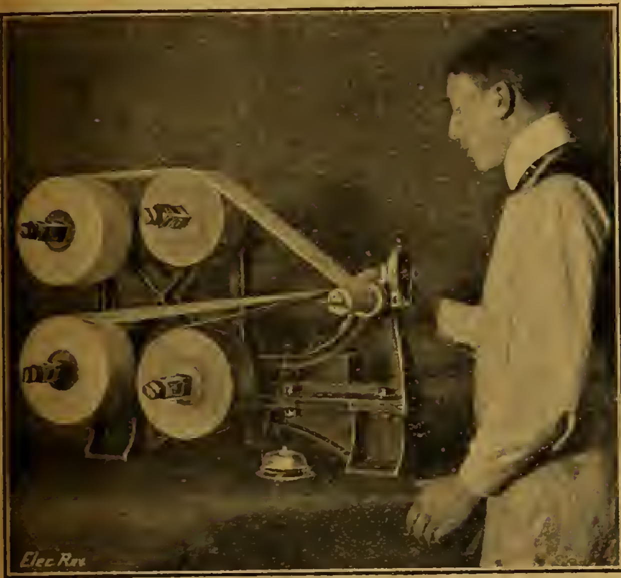

Fig. 1.—Condenser Winding Machine, Operated by Hand.

In order to manufacture such a condenser, somewhat special apparatus is required, so as to give a uniform and equal tension to all parts of the condenser winding, and to present an even and finished appearance to the cartridges when they are finally assembled. For this purpose, Messrs. Gimson & Co., Ltd., of Leicester, have brought out a series of machines made to the designs of Mr. Mansbridge, which are interesting from the point of view of specialisation in the manufacture of electrical apparatus. The condenser winding machine consists of a framework carrying five spindles, one of these being fitted with a crank and winding mandrel, the other spindles carrying respectively two rolls of foiled paper and two rolls of plain interleaving paper. Figs. 1 and 3 show respectively the machine adapted for hand operation and for driving by motor. The spindles carrying the paper are provided with adjustable band brakes, so that the tension on the paper when winding may be adjusted. The spindles for the plain paper are cylinders 3 in. in diameter, while those for the foiled paper are of square section 1½ in. across, and provided with extending cams, so adapted that they will grip the roll of foiled paper tightly, and thus prevent it from moving sideways during the process of winding. This provision is made in order to obviate spoiling the alignment. For rolling condensers of different sizes interchangeable mandrels of different diameters are provided, and it will be noticed that a revolution counter is provided on the machine gearing with the winding mandrel, so as to indicate the number of turns put on to the mandrel at any time. A fixed pointer is also provided which can be set to the number of turns which it is required to put on any particular pattern of winder, so that the machine can be operated by an unskilled attendant. A further device which will be noticed is a bell indicator, which automatically indicates if there is a breakdown at any point in the insulation of the paper strips.

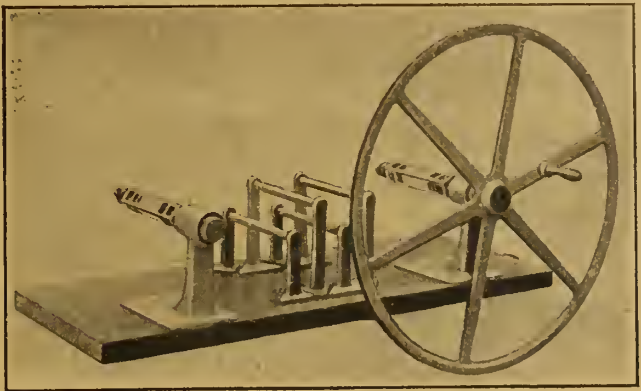

Fig. 2.—Machine for Testing Foiled Paper.

It is important, however, that the strip of paper upon which the finely divided tin is deposited should be thoroughly tested before making up into the condenser in order to eliminate all defects, and for this purpose a second machine is made by Messrs. Gimson, the general appearance of which we illustrate in fig. 2. The process of testing consists of drawing the paper under one and over another roller, the two rollers being connected respectively either to two poles of a battery or to electric light mains, giving a potential difference of about 100 volts.

The paper is first placed in the form of a roll on the square mandrel furthest from the driving wheel, and passed under one roller wheel, over the next, under the third, and over the fourth, and on to a second mandrel connected to the drawing-off hand wheel. The paper is thus drawn over the rollers at a speed of, say, 50 to 100 ft. per minute. When a defective place, for example, a pin hole, reaches the roller which is in contact with the plain side of the paper, there will be a momentary short circuit through the defective place. This causes a rush of current at the defective spot, and sparking results. If suitable means are taken, the rush of current will be insufficient to burn the paper, but will be enough to fuse the minute quantity of tin immediately surrounding the defective place, and thereby to isolate the hole from the neighbouring foiled surface. By thus isolating the defective place, it is in effect eliminated and condensers built up from paper after this treatment, will give a higher insulation and stand a higher voltage without disruptive discharge.

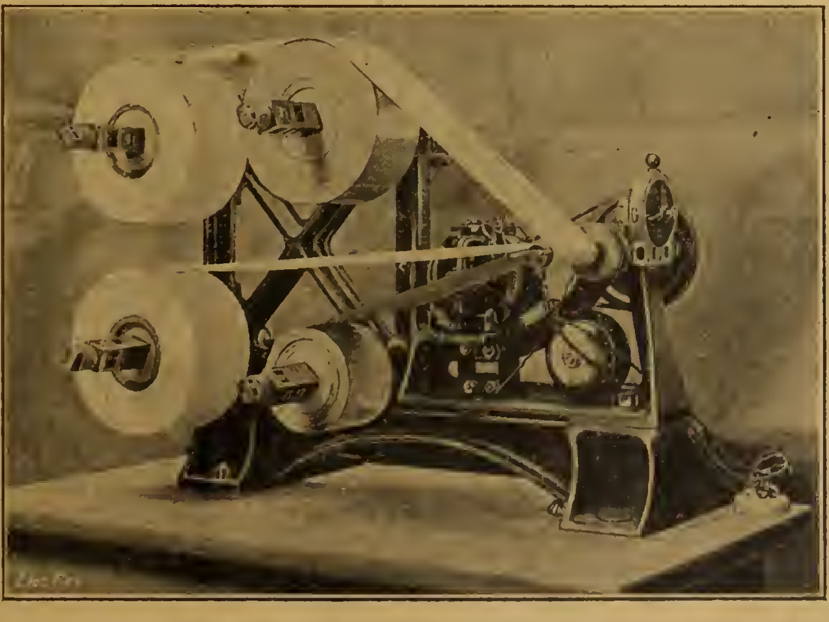

Fig. 3.—Motor-driven Winding Machine, showing Revolution Counter and Bell Indicator.

The breaking-down process is quite automatic once the strength of the current has been suitably adjusted. This adjustment is a simple matter, and may be made by means of a resistance of about 20 ohms inserted in series with one pole of the supply. The resistance should be capable of variation until the sparks produced on the roller appear to be about $\frac{1}{8}$ in. high. As a rule, with a 100-volt circuit a resistance of about 15 ohms will produce a satisfactory result, while with 200 volts a resistance of rather more than 100 ohms is usually necessary. Either continuous or alternating current may be used.

Although only two rollers are necessary (indeed, one could be made to answer if a rubbing contact were provided for the foiled paper), yet it is convenient to have four, inasmuch as a test for continuity of the foiled paper can then be made simultaneously with the carrying out of the breakdown process. This is done by connecting a relay or other device between the two rollers which are in contact with the foiled side of the paper, and connecting up a bell, lamp or other device to the relay, so that an indication is given when there is any break of continuity between the two rollers.

The most convenient way is to have the paper drawn past the rollers by means of a small motor and to pass the current driving the motor through the strip of foiled paper which is between the two rollers that are in contact with the foiled side. By this means the motor is deprived of its current immediately there is a break in the continuity of the foiled paper, and therefore stops, and automatically calls attention to the want of continuity.

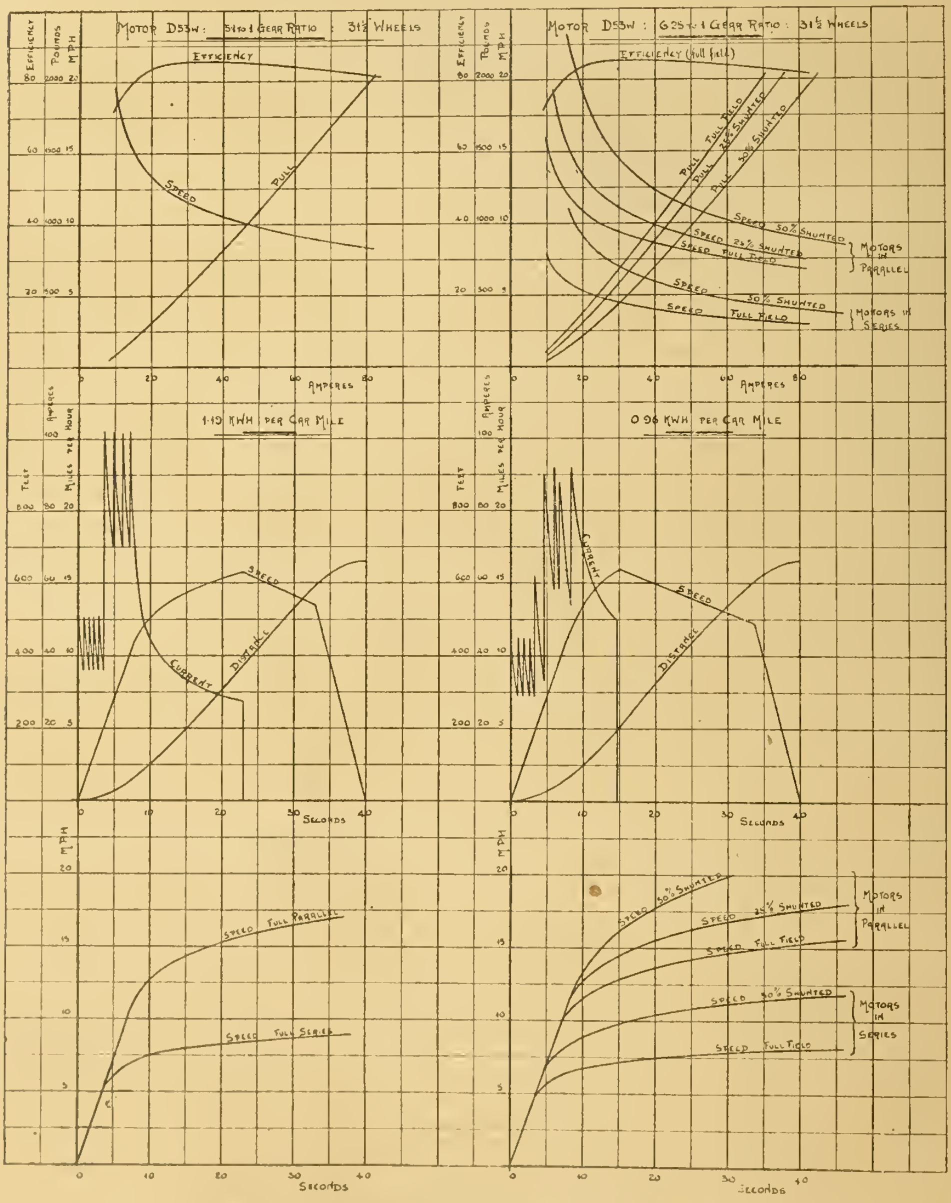

Fig. 1.—Performance Curves of Siemens Motors.

It will be seen from the above description that a very well devised and thought-out system for producing these condenser spools has been placed on the market, and it would seem that the invention has been well timed to meet an increasing demand for a type of apparatus which, formerly held of little account, nowadays occupies an important position in the sphere of practical electrical engineering.

Premier Accumulators.—The Premier Accumulator Co., Ltd., has recently completed the battery for the Tewkesbury Electricity Works, and is now executing orders for a lighting battery for the Chippenham Electricity Works, and a lighting battery for the N.E. Railway.

SIEMENS COMMUTATION-POLE TRACTION MOTORS.

Having found the use of commutation poles advantageous in connection with large railway motors, Messrs. Siemens Bros. Dynamo Works have extended the application to their tramway motors; for these a special patented design has been worked out, by means of which the introduction of commutation poles causes very little extra expense and very little increase on the overall dimensions of the motors.

The most obvious benefit gained by the use of commutation poles is freedom from sparking, and the consequent decrease in the cost of maintenance due to this cause; this, however, is by no means the only advantage. As soon as motors were introduced in which there was no fear of sparking, even when 50 per cent. of the field current was shunted, the objections urged against this method of control were no longer valid. Messrs. Siemens Bros. Dynamo Works, therefore, are now putting on the market a controller in which provision is made for shunting the field windings in varying degrees, as required by local conditions; in this way a controller is arrived at in which, instead of there being as usual only two economical running positions, namely, full series and full parallel, there are at least five, for example:—(1) Full series, full field; (2) full series, field shunted 50 per cent.; (3) full parallel, full field; (4) full parallel, field shunted 25 per cent.; (5) full parallel, field shunted 50 per cent.

This system of control offers two important advantages, namely:—

(*a*) The driver has a more complete control over his car, having the choice of five different speeds under any given conditions.

(*b*) A considerable economy in consumption of energy is made possible.

In order to illustrate these advantages, the curves shown in the accompanying figures have been prepared. These curves relate to a 10-ton tramcar, equipped with two 38-h.p. commutation-pole motors. Two sets of performance curves for these motors are given, one for the motor geared with a reduction of 97 : 19, and the other with a reduction of 100 : 16, the diameter of the driving wheels in each case being 31½ in. In the first case the speed and pull curves are given for the full parallel position of the controller, in the second case speed and pull curves are given for the five running positions of the controller; with these two sets of curves a sample run has been worked out, as shown in the diagrams, in accordance with the following particulars:—Tractive resistance assumed to be constant, 20 lb. per ton; number of stops per mile, eight; average speed (including five-second stops), 10 miles per hour; maximum speed, about 16 miles per hour.

The energy consumption has been worked out, with the following results: With fields not shunted, 1·19 units per car-mile; with fields shunted, 0·96 unit per car-mile. In this particular case, therefore, the change of gearing and the different method of control make possible a saving of about 20 per cent. in the energy consumption.

This may possibly be regarded as an extreme case, but the matter may be put in another way. The energy imparted to the car between standstill and the time when it reaches a speed of 12 miles per hour is, in the one case, 82 watt-hours, and in the other case 68 watt-hours, so that on the assumption that this is repeated at regular intervals of 45 seconds, that is, 80 times per hour, the energy saved per car during one hour is 1·12 units. Thus, quite apart from the question of the energy absorbed by the brakes, which may vary according to the particular circumstances of the case, there is a clear saving of 10 per cent. of the energy consumption in imparting to the car a speed of 12 miles per hour.

The flexibility of the modified system of control by means of shunting the fields is clearly seen on reference to the remaining figures. These two figures show speed-time curves for the two cases. In the first case, there are only two speed-time curves, namely, that in which the motors are in full series, and that in which the motors are in full parallel; in the second case there are five speed curves corresponding to the five running positions of the controller. The comparison between the two sets of curves requires no explanation. The degrees of shunting assumed for the purpose of this calculation were not necessarily fixed, but may be modified to suit each particular case for which the equipments are desired.

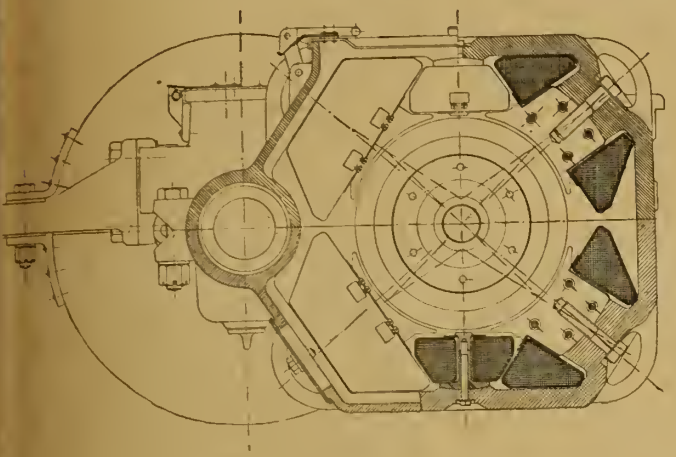

Fig. 2.

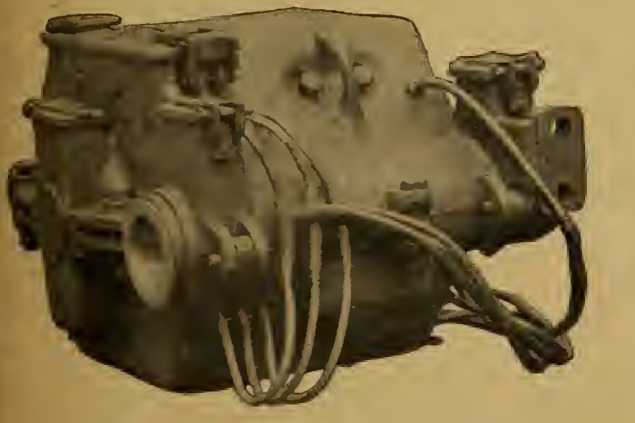

Fig. 3.

Referring now to the construction of the motor, the general features of the design worked out especially for tramway motors are shown in the general arrangement, fig. 2. In this figure it will be seen that there are the usual four main poles, and in addition two commutation poles, one between the main poles in the upper half of the motor and the other between the main poles in the lower half. In order to provide as much room as possible for these commutation poles and their windings, the main poles are given a special shape such that the magnet coils are not symmetrical about the centre lines of the poles, but are displaced sideways. The pole faces, however, are spaced symmetrically round the armature, so that there is no interference with the proper distribution of the magnetic flux. The main field coils and the commutation coils are specially wound to such a shape as to fit into one another, so that practically no extra space is required for the additional coils.

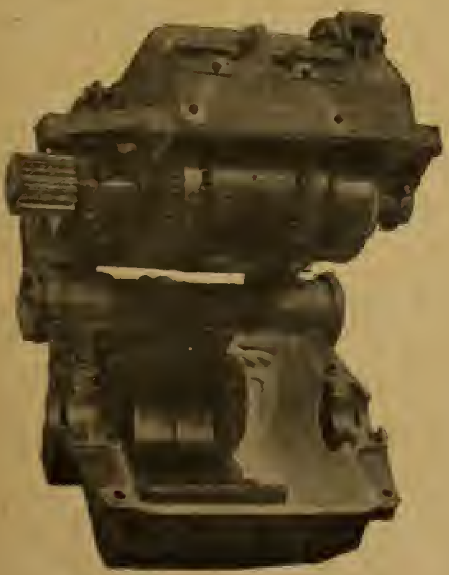

Fig. 4.

The general appearance of the motor will be seen from figs. 3 and 4, in which are shown the exterior and the interior of the motor.

Ten motors of this type for an output of 38 h.p. each have been supplied by Messrs. Siemens Bros. Dynamo Works to the Hull Corporation Tramways. A number of motors of larger output (50 h.p. type D 58 wa) have been supplied, or are now under construction, at their Stafford works for electric locomotives for the Harton Coal Co. in South Shields, for Brennan's experimental mono-rail car, and for the Adelaide Municipal Tramways Trust.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Kaleidoscopic Sign.

Messrs. Rashleigh Phipps & Co., of 147, Oxford Street, W., have brought out a new electric sign which presents some remarkable features. The sign consists of a disk about 3 ft. in diameter, and about 8 in. deep, the front of which is divided into cells after any desired pattern, one form being shown in the accompanying diagram, fig. 1. The cells are divided by opaque walls, which, as well as the back of the cells, are coloured in accordance with a symmetrical scheme, and in the middle of each cell there is a 5-c.p. lamp, set well back and not projecting beyond the front of the disk. There are 49 lamps in all, arranged in groups of four or eight, the odd one being in the centre; each group is controlled by a thermal flasher, the periods of extinction being purposely varied so that the different groups are lighted in a perpetually changing order. The opaque walls of the cells ensure that any cell in which the lamp is extinct appears dead black; there are five different colours, including white, and these, with the black spaces, continually flashing up in different combinations, produce a fascinating succession of brilliant symmetrical patterns, some of which are strikingly effective. Very seldom, the whole of the lamps are alight at once, for a moment; at other times only a few are alight. It is difficult to give an adequate impression in words of the effects produced; as the makers say, it is really necessary to see the device in action, in order to realise its merits. We are informed that the device described has 1,015 different possible combinations, and though they are constantly changing, one rarely recognises one of them as having been seen before. The sign consumes only one unit in three hours, so that it cannot be called extravagant in energy consumption. Nothing could be better calculated to arrest the attention of the casual passer-by—and to hold it, for a considerable period.

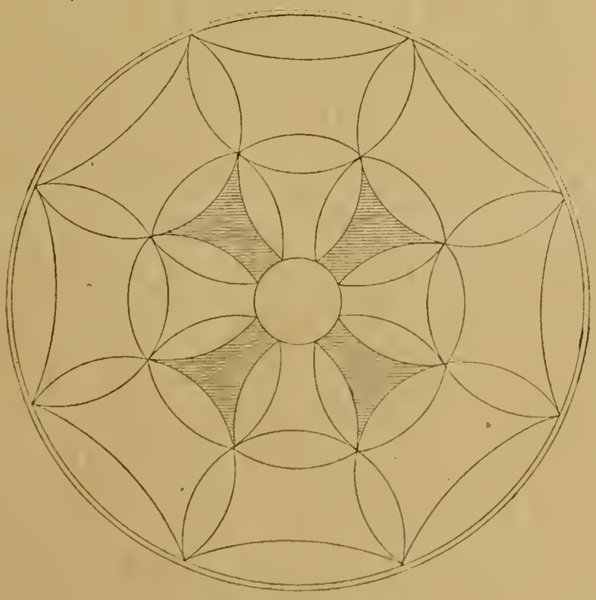

Fig. 1.—Kaleidoscopic Sign.

D. & S. New Devices.

Contractors and users are always ready to welcome anything which tends to simplify and facilitate the work of wiring up. The

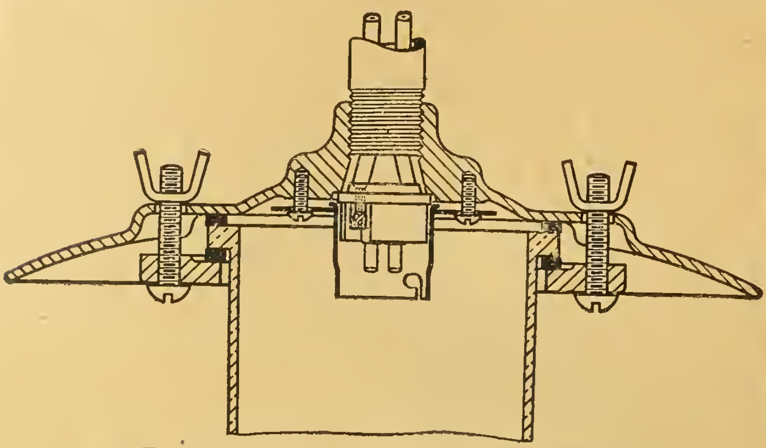

Fig. 2.—D. & S. Patent Well-Glass Fitting.

new lines of iron-cased switches which are now being made by Messrs. Dorman & Smith, of Ordsal Electrical Works, Salford, and of which they have sent us particulars, have been specially designed with this object in view.

From fig. 3 it will be observed that a bevelled inlet, as shown, is employed instead of the ordinary method of bringing the pipes or cables immediately to the box itself. This inlet being easily detached from, or fixed to the switch-box, the wiring is facilitated, and the arrangement possesses the further important advantage that, in the event of its being necessary to remove the switch-box, this can be done without disturbing the pipes or wires.

The switches are specially applicable to alternating-current installations, where it is desirable for lead and return to be carried in the same pipe. Messrs. Dorman & Smith are supplying this new pattern in both their watertight and non-watertight iron-cased switches.

The same firm have also placed on the market a new patented type of strong iron well-glass fitting, which, as in the case of the

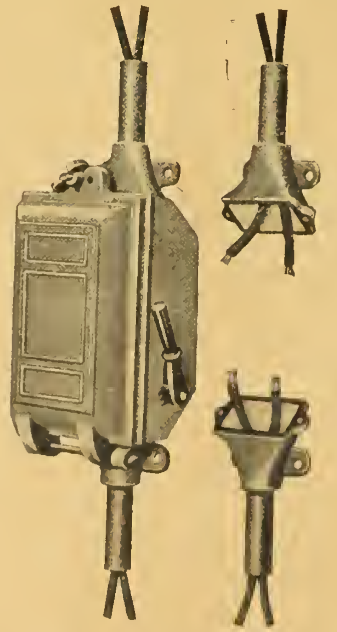

Fig. 3.—D. & S. Switch-Box.

switches, has been designed primarily with the object of facilitating the wiring-up of the fittings, and at the same time effecting some economy by reducing the number of parts.

In these fittings the usual lampholder nipple is dispensed with, and the wires have consequently a straight run through from the tube into the lampholder insulator, eliminating dangerous bends in the insulated wires at this point, as shown above in fig. 2.

"Ajax" Ironclad Distribution Fuse Boxes.

Of recent years ironclad distribution fuse boxes have been almost universally adopted for power work, in place of the older forms of teak boxes, but the use of cast-iron cases for distribution fuse boxes has always been open to one great objection—extensions were a matter of serious difficulty and expense.

The Hope unit system, for which patent rights have been applied for, overcomes this difficulty entirely. It is being introduced by Messrs. Parmiter, Hope & Sugden, of Hulme Electrics Works, Manchester. In this system the cases are of cast-iron, buil up in such a way as to allow of either end being removed, and a

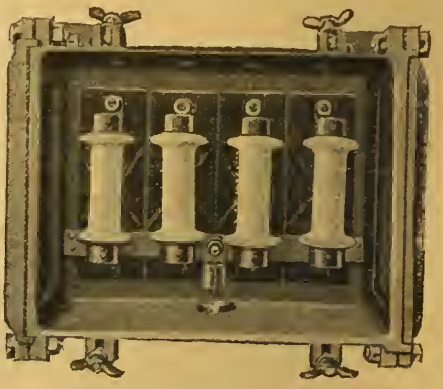

Fig. 4.—Hope Unit: Interior.

additional case unit being added, the box remaining perfectly watertight and gastight. One end of the case is a "male" and the

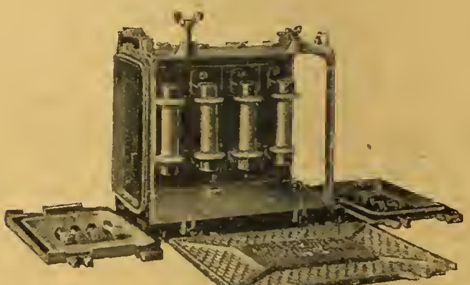

Fig. 5.—Box Dismantled.

other a "female," so that extra sections of case can be added at either end. Four strong set screws hold the cases, or end plates,

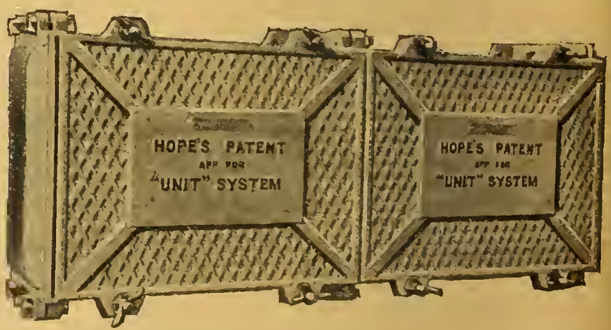

Fig. 6.—Exterior of Two Coupled Units.

as may be, together; additions can therefore be made in a moments. All the parts are "jig" made throughout, and

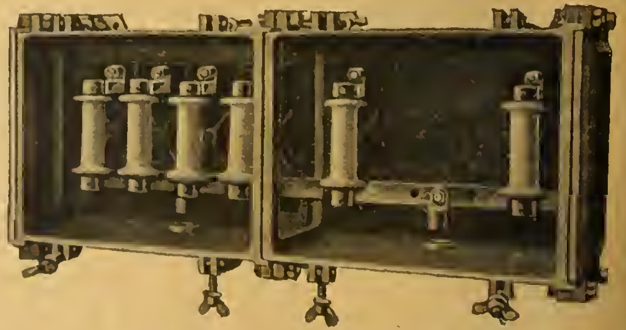

Fig. 7.—Interior of Coupled Units.

extension pieces will go together without any filing or fitting whatever.

With regard to the interior, each fuse-way is a separate unit complete in itself. The fixing of the bases and coupling-up of the same to the bus-bars is done entirely from the front of the board, and extra fuse-ways can be coupled up whilst the board is "live," and from the front of the case.

All the bases are of black china, and the insulation test of any complete board is guaranteed to be at least 50 megohms.

Fig. 4 shows the interior of a single unit; fig. 5, the single unit dismantled, showing the method of construction; fig. 6 shows the doubled unit coupled up, with the lids closed; and fig. 7, the interior of the coupled units.

It will be noticed in fig. 7 that the board is a six-line board, with provision made for two extra ways to be added later, and that the drilling is ready complete, so that the extra ways can be added in a few minutes.

The "Timken" Patent Roller Bearing.

The Electric and Ordnance Accessories Co., Ltd., of Chetton Road, Aston, Birmingham, have taken up the manufacture of the "Timken" roller bearing, of which we give some particulars below. We are informed that this type of bearing has been very largely adopted by automobile builders in the United States, as well as for horse-drawn vehicles. There are, of course, innumerable other uses to which it can be applied; for instance, the bearings of electric motors, tramway and railway cars, &c. The three principal advantages claimed for the "Timken" bearings as compared with ball bearings are: the long bearing surface of the rollers, their ability to withstand end thrust as well as radial load, and their ease of adjustment, owing to the conical shape of the bearing, a unique feature.

The illustrations practically explain the construction of the bearing. It will be seen that the inner cone, which is fixed on the shaft, is provided with two ribs, an essential feature of the device. Round each roller there is a groove corresponding to one of these ribs, by means of which the rollers are confined to their track, and are prevented from twisting; but the bottom of the groove does not touch the rib, the load being carried entirely on the part of the roller between the ribs, on the cone. A cage pressed out of one piece of steel keeps the rollers in position on the cone. Lastly, the outer cup is tapered to fit the rollers, and by variation of its axial position with regard to the inner cone provides adjustment for wear—an important feature of the system. The whole thing is very simple and compact, occupying the same length as a ball bearing (from $1\frac{1}{32}$ to $1\frac{9}{16}$ in., according to size). The rollers are made of special nickel steel, hardened in oil, and, as well as the cups and cones, are accurately ground to size by machines.

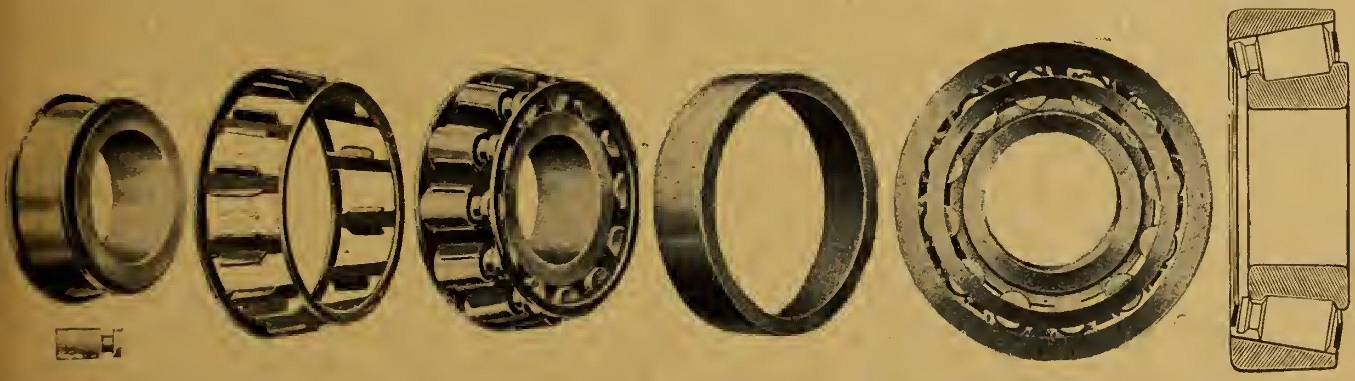

Fig. 8.—Details and Section of "Timken" Roller Bearing.

The Electric and Ordnance Accessories Co., who own the sole manufacturing rights for Europe and the British Empire (except Canada), are commencing the manufacture of these bearings immediately in their works at Aston, where they have ample facilities for producing a large output.

NOTES ON TRADE ABROAD.

(Continued from page 479.)

British Success in Canada.

We are pleased to be able to record on another page in this issue the success which has attended the efforts of some British firms to secure important electrical and other plant contracts for the City of Winnipeg. Generators and exciters have been ordered from Messrs. Vickers, Sons & Maxim, Ltd., of Sheffield, while Messrs. Jens Orten-Böving & Co., of London, have carried off the water turbines. The latter firm, who are naturally very pleased with this important result of their Canadian skirmish, in a letter to us concerning the contract, allude to our own comments on hydro-electric possibilities abroad in the article on "Notes on Trade Abroad." They say :—

"You will now see that the remark of the 'visitor' to your office that there were no hydraulic specialists in England, has been given the lie. As you know, we have now got a large staff of Continental engineers in this office continually occupied in preparing the lay-out of hydro-electric schemes in all countries, and every day brings us in a fresh inquiry. It is, of course, a pity that we have to get most of our engineers from the Continent, but we are now taking in a considerable number of men from the universities and technical colleges, and training them up as water-power engineers. Of course, the process is slow, but when completed it will mean that there are English-born water-power specialists, which fact in the Colonies will doubtless have a great deal of weight.

"Of course, we always need help from the many water-power owning companies for tramways or electric light, the money for which has been almost entirely raised in England, and we hope soon that these and future companies will be fully aware of our existence, and we think you can do a good deal to help us and the allied manufacturers."

A Difficulty Regarding Canadian Business.

We announced in our last issue that the City of Toronto was inviting tenders for certain electrical and pumping plant, the tenders for which were to be lodged by October 14th.* In the American papers advertisements appear stating that the specifications and forms of tender can be obtained on application to the city engineer. From the date of our announcement of the news this leaves just upon four weeks wherein firms in this country are to submit their applications for these documents, prepare their tenders, and send them across to Canada. We do not say that this cannot be done, but the margin of time is very narrow, and the case is a fair illustration of the necessity for direct efficient and alert representation on the spot by men capable of taking the whole thing in hand and submitting prices, or cabling intelligently. It does not always happen that the contract remains open so long as we have mentioned—as an instance, let us look at another Canadian advertisement appearing in a leading New York technical paper for September 2nd. Here it appears that the Toronto City Electrical Department were open to receive tenders until noon on Tuesday, September 7th, for approximately 15 tons of bare copper conductors, or the equivalent in aluminium. This advertisement is, of course, drafted and published for local Canadian and American tenderers, and nobody in this country could expect to have a finger in the business in any case—whatever the nature of the contract—seeing that the American advertisement does not reach England until the list is closed. In another case it is mentioned that the City of Toronto "will shortly call for tenders for pole line supplies, including poles, cross-arms, pins, braces, &c. . . . For information apply Electrical Department, City Hall." Here there is no date given, but we venture to suggest that the advertisement is drawn up for everybody rather than the tenderer resident in England or Europe. We cannot expect our Canadian friends to hold back their work for a very long time purely in order to give their "family relations" in this country a chance of tendering. For many lines we must be actually on the spot to tender, if we are not there to manufacture. We remember several years ago certain English municipal authorities in issuing their advertisements for electrical plant, &c., left so long for the preparation of tenders that it was generally regarded that they ardently desired the foreigner to have ample time in which to tender. Canadians are not in this position—they have electrical manufactories of all classes very near at hand, some on Canadian soil, some just over the border in the States, and they do not wish to wait for us unless for some special line. The point requires no further emphasising from us—we must be ready to tender promptly, whatever our price, if we are to succeed. Can we do this unless we are at the hub of Canadian electrical life? We must have our representative "right there."

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* Since these lines were written we have learned that the time for sending in tenders has been extended by a fortnight, to October 28th.

"Are Electrical Engineers Wanted in Canada?" We have had so many inquiries addressed to us regarding the prospects for electrical engineers in Canada that we are constrained to quote an opinion expressed by an esteemed engineer contributor who recently visited the country for the British Association meeting. We put to him the case of a young man of electrical training—now in search of employment—asking what were the prospects for him. His reply was that he stood a better chance there if he became a civil engineer entering at one of the Universities in Canada—say, McGill at Montreal—and emerging therefrom as a Canadian and an engineer, trained for aiding in the grand work of development that is awaiting the engineer. The Canadian Pacific Railway requires hundreds of young engineers every year, and all the "out-turn" of the Universities can be more than absorbed in their requirements alone. This is useful advice to young engineers and to parents or guardians who are seeking how best to place their sons or charges in fields less overcrowded than are most of the professions at home. But our contribntor does not ignore that later there will be a good demand for electrical engineers, for their part in the great development must come when the foundations, so to speak, have been put in by the civil engineer. Already in the larger cities important electrical works are being contracted for, as we have shown above, and electrical engineers will be required for these, both in their construction and operation. If British firms can manage to secure contracts, they may also make openings for British engineers, but if American works are called upon, especially for hydro-electric work, then we guess men will come up from over the border.

Spain Again. Why all this nervousness regarding Spain? We have said a good deal about its electrical possibilities in these columns, but we have yet more to say. Mr. British-Consul Maclean is pushing before us the claims of the Bilbao market, and he remarks:—

> In the heavy electrical trades the tendency still is for orders to go elsewhere in preference to the United Kingdom, and this is probably due to the fact that foreign manufacturers were first in the field. But it is worth while to call attention to the fact that the use of electricity is constantly extending, and that the key to the Spanish electrical trades is cheapness.

Writing of machinery generally, he says that "competition in this market takes the form of cheapness and easy terms of payment, and consequently a lower class of manufactures than is generally made in the United Kingdom is introduced." Of course, risks that have to be run in conducting trading transactions with the markets of Spain and some other parts. Other manufacturing nations run these risks with far less nervousness than we do, and they get their "blow in fust." We are frequently told that British conservatism in declining to accommodate the foreigner in the matter of payments is losing us much business.

Relations with Russia. We look for considerable benefit to British trade with Russia from the fraternising of the Russian and English peoples at the international exhibitions that are being arranged. In certain individual cases exhibiting may be too costly a matter, but these are only exceptions; the chances generally are of quite another kind, and in the sum total of British trade we are bound to gain from such events. We learn from the *Times* correspondent at St. Petersburg that in response to the invitation from the Russo-British Chamber of Commerce the representatives of the London, Liverpool and Manchester Chambers of Commerce will visit St. Petersburg on October 26th. Invitations will also be sent to Hull, Newcastle and Bristol.

The Tsar is taking a personal interest in the success of the Russian Exhibition to be held in London in 1911, the details of which were recently discussed between the St. Petersburg and London Chambers of Commerce. "The fundamental objects of the exhibition, which are to make the British public acquainted with Russian traders and products, will, it is hoped, be subsequently applied by the Chambers organising a British exhibition in St. Petersburg." We ourselves urged the adoption of the latter course in our issue of June 11th, 1909.

While alluding to Russian trade, we may remark that the *Anglo-Russian Gazette*, which has, so far, been running as a fortnightly, will, on October 1st, appear weekly. The September issue, which is before us, contains a good deal of matter, in both the English and Russian languages, regarding many points that require attention from those interesting themselves in Anglo-Russian commerce. There is one article that concerns us directly, as it relates to "Electrical Goods for Russia." Among other things, the writer says:—

> In view of the keen competition in all branches of the electrical industry and the fact that the German firms have representatives and often depôts on the spot, the best means of introducing new business is to do as the German manufacturers have done, that is, to open a selling agency and later on a small depôt of those goods which are most in demand.
>
> At the head of this branch should be placed an engineer or a good salesman, equipped with the necessary technical knowledge, and knowing the commercial and financial customs of Russia, and speaking both Russian and, if possible, German well. Another suggested means of doing business is to undertake electric installations, especially of motors, on the credit system—that is, by accepting monthly payments. This applies chiefly to small factories and workshops.

In a leading article on "Why Germany is Beating England," we are informed that "the truth is that Germany has beaten us in Russia because while we have been indolently unenterprising, lulled into a dull lethargic commercial slumber, she has been alert, resourceful, pushful, vigilant, and as untiring in her efforts as she has been varied in her methods and her desires to please."

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Laundry Irons with Indicators.

In January this year new rules, regulating the installation of electric light and power in buildings, were issued and enforced throughout Australia, these rules being practically those of the Institution of Electrical Engineers, London, with certain additional rules adopted by the local authorities.

It may be of interest to you to know that electric laundry irons have to conform with the following rule:—" . . . in addition, every electric iron must have a lamp or other approved device so connected as to indicate at all times when current is on the iron."

We should be very interested to hear if there is any other part of the world where a similar rule is in force, and if so, what class of indicator is used.

We see several means of getting over the difficulty, but they all, more or less, possess disadvantages.

It has been suggested to put a low-resistance lamp in series with the iron, but this has its drawbacks, as, unless spares were kept by the consumer, his ironing operations would be liable to be suspended in the event of the lamp failing. Again, in this part of the world there is, naturally, not a very large demand for these low-resistance lamps, and consequently there might be a difficulty in obtaining them when they were required by consumers at short notice.

The placing of an ordinary incandescent lamp in parallel with the leads supplying the current to the iron is not viewed with much favour by the suppliers of power where there is a preferential rate for power as against lighting supply. It would be quite possible to have the lamp burning without the iron being in use.

Another alternative which occurs to us is to use some cheap form of galvanometer which would indicate when the current is on, but this would only be suitable in districts supplied with direct current. Neither would it appeal to us as being practicable, as it would be a very poor form of indicator, and one which would not be likely to catch the eye of the user of the iron.

Seeing that in Australia the only apparatus which is considered so dangerous—from a fire risk point of view—that it requires an indicating device is an electric iron, we are practically compelled to come to the conclusion that the indicating device will have to be part of the iron itself, as otherwise the consumer who has, say, half a dozen power plugs installed in his house, would have to have each plug supplied with an indicating device just on the off chance of his (at some future date) purchasing a laundry iron and plugging it direct on the mains.

Newton, McLaren, Ltd.

D. Eardley McLaren, *Managing Director.*

Adelaide, South Australia,
August 17*th*, 1909.

Testing Condensers for Leakages.

On returning from holidays my attention was called to two letters appearing in your journal referring to the above.

In reply to Mr. Middleton (August 16th), with a good reliable make of condenser, I hardly think it necessary to have continuous records taken. A slight leakage (unless running for some time) cannot have a very serious effect on the boiler range, so that an occasional test as described should suffice. As pointed out, what happens is that a small leakage tends to exaggerate the water consumption at the engine, should a test be going on at the time. Referring to Mr. Bayntun's letter (August 23rd), which reads much like an advertisement, a leakage that will gulp in sufficient salts to saturate the whole boiler range and bring about violent priming in half an hour, is a good sized gap, and will certainly not require a chemical test to locate it.

The use of silver nitrate as a test for chlorides in water is, indeed, a very old one, but I certainly thought the method of using it for detecting leaky condensers was new. However, perhaps he will oblige me by giving name and date of any paper containing a similar article.

Harbee.

September 14*th*, 1909.

[Mr. Bayntun described the silver-nitrate test in the course of an article on "The Working of Water-tube Boilers," contributed to the Electrical Review, October 12th, 1906.—Eds. E.R.]

"El Dorado."

Under the heading "El Dorado" you publish, in your issue of the 10th inst., a paragraph relating to an advertisement which appeared in the "Situations Vacant" columns of your August numbers. You give the number of applicants for particulars of this certain position, and the actual number of formal applicants.

I enclose for your perusal, and for publication, if you think fit, a list of duties, for which I sent.

Can one wonder, after reading over and carefully considering the requirements of the advertiser, that only one-half the recipients of this list should be sufficiently courageous to risk by applying for the post in question, being appointed the successful candidate?

Should these 50 per cent. be credited, or should honour be to the non-triers? To the latter I personally think. It is good to know that there is a remnant of self-respect held in the bosom of some of our engineers.

From the list of duties, I gather that the man appointed must accept responsibility for the entire undertaking, be his own charge-man, his own engineer, electrician, clerk and plumber. Truly, a most wonderful personage he must prove, with a constitution of iron, or overtaxed nature will rebel, or indeed a "man of gold," that he may have the wherewithal to provide sustenance against the fag of brain and body which otherwise the lengthy hours of toil and duty would surely occasion.

And look at the princely salary offered!

I apologise, Sir, for thus encroaching upon your valuable time, but really cases of this description do make one sympathise with "Omar," and wish him all luck in his prospective Canadian farming.

Non-Trier.

LLANDILO URBAN DISTRICT COUNCIL.

Appointment of Electrical and Mechanical Engineer.

List of Duties.

The Llandilo electrical station is worked at present by a double set of D.C. generators driven by steam with battery of accumulators and battery booster.

The person appointed will be held responsible for the working of the complete installation and must take charge of the evening shift.

He will have to do all necessary extensions, alterations and repairs of generating plant, cables and storage battery.

A knowledge of lead-burning is essential.

To make new service connections, read, test and adjust meters.

Keep accounts of stores, &c., and present monthly reports to the Council.

The appointment is subject to three months' notice on either side.

Copies (not originals) of testimonials must be sent and will not be returned.

Applicants must be content with the above particulars.

Applications stating age, previous experience, and salary required, must be sent to me marked "Electricity Application," so that they may be received by me before August 31st inst.

By Order,
R. Shipley Lewis,
Clerk to the Council.

Llandilo, *August* 10*th*, 1909.

Unemployment.

I am interested in "Omar's" letter; it is refreshing to meet a loyal man who will not take work at 25s. per week or so, though it is not every man who can afford to be independent.

It is the same old story, and we shall never do any good until we have a glorified trade union at the back of us like the medical profession, and the law, &c. I quite thought that, as a result of the various letters from myself and others in the early part of last year, we had succeeded in starting something in the way of a protective association, but I have reason to know the matter has dropped, so we are just as backward as ever.

I can sympathise with "Omar" as regards replying to advertisements, especially those over numbers, which I find are usually "no class"; they never have the courtesy to reply even when a stamped addressed envelope is enclosed. I think it would be a good thing if assistants would abstain from replying to numbers.

I notice in the current issue of the Review there are no fewer than seven advertisements for premium pupils, notwithstanding the overcrowded state of the business; this is one of the things which is killing our profession, and which should be taken in hand by a union.

Electricity Supply.

September 13*th*, 1909.

As an engineer with 12 years' experience with good firms, who has been seeking employment in this country for the last 12 months without success, might I ask if any of your readers could give me some information as to the prospects of finding work in Canada or other British Colonies at the present time?

Desperate.

The Enclosed Arc, or the Metal-Filament Lamp?

The article in your current issue by "Pam" gives some useful hints which should prove very acceptable to arc lamp manufacturers; therefore, it is rather a pity that certain of the author's statements seem to be somewhat misleading.

For instance, we are told that 3,000 to 4,000 M.H.C.P. for 500-watt flame lamps is ridiculous, yet, later in the article it is acknowledged that flame lamps give five times the candle-power of enclosed lamps of similar current consumption; if, therefore, we select the author's example of a 600-C.P. enclosed lamp, and multiply by five, we arrive at one of the figures quoted as being ridiculous.

As a matter of fact, there is nothing to cavil at in such an estimation, and any responsible flame lamp makers will quote similar figures with actual photometer tests to back their claims.

One other point also calls for comment, namely, the comparison of costs between enclosed arc lamps and metal-filament lamps.

In both cases the energy consumption of one lamp only is given, but the depreciation is taken on four lamps, which does not give a fair comparison.

Harry J. Booker.

Manchester, *September 18th*, 1909.

The New Theory of Electricity.

You are hardly as courteous in your reply to my letter that you have been good enough to print in your current issue, as in that of last week. It is hardly courteous to misrepresent an opponent, and I presume I am an opponent in this case. It is not correct to say that I have heard of the investigations and experiments, for the first time. As I have before stated, I have followed the whole matter very closely. What I have not seen is an account of any experiment which justifies the claim which Sir Joseph Thomson made, and which I take it you endorsed. As you are aware, I am not the only doubter in this matter. The President of the Chemical Section of the British Association is apparently also a doubter, and I believe I am correct in saying that the new theory was never endorsed by Lord Kelvin to the extent of the claim made by Sir Joseph Thomson.

I presume I may also gather from the humorous letter signed "M. F. H. W.," which appears in your current issue, that he is also a doubter.

Sydney F. Walker.

Bath, *September 17th*, 1909.

P.S.—I should have thought that our many friendly bouts in past times would have told you that I only write when I have carefully studied my subject.

Automatic Transformer Switch.

Having read the letters *re* auto-transformer switches, I should be much obliged to "Engineer" for the name of maker of the switch he speaks of, which is sold for 32s. 6d. (subject), as I am about to fix three or four on an installation requiring same, and, having had no experience with these, would like one that is reliable, also without any appreciable drop; I might say that the full load of transformers are 2,000 watts and 1,250 watts. I have seen one working; it is very good from an electrical point, but its working is not always decided—*i.e.*, with a low C.P. lamp, say, 12 watts, it may go in or not.

I notice that "Student" says that transformers can be obtained with a no-load loss of 6 watts for 500 watts, but they don't seem to be usual marketable productions; 10 to 12 watts for the 500-watt size is about the average, and as much as 40 watts for 2 KW. These figures are actual tests from a number supplied, not from makers' lists.

I quite agree with "Climax" about the meter reading showing 10 per cent. higher on a small load, which equal the no-load loss, because from an actual test, not made by me, for three days, without any lights being used, the reading was not proportionate to the amount registered when the lights were used at full load. Hence the economy of switching off the transformer, or installing an auto switch if the former method is not convenient, which it was not in this case.

An Enquirer.

September 16th, 1909.

Electric Miners' Lamps.

Mr. Turquand's reply to my last letter dealing with the working costs of electric miners' lamps is evidently based not on personal experience, but on sources which may, or may not, be unimpeachable. I quite fail to see why anything so desirable as facts concerning the results of the Ediswan bulbs should be withheld; surely the cause of the electric lamp cannot be strengthened by such a policy.

The figures I have quoted are based on experience, the nature and extent of which are, I believe, familiar to Mr. Turquand. I am quite prepared to accept the assurance he has given that his lamp is a great advance on the Sussmann—so far as it goes—but, while I do not for one moment wish to put forward arguments calculated to assist the other "party," I cannot bring myself to accept unreservedly sweeping statements for or against the electric lamp unless some measure of practical proof is forthcoming. I do not agree with your correspondent's estimate of costs, which, I note, is the outcome of "further study" of the question. It has surprised me that he should have attempted to make any corrections on my statements before having thoroughly acquainted himself with the position.

I believe my experience with electric miners' lamps is the more extensive of the two; for this reason alone, I respectfully submit that my argument should be answered with figures. Meanwhile, I shall be glad to render any such help as may be at my command and likely to be of service to those interested in electric lamps.

Giraldus Jones.

Birmingham, *September 20th*, 1909.

Tramway Power Tariffs.

However much you may have qualified it, it cannot be denied that you deliberately compared the works costs of certain tramway power stations with the charges made by certain combined lighting and power stations for tramway energy, which charges are based on works costs plus capital charges. You then, in your explanatory notes, pick out certain items of the Glasgow tramways accounts which suit your purpose, because it would obviously not help you if you included *all* the items the Glasgow people themselves include.

A. H. Seabrook.

September 17th, 1909.

[Mr. Seabrook now says that we "deliberately" compared certain costs; last week he said we had "perpetrated a blunder." He is certainly nearer the mark now, for we knew perfectly well what we were doing, and no blunder was made. But we protest against his method of criticising a paragraph in our article, and refusing to recognise that it is inseparable from the remainder.—EDS. E.R.]

Before replying to your footnote to my letter, as published in the ELECTRICAL REVIEW of the 17th inst., I would like to say that my sole concern was, and still is, to (*a*) prove that your premises and conclusions as to Glasgow and Manchester were unsound, and (*b*) inferentially to show that probably your comparisons between other towns were also unsound. I have no wish to disparage the Glasgow Tramways Department in any way, nor to draw any comparisons further than are necessary, but your leader has put the advocates of combined undertakings on the defensive; and as one of them, I am merely wishful to prove that Manchester's traction policy has been a wise one.

May I further say, that I did not furnish the figures of cost for Manchester and Glasgow as absolutely, but only as approximately, comparable. My main object in giving the figures was to reveal the serious omissions in your survey, apparently with some result, for we now have a figure in the case of Glasgow of ·84d. per unit taking the place of the previous ·35d. I will, however, deal presently with the cost in greater detail, although there are serious difficulties in obtaining a really common basis of comparison. This difficulty of comparing like with like appears to have been entirely ignored by you, your assumption being that costs ought to be uniform, regardless of difference in financial policies, physical conditions, &c.

As an illustration of this, may I cite two cases—one town vhere, owing to halfpenny fares, many more passengers are arried than in the second town, the traffic being well spread ut over the day, the other town enjoying the benefit of igher fares, but experiencing much worse "peaks" in the nornings and evenings. Leaving out of consideration the iet results of the working of the two tramway systems, is t not obvious that the power costs in the first case are ound to be lower (reckoned per unit of energy consumed) han in the second? Then, again, as a more striking llustration, the cost of supplying energy in a widely scattered rea cannot conceivably be as low as in a very compact and nore densely populated area. All these differences unloubtedly influence costs.

But to return to the comparison of Glasgow and Manchester. It is true, as you say, that Glasgow's costs include £47,547 for depreciation, but you are in error in stating that there is no counterpart to this in the Manchester costs. Manchester provided £40,000 in respect of its entire capital outlay in the electricity department, and of this the tramways bore its proper quota. Glasgow's provision worked out at 4·58 per cent. on capital outlay as against Manchester's provision of 1·68 per cent., leaving a difference of 2·9 per cent. attributable to Glasgow's avowed policy of ultimately dispensing with borrowed capital.

On the score of provision for repayment of debt, Manchester had to provide 2¾ per cent. as against 2 per cent. in Glasgow—these percentages being, of course, beyond the control of either town; both towns, therefore, have to be put on an equality thereon for comparative purposes. On the score of rents, rates and taxes, the comparison between Glasgow and Manchester is anything but fair. Glasgow pays £48,000 against a total capital outlay of £3,145,576, but only debits power expenses (*vide* annual accounts, page 21) with £5,069, although the capital outlay on the supply of power (as distinct from operation of cars) is stated at £1,038,812. A proper allocation on the bare data published is not possible, but dividing the £48,000 in the ratio of the two outlays would give a further charge against the power costs of £10,053.

The Glasgow account as then put into line with Manchester (so far as circumstances permit) would read thus:—

Total costs as published	£136,145
Add amount under-estimated for rates, taxes, &c.	10,053
Difference in rates of sinking fund obligations	7,791
	£153,989
Deduct difference in rates of depreciation written off by the two undertakings	30,125
	£123,864

Dividing this by the figures admitted by you, viz., 25,204,530 units, less 496,770 units bought from the Glasgow electricity department, or 24,707,760 net, which allows for units "used in car works, depôts, &c.," we have a cost of 1·20d. per unit, as against Manchester's charge of 1·14d.

So far I have dealt with costs in the year 1908. If reference be made to the accounts for the year 1909, it will be found that in Glasgow there is a slight increase in costs, and that in Manchester the charge has fallen from 1·14d. to 1·04d. per unit. For the year now running the charge in Manchester is settled at 1d., plus or minus a slight adjustment in case coal differs from 10s. per ton.

It is thus patent that the tramways department in Manchester is buying current from the electricity department at a lower price than Glasgow's self-contained undertaking can produce it for.

As regards the linking of the two Glasgow departments, full advantage cannot obviously be taken until such time as renewals or extensions are necessary in one or both departments. The linking implies a decided change of policy, the whole fruit of which may not be apparent for some years.

G. L. Pearce.

[Mr. Pearce introduces certain questionable assumptions in order to support his case.

Thus he increases the Glasgow loan charges to a hypothetical amount in order to put them on the same basis as those of Manchester, but he makes no allowance for the overhead equipment, &c., cost included in Glasgow's capital expenditure, and not in Manchester's.

Then, again, he allocates three times as much rent, rates and taxes to the Glasgow power expenses as the Glasgow people themselves allow, but takes no account of the fact that the Scottish undertaking pays in rates, &c., 1·5 per cent. on its capital as against only ·92 per cent. in the case of Manchester; furthermore, he assumes the assessment at Glasgow to be *pro rata* on the capital employed in power plant and tramways, although the usual practice in tramway rating appears to be to assess the tramway undertaking on its gross receipts, while the power plant is allotted a proportion based on a small percentage of the structural value of buildings and plant.

If, as it appears, the power plant is favourably assessed as compared with the whole undertaking, and as compared with a combined plant, so much the better for the tramway power station.

Again, although Mr. Pearce makes an allowance for Glasgow's high rate of depreciation, he is significantly silent as to the proportion of the £40,000 provided at Manchester for depreciation, which may apply to tramway plant.

We have never suggested that exact comparison between the two cases was possible, but we do contend that something more than coincidence is required to explain away the lower power cost of tramway undertakings in general which possess their own plants, as compared with tramway undertakings in general purchasing energy, and particularly so in the case of undertakings in neighbouring towns.

For the rest, we quite appreciate Mr. Pearce's desire to prove that Manchester's traction policy is the correct one, although we may not agree with his method of doing so.—Eds. E.R.]

As Mr. S. L. Pearce's observations in your current issue respecting Sheffield's published figures on costs per units generated, may be open to an incorrect interpretation, may I be allowed to point out that the figure ·668d. was evidently taken from our statement of accounts to March 25th, 1908.

To bring these figures up to date, our total costs per unit generated for year ending March 25th, 1909, were ·659d., the allocation being taken from all items set out in what is now known, and happily agreed upon, as the "Standard Form of Tramway Accounts" (this having been considered suitable and applicable for comparative purposes to self-contained or other undertakings). The figure ·659d. is made up as follows:—

Works costs—including maintenance and repairs of all plant, ducts, cables, buildings, &c. ...	·390d.
Proportion of rates and taxes	·022d.
,, insurance premiums	·006d.
Interest and sinking fund	241d.
	·659d.

I agree that our figures "require considerable adjustment before they are comparable with those of Manchester," but it appears to me that Mr. Pearce, instead of bringing his figures down to our basis, raises our figures in his comparison up to ·81d. per unit, presumably from his own system of allocating certain charges.

As I am at the present time preparing a paper for the Institution of Electrical Engineers on "Equitable Charges for Tramway Supply," I must reserve my opinion as to what should be included under "fixed" charges in determining selling price to a tramways undertaking, which subject is a very debatable one.

H. E. Yerbury,
Chief Engineer.

Sheffield Corporation Tramways,
September 20th, 1909.

Induction Motor Trouble.

Could anyone, through the medium of this journal, enlighten me as to the explanation of the following tests on a 10-H.P. induction motor, slip-ring rotor:—Running light on 85 ∼ 210 volts, it took 29 amperes 1,100 watts, whereas when stationary and rotor on open-circuit, it took only 15 amperes on 210 volts 85 ∼. These readings give the following data: friction, windage and core losses, &c., = 1,100 watts;

therefore, at 210 volts, 5·25 amperes = energy amperes, and taking second reading as magnetising current, this = 15. Therefore, when running—

$$\text{resultant } c = \sqrt{15^2 + 5{\cdot}25^2} = 15{\cdot}9 \text{ amperes.}$$

This is totally different to test (1), which gave current = 29 amperes. Why is this? Are there any other losses to come in when running light?

Troubled.

REVIEWS.

Electricité Agricole. By A. PETIT. Paris: J. B. Baillière et fils. Price 5 fr.

This is one of the 60 volumes forming the excellent agricultural encyclopedia edited by Mons. G. Wery, assistant director of the French National Agricultural Institute.

The book is well written, and is intended to show the French farmer what use has been made of electrical energy in farming operations, and to familiarise him with the terms commonly employed in electrical work. After explaining these terms, the book deals with the conditions under which electrical energy is generated and distributed. Direct-current dynamos and motors, accumulators, alternating-current machines and induction motors are described, and diagrams are given showing the various methods of winding motor and dynamo field circuits, as well as the connections of polyphase circuits.

The question of generation or purchase of electrical energy is discussed from the standpoints of convenience and economy, the various systems of charging are detailed, and the tariffs of a number of supply undertakings are given both for lighting and for power.

The rest of the book is devoted to a systematic study of the uses of electricity in farm work. The various methods of lighting are dealt with, and a number of electric lamps described.

Electrically driven ploughs, threshing machines, saws, pumps, root crushers, ice-making machines, cream separators and chaff cutters are each described, and the various methods of driving them are given, with—where possible—the power required.

Afterwards the use which may be made of electricity as a heating and ventilating agent is considered, and a further chapter deals with the cases in which the chemical effects of the electric current are made use of, as in the sterilisation of milk and of water by means of ozone, tanning, sugar refining, bleaching, and the rectification of alcohol compounds.

It is noticeable that no reference is made to the effect on the growth of crops which electrostatic charges are said to cause, or to the experiments which have been made under the direction of Sir Oliver Lodge on this subject.

The physical effects of electric currents are considered, and directions given as to the treatment to be applied in cases of electric shock.

The book contains much information as to actual installations, and in many cases gives capital outlay and working results. It refers to the difficulties which have had to be overcome in early installations, due to the antipathy of the workers to new methods. The author looks forward to a largely-extended use of electricity for farming purposes in the near future.

Kinlochleven Assessment.—An Appeal Court under the Lands Valuation Act was held at Oban last week, when the case of the Kinlochleven Water and Electric Power Co., which the assessor had assessed at £60,000, was considered. According to the *Glasgow Daily Herald*, evidence was led at considerable length by Messrs. Tait, Munro and Ferguson for the Aluminium Co., and for the assessor by Mr. Jackson, assessor of railways, and by Mr. Allan Carter, C E, Edinburgh. After a hearing which lasted for five and a half hours, the Bench came to the decision that the works should be assessed at £30,000 when in full working order, being 5 per cent. on £642,000 of capital expenditure, and that for this year, owing to the incomplete state of the works, the valuation be restricted to £10,170.

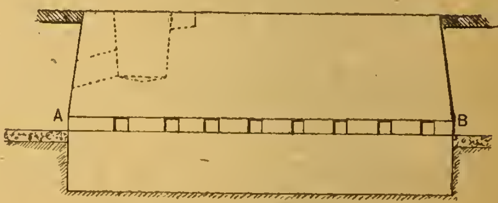
BUILDING AN ENGINE FOUNDATION.

By ENGINEER-IN-CHARGE.

THERE is no structure embodied in the lay-out of a powe house whose appearance appeals to the eye of an observe or is likely to stimulate his imagination to inquiry whe observed, less than the very basis of the most important an intricate machinery within the building, to wit, the engin foundation. As a rule, on the main floor of the engin room the foundation makes no appearance at all, and when o going below into the basement one does catch sight of it, i appears merely to be a wall erected for conveniently carrying racks for cables and conduits for lighting circuits, supporting the floor above it, and light duties of that kin giving no superficial evidence of the heavy responsibilit which is its *raison d'être.*

Nevertheless, in spite of its unpretentious appearanc there are many interesting details which must necessaril be considered and correctly summed up in order that th finished work may give satisfaction, and remain out o mind as well as out of sight during its existence. Th notes which follow refer to the building of a typical concret foundation, to carry a large high-speed engine and generator. Figs. 1 and 2 give a general idea of its shape an proportions; the superficial area was decided by the size o the plant to be installed on it, and the depth by the usu considerations of getting solid ground to carry the weigh and of not transmitting any vibration to the walls of th building. In the example shown the base is slightly wide than the top; this "batter" helps to counteract the tendency for transmission of vibration, though it is not necessity, many foundations for similar purposes havin vertical sides and ends. The first step on the site of the ne foundation is to mark out the plan, with its centre line dul set out from the adjacent machinery or other fixtures, as th occasion demands or allows. In the case under consideratio a smaller generating set was removed and its brick foundation with it, in order to make room for the larger set, an then the ground was dug to the necessary shape to receiv the lower part of the new foundation. In this process some water was encountered, but did not give much trouble, as it was only a small quantity of surface drainage, and by digging first one part and then another lower than the remainder of the space, the water could be drained away from the portion it was desired to work on. In order that the job should be done expeditiously, two shifts of eight men each were worked, 12 hours each, for four or five days, at the end of which time the space was ready for the new structure.

FIG. 1.



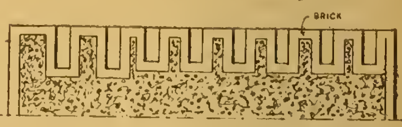


FIG. 2.

Whilst the work of clearing was proceeding, the adjacent machinery was protected from the dust, necessarily raised, by large sheets of tarpaulin hung as a screen between it and the work. Then the filling-in with concrete commenced, another process which was carried on continuously day and night, for the reason that if a layer of concrete were left exposed to the air some 10 or 12 hours, especially in such a warm atmosphere as is usual in an engine room, the surface would harden quite sufficiently to prevent its amalgamating perly with the next layer put on above it, and the result uld be, as has been shown by experience, that cracks would pear in lines marking the separate layers, and vibration ubles would set in. The concrete was prepared and ndled as follows :—

A square wooden frame 5 ft. 6 in. × 5 ft. 6 in. × 11 in., lding approximately 1 cb. yd. of material, was placed on a rel piece of ground, with bricks set in to make a good hard rface. The frame was nearly filled with good clean stone llast, crushed to pass through a sieve of about 1½ in. mesh, d clean sharp sand, in the proportion of ten of the former one of the latter, and on the top of the heap were deposited o and a half bags, 5 cwt., of Portland cement, making one bic yard of material. The frame was then removed and e whole mass mixed, dry at first and then watered, the ixing being continued until the desired consistency was tained. The concrete was then loaded into a hand barrow d wheeled to the foundation site, where it was deposited by eans of a long wooden shute leading down to the base of e foundation. The shute was moved about over the rface to be covered, and as the space was filled up, lengths ere sawn off it as required. Layers of 8 or 9 in. in depth ere spread over the whole area at one time. The ballast ould be inspected for soft pieces of bad stone, which can sily be crushed in the fingers, and any with an appreciable antity of such bad stuff should be rejected, or it would in the concrete. Similarly the sand is liable to be dirty, ntaining many pebbles and clayey lumps of sewage which pear black inside when broken ; these also have a deleterious fect.

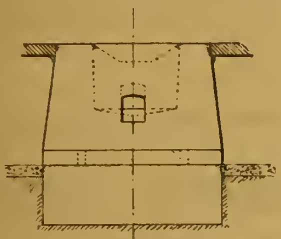


Fig. 3.

When the concrete was up to the lower floor level, it was refully levelled off round the edges, and five courses of affordshire blue brick were laid in such a manner as to ake openings from the sides for access to the nuts and ates of the bedplate holding-down bolts. (Fig. 3.)

The openings were then boarded up, three boards in each ig. 4); on the top boards the positions of the bottom ds of the foundation bolts were marked, and circular wood lugs, 3 in. in diameter, were nailed on accurately, with e aid of a large wood template frame (fig. 5). Above is level a frame was necessary to hold the concrete in e required shape until it had set ; this was constructed y making a skeleton frame all round, of nearly vertical attens 10 ft. long × 7 in. × 3 in., spaced at intervals of about 3 ft. 6 in., sloping in towards the top to give the required batter (fig. 4). Each batten was propped by a board nailed to it at one end and bearing on walls or other fixtures at the other end ; at the foot of each batten a prop was wedged, to hold it up against the strain which would tend to thrust it out when the interior was filled. Boards were then nailed horizontally against the battens, inside, and a layer of concrete filled in to a height of 8 or 9 in. The foundation bolt-holes were constructed by placing 3-ft. lengths of earthenware pipe, 4 in. in external diameter, centrally over the above-mentioned circular wood plugs, and concreting round. As soon as the concrete laid to the height of these pipes was able to retain its shape, the pipes were withdrawn and the process repeated for another length. Holes of 5 or 6 ft. length thus having been obtained, and the concrete-stiffened iron pipes, of 3 in. internal diameter, and of sufficient length to reach the final top level of the foundation, were placed in the holes, and some thin concrete run round them to fill the little annular space outside. Meanwhile, the bolt-hole template was fitted on to the tops of the iron pipes and each one supported *in situ* from the horizontal boards running round the top of the skeleton frame, by means of a board with a circular plug on it similar to the one at the bottom end of the pipe (fig. 4).

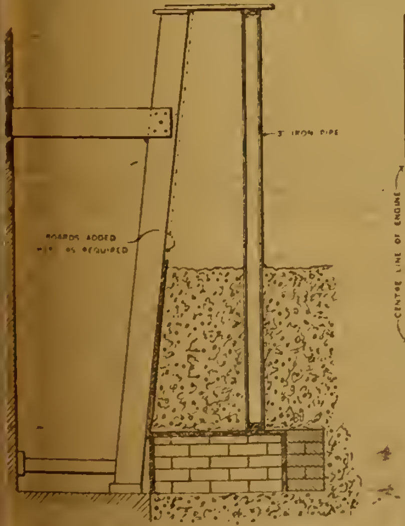


Fig. 4.

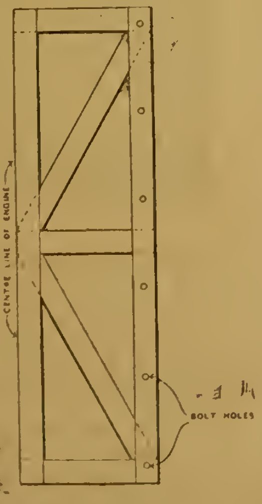


Fig. 5.

Then the process of filling up the frame with concrete was continued, boards being added horizontally as required to effect this. The boards at the ends of the frame were carefully sawn to shape the exact width of the foundation, allowing the longitudinal boards to project past their ends, and making a neat finish at the corners. At the generator end a pit was required to admit part of the machine and to allow for cleaning the same, inspecting cable connections, &c. To strengthen the walls round the pit, some two or three strips of expanded steel were laid, four square, enclosing the area of the pit, overlapping one another at the ends, with about 8 in. or 9 in. of concrete between the layers. The holes for carrying the cables from the generator to the basement, and for draining the pit in case of any liquid being spilt there, were made by laying iron pipes of suitable size in the required positions before the concrete was built up. The foundation top was finished off by a layer of special material 1½ in. thick, while the concrete was still wet, made up of two parts dross shingle (fine sharp slag refuse from iron furnaces, like flint) to one of sand and one of cement. This finishing layer was above the tops of the iron pipes and 2 in. below the floor level, which was made up by the flooring material after the machinery had been erected.

When the foundation was completed, a process taking about 18 days, day and night work without cessation, old sacks were spread over the top surface and nailed all round the timbering at the top, and kept damp by watering with a can every three or four hours for about ten days, in order to avoid any risk of the concrete cracking due to the outer portions drying and setting much more rapidly than the interior. Some nine days later the timbering was removed, and finally, rough places were filled in with concrete and smoothed off to make a neat job. The foundation was then ready to receive the machinery, so far as any work to be done was concerned, but such a large mass of concrete requires to stand about six weeks to two months at least before any great weight is put on it, and hence a very necessary consideration is to antedate this work by a considerable period to the delivery of the machinery. The weights of high-speed engines of the usual vertical enclosed type vary from about 14 tons for 250-B.H.P. size to 110 tons for 2,500 B.H.P., and though the turning moment of a well-balanced three-crank engine is very uniform, and gives rise to very little vibration, the dead weight is considerable and necessitates every precaution being taken to make the foundation firm, to avoid any risk of serious trouble after the plant has been put in commission.

South Africa.—The Customs Authorities of South Africa have recently given a decision to the effect that "electric magnetos and parts thereof imported separately" are to be classified under No. 986 of the tariff, the duty being 3 per cent. *ad valorem* on foreign goods, while those of British manufacture are admitted free of import duty.

USELESS TENDERING.

By "L. M."

It is surely high time that the electrical trade as a whole took up arms to put a determined stop to the present reckless waste of time and money in tendering for work which will never be given out, or for which some particular firm has been chosen, the invitation to tender being merely a cheap and easy way for the buyer to check the favoured firm's prices.

In many cases the amount spent by the various firms tendering must considerably exceed the profit to be obtained on the contract. Quite recently some 10 or 12 manufacturers were asked to tender for two or three small (20-H.P. and under) motors to special requirements, where they could not possibly hope to secure the order, seeing that the purchasers have a financial interest in certain electrical works. An invitation to tender should certainly imply that the client intends to make fair use of the tender, *i e.*, to buy from the party tendering if he sends in a favourable offer; and any departure from this course is nothing more or less than "obtaining prices and technical data under false pretences." In how many instances, after one has gone to a lot of trouble and expense to quote, does the client absolutely refuse to give any explanation as to why the order has been placed elsewhere! In fact, the treatment of contractors' representatives is in many instances little short of scandalous.

The consulting engineer has had many hard things said against him, such as making up his final specification from the contracting firm's tenders by the "scissors and paste method," and obtaining trade discounts for clients not connected with the trade; there is, however, a far more objectionable element—namely, the non-manufacturing contracting firm that usually poses as specialising in some particular branch such as power distribution or mining, ships' plant, &c.

Many of these firms are agents (openly or otherwise) for manufacturing firms, mostly Continental, on the one hand; while they are controlled and even actively managed by gentlemen who are at the same time managers or on the boards of directors of the firms purchasing plant. Now as these good people are naturally interested in the welfare of the agent firm, they must naturally be inclined to give their tenders undue preference, even to the extent of thereby going against the best interests of the company purchasing the plant, for no man can faithfully serve two masters.

Outside firms have little or no chance, as if they quote favourably the agent firm naturally knows their exact prices and simply modifies its tender to suit the case.

It is almost impossible for the electrical trade to stop this sort of thing, and the only course would appear to be the publishing of a sort of black list, so that the trade would know when owing to vested interests it would be useless to quote. It should, of course, be quite illegal for a director of any company at the same time to be on the board of, or connected with, a second company doing business with the first; but the present state of our company promotion law is a national disgrace. At present, A, B and C float a company; A's firm supply the building material, B's the electrical plant, and C's the engines and boilers; then they calmly make their exit, and leave the poor shareholders proper with the white elephant. As a well-known legal gentleman once said, "Don't steal a horse, or you will be put in prison for theft; buy it, but don't pay for it, and with reasonable care you will be quite safe."

Possibly when our foreign rivals have captured still more of our trade (they are certainly doing remarkably well at the moment in South Africa) we shall wake up and get a *business Government* and a set of *business, company and other laws*; meanwhile the only hope seems to lie in more united working together, and less "cut-throat" policy among the trade itself.

Abroad the various firms work together far more than we do, and, partly as a result, manage to pay decent dividends, whereas few electrical firms in this country are paying anything worth speaking about.

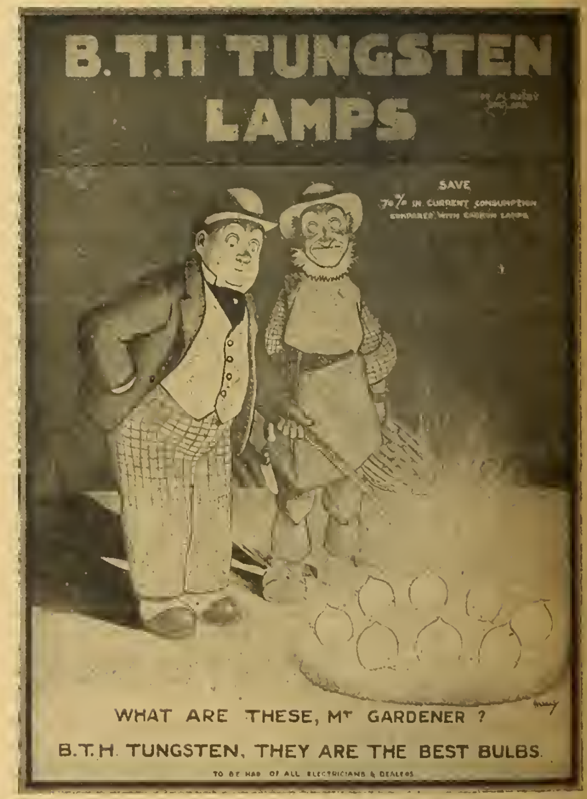
Almost without exception, the whole of the foreign agents are dealing in this country under Anglicised names, so that buyers dealing with these firms are often under the impression that they are getting British-made goods; this is very noticeable in the cable trade, and especially in the name-plate business.

A contractor in the Midlands, recently tendering for "British-made material throughout," offered cables made by a firm having a London address, believing this to be a British concern, whereas it is merely the English branch of one of the German cable works.

In this respect the Merchandise Marks Act is defective, as so long as no name or trade mark appears on the goods, it is not necessary to mark the goods as "made abroad." The cases, of course, have to be so marked, but there is nothing to prevent the goods being repacked, and sold, more or less, on the understanding that they are of English manufacture, after they have passed through the Customs.

BUSINESS NOTES.

B.T.-H. Lamp Poster.—We do not remember any line of electrical manufactures in which the British designer has evidenced so much ingenuity in the production of original and striking publicity cards as he has displayed in pushing the sale of metal-filament lamps. A number of these have already been alluded to in the Electrical Review. and we have now before us one, more humorous than some others affect to be, issued by the British Thomson-Houston Co, Ltd., of Rugby. It is easier to publish the accompanying block of the card than to write anything about it. The show-card is supplied in two sizes, the smaller one being before us. The larger, measuring 20 in. × 30 in., is expected off the press very shortly. Any dealer in B.T.-H. lamps can obtain a copy of the poster by sending a trade card to the makers' Publication Department at Rugby.


B.T.H TUNGSTEN LAMPS
SAVE 70% IN CURRENT CONSUMPTION COMPARED WITH CARBON LAMPS
WHAT ARE THESE, Mr GARDENER ?
B.T.H. TUNGSTEN, THEY ARE THE BEST BULBS.
TO BE HAD OF ALL ELECTRICIANS & DEALERS

Catalogues and Lists.—Messrs. Vickers, Sons and Maxim, Ltd, 32, Victoria Street, S.W.—Eight-page illustrated pamphlet containing a description, with a number of drawings in colour, of the V.S M. automatic forced lubrication system as made by them for all types of bearings, including axle boxes for rolling stock. Notes of advantages, and a list of prices of rigid pedestal bearings, and swivel bearings and component parts, are given.

Messrs. Baxendale & Co., Miller Street, Manchester.—Very complete illustrated catalogue of 76 pages, covering a large variety of electric bells and kindred manufactures. Prices are set out plainly, illustrations are profuse, and diagrams of connections are given. The articles included in the list are pushes in wood, china and metal—plain and ornamental—door contacts, burglar alarms, numerous electric bells for house, factory, outdoor, mining and other service, indicators, bell wires, overhead line material, batteries, complete bell sets, induction coils, magneto medical apparatus, lightning conductors, and very many other things.

Messrs. Dorman & Smith, Ordsal Electrical Works, Salford, Manchester.—Illustrated and priced leaflet of D. and S. 600-volt "C" type main switches and a new series of cast-iron mill fittings.

Messrs. Smithson, Sharpe & Co., Sykes Street, Hulme, Manchester.—Sixteen-page illustrated price list of "Manchester" arc lamps and accessories. It shows and describes briefly vertical and inverted differential arc lamps, vertical single enclosure, twin carbon, photographic printing, and miniature arc lamps, also a number of devices such as "live" resistances, transformers, choking coils, elevators, weather-proof hoods, &c.

Messrs. Ross & Co., 62, Robertson Street, Glasgow.—This is a bulky catalogue of 120 pages which is described as a "Wholesale and Export Price List of wires, cables and electrical accessories." Commencing in Section A with "Rosa" vulcanised electric light wires and cables and flexible cords, also bell, telephone and other wires, it proceeds to particularise in Section B, a large variety of of electric lighting accessories such as fuseboards and main switches, insulating material and tools, arc and incandescent lamps, dynamo brushes, ironclad switches and fuses, wall plugs, tumbler switches, ceiling roses and other things of that cult, with some wood blocks and shades, and factory and ships' fittings bringing up to the rear. The largest section of all ("C") is devoted entirely to electric bells and accessories, covering a host of materials used in that connection.

The Linolite Co., 25, Victoria Street, S.W.—Several new publications regarding the "Tubolite" system. One expatiates upon the efficiency and economy of the system using metal-filament lamps; another gives technical particulars of the system of both metal and carbon lamps and candle-power life curves; a third shows the system for shop window and stage lighting, and for desk use; another is a price list, while, lastly, a leaflet describes the "Challenge" patent door alarm.

Messrs. Atkinson Bros., Aire Place, Kirkstall Road, Leeds.—Several lists of their manufactures giving particulars with illustrations and prices of the following:—Electric box-blade fans, punkah fans, and motor-driven ceiling fans; three-speed sensitive electric drills, motors and polishing machines fitted with the firm's dust-proof bearings, hand-power bench screwing machines, motor-driven hack saws and factory ceiling fans, all of which are manufactured at the above address.

The Foster Arc Lamp and Engineering Co., Ltd., Worple Road, Wimbledon, S.W.—Two leaflets relating to the "Foster" automatic transformer switch, giving prices and instructions for working and connecting same, and to the electric bell transformers for use on A.C. supply.

Messrs. Litholite, Ltd., 55, Hackney Grove, N.E.—Sheets 16 and 17 (for insertion in their catalogue) giving illustrations and dimension sketches of their standard Litholite insulators—tube-end bushes, electrolier nipples, wall plugs, also formers and bobbins, and insulated spanners.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—20-page pamphlet (No. 21A) giving full descriptive particulars with dimensional sketches, and a good deal of tabulated technical data as to sizes, speeds, efficiencies, &c., of Peebles continuous-current dynamos and motors of medium size, self-contained—of the protected, semi-enclosed and totally enclosed types respectively. It is hoped that the fully approximate dimensions given of all machines listed will be useful to customers in determining the space necessary for any machine.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—A novelty which has been issued to continue the popularising of the "Efesca" metal-filament lamp with the private consumer, takes the form of a pasteboard cut-out reproducing the actual lamp. Upon opening out the two halves of the bulb one finds pasted within a folded circular telling about that 70 per cent. saving in current consumption and other interesting matters relating to the lamp. The firm will supply a batch of these novelties, with his own name and address printed thereon, to any trade customer interested.

Messrs. Druce & Co., 72, Temple Street, Wolverhampton.—Loose leaflet giving particulars and prices of overload circuit-breakers.

Messrs. Wm. Wadsworth & Sons, School Hill, Bolton.—"Something New in Transporting" is the title of a very attractively-produced folder with an impressive cover quite out of the ordinary style, informing the recipient that the firm is "At your service!" for any of the electric passenger lifts, goods lifts, electric transporters and other specialities, which are alluded to in the few pages of illustrations that are within.

Messrs. Elliott Bros., 36, Leicester Square, W.C.—Leaflet describing the Campbell-Hyslop Map and Fuse Scale, for the use of officers in field artillery training.

Messrs. Hawksley, Wild & Co., Ltd., Brightside Boiler Works, Sheffield.—Leaflet relating to the "Suckling" water-tube boilers, in which the tubes are vertical between two large drums, with ample provision for free circulation and facilities for removing any tube without disturbing others.

Photographic Exhibition.—The annual exhibition of the Royal Photographic Society of Great Britain is now open at the New Gallery, Regent Street, and includes a number of radiograms, and other examples of scientific photography.

Bankruptcy.—*Re* Joseph Richard Hill, The White House, Wollaston, Worcester, carrying on business at the Orb Works, Lye, Worcester, inventor, &c.—The first meeting of creditors was held at Dudley on September 21st, when a statement of affairs was submitted showing liabilities £1,037, of which £702 was expected to rank. There was a deficiency of £531. The causes of failure as alleged by the debtor, were chiefly heavy expenses in connection with experimenting and developing patents. The debtor, who is 58 years of age, patented a reduction gear for electric motors in August, 1904. Early in the following year he purchased the Orb Works, Lye, for £300, after paying which he had about £200 capital. He took these works to develop his inventions, which were chiefly in regard to electrical machinery, and to carry on business as a scrap iron merchant. In November, 1906, debtor sold a fourth share of his patent for reduction gear for electric motors for £250, but he had not been successful in selling the remainder, and it figured as an asset, but he could not estimate its value. The receiving order was made on August 30th on a creditor's petition, the act of bankruptcy alleged being that the debtor had made an assignment of his property to a trustee for the benefit of his creditors generally. The debtor has not yet been adjudicated a bankrupt, as he thinks possibly that his friends will assist him in offering a composition. The bank holds the deeds of the Orb Works as a security for an overdraft. In April, 1908, debtor purported to mortgage the whole of his household furniture for £200, then advanced, but as the document was not registered as a bill of sale it is of no value. At the meeting on September 21st, the question of a composition was considered, but the debtor said he was not prepared to make a definite offer. The matter was left in the hands of the Official Receiver.

E. F. Jones, plumber and electrical engineer, York Road, West Hartlepool.—Order made at Sunderland, September 16th.

H. P. Alison, 7, Great Newport Street, London (Laing, Wharton and Cunnington).—This bankrupt has applied for his discharge, and the application is to be heard on October 13th.

Herbert John Burdett, electrical engineer and contractor, 16, Regent Street, Rugby, and 32, Earl Street, Coventry.—The Official Receiver has issued a summary of the debtor's statement of affairs. —This shows gross liabilities amounting to £1,214, of which £1,154 is expected to rank. The assets, after deducting preferential claims, are estimated to produce £334, leaving a deficiency of £819. Debtor gives as the causes of failure, "trade depression in Rugby, competition, bad debts, illness and heavy rental." The first meeting of creditors was held on Monday at the offices of the Official Receiver (Mr. C. J. Band), Coventry. Mr. H. L. Reddish appeared on behalf of the debtor, and the proceedings were only formal. Mr. Alfred Cripwell (Messrs. Corfield & Cripwell) was appointed trustee.

Book Notices.—Manchester Steam Users' Association; Memorandum by Chief Engineer for 1908. Manchester: The Association.—It is well known that Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, during the past few years has devoted much attention to the study of water-hammer in steam pipes, and has practically made the subject his own; the present memorandum is entirely devoted to comparing actual cases with the theory of water-hammer which he has put forward. He finds that nearly one-half of the number of explosions are due either to the absence of drain cocks on steam pipes, or to their injudicious use. A large number of explosions, chiefly on steamers, are caused by admitting steam into pipes which contain water; other explosions have occurred when water was admitted into steam pipes, or when steam condensed in them. There are also cases of steam being admitted through valves on which water was resting, the injudicious opening of valves having steam and water on both sides, and injudicious manipulations of steam valves whereby plugs of water were set in motion. Mr. Stromeyer points out that as the fitting of draining arrangements, which are intended to obviate explosions, has been the cause of the majority of explosions, and because in complicated pipe arrangements the water-hammers which do occur may often be attributed to any one of the possibilities mentioned above, it would be dangerous at present to lay down definite rules for the design of pipe arrangements in general. He hopes, however, that his present memorandum will enable those who have to deal with steam pipes to do so in the light of the accumulated experiences of the past, which he has now carefully classified. Mr. Stromeyer complains of the deficiencies in the official reports of steam pipe explosions, and more particularly of the judicial pronouncements of the Official Courts of inquiry; instead of explaining the physical causes of the explosions, the finding of the Courts is generally devoted to matters of personal responsibility.

"Proceedings of the Incorporated Municipal Electrical Association, 1909." London: Wyman & Sons, Ltd. Price 5s.

"Chats on Electricity." By Frank Broadbent, M.I.E.E. London: T. Werner Laurie. 1909. Price 3s. 6d. net

"Experimental Physics and Mechanics." By J. L. Maxim. London: Longmans, Green & Co. 1909. Price 1s. 6d.

Important Canadian Contract.—As announced in our "Contracts Closed," Messrs. Jens Orten-Böving & Co., of London, have secured the order for the water turbines which the City of Winnipeg are about to install. The contract is to deliver five turbines of 5,300 H.P. and two of 450 H.P., the total value being $97,150, and we understand that the turbines are the largest of their type in the world. They are of the Francis type, and a considerable amount of the work will be done in this country, though the main hydraulic part will be delivered from Sweden. Unfortunately for this country, as we understand, the manufacture of Francis turbines requires a very long experience, otherwise these large turbines would have been turned out in Great Britian. The question of impulse wheels is quite a different matter, since the execution of work to drawings is comparatively simple in their case, and Messrs. Willans & Robinson, who are manufacturing impulse wheels to the designs of Messrs. Böving & Co., will shortly have several very large wheels under construction. That this order, however, has been obtained by an English firm in competition with all the world, shows what can be expected in the future in connection with the many hydro-electric developments that are going on, and opens up a promising vista for such firms as Messrs. Willans & Robinson, who have recently taken up the manufacture of water turbine machinery, and to hydraulic specialists such as Messrs. Böving & Co.

The "Wultun" Metal-Filament Lamp.—The business of the Premier Electric Lamp Co., Ltd., of Huyton Quarry, near Liverpool, has been absorbed by the British Tungsten Lamp Co., Ltd., who will continue the manufacture of all lamps previously made, and also metal-filaments of the highest quality, at the works at Huyton Quarry. For some months past the company has been engaged in the equipment of the factory with machinery and plant of the latest pattern. The "Wultun" lamp is manufactured solely by the firm under a patented process, and it is claimed to be the most durable and reliable, and that it will burn in any position, does not blacken, and has an average life of 1,000 hours. The "Wultun" lamp is manufactured throughout by British labour at the works, Huyton Quarry. Every lamp is thoroughly tested before leaving the factory.

Dissolutions and Liquidations.—Messrs. Wright Bros. & Co., electrical engineers, 6, Queen's Elm Parade, Chelsea.—Messrs. J. Hemingway, C. Wright and H. T. Wright have dissolved partnership. The Messrs. Wright will attend to debts, &c.

Thomas R. Martin & Co., Ltd., Pilgrim Street, Newcastle-on-Tyne.—A first and final dividend of 6d. in the £ is being paid.

Wireless Control Syndicate, Ltd.—This company is winding up voluntarily, with Mr. Ernest Mason, 6, Gracechurch Street, E.C., as liquidator. A meeting of creditors is to be held on September 30th at 14, Gracechurch Street, E C.

The Japan-British Exhibition.—We have received a copy of the preliminary prospectus of this Exhibition which is to be held from May to October next year at Shepherd's Bush. The Japanese Parliament has already voted 1,800,000 yen (£180,000), and the Government of Formosa and the Local Prefectures have also voted large sums for the Exhibition. It is hoped that the Exhibition will afford Great Britain exceptional opportunities for the maintenance of her position in the foreign trade of Japan. As many of the leading merchants of Japan, as well as business men from other countries, are expected to visit the Exhibition, it is thought that the display at Shepherd's Bush should serve as a powerful advertisement of British products and manufactures. Application forms with schedules of prices for exhibits can be obtained from the Secretary, Japan-British Exhibition, 1910, Exhibition Offices, Great White City, Shepherd's Bush, W.

Time Recorders.—The International Time Recording Co. have just received a repeat order for 12 automatic two-colour time recorders from Messrs. Marshall, Son & Co., Ltd., Gainsborough, also further orders from the Municipal Council of Shanghai, Imperial Japanese Navy and the Woolwich Arsenal.

Trade Announcements.—The Electrical Apparatus Co., Ltd, of Battersea, notify that in future they will be the only manufacturers of the "Koolark" enclosed fuse, and all inquiries and orders for same should be addressed to them, no other firm being authorised to sell or deal in this fuse unless they purchase same from this company in the first instance.

Mr. G. Braulik informs us that Mr. C. Hook, who was engaged in the sales department in his business for a number of years, and also Mr. G. W. Pointer, have severed their connection with the business, owing to a reorganisation of the staff.

Welsbach Metallic-Filament Lamps.—An interesting announcement has been made this week, to the effect that the Welsbach Incandescent Gas Light Co., Ltd., have decided to add the supply of metallic-filament electric lamps to their large trade in gas mantles, &c. For the present the lamps will be imported from Germany. The following extract from the official announcement is noteworthy: "As a business move there can be no question of the soundness of the Welsbach policy, because, whilst there is not, and cannot be, any suggestion that electricity is as yet anything like so cheap as incandescent gas, still the Welsbach is a business company, and there are factors other than cheapness to be taken into consideration, notably the greater cleanliness of electric light." Loyalty to their leading line naturally imposes a certain restraint upon the company's enthusiasm for electricity, but it is easy to read between the lines, and we congratulate the company on their shrewd insight into the future of electric lighting.

LIGHTING and POWER NOTES.

Braunton.—The P.C. has decided to have an interview with Messrs. Crompton & Co.'s engineer with reference to public lighting by electricity. The company offers to provide about 40 lamps, and the cost would be £50 a year, which is slightly less than the cost of the present oil lamps.

Brighton.—In consequence of a report by Mr. Christie on the unsatisfactory condition of the lock gates at Shoreham Harbour, which might result in serious consequences to the working of the electricity station, the Harbour Trustees have decided to refer the matter for consideration by the Works Committee.

Brumby and Frodingham.—The U.D.C. has decided to light the town by electricity in place of the present oil lamps. Energy will be supplied by the Frodingham Steel Co., and the annual cost will effect a saving of £60, whilst a much superior light will be obtained. The capital cost will be £300. The question of obtaining a prov. order so that electricity will be available for private lighting has been deferred for a year.

Bury St. Edmunds.—The T.C. has decided to have the Town Hall and offices wired for electric lighting, the work to be carried out by the electrical engineer, who is to engage a wireman. A motion in favour of the work being carried out by the electricians trading in the town was rejected.

Canada.—The amount of electricity developed in Canada during the past year amounted to 494,358,966 kw.-hours. Of this large amount, 359,280,286 units were exported and 135,075,680 consumed in Canada. The exports were, of course, largely from Niagara Falls production.

The Canadian Light and Power Co., of Montreal, has contracted with J. G. White & Co., New York, for the construction of a hydro-electric plant on the St. Lawrence River, near St. Timothee, Quebec. The plant will utilise the Beauharnois Canal water, giving an available and constant head of 50 ft. The power station will contain three 7,200-h.p. turbine units coupled to 4,000-kw. generators and have space for a fourth unit; also two 400-h.p. exciter units and switchgear; the 27-mile transmission line to Montreal, and sub-station and distributing system at that city, will also be included in the contract, which is estimated to cost about $4,000,000.

Carlisle.—The E.L. Committee has decided to ask the Council to agree to a reserve fund being formed, towards which £600 will be contributed.

Chippenham.—The Electric Supply Co. has commenced the laying of cables in the town.

Continental Notes.—Holland.—It is announced that the municipal authorities of Dordrecht have voted a sum of £600,000 for the establishment of a large central electric lighting station in the town.

Switzerland.—It is proposed to construct an electric mountain railway over the Pillon Pass, between Sepey and Gstaad, as a branch of the Montreux-Zweisimmen line.

Dundee.—The damage by the recent fire at the Corporations station has been assessed at £1,588, and the insurance company has paid the claim. This sum excludes the damage to 23 small transformers belonging to the B.T.-H. Co., which were in the building, and were scorched by the fire. The Corporation has accepted an offer of £550 from Wm. Kerr & Co., Glasgow, for four boilers and two generating sets which were also damaged.

Messrs. G. & A. D. Grimond, Ltd., jute manufacturers, have intimated a claim for £2,582 against the Corporation for failure to supply electrical current according to agreement. The firm bases its claim for damages on the ground of loss of production, disorganisation of plant, &c. The Electrical Committee decided to repudiate all liability, it being stated that Messrs. Grimond were not prepared to receive the supply on the date specified. A Committee has been appointed to watch matters in the interests of the town.

An automatically controlled system of stair lighting has been introduced in a tenement in Seymour Street, which it is hoped may help to solve the vexed question of stair lighting. The Dundee police are to be provided with electric lamps in place of the usual oil lamps.

London.—Hammersmith.—The town clerk has been instructed to make formal application on behalf of the Council to the Board of Trade to appoint a Referee under Sec. 33 of the Tramways Act, 1870, to determine the difference with the London United Tramways, Ltd., in regard to the tracks.

Bermondsey.—The Electricity Committee report having had under consideration a letter from the L C.C. as to the reserve and renewal funds in respect of wasting assets, where loans had been advanced for 42 years. The Committee points out that the Bermondsey B.C. has recognised the need of a reserve fund, and there is one in existence at the present time with an amount to credit on March 31st of £3,807, and after the current financial year it is intended to add to the fund until a limit is reached of 10 per cent. on the capital outlay.

Merthyr Tydfil.—The Traction and Lighting Co. has applied to the B. of T. for consent to the use of overhead lines for the supply of electricity to Pontmorlais Road West.

Mexborough.—The U.D.C. has received from the L.G.B. sanction to a loan of £3,986 for E.L. purposes. The Council had applied for £4,700, and the sum deducted included £271 for costs of the prov. order. The Council has decided to ask for an explanation of this deduction.

Ramsbottom.—The U.D.C. has approved of the deed of transfer of the E.L. order to the Lancashire Electric Power Co.

Salford.—On Tuesday, Mr. Hooper, of the L.G.B., held an inquiry into an application by the Corporation for sanction to borrow £9,500 for the purpose of electricity undertakings in the borough, including a Prestwich scheme. It was explained that £3,000 was required for the Prestwich undertaking. Three previous loans had totalled to £8,600. Mr. L. C. Evans, the town clerk, explained that great progress had been made in the district, and there were now 205 consumers against 12 in 1905. There was about £1,500 unexpended on the previous loans. The application to borrow £6,500 for a battery installation and other improvements at the generating station in Frederick Road was then dealt with, and Mr. Billington, chairman of the Electricity Committee, said that it would have been better for the undertaking if the profits had been utilised for the provision of better plant instead of bein devoted to the relief of the rates. Mr. Hunt and Mr. Hampsprotested against money being taken from the profits for the relief of the rates when the undertaking was not on a sound footing. They were looking to the future rather than to the present. The town clerk contended that the Council were acting on business lines, and that the undertaking was financially sound. The inquiry was shortly afterwards closed.

South Africa.—The report of the Johannesburg T.C. for the year ended June 30th and the estimate of expenditure for the new municipal year have just been published, and will be of interest to our readers. The revenue from the gas and electricity supply has been £51,900 and from tramways £21,300. The working costs have been reduced from 1·07d. to ·677d. per unit, and is accounted for largely by the fact that for the first time the Council has been enabled to generate its own current by the addition of a 1,000-KW. D.C. Belliss set, and by rearranging the Allen sets to work as balancers and motor-generators. The number of units sold to consumers amounted to 5,477,657, as against 4,522,454 in the previous year, the units for the month of July being 1,209,175, compared with 925,487 for the previous July. The car-miles run were 170,024, against 154,376 for the previous year; passengers carried 1,544,566, against 1,291,781; and fares £20,443, against £16,875. Average receipts per car-mile 2s. 4·84d., against 2s. 4·8d. for 1907-8. The estimated expenditure for the year is as follows:—

Power station improvements	£67,000
Tramway extensions	58,000
To improve day supply in suburbs	1,275
To improve street lighting by "Osrams" ...	3,000
Suburban mains extensions	36,650

The estimated profit for the new year by the gas and electricity department is £82,000, and by the tramways £46,000.

In connection with the power station improvements, it is stated that the maximum demand in June last was 5,400 KW., while in 1910, 1911 and 1912 it is estimated to be 6,400, 7,400 and 8,400 KW. respectively. The normal existing plant capacity to-day is 5,600 KW., so that since June 23rd last it has been found necessary not to accept applications for light and power. The additional generating plant authorised in July last, at an estimated cost of £53,000, will meet all demands for load up to 1911.

In connection with the tramway extensions, the following are the details of the chief extensions to be carried out under the amount voted:—Extend Fordsburg tramway to station, £6,410; Bezuidenhout Valley line to south side, £6,500; extend Parktown West line to Rosebank terminus, £13,836; duplicate Parktown line from Ridge to Zoo, £3,800; extend Auckland Park line to Helville, £6,800; and extend Newtown line to Brixton, £19,295.

South Shields.—The annual report of the Corporation's electricity undertaking has just been issued by Mr. J. H. Cawthra, the engineer. It states that the result of last year's working is satisfactory, considering trade depression and the advent of the metallic-filament lamp. The capital expenditure is £182,268, an increase of £4,830. The revenue for the year ended March 31st last, was £25,559, compared with £25,608 in the previous year, a decrease of £48. The total costs chargeable against revenue for the year were £13,003, against £13,537, a decrease of £534 compared with the previous 12 months. The gross profits were £12,555, against £12,070, an increase of £485. The amount required this year for interest and sinking fund was £11,371, compared with £10,711, an increase of £660. The surplus, after meeting all charges, was £1,184. The net profit was down by £193. The total number of units sold was 3,127,039, an increase of 172,049. During the past year the works costs had been reduced to 0·62d. per unit, and the total operating costs to 0·998d.

On the 17th inst. an inquiry was held on behalf of the L.G.B. into the application by the Corporation for sanction to borrow £3,735 for the purposes of the electrical undertaking. The town clerk said that £2,600 of the amount sought to be borrowed was required for the purpose of duplicating the power mains in order to prevent any stoppage in the supply of current to the docks, shipyards and other industries; £135 was to provide two 1,000-ampere traction-feeder panels for the existing board; and £1,000 was required to connect up new consumers. After evidence had been taken the inquiry was adjourned.

Swinton and Pendlebury.—With regard to the recommendation of the Committee that the Council should appoint its own electrical engineer in place of the present arrangement of management by the Lancs. Electrical Power Co., for which the Council pays £156 per annum, the Council has deferred decision pending an interview between representatives of the Council and the Power Co. The Committee considers that the present arrangement is not consistent with true business principles, as the company is the supplier of energy in bulk to the Council, is manager of the distribution and supply to customers on behalf of the Council, and is contractor both to the Council and the consumers.

Watford.—The U.D.C. is to call the attention of the Herts C.C. to an offer made by the latter body in July, 1905, to take electricity from the U.D.C. for the working of the proposed tramways at Watford at a price to be agreed upon, or in default of agreement the price to be fixed by the B. of T. It was mentioned at a meeting of the District Council that the County Council is now about to obtain tenders for the construction of the tramways. The Urban District Council has instructed its engineer to ascertain the names of owners and occupiers outside the area who desire a supply of electricity.

Worcester.—The T.C. has received from the L.G.B. sanction to a loan of £656 for the plant for storage and handling of coal at Hylton Road electricity works,

TRAMWAY and RAILWAY NOTES.

Argentine.—The Chamber has adopted a Bill authorising the construction of an underground electric railway running across the city of Buenos Ayres from east to west. This is stated to represent a victory for English interests, as the railway will operate in conjunction with a British-owned tramway system.

Colwyn Bay.—Arising out of a joint conference between the Llandudno and Colwyn Bay Electric Railway, Ltd., and the U.D.C., the company has written stating that the directors were unanimous in their view that the question of the construction of any extension of the tramway line could not be taken up unless it was to be extended from the present terminus to the Queen's Hotel, Old Colwyn. The company proposes to apply to the B. of T. for an extension of time to construct this part of the railway until September 30th, 1910. The Council has decided to accept a sum of £5,000, payable on January 1st next, in addition to what has already been paid by the company, and the company to release the Council in respect of £500 towards the Combermere Lodge improvement. The Council, on the condition that this payment be made, will support the application for an extension of the powers.

Croydon.—The completion of the tramway system between Croydon and London by the opening of the L.C.C. extension from Streatham to Norbury (the Croydon terminus) has been followed by the withdrawal of the motor-'bus service in operation in Croydon since July of last year. Apart from this, the new development has had important results for the Croydon undertaking. On 12 Saturdays and Sundays since the through bookings have been in operation the increase in takings totalled £794. The weekly increases for the first five weeks of the through bookings, as compared with the corresponding period of 1908, totalled £1,711. With the absence of motor-'bus competition and increase of receipts due to the link with London, the prospects of the Croydon tramways have taken a very favourable turn.

Horbury.—The U.D.C. has resolved not to consent to the application of the Wakefield and District Light Railways Co. to the B. of T. that the powers with regard to the portion No. 1 of the line in Horbury shall cease.

Keighley.—The Tramways Committee of the T.C. has recommended that application be made to the B. of T. for a prov. order to construct a circular route of tramways from Devonshire Street to West Lane, and from South Street to Lynum Street, linking up the first line at West Lane. Another line from the Ingrow terminus to Whins Wood is proposed.

Rawtenstall.—The T.C. has decided to take steps with a view to laying tramways in the Whitewell Valley in order to meet the wishes of the residents in that growing district. A petition signed by 1,285 ratepayers there has been presented to the T.C. asking that tramways should be constructed.

Shrewsbury.—The T.C. has agreed to advance £500 to the Shropshire and Montgomeryshire Light Railway Co., which intends carrying out a light railway scheme at a cost of £32,000.

Continental Notes.—AUSTRIA.—The horse tramways in Klagenfurt, Carinthia, are to be converted to electric traction.

SPAIN.—The Compania del Tranvia Urbano, Bilbao, is authorised to convert its present horse tramways into electric tramways, and to widen the gauge of certain lines. The Compania Vizcaina de Electricidad has applied to the Direccion General de Obras Publicas, Madrid, for a concession for the construction and working of an electric tramway from Avanzada to Algorta.

SWITZERLAND.—The Compagnie du Chemin de Fer du Birsigtal, of Bâle, has been granted a concession for the construction and working of a metre gauge, single track, electric railway from Bâle to Rodersdorf *via* Flühen.

ITALY.—The *Gazzetta Ufficiale* publishes the terms of a contract granting to the Societá Elettrica Comense "A. Volta" a concession for the construction and working of an electric tramway from Camerlata to Appiano and Mozzate. The concession will be for 60 years, and will carry with it for a period of 50 years from the date of the opening of the line, a State subsidy of £56 per km. yearly.—*Board of Trade Journal.*

RUSSIA.—The central power station which is (according to *Electric Traction Weekly*) being erected to furnish power to the electrified tramway system of St. Petersburg, contains three 2,200-KW. Westinghouse turbo-generators supplying three-phase current at 6,600 volts and 25 cycles; these units are provided with surface condensing plant. The steam raising plant includes 12 water-tube boilers, the gases discharging through two sets of economisers in parallel to two chimneys. The excitation is provided for by steam and electrically-driven generators and a battery; H.T. oil switchgear controls the output of the turbine sets, being installed in a separate fireproof building. The distributing system is arranged in duplicate, and the station is arranged for ultimate extension to 18,000 KW. capacity.

Venezuela.—The Compania Anonima Tranvias Eléctricos de Caracas is to extend its system from Palo Grande to the Nuevo Matadero.

Wolverhampton.—The Lea Road section of the Corporation tramway undertaking was formally inspected by Col. Yorke on behalf of the B. of T. last week.

York.—In view of the impending conversion of the tramways to electrical working, the existing horse service was discontinued last week.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions:—

Tangier-Cadiz	May 19, 1909
Tourane-Amoy	June 17, 1909
Assab-Perim	July 8, 1909
Dakar-Conakry	August 20, 1909
Balikpapan-Kwandang	Sept. 2, 1909
Cheiksaid-Perim	Sept. 15, 1909

Transvaal.—According to the *Board of Trade Journal*, underground telephonic communication has been established in one of the Rand mines, and the installation of telephones underground is likely to be carried out on other mining properties.

Iron Telegraph Poles.—It is reported that a Mr. J. H. Skinner, of Durban, has invented an improved telegraph pole of cast-iron, consisting of sections 5 or 6 ft. long, which can be put together on site. The poles are manufactured at Wentworth, near Durban.

Telephone Amalgamation.—It is reported that the American Telephone and Telegraph Co. has acquired £3,200,000 worth of the New York Telephone Co.'s stock owned by the Western Union Telegraph Co. This ensures in the near future the consolidation in a single huge telephone company, of the Bell Telephone Co. and its subsidiaries working in New York State.

Wireless Telegraphy.—The Postmaster-General has announced that it is proposed to renew the Wireless Telegraphy Act to the end of next year by means of the Expiring Laws Continuance Bill.

Funds are being raised for the erection of a wireless station on or near the summit of Mont Blanc, which is close to the frontiers of France, Italy and Switzerland.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Telegraph and telephone material for the P.M.G., Melbourne. See "Official Notices" September 10th.

Common battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" to-day.

Austria.—The Austrian State Railway authorities at Prague have just invited tenders for the establishment of an electric lighting installation at the railway station at Wiesa-Oberleutensdorf.

Belgium.—September 29th. La Société Nationale de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply and erection of the overhead equipment and the return rail of the Anderlues-Lobbes section of the Carnieres-Thuin electric railway.

Birkenhead. — September 30th. Electrical sundries (Form No. 13) for the Mersey Railway Co. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Bridgend.—September 25th. Electric light installation at the Cottage Homes, for Bridgend and Cowbridge B.G. P. J. Thomas, architect, Bridgend.

Canada.—Toronto.—October 28th. (Extended from October 14th).

Electric motors for the city of Toronto four 1500-H.P. synchronous motors; two 1,500-H.P. induction motors; four 500-H.P. synchronous motors; four 500-H.P. induction motors; two 225-H.P. synchronous motors; with exciters, switchboards, connecting material, &c. Specifications and forms of tender may be obtained on application to the City Engineer.

Turbine pumps as follows:—

Four 13½-million gallon pumps, 100 lb.
Two 5-million gallon pumps, 300 lb. pressure.
Two 10-million gallon pumps, 65 lb. pressure.
Two 10-million gallon pumps, 110 lb. pressure.
Two 6½-million gallon pumps, 90 lb. pressure.
Two 6½-million gallon pumps, 160 lb. pressure.
Two 1½-million gallon pumps, 65 lb. pressure.
Two 1½ million gallon pumps, 110 lb. pressure.
With valves, piping, bed-plates, couplings, &c.

Specifications and forms of tender for these also may be obtained from the City Engineer.

Colchester.—September 28th. 5,000 tons of steam coal for the electricity works. Mr. A. R. Sillar, borough electrical engineer.

Glasgow. — October 4th. The Corporation invites tenders for the general supply, delivery and erection of mains, switchboards, distribution boards, cables, switches, &c., wiring and accessories for transmission of electrical power to motors, &c., and for lighting at their Shieldhall sewage purification works. Specifications from the Office of Public Works, 64, Cochrane Street, Glasgow.

Halifax.—September 28th. Electrical fittings for six months, for the B.G. A. T. Longbotham, Clerk, 4, Carlton Street.

Isle of Thanet.—Stores for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 3rd.

London.—October 4th. Electric wires and cables, lamps, carbons, switches, fuses, telephones, cells and electrical insulating materials for the Metropolitan Railway Co. for a year. W. H. Brown, secretary, 32, Westbourne Terrace, W.

Oulton Broad.—The U.D.C. invites applications from those willing to carry out its E.L. order. See "Official Notices" September 10th.

Rotherham.—October 23rd. The T.C. has two steam-dynamos, 32 KW. each, for disposal. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Paterson Engineering Co., Ltd., have received from the Admiralty a repeat order for oil-eliminating plant with quartz sand filter for H.M. dockyard at Chatham, together with steel carrying structure and pipework. The total capacity of the Paterson purifying plant at this station will now be 10,000 gallons per hour. Paterson oil eliminators are also installed at H.M. dockyards, Pembroke, Portsmouth, Gibraltar, Priddy's Hard victualling station and Portland permanent coal depôt.

Bromley (Kent).—The T.C. has accepted the tender of Horsfall Destructor Co., Ltd., for plant, &c., for the refuse destructor, at £565.

Canada.—Our correspondent writes:—The city of Winnipeg has awarded the contracts for electrical apparatus in connection with the power plant at Point Du Bois, which are $157,000 lower than the best tenders recommended in October, 1907. The total of the contracts awarded amounts to $425,000, and the successful tenderers for the larger items are British firms:—

Turbines.—Jens Orten-Böving & Co., London, $97,150; $11,000 for erection
Generators and exciters.—Vickers, Sons & Maxim, Ltd., Sheffield, $93,080 this price includes erection.
Transformers, switching and protective apparatus.—Canadian Westinghouse Co., Ltd., Hamilton, $150,800.

The other smaller contracts are given to Canadian firms.

Golden & Lanseng, of Troy, New York, has secured the contract for the City of Toronto's new electrical distribution plant, and work has commenced. The laying of the conduits is to cost $65,800 or £13,180.

Dundee.—Mr. T. C. Keay has secured the contract for the electric lighting of Dudhope Museum. The supply will also be used for working a large number of models, which have been installed for educational purposes.

Elland.—The U.D.C. has accepted the tender of Messrs. J. Newsome & Sons for coals at the electricity works for the nine months ending May, 1910.

Fulham.—The Council has just placed a contract with the Beeston Manufacturing Co., of Leeds, for 288 special lanterns and brackets in connection with improvements they are making on the Fulham Palace Road tramway route. These brackets are specially designed for placing on tramway poles, and the new arrangement will replace about 48 arc lamps and posts. The necessary switches for these lamps have been ordered from the Reason Manufacturing Co., Brighton.

Contracts have also been placed with the Stirling Boiler Co., for two of their patent water-tube boilers, having a capacity of 14,000 lb. per hour each, and with the Underfeed Stoker Co. for two stokers and accessories, to work in connection with the new boilers.

Norway.—The A.G. Brown, Boveri & Cie., of Baden, Switzerland, has recently obtained one of the largest orders for electrical generating plant ever placed in Europe. This consists of five three-phase generating units, each rated at 17,000 K.V.A. (at 0·6 power factor), at 10,000–11,000 volts and 50 cycles, with direct-coupled exciters of 130 KW., for coupling to water turbines of 14,000 H.P at 250 R.P.M. This generating plant will form one-half of the power equipment of the new generating station now being built for Messrs. A. S. Rjukanfos, of Christiania, for the production of saltpetre from atmospheric nitrogen, which station, when completed, will be the largest in the world. Messrs. Brown, Boveri and Co, Ltd. (London), to whom we are indebted for the foregoing particulars, in referring to the extremely severe character of furnace work of this description, mention that the weight of one of these generators is about 200 tons, the diameter being nearly 20 ft. They add that the above order was obtained in competition with the leading firms of the Continent, and that it was settled upon the technical merits of the designs, and not upon considerations of price; and, further, that the A.G. Brown, Boveri & Cie. have no financial interest whatever in the undertaking.

Government Contracts.—The following tenders have been accepted for the Government Departments named:—

War Office.

Dynamos.—Siemens Bros. Dynamo Works, Ltd.
Lamps, electric arc.—Siemens Bros. Dynamo Works, Ltd.

General Post Office.

Cable, india-rubber and cotton core.—W. T. Henley's Telegraph Works, Co., Ltd., Johnson & Phillips.
Cable loop.—British Insulated and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.; Western Electric Co.
Cable, paper core.—British Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Western Electric Co.
Cup-holders, galvanised steel.—Bullers, Ltd.
Insulators.—Taylor, Tunnicliff & Co , Ltd
Lamps, tantalum.—Siemens Bros. Dynamo Works, Ltd.
Machine, testing.—Joshua Buckton & Co., Ltd.
Pipes, cast-iron.—Bailey, Pegg & Co., Ltd.
Spindles, insulator.—F. W. Cotterill, Ltd.; Guest, Keen & Nettlefolds, Ltd.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.; British Insulated and Helsby Cables, Ltd.; General Electric Co., Ltd.; International Electric Co.
Transmitters, telephone.—Western Electric Co., Ltd.
Electric lighting at Newton Street Sorting Office, Manchester.—J. Collier and Co.
Equipment at the Post Office Central Telephone Exchange.—Western Electric Co.

Keighley.—The Tramways Committee for the T.C. has accepted the tender of Messrs. Grace & Sutcliffe for two motor chassis, at £1,303.

Leicester.—The Coporation Tramway Department has placed an order with Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, for two pairs of "Bennis" smokeless and gritless high temperature coking stokers and compressed air furnaces for 8 ft. 6 in. Lancs. boilers at the generating station, Belgrave Road. This is a repeat order.

Leyton.—For installing the electric light at the extension of the public offices, the U.D.C. received the following tenders:—

H. J. Whitehead, Wandsworth	(accepted)	£233
E. E. Beaven, Dartford		296
British Westinghouse Co., Ltd.		375
Electrical and Motor Co., Banbury		239
Felgate & Storey, Reading		473
T. J. Halsey, Stratford		260
Johnson & Phillips, Ltd.		240
W. E. King, Barnet		311
Larkins & Co., London		340
Malcolm & Allan, London		355
Newbold & Co., Sutton		321
Nunn, Watts & Co., London		309
Rowland & Hulton, London		335
Russell, Bridger & Co., Putney		360
Saunders & Co., London		315
Tilley Bros., London		330
Vaughan Engineering Co., London		375
Wells, Rayner & Co., London		299
Weston & Sons, London		255

The following tenders were received for 100 public lighting lanterns with clock switches, and have been referred to the Electric Lighting Committee:—

Electrical Joint-Box Compound Co., Blackheath, S.E.	£307
General Electric Co., Ltd.	325
Haydon Harrison, London	345
Lucy & Co., Ltd., Oxford	317
Pontifex & Co., London	307
Reason Manufacturing Co., Brighton	350
Bertram Thomss, Ltd., Manchester	442
Tilley Bros., London	383
Venner & Co., London	330

Pretoria.—The A.E.G. Co.'s tender of £3,740 for a generating set with necessary spares has been accepted by the Pretoria Town Council, also Messrs. Reunert & Lenz's tender of £2,508 for a boiler, feed pumps, &c.

Rawtenstall.—The T.C. has accepted the tender of the D.P. Battery Co., Ltd., for the maintenance of the battery at Harebolme electricity works.

The Rand.—According to an exchange a number of large mill motors, of 400, 240 and 165 h.p., are on order with Messrs. Dick Kerr & Co., Ltd., in connection with the electrification of the Rand Mines, Ltd.

Wakefield.—The B.G. has accepted the tender of the Wakefield Electrical Engineering Co. for electrical work for six months.

West Ham.—The Education Committee has received the following tenders for the installation of electric light at the Abbey School:—

Alliance Electrical Co.	£383	H. J. Whitehead	£304
W. R. Woodward	462	E. P. Allam & Co.	297
Troup, Curtis & Co.	347	Vulcan Electric Co.	286
C. Larkins & Co.	326	Jackson Bros.	279
West Ham Corp. Elec. Supply	350	J. T. Halsey	278
Whitehead Bros.	316	G. Weston & Sons	264
Pinching & Walton	411	Pemberton, Arber & Carey	249
W. Simmons	306	**Rowland & Hulton** (accepted)	286

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, September 25th. At 3 p.m. Visit to the Imperial International Exhibition, Shepherd's Bush.

Society of Engineers.—Monday, October 4th. At 7.30 p.m. At Caxton Hall, S.W. Prize essay on "The Status of the Engineering Profession," by G. A. Thomas.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 2nd, 1909:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, September 27th.—"A" Company. Technical drill, 7 to 9.30 p.m.
Tuesday, September 28th.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, September 29th.—Gymnssium, 6.30 to 9.30 p m.
Thursday, September 30th.—"C" Company. Technical drill, 7 to 9.30 p.m,
Friday, October 1st.—"D" Company. Technical drill, 7 to 9.30 p.m.

(Signed) P. H. Campbell,
Capt. R.E. and Adjutant.
For O.C. E.E. (L D.)

NOTES.

Liability for Tramway Accidents.—The Association of German Tramway and Secondary Railway Administrations, at the recent annual congress held at Hamburg, decided to address a petition to Parliament praying that the liability of tramways in regard to accidents should be placed upon an equality with that applicable to motor-cars. Dr. Wuspsow, of Berlin, who brought forward the question in the course of a report, stated that tramways were subject to the strict provisions of the Ancient Imperial Liability Act of 1871, in the case of injuries caused to persons, although the peculiarity of their development had long since demanded a special regulation as to the liability of tramways. The interests associated with horse vehicular traffic now desired to extend the provisions of this law to the subject of material damage caused by tramways, notwithstanding that, as proved by statistics collected since 1900, on an average 60 per cent. of the recorded collisions have been due to the fault of the "foreign driver," and only 11·4 per cent. to that of the tramcar driver. In the circumstances, the author had come to the conclusion that a special liability law was needed for tramways which would correspond with the general feeling of right, and he expressed the opinion that the new Automobile Act contained almost everything which would suit the tramways from the point of view of liability.

Electric Shock Fatality.—Coroner J. T. Proud held an inquiry on the 17th inst. into the circumstances of the death of John Dent Thompson (27), pump attendant at Shildon Lodge Colliery, County Durham, who was found dead behind the electrical switchboard in the mine, on the 7th inst. The Home Office was represented by Mr. Nelson. Mr. R. Bell, the manager, said the deceased's duties were merely to attend to the pump. He thought Thompson had gone within the fence to adjust one of the terminals which had been "sparking." William Bryce, generator attendant, said Thompson telephoned from the Brockwell seem that "she was hot," but he would be able to start soon. Witness thought "she" referred to the pump. William Hepburn, the electrician, said after the accident he went to the place. There was a terminal which had been moved, and to reach that Thompson would have to pass two charged wires. There were burns on two fingers and a thumb of the deceased, and these could have been caused by the terminal. The man might have touched something when attending to the terminal. The voltage was 2,400. The jury returned a verdict of "Accidental death."

Ozone Works at St. Petersburg.—In view of the unsatisfactory results obtained during the cholera epidemic, which has lasted more than a year, in connection with the purification of the water of the Neva by means of ordinary sand filters, the water distribution system being exposed to constantly renewed cholera infection, the municipal Duma and city authorities have decided to adopt the ozone process for the sterilising of drinking water, and to erect a large ozone water works. The sanitary authorities, both of the City of St. Petersburg and of the State, are, in fact, of opinion that only by the ozone method will effective purification of the drinking water of St. Petersburg be obtained, as their own investigations, in accordance with those of the German Imperial Sanitary Office and the Pasteur and Koch Institutes, have shown ozone to be the safest means of ensuring the complete destruction of bacteria in water. The large ozone works, which is to be installed in connection with what is called a "rapid filtering plant" (Howatson system), is to be designed according to the combined Siemens-De Frise, Otto ozonising system. The electrical part and the ozonisers will be constructed by the Siemens and Halske Co., and the Felten-Guilleaume Lahmeyer Works.

Commemoration Dinner of the International Correspondence Schools.—If means can ensure the really practical value of an educational course in electrical engineering, the expenditure of so great a sum as upwards of £15,000 on the preparation of the details of that course should place its worth beyond all question. Such is the outlay that Mr. E. A. Seitz, the managing director of the International Correspondence Schools, assured the guests at a banquet of that institution at the Hotel Cecil on the 18th inst., had been made on the I.C.S. electrical engineering course. Considering that there are 210 I.C.S. courses of instruction, covering every branch of commercial and industrial activity, the scale of its operations may be recognised as very large

The preparation of all the courses is said to have involved a capital cost of about £300,000, while about £50,000 is spent annually in revising them and keeping them up to date.

Last Saturday's banquet was held in view of a special visit of students and representatives of the International Correspondence Schools to London, and about 400 of those who were interested in the work sat down to dinner in the Grand Hall of the hotel. Sir Thomas Brooke-Hitching, himself a satisfied investigator of I.C.S. instruction, took the chair in the unavoidable absence of Lord Montagu of Beaulieu. Among those present were Mr. L. A. Atherley-Jones, K.C., M.P., Mr. Dennis Hird, M.A., of the Central Labour College, Oxford, and several gentlemen connected with various scientific institutions.

In response to the toast of "The International Correspondence Schools," Mr. Seitz gave a brief sketch of I.C.S. work. While not claiming for the I.C.S. absolute originality in postal educational instruction, seeing that ancient Babylon had been found to possess such a service, he said that a twentieth century postal system was kinder to the extension of their work than the expensive transmission of the Babylonian tutorial bricks. He succeeded in convincing his hearers that the International Correspondence Schools pervaded all countries and were capable of everything. Only that week Mr. Seitz had had word from an I.C.S. student that he intended competing for the *Daily Mail* aviation prize of £10,000. The name of Mr. T. J. Foster, the American founder of the International Correspondence Schools, was enthusically received.

Better evidence as to the adaptability of I.C.S. technical instruction could not have been afforded than that contained in two illustrations put forward by Mr. Seitz. One was the quick rise of a student from a labourer's low salary to £6 per week as superintendent of a large manufacturing firm's engineering plant. Another, a motorman, who had taken I.C.S. instruction, was now general manager of one of the largest municipal electric tramway systems in the country. More striking still, perhaps, was Mr. Seitz's statement that only recently Sir Charles Elliott, late general manager of Government railways in South Africa, had called at the International Correspondence Schools' new London headquarters in the International Buildings, Kingsway, and had there told him that he, Sir Charles, had observed the value of the I.C.S. tuition in South Africa, and had, in fact, taken a short course himself, and now wished to enter for the full mechanical course. Other remarkable statistics showed that in the British Empire there were now 100,000 I.C.S. students, over 1½ million having been enrolled in the schools all over the world. The I.C.S. was not in competition with evening classes, as its students, averaging between 26 and 27 years of age, were mostly those who would not sit in evening classes by the side of youths.

The testimony of Mr. Dennis Hird that the I.C.S. was a real force for the betterment of mankind was listened to with attention. Altogether, the evening reflected in a strong light the usefulness of a big educational institution.

Electric Shock Accident.—Our Dundee correspondent says that a miner employed in No. 23 pit, Wallacestone, Stirlingshire, has been seriously injured through coming in contact with the electric cable. It was found that the bones of his left hand were calcined, and will have to be removed.

Aviation Dangers.—We have on previous occasions noted accidents to balloons through fouling telegraph wires; more serious conditions are met with by aeronauts abroad. According to the *Times*, the aviator Nassr recently made an ascent at Ottawa in an aeroplane. While he was ascending, the propeller became caught in an electric wire, causing it to fall to the ground. Four persons received shocks, and two were taken to a hospital.

Parliamentary.—In the House of Commons on September 21st, Mr. Markham asked the Chancellor of the Exchequer if he would state the reasons which caused him to refuse the request of the Mines Royal Commission for a grant to make experiments on the use of electricity in mines; and whether, in view of further recent explosions believed to be due to electricity, causing the loss of large numbers of men, he would reconsider his decision in this matter. Mr. Hobhouse replied: My right hon. friend has not received any such request from the Royal Commission. Mr. Markham: Is the right hon. gentleman aware that in the report of the Royal Commission it was definitely stated that the Chancellor of the Exchequer refused to make this grant? Mr. Hobhouse: My attention has not been drawn to that statement. I am prepared to look at it. My information is as I have given it to the hon. gentleman.

Royal Assent.—The following Acts have received the Royal Assent:—

Electric Lighting Orders Confirmation (No. 1) Act, 1909.
Tramways Orders Confirmation Act, 1909.

Town Planning Bill.—Mr. Clough asked in the Parliamentary papers, whether the President of the Local Government Board could give any assurance that in the event of a local sanitary authority acting as a responsible authority under the Housing and Town Planning Bill for a town planning scheme within the area of a neighbouring authority, the latter would retain all its duties and powers as regarded the provision of sewerage, water supply, lighting and consequential works throughout its own area, and that none of such powers and duties would pass to the responsible authority by virtue of any regulation hereafter made under that Act by the Local Government Board.

Mr. John Burns, in reply, stated that it was not intended that the powers and duties of a neighbouring local authority should be transferred to the local authority responsible for the execution of a town planning scheme. These powers and duties would not be interfered with, except in so far as it might be necessary in order to secure the carrying-out of the scheme. For example, it might be necessary to provide that they should be exercised in some particular way.

National Telephone Co.—Replying to a question by Mr. Lloyd Morgan, who asked in the Parliamentary Papers whether, in view of the approaching taking-over of the business of the National Telephone Co. by the Post Office, the privileges enjoyed by the telephoning public would be in any way restricted when under the Government, and whether it was proposed to make any change as to the use of the telephone on Sundays, Mr. Sidney Buxton said he did not anticipate that the present facilities would be restricted. As to the question of Sunday use, that would require very careful consideration.

Canadian Development.—The minimum-flow development of all the water-powers of Canada, according to Mr. J. B. Challies, of the Canadian Department of the Interior, is estimated at over 25,680,000 H.P., of which about 516,900 H.P. has been utilised. Hamilton River, in the Labrador Peninsula, is the largest available power, with a possible development of 9,000,000 H.P., Niagara Falls being second to it.—*Electrical World.*

Meters on Tramway Cars.—As might be expected, papers read on traction subjects bulk very largely in American engineering proceedings, and as in this country, the question of energy consumption on cars has come to the front. Quite recently a paper on the subject, read apparently with the view of putting forward the claims of the mercury-motor meter for this class of work, elicited some interesting discussion. Thus it appears that seven trips, under test conditions, on the loop and metropolitan sections of the West Side Co., Chicago, showed energy consumptions of 3·67 and 2·30 KW.-hours per c.m. respectively, using a 33-ton motor-car and 16-ton trailer. Seven carelessly-driven trips showed energy consumptions of 4·29 and 2·90 KW.-hours respectively. An average gain of 2 per cent. in time and an excess of energy consumption of 26 per cent. occurred in the last seven trips. The higher energy consumption on the loop was due to frequent stopping and starting.

In view of the above, the operating efficiency of each motorman, as regards power consumption, will in future be entered on his record of service, a copy of each entry being sent to him. At Cleveland a series of tests of energy consumption on city and inter-urban cars, 14 of each kind being tested, showed that while the inter-urban cars weighed 50 per cent. more than the city cars, the energy consumption of the former averaged 3·75 KW.-hours per car-mile, against 3·84 KW.-hours in the latter case; this is equivalent to 88 watt-hours per ton-mile, against 125 watt-hours—the difference being due to the inter-urban stops averaging 15, against 65 in the case of the city cars. It was considered a good plan to keep a man on testing work, but a meter equipment on every car was prohibited, on account of expense.

Automatic Thermo-Electric Control.—A patent was issued to Mr. H. Ward Leonard on March 23rd relating to the automatic control of the energy supplied to an electrically-heated tool. The patent states that if an electrically-heated flatiron be used to iron damp goods as rapidly as possible, the iron becomes chilled, or if this difficulty be overcome by increasing the watts, then, when the iron is idle, it is likely to become destructively overheated. What is needed is a wide variation of the current, automatically controlled as needed to maintain a definite temperature, irrespective of whether the iron is idle or being worked to the limit.

The invention provides in the flatiron, in addition to the heating wire, an auxiliary controlling resistance of nickel or other material, whose resistance responds immediately to a change of temperature. This change of resistance affects an exterior automatic magnetically-controlled switch in series with the controlling resistance, and the automatic switch, thus made responsive to a change in the temperature of the flatiron, is caused to vary the heating current as required. Thus, in practice, as soon as the iron is worked to the limit, this exterior automatic switch cuts out the exterior controlling resistance, and causes the iron to take, say, three or four times as much energy as when it was idle. When the iron is set aside, and tends to heat up under this very large working current, the automatic switch immediately inserts the resistance needed to prevent the iron from becoming overheated.—*Electrical World.*

Large Electric Organ.—One of the largest electric organs ever built in the United States, according to the *Scientific American*, is about to be erected in the Auditorium at Atlanta, Ga. It will be played from a movable four-manual control 65 ft. away by an 8-volt current from a specially wound generator, and blown by a 20-H.P. motor direct connected to a series of fans raising the air pressure by steps.

Educational.—British Correspondence School of Electrical Engineering.—We are informed that this institution has added a course on "Aeronautics" to its syllabus; the course covers dirigible balloons, the problems of flight, aeroplanes, motors and propellers, and is divided into nine lessons. The subject is a fascinating one, and as M. Blériot, for instance, has already received orders for over 100 monoplanes, it is clear that a new industry is in course of development.

As the result of the inquiries which we have made as to the special facilities provided for the benefit of charge engineers and others who cannot attend continuously a course of evening classes, we have ascertained that the following institutions afford such facilities :—

University College : Faculty of Engineering.—Special courses for engineers in practice and graduates in engineering. The Electrical Engineering Laboratories are open daily from 10 to 5 (Saturdays 10 to 1). Shift engineers can attend at any time within these hours, and can also attend the day courses in electrical engineering. Particulars from the Secretary.

East London College.—Alternative day classes are provided in order to assist shift engineers. Apply to the Registrar.

Northampton Institute.—The subject has received consideration, and suitable arrangements will be made if a sufficient number of applications is received. Apply to the Principal.

The Polytechnic, Regent Street.—The evening lectures are repeated on a convenient morning, removing the disability of shift men almost entirely. Apply to Mr. W. Hibbert.

South-Western Polytechnic Institute.—Shift engineers are allowed to attend the ordinary day classes and laboratories when on duty in the evening. Apply to Mr. A. J. Makower.

On the whole, it is clear that little more can be done than is already done, without co-ordinate action on the part of both the would-be students and the various teaching institutions. The former should write *at once* for particulars of the arrangements made on their behalf, as the new session is already under way.

Copper.—A writer in the *Financial Times*, for September 18th, on the copper outlook, is rather inclined to the view of peace and increased production. The U.S. Copper Producers' Association statistics quoted by him show for August last an increase of 1,000 tons over the output for the previous month, or at the rate of 645,000 tons per annum. The statistics for last year were :—U.S. output, 425,000 tons ; Spain and Portugal, 52,000 ; Japan, 43,000 ; Australasia, 39,000 ; Chile, 38,000 ; Mexico, 37,000 ; Canada, 28,000 ; Germany, 20,000 ; Russia, 20,000, and Peru 15,000. With regard to the U.S. production which, of course, sways the market, the writer says :—"It is believed, however, that the limit of this expansion has now been to all intents and purposes reached, the present rate of output being very considerably in excess of that of last year."

Messrs. Merton's statistical summary for the first half of September shows visible supplies at 90,387 tons, an increase of only 2,169 tons on the return for the end of August. This still consists largely of stocks in English ports, French stocks being 6,119 tons, and afloat 7,500 tons (Chile and Australia). Supplies from North America appear to be down a little; from Spain to this country up to the average. The total supplies are 18,413 tons, and deliveries 16,244, which works out at average deliveries, but lower supplies for the month.

The Manufacture of Nitrates from the Air.—Of the many attempts to produce nitrates from the air few have gained any public notice. This has been due largely to the impossibility of carrying out on a successful commercial scale what is a matter of considerable ease in an experimental way. With the exception of the Birkeland-Eyde process, little is known of the practical manufacture of nitrates from the air. Details of the method employed by Schönherr have been boomed to a considerable extent, but as yet nothing is known of the manufacturing scale. It is of interest to learn that another process is being successfully applied commercially, details of the operation forming the substance of a paper by Dr. Franz Russ before the Verein Oesterreichischer Chemiker. The principle involved is similar to that utilised in other methods. It is necessary to produce a large electric flame capable of absorbing large amounts of power. The method adopted is very simple. Two conductors are arranged almost to meet at one end, but widen out at the other. Between the converging ends of these conductors a hot blast of air is driven. An arc is struck across the short gap between the conductors, and is forced along the latter by the hot blast in a continually widening flame, which is broken for every half period of the alternating current used. In this manner a rapid succession of arcs are formed, which have the appearance of a quietly-burning flame. The electrodes are made of iron, and are cooled with water ; they last about 200 hours when producing a flame 1 yard long. The hot gases, after passing through the flame, are cooled by means of a second blast of air, which also serves the purpose of elongating the flame. In this manner oxides of nitrogen are produced up to a concentration of 1·5 per cent. In practice two arcs are struck in one furnace in order to concentrate the energy consumption. Each furnace requires 400 kw., current being supplied at 4,000 volts. Through the lower air passage 600 cb. metres of air are blown per hour. In a factory erected at Innsbruck 24 furnaces are now in use. The furnace gases have a temperature of 700-800° C., and are used for the manufacture of both nitric acid and sodium nitrate. The large amount of heat in these gases is utilised for the concentration vats and for preheating the air blast. Nitric acid is condensed in a series of earthenware pipes and towers when a strength of 40 per cent. is obtained. This is further concentrated by means of the furnace gases up to 60 per cent., and placed on the market in this form. The yield of nitric acid per kilowatt-hour is 60 grammes. The Innsbruck factory is designed for a power consumption of 15,000 h.p. Two other factories are in process of construction—one in the South of France and another in the North of Italy—each to consume 10,000 h.p. The inventors of this process are the Bros. Pauling.

Institution and Lecture Notes.—Municipal Tramways' Association.—The eighth annual conference of this Association was opened on Wednesday last at the London County Hall by an address, welcoming the delegates, given by Sir Melvill Beachroft, J.P., Chairman of the Council. In his address Sir Melvill Beachcroft remarked that four years had elapsed since the Association met in London, and that he hoped the next time they came, the Council could entertain them in a building worthy of the capital of the Empire. He was fully conscious of the important work carried out by the members of the Conference, and trusted that during the discussions many of the knotty subjects besetting all who are engaged in tramway work would be solved. He then referred to the important position that tramwork now held in the estimation of the County Council, the rapid progress which was being made in the electrification of the tramway system in the Metropolis and the results which had so far been obtained. He held that in view of the magnitude of the issues at stake, the experiment of the installation of the stud system at Bow Road was fully justified, although as a result they felt themselves compelled to retain the conduit system. He was impressed with the importance of establishing through running between different systems, though he felt that many of those present held different opinions, and was glad to be able to refer to the establishment through the good offices of the Board of Trade of a Conciliation Board to which would be referred all questions relating to the labour conditions of the Council's 9,000 tramway employés. A hearty vote of thanks to the London County Council and also to Sir Melvill Beachcroft was then proposed by Mr. J. Aldworth, of Nottingham, seconded by C. J. Spencer, of Bradford, and carried unanimously, and the Conference settled down to listen to the address of Mr. A. L. C. Fell, the President of the Association, to which we refer in our leading columns to-day.

Institution of Metals.—At the forthcoming meeting in Manchester (October 14th and 15th), of which we gave some particulars in our last issue, each paper will be read in abstract only, ten minutes being allowed the author for this purpose, and each speaker will be limited to five minutes in the discussion. The papers will, of course, be available to members a week before the meeting. We commend this system to the notice of other societies ; as we have often pointed out, it is hardly fair to the author to discuss his paper without first studying it at leisure, and it is a waste of time to read it *in extenso* at the meeting. Several local works and educational institutions will be visited. Those desiring to attend must apply to the Secretary not later than September 30th.

Institution of Mining Engineers.—The members of this Institution held their twentieth annual gathering at Newcastle-on-Tyne on the 15th, 16th and 17th insts., the two latter days being given up to sightseeing. On the 16th inst. the members visited the works of the Newcastle-on-Tyne Electric Supply Co., Ltd., at Carville, in the morning, which has a total capacity of 56,000 h.p. installed. The members also visited Harton Colliery, where there is a large electric winding engine. Sir Lindsay Wood, chairman of the company, stated that the winding engine had not been in use very long, and he could not say what was the exact saving on it, as compared with a steam-worked winding engine. He expected, however, that the use of the electrically driven winding engine would be found to be advantageous, and would tend to increased output. No steam was now used in the Harton Colliery, all the machinery being electrically driven. The winding engine is designed to deal with an output of 240 tons per hour, the motor being of 800 h.p. The cages in use have four decks, carrying two tubs on each deck. The weight on the pulleys at the start, including the rope, is 14½ tons, and the wind occupies 48 secs. The haulage engines are also electrically driven, and the horse-power of the motors installed is 1,645.

Municipal Secondary School, Hanley.—A course of lectures on "Electrical Engineering" is to be delivered at the above school by Mr. C. H. Yeaman, borough electrical engineer, Hanley, commencing to-day.

A New Mercury Ammeter.—The problem of measuring large alternating currents with any degree of accuracy is, from the technical standpoint, a difficult one. There is a distinct need for a standardisation instrument which can be inserted into an alternating-current circuit carrying 500 amperes and will record to the same degree of precision as one of the smaller instruments. As a result of observations of the forces in the interior of electric conductors, Dr. E. F. Northrup has constructed an instrument whose only limit to accuracy is that with which the unit of current is known. This ammeter is intended as a primary standard instrument for large currents, either alternating or direct. The lowest range is from 200 to 500 amperes, and the degree of accuracy at 200 amperes is 1·5 per cent. In the tests it was found that for three-quarters of the scale, the reading error did not exceed 0·1 per cent., and was quite independent of the kind of current used. The temperature coefficient is negligible, and the effect of external currents is almost inappreciable. The operation of the instrument is quite simple. The terminals are connected to the circuit without regard for polarities. The zero is first adjusted and the current switched on, when a coloured liquid flows to a point on the scale to indicate the number of amperes passing. The principle involved is entirely new, as far as instruments are concerned, and cannot be fully reproduced in abstract. It is similar, however, to the action of conductors carrying a current, which are known to attract each other and produce a certain amount of sag towards the middle. A liquid conductor can be supposed to consist of an infinite number of elemental conductors, parallel to the direction of the line of flow which will also cause the same tendency for contraction. It is this force which is utilised in the above construction. The simplicity of construction and the ease with which it works place this new instrument in a position which is bound to make itself felt in the near future.—*E.M.I.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The salary of Mr. Turnbull, electrical engineer and manager to the Broughty Ferry Corporation, has been increased by £20 per annum.

Mr. Francis Teague, city electrical engineer of Bath, and his wife, celebrated their silver wedding on September 21st, and the staff and employés of the department presented them with a silver tea service and salver.

Tramway Officials.—Out of 108 applicants Mr. H. P. Stokes, assistant manager of the Burton-on-Trent tramways, has been appointed manager of the tramways at Ilkeston.

Portsmouth T.C. has granted an honorarium of 100 guineas to Mr. V. G. Lironi, tramways engineer, in recognition of the excellent way in which the Goldsmith Avenue tramway extension was carried out under his supervision.

General.—The Council of the Association of Engineers-in-Charge have unanimously elected Mr. Henry Adams, M.I.C.E., M.I.Mech.E., &c., as their President in succession to Mr. James Swinburne, F.R.S., M.Inst.C.E., and an attractive programme has been drawn up for the new session, including some good papers and several social functions. Among the members of the Association Mr. Adams is one of the oldest of the engineers-in-charge, having so far back as 1865 been in responsible charge in the outdoor department of Sir W. G. Armstrong & Co., of Elswick Works.

Capt. P. H. Campbell, R.E., has been appointed Adjutant to the London Electrical Engineers (Territorial Force).

We read in the Press that on Monday evening the Postmaster-General presided at a dinner given at the Grand Hotel, London, in honour of Sir Henry Babington Smith on his resignation of the Secretaryship to the Post Office, in order to take up the appointment, at Constantinople, of President of the new National Bank of Turkey. Among those present was Sir Matthew Nathan, who is to succeed Sir Henry Babington Smith, as well as the heads of the various departments of the Post Office.

Obituary.—Mr. H. C. A. Pratt.—The death is announced of Mr. Herbert C. A. Pratt, of the firm of Campbell & Isherwood, electrical engineers, Raleigh Street, Liverpool. He was only 28 years of age.

NEW COMPANIES REGISTERED.

Cunnington & Harris, Ltd. (104,982).—This company was registered on September 16th, with a capital of £5,000 in £1 shares (2,000 preference), to adopt an agreement with S. Harris, and to carry on the business of electrical engineers, electricians, workers of and dealers in electricity, motive power and light, &c. The subscribers are:—J. G. S. Cunnington, 21, North Audley Street, W., electrical engineer, one share; S. Harris, 21, North Audley Street, W., surveyor, one share; A. Harris, 79, Priory Road, West Hampstead, N.W., solicitor, two shares. Private company. Table "A" mainly applies. Directors' borrowing powers restricted, but no debentures or debenture stock shall be issued which shall rank in priority to or *pari passu* with a £250 first mortgage debenture to be issued to Mrs. S. L. Attrill, or a £500 second mortgage debenture to be issued to S. Harris. Registered office, 21, North Audley Street, Grosvenor Square, W.

Boudjah Electric Lighting Co., Ltd. (104.953).—This company was registered on September 14th, with a capital of £5,000 in £1 shares, to undertake the electric lighting of streets, public places and private dwellings in Boudjah or elsewhere, to obtain concessions for electric lighting and electric power supply in the Turkish Empire. The subscribers (with one share each) are:—D. Forbes, jun., Smyrna, merchant; T. S. Catto, Smyrna, merchant; F. W. Parry, 110, Cannon Street, E.C., secretary. Private company. The number of directors is not to be less than three or more than nine; the first are D. Forbes, jun., T. S. Catto and F. W. Parry; remuneration as fixed by the company. Registered office, 110, Cannon Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Le Radiant, Ltd. (102,296).—Particulars of £2,000 debentures created August 24th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £700. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Crompton & Co., Ltd.—Issue on August 17th of £65,625 debentures, part of series created November 15th, 1909, to secure £100,000, charged on the company's undertaking and property, present and future. No trustees. Previously issued of same series: £9,275.

Newtons, Ltd. (48,936).—An amended statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Indentures dated 1900 to 1906, securing £12,500.

The original statement omitted to give notice of debentures bearing various dates in 1900, securing £10,000.

CITY NOTES.

United Electric Car Co., Ltd.

The annual meeting of this company was held at Preston on 15th inst.

Mr. G. Richardson presided, and in moving the adoption of the report (see Electrical Review, September 10th, 1909) he said the result was an improvement on the previous year, but the output, owing to continued slackness in their special business, had been considerably below the capacity of their works and plant. Their net profit, in spite of these circumstances, was £1,800 more than last year, which clearly showed that the work they had done had been profitable. After charging debenture interest, depreciation, and all charges, there was a net profit of £8,896, from which, with the substantial amount brought forward, the directors felt justified in declaring a dividend on the ordinary shares of 2½ per cent. for the year, and after allowing for this and the preference dividend they would be able to carry forward to next year £5,333, as against the £6,187 brought into the accounts. The bank interest received showed an increase over last year of £700. Financially, they were in a strong position. Their total liabilities to creditors on June 30th was only £15,364, whereas their bank balance was £59,000, and the debtors, all perfectly good, nearly £48,000. Of course they would understand that when business was slack there was a tendency for money to accumulate at the bank, but if they should become very busy, a position they were all doing their best to bring about, this large bank balance, together with their large stock of seasoned timber, would be useful not only to enable them to make purchases on the lowest terms, but also, if thought advisable, to secure safe orders on deferred payment terms. The reserve for depreciation amounting to £34,500 had been increased since last year by £4,500. The directors believed this was a very ample reserve. The buildings were in an excellent state of repair, the machinery was as good as new, and there was nothing of an obsolete character. They continued to enjoy an excellent reputation for turning out only the highest class of work. They had always pursued this policy, and would not cut down cost by turning out cheap and inferior work. With regard to the prospects for the coming year, he observed that they were obtaining a fair share of the orders given out, although such orders were small, and he regretted that he could not see any immediate prospect of trade improving in their line of business; but when an improvement did take place they were in a most satisfactory position to meet it, both in regard to money, stocks of material and management. They had two very able officials in their secretary (Mr. Pickin) and Mr. Anger.

Mr. Mylchreest asked why the company had not gone in for the manufacture of wagons, which appear to have been contemplated in the original prospectus. He also wished to know if they had sold the Old Trafford and Hadley Works.

The Chairman replied that they had so much to do in the beginning with the ordinary tramway carriages that they thought it was well to stick to that which they knew something about. Later, competition became so great in the various departments that they really did not see their way to invest any more of their capital in railway wagon works. They had powerful competitors, and they thought it was just as well to devote attention to tramway and omnibus work, for which they originally laid out the works. With regard to the Hadley and Trafford Park Works, they had tried to dispose of them, but trade had been so bad they had had no offer equal to their expectations. They hoped as soon as trade improved to dispose of them.

The report was adopted.

Underground Electric Railways Co., Ltd.

The half-yearly meeting of this company was held on Tuesday at Hamilton House, Victoria Embankment, Sir Edgar Speyer presiding.

In moving the adoption of the report (see Electrical Review, September 3rd, 1909), the Chairman said he was pleased to be able to record a period of continued progress and to express unqualified satisfaction at the results attained. Turning to the balance-sheet, the temporary loans, which stood at £225,000 on the debit side of the balance-sheet, would be paid off on October 1st next, and the redemption of the 4½ per cent. power house second debentures would be effected by the sale and issue of £1,000,000 4½ per cent. first debentures. Thus they would be free of a floating debt, and would have a good cash balance. The net revenue for the half-year was insufficient by £16,240, to meet the half-yearly charges. They would remember, however, it was estimated when the scheme was published that there would be a deficit for the year 1909 of £96,000. The result was, therefore, distinctly encouraging. If they compared the figures one by one with the first issued accounts, it would appear that the deficit was increasing, but that was accounted for by the fact of their holding with the tube railways and that part of the fixed charges were charged to capital under the scheme of re-adjustment. The accounts, taken altogether, showed a healthy increase and reduced working costs. In that connection, the directors were appreciative of their general manager, Mr. Stanley. The result of the tramways had again been unsatisfactory, but as that company published their accounts yearly, he would reserve his observations on that point until the next meeting. He thought, from the various expressions of opinions he had received, that the directors' policy of publishing a monthly statement of net earnings of the associated companies was appreciated by the investing public. That would be the last meeting they would hold in that building, as the company had taken a set of rooms at the St. James' Station of the District Railway, which he thought would not only result in a considerable saving of rent, but also of time.

The Right Hon. Lord George Hamilton seconded the motion, and the report was adopted without discussion.

Yorkshire Electric Power Co., Ltd.

The directors' report for the half-year to June 30th, 1909, states that the receipts from the sale of energy and for work charged out to consumers, &c., for the half-year ending June 30th last amount to £11,169, against for the half-year ending June 30th, 1908, £8,698, and for the half-year ending June 30th, 1907, £4,700. The gross profit on the revenue account for the half-year is £2,598, against a gross profit for the half-year ending June 30th, 1908, of £1,249, and a gross loss for the half-year ending June 30th, 1907, of £403. After payment of mortgage interest the net revenue account shows a profit on the half-year just ended of £1,069, compared with a profit for the corresponding half-year in 1908 of £363, and a loss for the half-year ending June 30th, 1907, of £1,211. The demand for energy per horse-power connected has been low owing to the depressed state of nearly all the industries in the company's area; notwithstanding the adverse conditions of trade, there has been a steady increase in the use of the company's supply.

Mr. A. G. Lupton presided at the half-yearly meeting held at Leeds on Tuesday. He said that the company was making steady advance. According to the *Financial News*, he said that the mains on which the capital had been spent were only beginning to bring in revenue during the past half-year. The textile industries continued to bring in the largest revenue, but the colliery load was also increasing satisfactorily. The company's meter readings confirmed what had been said of the revival of trade, and the increased output has been the result of new business. Consumers in undeveloped portions of the district were pressing for the mains to be extended to them, and the directors had decided, in the first place, to meet the urgent demand from the Castleford district. In consequence of increased demand, a boiler of a capacity of 50 per cent. greater than the boilers originally installed had been put down, and it had been decided to install a fourth turbine of a capacity equal to any two of those at present in the station. Those extensions would entail the provision of further capital. The whole of the borrowing powers had been exhausted. Under the powers of the company's Act, further capital could only be obtained by the issue of ordinary shares at par value. That was not at present practicable, and it would be necessary to amend the company's Act by applying to Parliament for further powers to authorise the issue of preference stock. The directors considered it advisable to ask for other powers which had been granted to later-formed companies, which would much facilitate the work of the company.

Mr. T. O. Callender seconded, and the report was adopted.

Prospectus. — "*Thorium*" (*Metal-Filament*) *Lamp Works, Ltd.*—A prospectus is in circulation offering for subscription until Monday next, September 27th, 11,000 7 per cent. cumulative preference shares in this company. The nominal capital is £30,000 in 11,000 preference and 19,000 ordinary shares of £1 each. The company will acquire the Britannia Electric Lamp Works at South Tottenham, together with patent and license rights for the "Thorium" and "Reflex" lamps, also plant and machinery and contracts, from the Merchants' Trading Co., Ltd., the vendors, for £20,000, paid as to £1,000 in cash, and the remainder in ordinary shares. The £10,000 preference capital, which the public are desired to apply for, will be set aside for working capital and general purposes. The works are sufficient for the manufacture of 300,000 lamps per annum. A contract has been entered into with "a leading house in the wholesale electric lamp trade" for the purchase of up to 250,000 "Thorium" lamps per annum for two years.

Rio de Janeiro Tramway, Light and Power Co.—A dividend of 1 per cent. is announced.

Dick, Kerr & Co., Ltd.—The directors' report of the trading for the 12 months ended June 30th, 1909, states that the profits earned during the 12 months' trading to June 30th, 1909, amount to £28,168. Out of this has had to be paid debenture interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £12,693, leaving a balance of £15,475, to which must be added the profits brought forward from last year—viz., £81,567, making a total of £97,041 available for appropriation as under:—Dividend of 6 per cent. per annum on the preference share capital (the proportion of this dividend to December 31st, 1908, has already been paid), £18 300; dividend of 6 per cent. on the ordinary share capital of £260,000, to be paid less income-tax, £15,600; to carry forward £63,141. The dividend on the preference shares will be paid on October 1st, 1909, as usual, and the dividend recommended on the ordinary shares will be paid on same date if approved by the shareholders. The directors regret that the severe competition referred to in the last annual report has continued throughout the past year in a more acute form. In addition, the quantity of work carried out in all departments has been considerably below the average.

Demerara Electric Co.—Gross earnings for the seven months ended July are $74,929; for the same period in the previous year they were $68,952. Net earnings for the same period totalled $34,155, in comparison with $25,940 last year.

British Electromobile Co., Ltd.—A financial paper states that the report of this company states that the accounts for the period to March 31st show an adverse balance of £204.

Halifax and Bermudas Cable Co., Ltd. — The directors' report for the year ended June 30th, 1909, which was presented at the meeting held on 16th inst., showed that the net result of the year's working was an available balance of £3,313, as compared with £3,096 for the previous year. An interim dividend of 2½ per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £813 to be carried forward. Opportunity was taken of a cable ship being in the vicinity of Bermuda to engage her to thoroughly overhaul and renew where necessary the harbour cable and the shore end of the main section at the cost of £817. The balance to credit of revenue account, which was last year increased to £18,444, has been debited with £1,250 applied to dividend, and with £817 expended in renewals during the year, and credited with £813, surplus revenue of the past year, and it now stands at £17,189. The company's cable has worked efficiently. During the year debentures have been paid off to the amount of £9,600, leaving £10,000 outstanding. Mr. Charles R. Hosmer has resigned his seat at the board.

United River Plate Telephone Co., Ltd.—An issue of 30,000 ordinary shares of £5 each has been offered to holders of ordinary shares in the proportion of one new share for every four held. The latest price of this new issue is 1⅛ to 1¼ premium.

Folkestone Electricity Supply Co., Ltd. — The directors have declared an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the past half-year.

Direct West India Cable Co., Ltd.—The annual report for the year ended June 30th, 1909, which was presented at the meeting held on September 16th, states that the net result of the year's working was an available balance of £5,190, as compared with £6,150 for the previous year. An interim dividend of 3 per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £3,390 to be carried forward. The hurricane of September last year did very serious damage to the company's cable property, and the necessary repairs and renewals, together with work at Bermuda, involved an outlay of £3,821. The balance to credit of revenue account, which was last year increased to £34,397, has been debited with £900 applied to dividend, and with £3,821 expended in renewals and repairs during the year, and credited with £3,390 surplus revenue of the past year, and it now stands at £33,065. The company's cables have worked efficiently. A licence to establish, install and work a wireless coast station was granted to the company by the Jamaica Government on February 16th last, and the cost to date has been taken to capital expenditure. During the year debentures have been paid off to the amount of £7,400, leaving £43,500 outstanding. Mr. Charles R. Hosmer resigns his seat at the board.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the half-year ended June 30th last, payable on October 15th next.

Stock Exchange Notice.—Application has been made to the Committee to allow the following security to be quoted in the Official List:—British Aluminium Co.—Further issue of £175,600 5 per cent. mortgage debenture stock.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended August 27th, 1909, were 735,625, compared with 615,469 units in the corresponding four weeks of 1908.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Sept. 15	2,884	+ 42	15	23,832	— 558	..	..
Ayr	,, 18	1,002	+ 137	18	7,601	— 55	8	..
Bath	,, 15	1,762	+ 102	37	29,062	+ 1,402	..	..
Belfast	,, 17	7,573	+ 265	23	94,009	+ 4,092	37	..
Birkenhead.. ..	,, 19	2,186	— 30	24	26,686	— 405	18·5	..
Birmingham Corp.	,, 11	12,748	— 59	24	154,442	+ 3,786	34	..
Blackburn	,, 15	2,340	+ 102	24$\frac{6}{7}$	28,393	— 907	13·97	..
Blackpool-Fleetw'd	,, 18	2,717	+ 457	11	17,204	+ 1,094	..	..
Bolton	,, 5	4,698	+ 215	23	54,228	— 675	26	..
Bournemouth ..	,, 15	4,016	+ 1	24	44,478	+ 266	21·96	..
Bradford	,, 12	7,465	+ 561	24	56,797	— 287	54·30	..
Brighton	,, 19	2,281	+ 189	25	26,704	+ 1,299	9·5	..
Bristol	,, 17	11,318	+ 794	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 10	460	+ 25	36	7,870	— 75	3·65	..
Barnsley	,, 10	349	+ 6	,,	6,095	— 310	..	..
Barrow	,, 10	521	+ 1	,,	8,427	— 603	5·37	..
Cavehill	,, 10	182	+ 17	,,	3,241	— 120	..	..
Devonport ..	,, 10	767	— 228	,,	13,364	— 3,298	8·85	..
Gateshead ..	,, 10	1,984	— 39	,,	35,869	— 335	11·25	..
Gravesend ..	,, 10	482	+ 22	,,	7,613	— 117	6·5	..
Greenock	,, 10	1,282	+ 231	,,	20,012	+ 756	7·25	..
Hartlepool ..	,, 10	530	+ 11	,,	8,547	— 212	6·72	..
Kidderminster ..	,, 10	261	+ 23	,,	4,015	— 195	..	..
Leamington ..	,, 10	413	+ 48	,,	6,391	+ 230	..	..
Merthyr	,, 10	441	— 8	,,	7,761	+ 96	2·9	..
Metropolitan ..	,, 10	13,982	+ 1,218	,,	223,750	+ 17,753	22	..
Middleton ..	,, 10	799	+ 25	,,	12,327	— 924	8·5	..
Mid. Joint Com'tee	,, 10	11,635	+ 74	,,	205,324	— 2,197	..	..
Oldham—Ashton	,, 10	1,209	— 29	,,	20,315	— 1,247	9·13	..
Peterborough ..	,, 10	252	— 15	,,	40,294	— 345	5·31	..
Potteries	,, 10	3.720	+ 78	,,	63,785	— 1,207	29	..
Rothesay	,, 10	652	+ 127	,,	8 692	— 3	2·75	..
Southport.. ..	,, 10	696	+ 27	,,	10,771	— 284	8·17	..
S. Metropolitan ..	,, 10	1,790	+ 71	,,	29,018	— 323	..	..
Swansea	,, 10	2,101	+ 142	,,	34,935	+ 727	12·5	..
Tynemouth ..	,, 10	692	+ 167	,,	9,422	+ 731	3·75	..
Weston-s-Mare ..	,, 10	633	+ 100	,,	6,163	+ 364	3	..
‡Worcester ..	,, 10	640	— 31	,,	10,195	— 101	5·75	..
Wrexham ..	,, 10	224	+ 2	,,	3,560	— 147	..	..
Yorks. Wool. Dist.	,, 10	1,975	+ 183	,,	32,835	— 201	17	..
Miscellaneous ..	,, 10	482	+ 35	,,	7,637	— 119	..	..
Burnley	,, 18	2,704	+ 263	..	..	..	..	..
Burton-on-Trent ..	,, 19	530	— 7	25	6,739	— 177	6·63	..
†Bury	,, 19	1.266	— 7	24$\frac{4}{7}$	29,786	— 487	22·5	..
†Cardiff	,, 11	2,180	— 83	24	53,979	+ 446	..	..
Carlisle	,, 18	348	— 19	37	6,207	— 265	..	..
Chatham and Dist.	,, 16	1,827	+ 51	37	30,527	+ 1,740	15	..
Cork	,, 16	1,015	+ 76	37	16,496	— 690	9·89	..
†Croydon	,, 3	1,714	+ 433	..	35,098	+ 1,682	11·25	4·75
†Darlington.. ..	,, 18	178	— 28	25	4,674	— 842	..	..
Darwen	,, 18	539	+ 22	24	6,193	— 206	4·36	..
Dover..	,, 11	518	+ 7	24	5,510	— 373	4·75	..
Dublin	,, 17	10,683	— 155	.	67,312	+ 1,001	54·25	..
Dundee	,, 15	2,604	— 99	17$\frac{4}{7}$	21,804	— 514	15	..
East Ham	,, 18	2,012	+ 223	24½	25,132	+ 3,438	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 18	35,443	+ 393	..	266,015	— 2,756	94½	5
Hastings	,, 16	2,814	+ 12	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
†Hull	Aug. 28	2,571	+ 214	21	54,383	+ 1,433	14·5	1·5
Ilkeston	Sept. 16	271	— 19	24	8,340	— 213	..	..
Ipswich	,, 18	936	+ 20	25	10,722	+ 175	10·5	..
†Kilmarnock ..	,, 11	146	— 3	17	2,622	— 91	4·25	..
Lan'kshire Trm. Co.	..	.	..	..	..	..	..	..
Lancashire United	,, 15	2,792	+ 115	37	49,876	— 465	..	..
Leeds	,, 11	13,772	+ 869	24	163,311	+ 3,376	54	6
Leicester	,, 18	4.418	+ 94	..	..	..	..	..
Leith	,, 11	1,256	+ 244	17$\frac{1}{7}$	11,146	+ 1,435	9	3
Liverpool	,, 11	21,780	+ 227	36$\frac{2}{7}$	889,164	— 2,149	58·5	.
‡L.C.C.	,, 4	73,411	+ 4,648	..	820,937	+ 31,848	90	4·25
London United ..	,, 18	13,014	— 2,075	.	229,700	— 22,864	..	..
†Lowestoft	,, 11	331	— 6	50	9,313	— 1,041	3·5	..
†Manchester ..	,, 18	14,862	— 178	25	373,599	— 2,907	105	..
Newcastle	,, 18	7,415	— 229	..	95,605	— 1,890	..	..
†Newport	,, 18	634	— 22	25	16,700	— 336	14·5	..
†Oldham	,, 19	1,830	— 49	25	48,106	— 3,452	23·75	..
†Pontypridd.. ..	,, 4	394	— 23	22½	9,549	+ 1,094	5·5	1·75
Portsmouth.. ..	,, 18	4,720	+ 197	25	56,551	1,796	15·25	·75
†Preston	,, 8	783	+ 19	..	..	..	..	..
Rotherham	,, 16	1,145	— 94	24$\frac{1}{7}$	14,431	— 685	10	·66
Salford	,, 13	9,139	+ 189	23$\frac{4}{7}$	110,904	— 3,833	..	..
Sheffield	,, 21	11,190	+ 289	25$\frac{6}{7}$	142,948	— 949	39·62	2·6
Southampton ..	,, 15	2,300	+ 58	24	26,948	— 388	..	..
Southend-on-Sea ..	,, 15	1,345	+ 115	24	14,938	+ 2,229	..	..
†South Shields ..	,, 11	560	+ 2	28$\frac{2}{7}$	13,797	+ 8	..	..
†Swindon	,, 1	154	— 3	.	..	..	..	..
Tyneside	,, 15	849	+ 63	11	5,116	+ 284	..	..
Wallasey	,, 18	1,927	— 22	24½	28.945	+ 956	..	·22
Walthamstow ..	,, 18	1,349	+ 11	25	17,302	+ 344	9	..
†West Ham.. ..	,, 9	4,720	+ 410	28$\frac{1}{7}$	55,496	+ 3,492	15·13	·43
Wolverhampton ..	,, 16	1,657	+ 90	24	19,773	— 860	12·5	..
Baker St.-Waterloo	,, 18	5 815	— 285	11	81 810	+ 160	4·25	..
Cen. London Rly...	,, 18	10,067	— 6,589	11	54,206	— 25,134	6 82	·55
Char. +, Eus. Hamp.	,, 18	7,230	+ 160	11	89,920	+ 4,470	7.75	..
City & S. Lon. Rly.	,, 19	6 218	+ 50	11	83,589	+ 1,220	7·8	..
Dublin-Lucan Rly.	,, 17	292	— 8	11	1,853	+ 39	7	..
G.N. and City Rly.	,, 18	2 611	+ 10	11	13,739	— 38	3·5	..
G N., P'y. & Brmtn.	,, 18	10,065	— 100	11	58,725	+ 490	9·25	..
L'pool Overh'd Rly.	,, 19	2,893	+ 82	..	17,580	+ 172	6·8	4·8
†Llandudno-Col. Bay	,, 10	698	+ 141	41	11,982	+ 2.048	..	..
Mersey Railway ..	,, 18	3,857	+ 84	11	21,003	+ 770	4·5	..
Metropolitan Rly...	,, 19	31 598	— 2,186	..	172,201	— 521	24·5	..
Met. District Rly...	,, 18	18,810	— 156	11	103,003	+ 5,844	24	..
Anglo-Argentine ..	,, 16	79,659	— 4,298	..	1,442,268	+ 88,925	..	..
§Auckland	Aug. 13	18,100	— 2,471	..	109,614	+ 10,825	22·8	1·88
Bombay (B.E.T.) ..	,,	5,186	+ 525	33	82,650	+ 5,036	..	..
§Brisbane	..	..	..	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 18	6.917	+ 449	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	..	..	..	..	..	..	..	..
Madras	,, 15	182	+ 82	..	2,167	+ 504	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	
Perth (W.A.)	,, 17	9.685	+ 184	..	51,899	+ 876	28	2·32

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon

Taken on the whole, the past week has not been a very exciting one for the Stock Exchange, and the majority of markets have presented a very idle appearance. An exception to this, however, has been the rubber division, where a large business has been done at improving prices. Most of the new issues have been well applied for by the public, but the cautious investor refuses to budge from the old-established concerns.

Business in the Home Railway market has been at a very low ebb, and the smallest transaction has been quite sufficient to move prices. Owing to the coal strike news being better, things generally are harder in tone, but that is about as much as one can say. Metropolitan Consolidated moved up ¼ to 38½-9, but Districts fell to the same extent to 15¾-16¼.

The Canadian group of Tramway, Light and Power concerns has been the subject of some newspaper criticism during the past week, and prices in consequence have fluctuated rather more than usual. Mexico Tramways close a little off the top at 127 to 128, and Rio Tramways fell from 95½ to 94 on the announcement of the company's first dividend of 1 per cent. Mexican Light and Power and Common shares shot up smartly to 72-3, after changing hands as low as 68, but quickly fell back to 68½-69½. The returns for August show a very serious falling off as compared with the previous 12 months. Sao Paulo Tramways were wanted, and rose a point to 149 151. Monterey Debenture still keeps firm at 88½ to 89½, whilst Brazil Rails at 50 to 51 are as hard as nails. Bahia Tramway Common are no better than 11 to 12, and it is almost impossible to deal in the 5 per cent. Gold bonds, which are quoted nominally 61 to 63 per cent.

Strong buying of British Columbia issues has caused a sharp spurt in prices, and the market is none too flush of stock at the moment. The new shares have hardened in sympathy, the quotations for "delivery" now being Preference 3d. dis.—3d. prem.; Preferred Ordinary 6d.—1s. 6d. prem.; Deferred Ordinary 4s. 9d.—5s. 9d. prem. over the issue price.

Anglo-Argentine Tramway descriptions were put down a fraction on the announcement that the Chamber had adopted a Bill authorising the construction of an underground electric railway running across the city from east to west. It is understood in the market, however, that the tramways have nothing to fear in the way of competition. British Electic Traction issues are lifeless, and quotations show no movement.

Trading amongst telegraph and cable companies has been very steady with a strong demand for the lower priced shares. The feature has been the further rise in Anglo-American Deferred on expectations of an increased dividend. The Ordinary stock has also improved ½ per cent. to 62—63. West Coast of America shares are higher to the extent of ⅛ to 1⅜—⅝, and West India and Panama issues have enjoyed an all-round advance.

Not quite so much has been doing in the iron and steel division, and prices, through being neglected, have sagged a little all along the line.

The Electricity Supply division presents a firm front, and, if anything, rather more business has been passing in the favourite stocks. Charing Cross Preference were marked up ⅛ to $4\frac{9}{16}$—$4\frac{13}{16}$, and County Preferences were bought for investment purposes, and finished ⅛ better at 10¾—11. Kensingtons were in demand, and rose ¼ to 6¾—7¼. St. James improved ⅛ to 8⅝—9⅛, but Urban Preferences were put down ⅛ in the Official List to 1⅜—1⅞. South Metropolitan Light and Power Preferences were a shade easier at $1\frac{1}{16}$—$1\frac{3}{16}$.

Johnson-Lundell Electric Traction Co., Ltd.—The report for the thirteen months to June 30th last, to be submitted to the meeting on the 28th inst., states (as published in the *Financial Times*) that the sale of the works at Southall, as reported at the last meeting, was duly completed and the purchase price paid. The operations of the year have been limited to carrying forward certain improvements in the apparatus connected with the company's regenerative system and to maintaining the patents. The efforts of the board to make a sale of the patents at a satisfactory price have not yet been successful. In the course of the current year it is hoped that something in this direction may be accomplished, or that a proposal to reorganise the company may be submitted for the shareholders' consideration. Messrs. J. H. Holmes and Co. have transferred in terms of their undertaking the whole of the paid up shares held by them. The present meeting is convened to comply with the requirements of the Companies' Acts. The directors, owing to the chairman's absence abroad, propose that the meeting be of a formal character only, and that it be adjourned *sine die* without doing any business. The directors have waived their fees in respect of the period now under review.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Sept. 14th.	Closing Quotations Sept. 21st.	Business done week ended Sept. 21st, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	146 —148	147⅞	146¾	+1	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	97 — 99	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3¼%	3⅞%	3½%	£3 4s.	61 — 63	61½ — 63½	..	..	+ ½	5 2 3
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	104 —105	105	104⅛	..	5 14 8
8,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21¼ — 21½	22 — 22¼	22 7/16	21 5/16	+ ¾	1 16 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	91	..	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ — 9¼	8½ — 9¼	9	8½	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17¼ — 18¼	..	..	+ ¼	5 9 7
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 11 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅛ — 8⅝	8⅛ — 8⅝	..	..	..	5 15 11
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100½ —102½	..	..	+ ½	2 3 11
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13 — 13½	13⅛ — 13⅝	13⅝	13 1/16	+ 1/16	6 4 9
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	129 —132	129 —131	131	129½	..	5 6 10
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	84½ — 86½	85 — 87	86	85	+ ½	4 0 6
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	104½ —106½	105¼	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ — 12½	11¾ — 12¼	12⅛	11 15/16	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. (Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ — 10¾	10¼ — 10¾	10½	10⅜	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾ — 14¼	13¾ — 14¼	14 1/16	..	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	26 11/16	26¼	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	53¼	53	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	83 — 86	89 — 92	90	..	+6½	4 7 0
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	77 — 80	..	..	+2½	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	¾ — ⅞	¾ — ⅞	16/6	15/6	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝ — ⅞	⅝ — ⅞	..	..	..	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝ — ⅞	⅝ — ⅞	..	..	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 —107½	107	106½	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	121⅞	121¼	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛ — 10⅞	10⅛ — 10⅞	10⅜	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ — 10⅝	10⅛ — 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 7/16 — 5 11/16	5 19/32	5 7/16	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 13/32 — 1 17/32	1 15/32 — 1 19/32	31/3	29/4½	+ 1/16	5 5 9
60,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 5/32 — 1 9/32	1 5/32 — 1 9/32	..	..	..	4 15 3
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87	86½	..	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	7¾	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6¾ — 7	6⅜ — 6⅝	6 13/16	6⅝	— ⅜	6 0 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1¼ — 1½	1⅜ — 1⅝	30/-	27/6	+ ⅛	3 15 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13¼ — 13¾	13¼ — 13¾	13 9/16	..	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝ — ¾	11/16 — 13/16	14/9	11/4½	+ 1/16	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8⅜ — 8⅞	8½ — 9	8 11/16	..	+ ⅛	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8¼ — 9½	..	..	+ 3/16	15 15 10
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101½ —103½	..	..	+ ½	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝ — 4⅞	4⅝ — 4⅞	96/3	93/9	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 9/16 — 4 13/16	4½ — 4¾	91/3	..	— 1/16	5 17 8
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	92½ — 93½	92½ — 93½	93⅛	92⅞	..	4 6 6
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	102¾	..	..	4 15 3
880,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅝ — 4¾	4½ — 4⅝	93/9	90/7½	— ⅛	4 6 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼ — ¾	¼ — ¾	15/-	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾ — 2¼	1⅝ — 2⅛	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ — 3⅞	3⅜ — 3⅞	70/-	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	95 — 98	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —147	144 —149	146	..	+2	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	114 —119	117 —122	120¾	117½	..	5 0 1
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —109	106 —110	108	106½	+1	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	9/16 — 15/16	½ — ⅞	12/3	11/3	— 1/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 — 2½	2 — 2½	43/9	40/-	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	81 — 87	84 — 87	85¾	85½	..	5 14 11
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼ — 7⅝	7¼ — 7⅝	7 15/32	..	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6½	6⅛ — 6½	6⅛	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
904,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
1,316,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	40	39½	..	9 10
60,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
60,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4¾ — 5¼	4¾ — 5¼	97/6	..	..	4 5 9
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	95/-	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅝ — 11⅛	10⅝ — 11⅛	10 15/16	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝ — 5¾	5⅝ — 5¾	5⅝	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 — 2⅛	41/3	41/-	..	5 17 8
710,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —108	106 —109	106½	..	+1	3 13 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	62 — 64	61 — 63	62	..	—1	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44⅞	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	31 — 32	31 — 32	31⅛	31	— ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	⅞ — 1⅛	⅞ — 1⅛	..	..	..	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

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* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sept. 14th.	Closing Quotations Sept. 21st.	Business done week ended Sept. 21st, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅛ — 1 5/16	1 — 1¼	20/-	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 5/32 — 1 9/32	1⅛ — 1¼	..	..	..	4 14 1
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/16 — 5/16	3/16 — 5/16	..	..	..	24 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
300,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12⅝ — 12⅞	12½ — 13¼	13	12½	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ - 107½	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14¾ — 15½	14¾ — 15½	15⅜	15 5/16	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾ — ⅞	¾ — ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4¼ — 4¾	4¼ — 4¾	..	..	..	10 10
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	6 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅛ — 2⅝	2¼ — 2¾	48/9	..	+ ⅛	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	67 — 70	67 — 70	67¾	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	37¾ — 38¼	39¼ — 39¾	39⅝	37¾	+1½	1 5 2
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 —67	..	..	..	4 2 1
6,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	16 — 16½	16 3/16	15 13/16	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	15/-	10/-	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	15/7½	14/6	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94 — 95	94½ — 96½	96	94	+ ½	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —128	126½ —129½	129⅝	125⅞	+1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	90 — 92	91 — 93	93	90	+1	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	34½	..	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100½ —102½	..	..	+ ½	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½ —103½	102½ —103½	103	102⅝	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	88 — 90	90	88⅜	..	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	36 — 38	36 — 38	37½	36	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝ — 3⅛	2⅝ — 3⅛	58/9	52/6	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	78 — 82	78 — 82	79¼	79	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Sept. 14th.	Closing Quotations Sept. 21st.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼ — 4¾	4¼ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7⅜ — 7⅞	7¼ — 7¾	..	..	— ⅛	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ — 8	7½ — 8	..	..	..	4 7 6
636,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 — 100	97 —100	..	..	..	3 18 5
60,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	82/6	..	..	5 11 1
30,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4½ — 5	..	..	+ ⅛	4 10 0
30,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3⅞ — 4⅜	85/-	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	6 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½ — 4	3½ — 4	..	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅝ — 10⅞	10⅝ — 10⅞	10⅝	10 7/16	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	124	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10⅝ — 11⅛	11	10¾	+ ⅛	5 7 10
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
30,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	Nil	Nil	⅜ — ⅞	⅜ — ⅝	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84 — 86	84 — 86	85½	..	..	5 16 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	90/-	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	6½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	99 —101	100¼	99¾	+ ½	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6½ — 7	6¾ — 7¼	..	..	+ ¼	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	37/6	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5¼	5 — 5¼	5	..	..	5 17 1
682,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
900,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛ — 4⅝	4 — 4½	87/6	82/6	— ⅛	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000l	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	6½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	79 — 81	82¼	60¼	—1	6 3 5
18,685,000	Do. Light and Power Co Ltd., Common	$100	..	..	..	3½%	66 — 70	67 — 71	72	68¼	+1	4 18 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	100 —104	102 —106	106	100¼	+2	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	82 — 84	83 — 85	84¾	81½	+1	5 17 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 4
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	6 %	8 %	2½%	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	2 14 0
167,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 16 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Electy. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½ — 9	8⅝ — 9⅛	8¾	8⅝	+ ⅛	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	6½%	3½%	64 — 88	84 — 88	..	..	..	6 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16 — 13/16	½ — ¾	..	..	— 1/16	Nil
65,000	South London Electric Supply, Ord.	4	4 %	6 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1¼	1 1/16 — 1 3/16	21/3	..	— 1/16	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102—105	102 —105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	25 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2	1⅜ — 1⅞	33/-	..	— ⅛	18 8 8
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	77 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	27/32 — 29/32	27/32 — 29/32	18/-	..	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½ — 9	8½ — 9	8¾	8 9/16	..	5 11 1
31,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 1/16	..	..	4 3 0

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* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1909.

The August export returns, although, of course, not up to the exceptionally high total of July, which included a large telegraphic export, are well above the average of previous months. The exports amounted in total to £302,849, and for comparison, deducting telegraphic exports, we have £257,534 remaining as general business, as compared with £246,663 in July, £250,000 in June, &c.

As regards the imports, these amounted to £130,678, as compared with £161,190 in July; the total being under the average of the previous seven months of the year; the re-exports show an improvement, totalling £15,591, as compared with £12,577 in the previous month.

Of the individual items of the exports, electrical machinery shows an increase in value, although other items, such as telephonic and telegraphic material—particularly the latter—are considerably below the July values.

The import items show general reductions all round, and do not call for special comment.

Japan, India, the U.S.A., Canada and the Argentine figured as prominent purchasers, while the importing countries remained much as in previous months.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	144	4,665	195	81	84	3,380	50	78	...	15	85	8,777
Germany	228	237	5	60	30	242	...	9	...	70	...	881
Netherlands and Java	275	1,747	2	...	5	479	...	2	...	15	95	2,620
Belgium	65	293	63	...	317	865	20	...	...	397	296	2,321
France and French Indo-China	270	...	158	227	...	439	...	92	...	8	...	1,194
Switzerland	2	...	...	...	6	542	...	...	...	...	...	550
Portugal, Azores, Madeira, Portuguese Africa and India	97	579	16	110	71	165	95	...	...	4	224	1,361
Spain, Canary Isles and Morocco	42	56	...	144	110	899	505	...	...	...	73	1 829
Italy and Austria-Hungary	48	22	72	...	1 367	5,130	700	...	23	630	1,815	9,807
Greece, Bulgaria and Turkey	23	13	22	30	18	286	...	187	...	...	26	605
Channel Isles, Gibraltar and Malta	90	288	11	...	52	472	...	85	...	62	11,319	12,369
U.S.A.	90	...	8	...	307	26,009	52	8	106	...	841	27,421
Canada and Newfoundland	606	874	1,038	145	1,390	1,477	1,388	46	...	1,889	11,189	20,042
Bahamas, British Honduras, British West Indies and British Guiana	136	...	47	25	84	159	...	131	...	56	20	658
Mexico, Venezuela and Bolivia	621	...	12	112	...	51	...	3	...	...	...	799
Peru and Uruguay	11	...	...	...	14	752	...	...	...	500	10,928	12,205
Chile	...	30	22	1,184	113	2,125	50	24	...	59	19	3,626
Brazil	329	763	175	484	282	5,435	...	44	10	8	2,822	10,352
Argentine	647	2,291	88	942	2,015	9,778	3,492	382	150	2,364	967	23,116
Egypt and Tunis...	22	176	101	199	38	97	16	46	20	110	...	825
British West Africa and St. Helena	39	56	36	61	...	278	...	2	...	159	83	714
Cape of Good Hope	369	1,818	75	163	325	2,556	596	498	25	9	34	6,468
Natal	1,094	4,864	80	339	20	3,831	...	...	37	...	...	10,265
Rhodesia, Orange River Colony and Transvaal	1,340	2,577	461	1,131	84	2,342	...	59	7	43	10	8,054
Zanzibar, Brit. East Africa and Mauritius ...	14	61	19	38	40	33	...	21	...	62	232	520
China and Siam	1,728	133	228	153	234	243	58	401	...	328	1,060	4,566
Japan and Korea	3,331	8,692	384	22	1,759	21,214	3,280	16	151	1,723	1,196	41,768
India	1,336	5,144	1,511	2,148	855	11,383	7,232	497	151	40	469	30,766
Ceylon	59	217	...	41	...	20	...	...	...	39	12	388
Straits Settlements and Fed. Malay States ...	53	596	236	20	33	192	40	58	78	59	32	1,197
Hong Kong	152	464	4	256	...	242	67	...	...	10	66	1,261
West Australia	418	...	...	51	148	520	40	3	...	10	139	1,329
South Australia	152	150	47	101	19	3,383	937	88	...	397	...	5,274
Victoria	443	4,283	...	961	756	1,645	...	146	...	2,416	723	11,373
New South Wales	1,830	710	376	...	764	9,504	170	187	...	41	...	13,582
Queensland	28	...	26	88	...	1,596	...	26	97	2,474	...	4,335
Tasmania	...	...	...	...	...	...	...	616	...	129	...	745
New Zealand	621	5 261	445	269	274	7,583	1,135	312	8	2,238	540	18,686
Total, £	16,753	47,065	5,963	9,585	11,614	125,347	19,923	4,067	863	16,354	45,315	302,849

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	...	18	...	28	23	1,160	...	239	...	3,024	4,492
Germany	579	10,372	1,356	20,272	2,246	25,264	817	761	3,781	7,873	73,321
Holland	24	4	4	1,945	5	53	...	...	134	324	2,493
Belgium	159	1,272	215	192	51	1,407	...	82	337	8,979	12,694
France	641	...	545	1,228	1,152	135	29	1,035	2,593	4,824	12,182
Switzerland	182	...	12	20	64	201	2	...	1	101	583
Italy	45	796	...	...	...	...	...	...	...	1,852	2,693
Austria-Hungary...	...	304	...	434	...	783	...	18	1,396	340	3,275
United States	1,627	267	225	965	647	9,647	4,865	83	223	276	18,825
Canada	...	...	45	...	...	43	...	...	...	...	88
Total, £	3,257	13,033	2,402	25,084	4,188	38,693	5,713	2,218	8,465	27,593	130,646

Additional imports: Spain, carbons, £25; New South Wales, electrical machinery, £7.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	1,825	278	...	2,821	...	3,550	...	181	932	6,004	...

Total Exports: £302,849. **Total Re-Exports: £15,591.** **Total Imports: £130,678.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

CATALOGUES AGAIN.

By "QUID NUNC."

It will probably be admitted, when one considers the different forms of catalogues, price lists, &c., that the filing of these really seems a vexed question. For instance, there are the firms who advertise their goods by sending out a handsome bound book, large enough in some instances to take up two or three inches of space; others send out as many as three smaller volumes; again, we have the single sheet, sent out at intervals, and the large beautifully illustrated stiff cardboard advertisement for hanging on the wall; then there is the large illustrated sheet, presumably for pasting on the wall; we next have the loose-leaf-holder arrangement, in order that further sheets issued may be inserted therein, and the very small pamphlet suitable for the waistcoat pocket. Unless this variety is separated into some order or other, the result must necessarily be chaotic.

Whilst the writer does not claim perfection for the system now advocated, he may state that the method has worked admirably and without hitch for a number of years past, and it further has this advantage: only the latest books and lists are kept; unless this is done, the accumulation of old and out-of-date matter will grow to an alarming extent, necessitating a periodical overhaul, which in an engineering department means rather a large order.

The first factor to be considered is an efficient system of indexing; without doubt the card index claims many advantages over the ordinary alphabetical book index, and as the advantages are so well known, it is not necessary to describe them.

The following is a suggested ruling of the cards:—"A" for indexing under name of firm; "B" for cross-indexing under name of article.

A.

Name..............................

Address ....

Telegraphic Address.........

Description of article.	Catalogue No.	Location.

B.

Description of article.	Catalogue No.	Location.

The next step to consider is the arrangement, and the following method is suggested:—All catalogues in book form should be numbered, and placed in numerical order on shelves separate from the other classes of catalogues. Leaflets, pamphlets, &c., should be numbered and filed in cases; where a sheet is too large, it should be neatly folded. The cases should be numbered and placed in numerical order on their particular set of shelves. Suitable cases can be obtained 15 in. × 10 in. × 3 in. deep, with a spring clip to hold the papers in position, at a very reasonable price. All lists of the large cardboard type should be numbered and placed in order on another shelf; very little space will be required for these, as they are not very numerous.

For indexing, a small gummed disk should be affixed to the back of the books and numbered; the card written up, with the number given to the book, the location, and other particulars regarding name, specialities, &c., and the card placed in alphabetical order in the tray. With regard to books, no cross-indexing is necessary, as the specialities of the firms issuing these books are generally well known, and to endeavour to cross-index every article described would entail too much unnecessary labour; moreover, the books contain, as a rule, a very complete index of their contents.

Single sheets, pamphlets, &c., should be numbered; a small gummed disk affixed to the top of the sheet, or on the top of the cover of the pamphlet, is suitable for this purpose, and the sheets or pamphlets should be placed in the case in numerical order, after the index card has been written up. The number in each case should start from 1; the number and location on the index card will be described thus: "Catalogue No. 1; Location, Case 2," or as required; the disk on the catalogue will be marked likewise "No. 1 C2," so that when taken out of a case for reference, it can always be returned to its proper case and placed in numerical order. Cross-indexing should be used in the case of single sheets and pamphlets by aid of the cards already described. It is not necessary to write up a fresh card for every article, as a card can be used for the same class of article until full, and a new card can then be inserted behind it.

It is advisable not to fill the cases to anything like their full limit, as leaflets and pamphlets may arrive from a firm whose name has already been indexed, describing other articles. The number in this case should be given thus:—Say the number of the first sheet received is 20, the next sheet received from the same firm should be numbered 20·1, the next 20·2 and so on, and entered up on the card index accordingly; thus all sheets, &c., belonging to any particular firm are kept together.

Before filing, reference should be made to the index, and if a catalogue has already been received from the same firm describing the same speciality, the new catalogue should be given the same number, the old catalogue taken out and destroyed and the new one put in its place. No further indexing is required, as the name of the firm and particulars are already in the index, and by this method only the latest lists are retained.

EVAPORATIVE CONDENSERS.

By E. KILBURN SCOTT.

The efficiency of a surface condenser over other types is well known, and also the effectiveness of a cooling tower for saving condensing water. But the possibility of combining these two in an evaporative condenser is not so well recognised.

At the Southend electricity works such an evaporative condenser, made by Messrs. Ledward & Beckett, is in use, and it has been such a great success that some data respecting it may be of interest. Although Southend is a seaside resort, the sea, when the tide is out, is over a mile from the power station, and it is therefore impossible to use sea water for condensing purposes. Town's water has to be used, and as it is 1s. 6d. a gallon, the engineer, Mr. Birkett, recognised the importance of economising it if possible.

The apparatus which has been installed is capable of dealing with 60,000 lb. of steam per hour, and it takes the place of two separate sets of cooling towers and surface condensers.

With the new arrangement, a better vacuum can be obtained, ranging from 27 to 25 in., according to load, with only a quarter of the water when running on load. Also no water at all is used during the daytime, when on light loads, because the pipes give up their heat to the surrounding atmosphere. The evaporative condenser consists of 2,160 cast-iron corrugated tubes, laid horizontally, and built up into sets something like economiser tubes. Under the pipes there is a large brick tank filled with water, from which two motor-driven circulating pumps raise the water to distributing perforated pipes on the top of the condenser. The lift is only 14 ft., whereas with the old cooling towers it was nearly 30 ft.

The steam from the engines enters the cast-iron tubes at the top, and as it is condensed it is tapped off at intervals from the pipes below. The pipes are therefore freed from water directly it is condensed, as in the Contraflo type condenser. This hot water goes straight to the boilers through a rotary "wet" pump, and so a great deal of heat is saved, and the water has no chance to become aerated.

The Southend plant has two three-throw motor-driven Edwards air pumps, either of which is capable of dealing with the whole of the steam, except at periods of heaviest load. These air pumps remove the vapour and air, as well as the water of condensation, from the last three tubes in each coil. The water is delivered into the hot well, and from there it is fed into the boilers by feed pumps.

One of the old plants, which dealt with only half the load, required 75 B.H.P. in power, whereas the new plant, dealing with the full load, absorbs only 22 B.H.P. During the daytime the light load only requires 9 B.H.P., this being the power of the air pump. As soon as the plant was put to work it saved 80 per cent. of the water used in the station.

A similar, but smaller, plant to the one at Southend has recently been started at Bridlington. The borough engineer, Mr. A. J. Beckett, called for a guarantee of coal saving, and Messrs. Ledward & Beckett, with the Southend and other data to go upon, were able to guarantee 25 per cent. The tests carried out last month showed 26·7 per cent. saving, with the barometer at only 29·1 inches.

The above appears to indicate a way in which many of the smaller municipal plants might turn an annual loss into a profit, for although the first cost of the evaporative condenser is more than that of the old arrangement of a separate condenser and cooling tower, it is only a small percentage on the total outlay on the station.

A 150-TON ELECTRIC TITAN CRANE.

Within recent years a type of heavy electric wharf crane, known as the hammer-head or cantilever titan crane, has been designed and constructed to meet the demands of marine engineers and shipbuilders, and several large cranes of this pattern have been erected in this country and abroad. These cranes are of two distinct types of construction; the early type, favoured in Germany, consists of a horizontal jib, carrying the travelling jenny, and secured to a vertical shaft passing through a tower to the wharf level, where the slewing gear is fixed. At the top of the tower, which extends nearly to the underside of the jib, horizontal rollers are placed to permit of easy rotation of the internal shaft and jib. The duty of the tower is simply to resist the horizontal force of the wind, and to maintain the internal mast or shaft in a vertical position. In the titan type, or British design, the horizontal jib is placed upon a ring of live rollers resting upon the top of the tower, which supports the whole of the live and dead loads in addition to resisting the overturning force of the wind. The British designs are simply rim-bearing swing bridges on tall towers. The principal advantage of the titan type is more substantial construction; the deflections are about one-third those of the hammer-head type, and the amplitude of vibrations about one-sixth. The steadiness in lowering is a great advantage in dealing with heavy loads, and allows them to be placed more rapidly in their correct position.

An electric titan crane of 150 tons capacity has just been completed for the North-Eastern Marine Engineering Co. at their Wallsend Yard, by Sir William Arrol & Co., of Glasgow. It consists of a tower 125 ft. in height and 40 ft. square at the base, and carrying a ring of live rollers on top, upon which a horizontal jib, having a total length of 245 ft., is supported. The long arm of the jib has a total radius of 150 ft. The jib is fitted with slewing gear to revolve it in either direction, and has racking gear and separate lifting motions for the main and auxiliary hooks.

The speeds of the various motions are as follows:—

Main lift	150 tons... ...	at 5 ft. per minute
„	100 „	at 7½ „ „
Auxiliary lift	30 „	at 12 „ „
„ „	7½ „	at 50 „ „
Racking	150 „	at 40 „ „
„	30 „	at 100 „ „
Slewing	150 „	1 rev. in 10 minutes
„	30 „	1 „ 5 „

The total height of lift provided for is 173 ft., viz., 143 ft. above and 30 ft. below quay level. The height from quay to rail level is 156 ft. The racking and lifting machinery is placed in a steel-plated house at the tail-end of the jib, and assists in counterbalancing the crane. The slewing gear is placed in a steel-plated house over the circular rack at the back end. The operator's cabin of steel plating containing the controllers and resistances is placed on the right-hand girder of the jib, and is provided with projecting windows, so that a clear view is obtained of the load at all times. It is connected to the machinery house by speaking tubes, and by telephone to the ground.

The foundations of the crane are formed of four steel cylinders founded upon hard boulder clay at depths of 73 ft. for the two front cylinders, and 58 ft. for the two back cylinders, subsequently filled with concrete.

The tower is constructed of four legs of open angle section, forming a square 40 ft. at the base, tapering to 35 ft. at the top, braced together by three bays of horizontal and diagonal bracing of braced box section. The centre pivot pin, 14 ft. long × 18 in. diameter, passes through the cross girders of the tower at their intersection and through a box girder secured to the jib main girders and the drum girder. It provides a centre of rotation for the jib and prevents its displacement. To provide for emergency loading and a construction of a substantial and durable character, the centre pin, with the girders carrying it, is designed to resist a vertical or horizontal force of 100 tons, although, by the construction of the crane, no tension will be on the pin under any ordinary conditions of the loaded or unloaded jib, as the centre of gravity does not approach at any time nearer the centre of the roller path than about 3 ft. The centre pin and the castings which revolve round it are bushed with hard gun-metal. The collector rings are fixed above the head of the centre pin, and the electrical cables are brought up through a 5-in. hole bored through the centre of it.

The mean diameter of the roller path is 35 ft. The upper and lower tracks are of cast-steel, 2½ in. in thickness, and their rolling surfaces are machined to form conical surfaces with a common vertex at the centre. There are 75 rollers of solid forged steel, 14 in. mean diameter, 14 in. in length and spaced about 16½ in. centres. The circular slewing rack is 5⅓ in. pitch, and is bolted to palms cast on the lower roller path. The upper roller path is carried by a drum girder, 35 ft. diameter, 24 in. deep, and 24 in. wide. It is of sufficient strength and stiffness to distribute the maximum pressure from the full load being lifted over 19 rollers.

A pair of open lattice girders, 14 ft. apart, and braced together, was adopted for the jib, which is 26 ft. over the tower; ballast tanks are placed under the machinery house at the tail end and contain 65 tons of counterweight. Four lines of bridge rails are provided, one over each web of the box girders, and are riveted to the top flanges.

All the motions are actuated by Westinghouse motors, and for convenience these have been made of the same size throughout, being all of 50 B.H.P., running at about 380 R.P.M., and worked on direct current of 480-500 volts.

Two of the motors actuate the main hoisting gear, and these are arranged to run in series or parallel, giving a further range of speed, besides that supplied by the change of gearing. The main lifting barrel is 10 ft. in diameter; it is spirally grooved, and takes the whole of the rope in one lap. It is driven by a very fine steel spur-wheel, keyed directly on to the barrel, and the teeth of this wheel are specially formed, to give great strength at the root.

The main hoisting rope is 5 in. in circumference, and the load is lifted on 12 parts, two parts being led direct from the barrel; this gives a six-fall purchase in the ropes.

On the main hoist there are magnetic brakes controlled by solenoids, and mechanical releases for emergency use are fitted.

In addition, there are rheostatic braking points in the controllers, but a notable point as regards the arrangement for lowering is the adoption of "Matthew's" hydraulic brakes, which give an extraordinarily delicate control of lowering. The hydraulic brakes consist essentially of a pair of water cylinders, containing pistons; these pistons are driven from cranks at right angles, actuated by the main gear when lowering. The cylinders are provided with a by-pass, with a specially designed valve, allowing the water to pass from back to front of the pistons as required for lowering at any desired speed. The heat generated in the hydraulic cylinders is carried away by water-jackets to circulating tanks.

The connection of the water-cylinders to the gearing is such that the pistons are not actuated when lifting, and therefore do not cause a drag on the lifting motors. The effect of the arrangement is that lowering can be performed with absolute smoothness; this, combined with the extreme rigidity of the steel structure, keeps the pulsation of the load within extraordinarily small limits, a point that will be appreciated by all those who have attempted to accurately place loads in position when being lowered from elastic cranes with a great pulsating deflection.

The auxiliary hoisting gear is worked by one 50-H.P. motor, and, as mentioned above, is fitted with two speeds, and this also has magnetic, mechanical and rheostatic brakes.

The racking motion is worked by a separate motor, actuating a barrel on which coils off and on the 3-in. circumference rope, which propels the jenny.

The gearing is mostly of cast-steel, the first reductions being in oil baths.

The travelling jenny runs on 12 double-flanged cast-steel wheels, rolling on two rails on each cantilever. Compensating pulleys are placed at the end of the jib, to ensure equal stresses on the ropes. The load is lifted by a heavy forged hook, attached to the snatch-block, through the medium of a ball bearing.

The driver's cabin is very completely fitted up, with switchboard, ammeter and voltmeter, no-voltage releases and the usual fuses, and there is also in the cabin an indicator, to show the radius at which the jenny is working. This indicator has a glass front, behind which lamps are placed; the lights appear and disappear in succession as the jenny moves down the jib. The cabin also contains the working gear for the brakes, and for actuating the hydraulic valves of the hydraulic brakes.

The slewing gear is actuated by a 50-H.P. motor of the same type as the others; this drives the main slewing pinion, through the medium of a set of gear wheels, which are self-contained on a massive bracket, fitted to the upper slewing ring. A powerful solenoid brake is fitted to the slewing gear. Releasing gear is fitted to the brake, so that the crane may come round to the wind when not in use.

A new feature in this crane is the adoption in the machinery house of a complete electric traveller, a trap door being so arranged in the floor of the house, that a 2½-ton load can be lifted right up from the ground to the machinery house. This is a great convenience for changing armatures or dismantling for repairs or cleaning.

The crane was erected by means of a 15-ton steam crane placed on top of a travelling timber stage, which was about 100 ft. in height. In its first position the crane erected the whole of the tower, live ring and portion of the jib over the tower, and it was gradually moved towards the tail end to erect the remainder of the jib and machinery. While the tail end was being erected the long arm was built from a 3-ton hand crane, which was pushed forward as the erection proceeded and the crane kept in balance.

The tests of the crane were successfully completed on July 2nd, when it was put through all its evolutions with a test load of 187 tons, 25 per cent. over the maximum working load. The maximum deflection was $7\frac{7}{16}$ in. under the 187 tons load and 6⅛ in. under 150 tons. The amplitude of the vibrations was observed during the tests, and did not exceed $\frac{5}{16}$ in. under the 150 tons load.

We are indebted to Mr. Adam Hunter, M.Inst.C.E., chief engineer to Sir W. Arrol & Co., for the above particulars.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

The single-phase system on the suburban railway between Blankenese and Ohlsdorf has answered so well in conjunction with an expansion in the traffic, that the State Railway authorities have ordered a further batch of 25 motor coaches. It is said that the favourable experience gained with this line will probably contribute towards the speedy introduction of electric traction on the Berlin City Railway. A similar prediction has been made on former occasions, but now, as then, the State Railways make haste slowly.

The close connection which was financially established between the A.E.G. and the Swiss firm of Brown, Boveri & Co. in 1904 has now been dissolved, and the directors in the one company have retired from the board of the other, and *vice versa*.

The Wolfram Lampen Gesellschaft, of Augsburg, reporting on the year 1908-9, which was the first year since the taking over of the Bavarian incandescent filament factory, states that the manufacture of the Just metallic-filament lamp experienced a further satisfactory development. The continued trials in the direction of the improvement of the tungsten lamp for working on a large scale had, however, resulted in a complete transformation of several departments, and this was the principal cause of the unfavourable trading for the year, although the advantages of the alterations would be observable in future years. The demand had become brisker, and sales were further increased notwithstanding the advent of severe competition. It had recently been possible in a short time to place on the market 16 c.p. tungsten lamps, as well as lamps of 600 and 1,000 c.p. The constant increase in the scope for the productions was, however, being accomplished with constant concessions in prices. It was proposed to extend the Lechhausen factory, and the work would be commenced in this year. An agreement had been entered into with the International Wolfram Lamp Co., of Buda-Pesth, and the United Glow Lamp and Electricity Co., of Ujpest, whereby the market for the company had been substantially enlarged. The accounts show a loss of £10,100 for 1908-9, which is to be covered out of the reserve fund, on a share capital of £150,000. The directors add that the effects of the new lamp tax could not be foreseen, and that the financial consequences of it would probably have to be borne by consumers.

The directors of the Swiss firm of Brown, Boveri & Co., of Baden, state in their report for 1908 9 that the whole of the year stood under the influence of the general crisis in trade, and the reason the company was able to propose the same rate of dividend was principally to be found in the circumstance that many old orders were completed in the 12 months. Moreover, the works were fully employed without interruption, owing to the numerous special branches worked up by the company. The sale prices were further depressed, and the general expenses increased annually, and, notwithstanding improvements in manufacture, a diminution of the financial results could scarcely be avoided unless prices became firmer by a general revival in trade. The financial results for the past two years are as follows:—

	1908-9.	1907-8.
Share capital	£800,000	£800,000
Bond capital	400,000	400,000
Gross profits	275,000	262,000
Depreciation provision ...	22,100	36,600
Net profits	110,000	94,000
Dividend	88,000	74,800
Per cent.	11	11

The report proceeds to state that the company is very actively employed principally on the construction of generators and transformers of very high output, and the single-phase commutator motors have become a bulk article of manufacture. These motors have also been developed to great perfection for railway working, and the company is in course of building locomotives on this system for large powers. The work of converting the Swiss Seethal Railway to electric traction on the single-phase method is proceeding, and is to be completed in the next few months. The invoice value of the steam turbines has declined partly in consequence of lower prices, and partly because of the circumstance that a standstill has been reached in the erection of large central stations. As to the electric lighting of trains, 2,000 coaches have been equipped, mainly on the Swiss Federal Railways, and a further 1,000 coaches are in prospect. It is added that the works are fully employed, and that the orders on hand on April 1st were only inconsiderably less than those at the corresponding period in 1908.

The Compagnie Internationale d'Électricité, of Liége, which has a share capital of £251,000, and a bond issue of £83,000, realised gross profits of £36,400 in 1908-9 and net profits of £17,570, the latter of which has been devoted to the purpose of depreciation in order to consolidate the financial position. If the results are less than in the preceding year, the directors state in their report that the circumstance was notably due to the fact that during the final months the workshops were not fully employed owing to the crisis in trade in general, and because the extraordinary profits were less considerable. It was also necessary to take into account that profits resulting from the construction and working of the Liége central station for the city had not been included in the balance-sheet, although the works were nearly completed on April 30th. The station was now in operation and the current year would benefit from the operation of the undertaking. The order book was at present well filled, and the amount was higher than at the same date a year ago. The economical organisation of working in the shops had made fresh progress, and the company had started the manufacture of standard series of dynamos and motors, the increasing demand for which had stimulated the construction of new and very economical types. The branch at Paris continued to yield satisfactory results, but as the English market had not improved, the company had closed the London office and would endeavour to dispose of its manufactures direct.

The report for 1908 of the Austrian Siemens-Schuckert Works Co., of Vienna, states that the number of consumers again experienced a considerable increase; the turnover was materially greater, and all departments, including the newly associated cable factory, were fully employed. Among the orders received during the year are mentioned those for 11 central stations and four tramways, and extensions for 49 stations and six tramways, together with power transmission and lighting plants, &c. The output of the machines delivered was 170,000 kw., or 60,000 kw. in excess of 1907, and the number of workmen employed at the end of 1908 was 4,000, as against 3,700 at the close of the preceding year. The accounts show net profits of £45,000, as compared with £34,200 in 1907, and a dividend at the rate of 5 per cent. has been declared, this contrasting with 4 per cent. in the previous year.

THE AUDIT OF THE ACCOUNTS OF TRAMWAY UNDERTAKINGS AND TRAMWAY FINANCE COMPANIES.

By "ACCOUNTANT."

The construction of tramways is governed by the Tramway Act of 1870. Discussion of that Act, or of the procedure by municipal authorities and companies incidental to the promotion of a tramway order not being germane to our subject, we may conveniently eliminate it from our introductory observations.

It is proposed to present as briefly as possible an outline of some of the more important matters which come within the purview of the auditor in relation of his duty towards the accounts of tramway undertakings, and to notice some of the principal points that appear in tramway finance. The subject possesses features probably more instructive than interesting.

The usual practice is for a copy of the balance-sheet and profit and loss account, with convenient schedules, to be submitted to the board, discussed, and the approval of the directors minuted in the ordinary way, copies of these documents, as approved by the directorate, being supplied to the auditor when he subsequently commences his audit.

It is assumed that the auditor is familiar with the Memorandum and Articles of Association, so that he may ascertain whether the nature of any of the transactions which have transpired, or which have been entered into, have been or are within the powers of the board or the company, and that the Articles of Association have not been disregarded or transgressed in the carrying out of such transactions, and in the general administration of the affairs of the undertaking.

It is a common assertion that accountancy attains the apex of interestedness only on occasions of stress of necessary funds, which is frequently true in practice.

Two of the preliminary duties are (1) to check the commencing balances, and (2) to read carefully the minutes, noting anything which may be important or unusual, and the effect, if any, in some instances which has been given to the resolutions of the board in matters of account.

The manner in which some descriptions of assets and capital expenditure are assembled and presented in groups in balance-sheets leaves much to be desired. The inference is obvious, and the practice, needless to state, does not contribute to that reasonable fulness and lucidity of balance-sheets which is so essential, but which is so generally neglected.

Treating, first, of the accounts of tramway companies proper, we may proceed to sketch some of the principal features of the auditorial work. Incidentally, it may be observed that the books in use at the chief office are of the usual design and variety, and generally embrace ledgers (personal and impersonal), cash books and journal.

In some undertakings the accounts are recorded in separate ledgers, viz.:—

Real accounts ...	1. Accounts of debtors and creditors.	Personal ledger.
	2. Accounts of stock, construction, investments.	Real accounts ledger.
Nominal accounts	Accounts constituting the revenue or profit and loss account.	Nominal accounts or revenue ledger.

Personal accounts, where the accounts are regularly paid, may be avoided to a certain extent by merely dissecting the invoices in a purchase book with dissecting columns, and posting the total of each dissection to the debit of the impersonal account concerned, each invoice after payment being pasted in a guard book and numbered and indexed, a corresponding reference being indicated opposite each entry in the purchase book of the number and folio of the invoice in the guard book.

There is not anything unusual in the form of the general cash book. The tramway business being essentially one of cash, the entries on the debit side of the book consist, with few exceptions, almost entirely of traffic receipts, returns of which are sent daily by the traffic manager's department to the head office, and which are posted in monthly total to the credit of a traffic receipts account in the impersonal ledger, the postings being checked in the ordinary way.

As part of a proper system of internal check, these returns should be compared from time to time with the traffic book and way bills. The receipts, which are paid into the bank daily, should be checked with the daily advices and pass books. To vouch them to their foundation, it would be necessary to check the daily advices with the daily traffic book, that book with the conductors' way bills, and the way bills with the ticket issue book, as regards the issue of tickets.

There are, of course, from time to time, sundry receipts arising, *inter alia*, from the sale of materials and old and superseded plant, which may be compared with the pass book and the documentary proof of sale.

It is essential that the allocation, as between capital and revenue of these sales, should be carefully scrutinised and questioned if the documents are explanatorily deficient. Generally, it will be found that there are proper advices from the traffic and engineering departments, and that the debit notes have been impressed in an invoice copying book.

The payments arise in respect of purchases of stores and materials, plant, directors' fees, wages, salaries, and so forth, and the usual receipts will be available, whilst the postings will be checked as usual. These receipts should be kept quite distinct from the accounts and numbered with the corresponding numbers of the entries in the cash book.

According to the magnitude of the undertaking and the routine adopted, it is not unusual to find several accounts opened for the record of petty expenditure, such as head office, traffic department, and engineering department. There will be formal receipts by the persons to whom the cash is given, and by whom it is accountable, as well as the production of the usual vouchers for the payments. In that event there are generally separate books for each department in which the expenditure is recorded and allocated, the books being sent to the head office with the vouchers monthly where they are checked, the necessary entries made, and a copy of the allocations made for the use of the auditor and the office somewhat in the following form, viz.:—

Month.	Cash in hand.	Cash received during the month.	Total.	Allocations.			Total.	Balance.
				Stock.	G. E.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.

The auditor is dependent, of course, upon the allocations as between capital and revenue of those responsible for each department.

It is usual to indicate in the cash book at the end of each month a reconciliation statement agreeing the cash book balance with that of the bank pass book.

Bank certificates will be available for the balance of the current account, any deposit or deposits accounts, and any balances of dividend or debenture interest accounts, whilst the existing balance of the petty cash book will be checked backwards and agreed with the balance as at the date of the accounts.

Current and deposit accounts should be shown separately in the balance-sheet, and distinct prominence should not be denied to the cash held by the bank in special accounts for the satisfaction of unclaimed liabilities on dividend and debenture interest accounts.

It may be observed that the total amount of cash taken on account of traffic receipts on the last day of the financial year will not, of course, be on that day. The difference will be checked with the daily advice of traffic receipts, and included in the reconciliation statement as cash received but not paid into the bank.

The cash discounts received by the company are either included as a credit in the schedule of details of the general administration expenses, or are exhibited separately as a credit in the profit and loss account.

Care should be taken to see vouchers and allocations for items posted direct from the cash book to impersonal accounts.

It is customary for all purchase and other accounts, after being certified by the responsible persons concerned as to condition, weight or quality, and also after having been dealt with by them in their books, to be handed to the head office, where they are checked with the orders issued for prices, discounts, additions and extensions, when they are entered in a purchase day-book with columns for the allocations and consequently for the impersonal accounts, each entry being posted to a personal account, and the total of each allocation to an impersonal account in the ledger. All the work just indicated finds indication on each invoice before it is submitted for payment. The postings from the purchase day-book are carefully checked, and the entries therein vouched, each invoice or complete or incomplete documentary evidence being carefully scrutinised. Special attention is devoted to the allocations.

Inquiry should be directed as to the existence of any unpaid accounts, which may not appear in the books, whether all invoices and accounts have been received and recorded in the books of account in respect of goods delivered or other consideration received during the period of the accounts under audit.

It is a usual custom for returns to be made to the head office monthly of stores received and of allocated issues from stores, as well as of wages and salaries and their allocation, the returns being certified by the persons responsible therefor. Of the utmost importance are the appropriations to capital and revenue, which are generally accepted by the auditor unquestioned, as it would be futile in most cases for him to go behind the certified allocations of the departmental heads, though it has occurred that expenditure, which was obviously of a revenue nature, has been allocated deliberately to capital in the course of a strenuous and successful exertion to pay an ordinary dividend. The allocations are journalised and posted to accounts in the impersonal ledger, with convenient titles for their reception. Salaries and wages are similarly treated. Full details of all appropriations to capital, whether from stores, wages, salaries or petty cash, should be available.

In the ordinary course there are few debtors. Such as do arise are due mainly to sundry sales of materials and miscellaneous forms of indebtedness which it is unnecessary to particularise. Incorporated therewith are "and debit balances," sometimes known as payments in advance as, for example, proportions of insurance premiums inapplicable to the period represented by the accounts. A schedule should be in evidence showing the name and amount of each debtor, and the details of the debit balances mentioned.

Sundry creditors, with which is commonly incorporated "and credit balances," such as rent accrued at the date of the accounts, comprise mainly invoices for goods supplied during the concluding part of the financial year.

Cash creditors should be indicated separately. As in the case of sundry debtors and debit balances, a schedule should be available of the sundry creditors and credit balances. There is generally a record in book form of standing charges, such as rents, rates, different descriptions of insurances, wayleaves, directors' fees, office salaries, and other similar charges which may be consulted by the auditor for the purpose of satisfying himself that all permanent and accruing charges have been accounted for in the accounts under review. Inquiry should be made as to any claims for which the company may be not wholly protected by insurance in respect of accidents pending or outstanding at the end of the financial year, and if so, whether it is desirable to make provision therefor in the accounts, if none has been made already.

Should there happen to be a public issue of unissued shares or of debentures, there will be recorded as authority the necessary resolutions of the board. The subject of reserve capital does not arise in practice in tramway undertakings. The usual routine followed is to check the applications with the allotment lists which are initialled by the chairman of the meetings at which the allotments were made, the total cash received with the pass books, and with the entries on the debit side of the cash book of the transfers from application, allotment and the different call accounts to current accounts, and any entries on the credit side of the cash book of transfers to deposit account.

It is the practice in some instances for the transfers to be checked periodically by the auditors. This, however, may be a matter for inclusion in the system of internal check.

Share warrants to bearer do not obtain except in foreign enterprises. The warrants are sent to the bank of the local office by the company's bankers, the charges being insurance (for face value), postage and commission, instructions being given to the bank to deliver the warrants in exchange only for payment of the nominal sum indicated upon them, or other sum if issued at a premium.

It is desirable to ascertain the number and value of any share warrants unissued and on hand.

With regard to any item of forfeited shares the auditor will, of course, consult the articles of association and the minutes.

The subject of exchange plays an important part in the administration of tramway concessions abroad in regard to finance and home remittances. For instance, the Portuguese Exchange will sometimes rise or fall very rapidly. Just lately the exchange at Lisbon was \$12⅞, which means about 5\$600 per £. An hour or two later the cheque rate was 47½, which is equivalent to about 5$050 per £. The subject is adequately treated in "Johnson's Foreign Exchanges in Accounts," which is applicable to the accounts of foreign tramway concessions.

Where a company has been operating for some years it is not unreasonable to apprehend that the trading has yielded an accumulated and undivided surplus in the shape of a reserve fund. Reserve funds in tramways are unfortunately somewhat remote. So-called reserve funds, however, in tramway undertakings are with rare exceptions technically not entitled to claim the distinction of reserve funds, and in some instances they have been accumulated mainly out of capital profits as distinguished from profits on revenue account.

There are, of course, in vogue working and pooling arrangements with municipal authorities, which are of a varied character. The company may in some cases pay the sinking fund and interest, or participate in a share of the profits. Then there may be running powers. With all of these matters the auditor should make himself familiar when checking the sums due from one party to the other, and scrutinising the periodical settlements.

Generally, provision for obsolescence *per se* has been and is a negligible quantity, though its importance is none the less recognised; but the necessary prior demands upon an insufficient revenue, seem in many cases to discourage the attainment of a reasonable credit balance for the object indicated. The sums periodically devoted to depreciation and renewal are generally extremely inadequate, and are dependent as a rule upon the amount available for ordinary distribution. Though there is no general rule, on the basis of generalisation, 1d. per car-mile is usually recognised as a fair rate of estimate for depreciation.

In some auditors' certificates, where no provision has been made for depreciation, it is stated that the question as to what provision is required to meet depreciation is left to the directors and shareholders to determine. Such a statement is of no value, and is hardly within the province of the auditor. He should merely state whether depreciation has been provided for or not, and that he does not express any opinion as to its sufficiency, or otherwise.

In the promotion and construction days, legal charges and their allocation require more than ordinary attention.

Expenditure upon unsuccessful promotions and abandoned bills should, of course, find its last rest in the profit and loss account.

The stock of a tramway undertaking consists of consumable stores and materials and working tools and plant, for which there may be distinct accounts in the books, and for which there will be produced the usual certified inventories. Any unuseable stores or materials in stock should be sold, and if unsaleable, written off. Similarly with working tools and plant worn out or lost, the remainder being subject to a substantial deduction for depreciation. In balance-sheets such accounts are amalgamated and exhibited as a single item.

In the traffic manager's office there is kept a record of tickets received from the ticket printer, and particulars of those issued to the conductors, of which a monthly return is made to the head office, showing the balance of each description of ticket in hand at the end of the month. The balance at the end of the year should be checked with the actual stock, and forms part generally of the internal system of check and control. In those cases where horse or any other system of traction has been converted into that of electric, the converted asset, less what has been realised in respect of the sale of old materials therefrom, is not written off against revenue, though it is non-existent, but is allowed to remain in the capital expenditure until the doom of the undertaking. Needless to say, such remaining expenditure is in some cases of huge proportion, and is seldom exhibited in open relief in balance-sheets. In this connection it may be not an inappropriate comment that all such expenditure is written off by municipal authorities, though the length of time involved in the process is as the tenure of the oans affected. The whole of the sinking fund is an appropriation of revenue, which obviously means a deduction from the capital expenditure concerned.

(*To be concluded.*)

PROCEEDINGS OF INSTITUTIONS.

Institution of Mining Engineers.

The twentieth annual general meeting of this Institution was held at Newcastle-on-Tyne on the 15th, 16th and 17th inst., there being a considerable gathering of members from all parts of the country. The proceedings were opened on the 15th inst., in the Wood Memorial Hall, Newcastle-on-Tyne, with a civic reception by the Lord Mayor and representatives of the municipality, who gave the members a hearty welcome to the "Canny Toon." The annual meeting was then opened by Dr. R. T. Moore, the retiring President, who introduced Mr. J. B. Simpson, the President for the ensuing year. The remainder of the day was given up to the reading of the annual report, and a number of papers. Several other papers were down for discussion, but these were not reached by the time when it was necessary to terminate the day's proceedings. The annual dinner was held at the Armstrong College, in the "King's Hall," in the evening, under the presidency of Mr. J. B. Simpson, who was supported by Sir Henry Cunynghame, Mr. T. E. Forster, President of the North of England Institute of Mining and Mechanical Engineers, the Deputy Lord Mayor, and others. Sir Henry Cunynghame, in proposing "the Institution of Mining Engineers," said, in speaking of the papers read during the meeting, that he was more than pleased when one member said "there was no need to call in foreign engineers to show us how to overcome difficulties in mining." He (Sir Henry) had been in Germany and other countries on behalf of the Home Office, in the company of eminent English mining engineers, and in all cases they found that the mines abroad were far behind those of our own country, from a mining engineering point of view. They had far too much on the surface and too little below ground, and he hoped that the mining engineers of this country who were prone to applaud and adopt German plant would see what our own country could produce before rushing abroad. If they gave British manufacturers a fair chance, he had no reason to think that they would have any difficulty in producing exactly what they wanted, and a very great deal better than they could obtain elsewhere. We sincerely hope these words of Sir Henry will receive the attention they richly deserve, and that our British mining engineers will remove their objections to "British manufactures." It is absurd to say that there are no electrical engineering firms in this country able to deal with large main winding engines, such as that seen at Harton Colliery on the following day, as we very much question whether they ever had an opportunity of quoting. We were glad to notice that the mechanical portion of the above-named winder was by a British firm, but one had not to look far to see that the remainder was German. The British mining engineer is the best in the world; but he would appear to be fast losing his patriotism, so far as the application of electricity is concerned. We hope, therefore, that the words of Sir Henry Cunynghame will be as "seed fallen upon good ground." On Thursday, the 16th, the members visited the Carville power station of the Newcastle-upon-Tyne Supply Co. and Harton Colliery, belonging to the Harton Coal Co., Ltd., who are gradually replacing their steam-driven plant with electric, the current being taken from the above-named supply company. The following description of both the power station and the colliery will, no doubt, be of interest.

CARVILLE POWER STATION.

This station, which has a total capacity of 56,000 H.P. in plant installed, consists of the engine house and three boiler houses placed at right angles thereto. Each boiler house is complete in itself, with coal bunkers, boilers, mechanical stokers, economisers, induced draught fans, feed pumps, ash conveyors, &c. Coal is brought in by overhead sidings, and water for condensing is pumped to the station from a pump house at the river side. With the exception of the feed pumps, all the auxiliary machinery is electrically driven.

No. 1 boiler house contains 10 Babcock & Wilcox marine type water-tube boilers, each capable of evaporating 20,000 lb. of water per hour at a pressure of 200 lb. per sq. in., superheated 150° F. Two economisers of 480 pipes each are placed in the main flues to the chimney.

Nos. 2 and 3 boiler houses each contain eight Stirling water-tube boilers, each capable of evaporating 33,000 lb. of water per hour. In these boiler houses each boiler is fitted with its own economiser of 120 pipes.

All the boilers are fitted with chain-grate stokers, which are fed with coal direct from overhead bunkers. The coal bunkers of each boiler house will contain about 800 tons.

The induced draught is maintained by means of Sirocco fans driven by electric motors. The chimneys are 14 ft. in diameter and 120 ft. high.

The engine house contains eight Parsons turbo-alternators of 7,000 H.P. each. The condensers and air-pumps are situated below each machine. The alternators run at 1,200 R.P.M., and generate three-phase current at 6,000 volts and 40 cycles per second. Each alternator supplies current at a reduced voltage (by means of a transformer) to its own auxiliaries, which include air-pump, circulating pump, ventilating fan, and exhaust-valve motor, and also to the corresponding auxiliaries for the boilers supplying the steam.

The main switches, which are each in a concrete cell, are of the remote-control type, operated by electric motors. The switches are each capable of controlling circuits normally carrying 10,000 H.P., and there are, in all, 47 switches. There is also an auxiliary board of the ironclad type, which contains eight switches, each capable of controlling circuits of 3,000 H.P.

The whole system is operated and controlled from the control-room by the "system engineer," who is in direct telephonic communication with each sub-station in the area, which now covers some 700 square miles. The control-room contains a large diagram of the whole system, and upon it a record is kept of the positions of all switches.

Adjacent to the control-room are the operation offices and telephone exchange, from which the large private telephone system of the company is operated.

In the sub-station near the control-room are installed two large step-up transformers for raising the pressure from 6,000 to 20,000 volts for transmission to the extreme north and south of the area. The transformers are of the oil-immersed air-cooled type, each of 3,300 E.H.P. There are in all eight transformers of this size on the system.

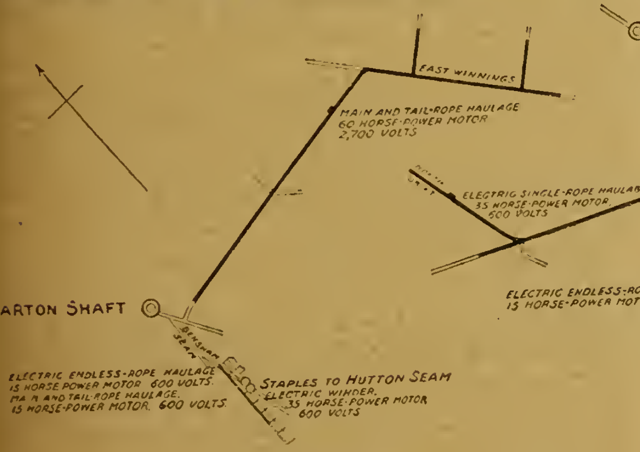
At the northern end of the power station there is a step-down sub-station of 4,000 H.P. capacity, which supplies current to adjacent works.

The bottom of the pump house is below the level of the lowest tide, to enable the pumps to be drowned at all states of the tide. The pumps, seven in number, are of the centrifugal type, with vertical shafts, and are each capable of delivering into the 48-in. mains 400,000 gallons of water per hour at any state of the tide; they are driven by three-phase electric motors, each of 150 H.P. The whole of the circulating-water system is arranged to work as a siphon.

Harton Colliery.

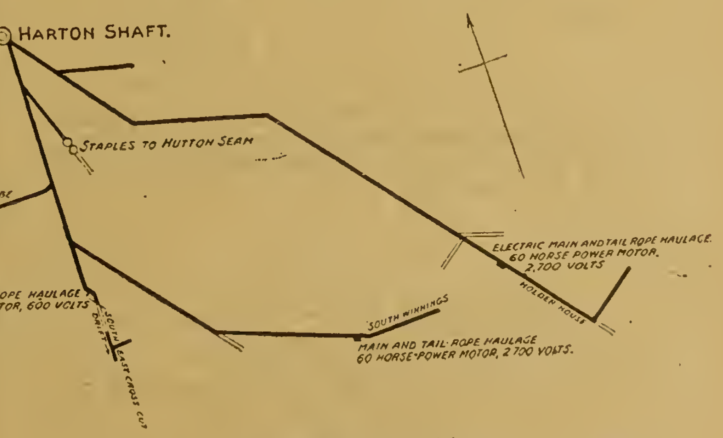
This colliery, situated in the borough of South Shields, near Tyne Dock railway station, is the property of the Harton Coal Co., Ltd., who are also the owners of the St. Hilda, Boldon and Whitburn collieries. The whole of the appliances at the colliery are worked entirely by electricity, no steam power being used for any purpose.

The existing shaft acts as the downcast to the St. Hilda colliery. The new shaft now being sunk will become the upcast for Harton colliery; and the new shaft which is being sunk at Westoe will be the upcast for St Hilda colliery. The existing shaft is 14 ft. in diameter, and is sunk to the Bensham Seam, a depth of 1,284 ft. from the surface. The new shaft is to have a finished diameter of 16 ft., and it is intended to sink it also to the Bensham Seam.


EAST WINNINGS
MAIN AND TAIL-ROPE HAULAGE
60 HORSE-POWER MOTOR
2,700 VOLTS
ELECTRIC SINGLE-ROPE HAULAGE
35 HORSE-POWER MOTOR
500 VOLTS
ELECTRIC ENDLESS-ROPE HAULAGE
15 HORSE-POWER MOTOR, 600 VOLTS
HARTON SHAFT
BENSHAM SEAM
ELECTRIC ENDLESS-ROPE HAULAGE
15 HORSE POWER MOTOR 600 VOLTS.
MAIN AND TAIL-ROPE HAULAGE.
15 HORSE-POWER MOTOR. 600 VOLTS
STAPLES TO HUTTON SEAM
ELECTRIC WINDER.
35 HORSE-POWER MOTOR
600 VOLTS

Scale, 1 mile to 2 in.

Fig. 1.—Plan showing Engine-planes, &c., in Hutton Seam, Harton Colliery.



Scale, 1 mile to 2 in.

Fig. 2.—Plan showing Engine-planes, &c., in Bensham Seam, Harton Colliery.

The seams at present being worked are the Bensham and Hutton, the output of the colliery being about 1,200 tons per day of 10 hours. The electrical winding-engine, which has just been erected, is, however, designed to deal with an output of 240 tons per hour.

The motor is of 800 B.H.P. normal capacity, with a maximum output, when starting, of 1,700 H.P. at 5,500 volts. The motor works at a speed of 51·8 revolutions per minute, and is coupled direct to the winding-drum, which is 14 ft. in diameter by 8 ft. in width. The brakes on the drum are operated by means of compressed air at a pressure of 60 lb., and can be applied in three ways, namely:—(1) By the winding-engineman, by means of an operating lever; (2) automatically by the depth-indicator, in the event of an overwind; and (3) by an auxiliary magnet, in case of failure of the electrical energy.

Round winding-ropes are used, 5⅞ in. in circumference, made of best extra improved plough steel, with a breaking-strain of about 145 tons.

The balance-rope is flat, 8½ in. in width, and weighs about 4¾ tons, which is 1¼ tons heavier than the winding-rope. The engine draws coals from the Bensham Seam level.

The cages in use have four decks, and carry two tubs on each deck. The total weight on the loaded rope at starting, including the rope, cage, tubs, coal, &c., is 14¾ tons; the net weight of the coal raised at each wind is 4¼ tons. The time occupied per wind is 48 seconds. The guides are of pitch-pine.

The following engines are placed underground, and are electrically driven:—

There are two principal haulage-engines, one in the Bensham and one in the Hutton Seam, which are worked on the main-and-tail system. Each is driven by a 250-600-H.P. motor working under 2,600 volts at 230 revolutions per minute. The drums of the engines are each 6 ft. in diameter, and are geared at 4½ to 1. The speed of the set is about 10 miles per hour.

The sidings for these haulages are situated 1,050 ft. from the shafts, and two small haulage gears are used to bring the coals from them to the onsetting station.

There are also several auxiliary haulages. One in the Hutton Seam is driven by a 60-H.P. motor at 2,700 volts; it is placed ⅞ mile from the shaft, and brings tubs from the different flats to the main-hauler; the speed of the set is 6 miles per hour. In the new Hutton Seam there is a small endless-rope gear, driven by a 15-H.P. motor at 600 volts; and the speed of the set is 1½ miles per hour.

At the top of the staple is a small main-and-tail haulage gear, the motor being of 15 H.P. at 600 volts, and the speed of the set 5 miles per hour.

In the Hutton Seam, South-east District, is a main-and-tail haulage gear, driven by a 60-H.P. motor at 2,600 volts. It is situated 1¾ miles from the shaft, and the speed of the set is 6 miles per hour.

There are exactly similar haulage gears in the South Winnings and Holder House in the Bensham Seam Districts.

In the South-west Cross-cuts District is a small endless-rope gear, driven by a 15-H.P. motor at 600 volts, the speed of the set being 1½ miles per hour.

In the North Drift District a small main-drum gear is installed, the motor being of 15 H.P. at 600 volts.

These auxiliary haulages haul the coals from the flats to the main hauling engine roads, so as to avoid the use of driving ponies; only four driving ponies are employed in the pit.

Figs. 1 and 2 are plans respectively of the engine-planes in the Hutton and Bensham Seams.

A small electrical winding-gear is installed, winding coals from the New Hutton Seam to the Bensham Seam level, a distance of 132 ft. This is worked by a 35-H.P. motor at 600 volts, and winds one tub at each lift.

The whole of the water is pumped from the face by means of small electrically-driven pumps, and is raised from the Bensham Seam to bank by a Sulzer four-stage high-lift centrifugal pump of a capacity of 1,000 gallons per minute, against a head of 1,380 ft. when working at 2,300 R.P.M. The pump is direct coupled to a 650-H.P. Brown-Boveri motor, working at 2,700 volts.

A spare and stand-by pumping plant is also installed, consisting of a motor of 140 H.P., working at 480 R.P.M. at 2,600 volts; and a horizontal three-throw pump, with three rams, each 9 in. in diameter with 18-in. stroke, making 24 R.P.M., and capable of pumping 300 gallons per minute against a vertical head of 1,300 ft.

The headgears and pulley frames are constructed of steel, being of the lattice-girder pattern, and they have been recently erected. The pulleys are made of cast-iron, and are 16 ft. in diameter, the pulley centres being 102 ft. from the surface.

Creepers and gravitation roads are employed on the surface to conduct the tubs from the shaft-mouth to the tipplers leading to the screens; the empty tubs afterwards gravitate back to the cage. A similar arrangement is in operation at the bottom of each shaft. The tubs on all four decks of the cage are simultaneously discharged, no movement of the cage being necessary when it has been brought to a standstill. The motors driving the creepers are of 7½ H.P., and work at 1,120 R.P.M. at 600 volts.

These consist of three main belts, 5 ft. wide, formed of steel plates, varying in length from 48¼ to 63¼ ft. × 4 ft. The subsidiary belts for nuts and small-coal are 3 ft. wide × 52 ft. and 46 ft. in length respectively. The two motors driving the screening appliances are each of 35 H.P. and work at 480 R.P.M. at 600 volts.

The lamp room is of a suitable capacity for cleaning, examining, repairing and storing upwards of 850 safety lamps; these are electrically lighted and magnetically locked, by means of patent devices.

The motor driving the granary plant is of 15 H.P., and the horse-food for the whole of the company's collieries is suitably crushed, chopped, mixed and cleaned at Harton colliery.

The following are particulars of the electric sinking engine and plant as used at the Harton Sinking:

Weight of kibble and stones ...	... 3 tons.
Weight of rope (1,300 ft.) ...	... 15 cwt.
Maximum speed of rope ...	... 1,000 ft. per minute.

The drum is 6 ft. in diameter over the barrel, 5¼ ft. wide, and runs at 51 R.P.M. when at full speed.

The rope is 2¾ in. in circumference, and is of best plough-steel.

The brakes are of the post type, and are operated by compressed air at a pressure of 50 to 60 lb. They are applied by the driver by means of a lever, act automatically in case of failure of supply, and can also be operated by means of a foot lever by the driver.

The drum is geared at 7½ to 1; the gearing is steel and the teeth are machine cut and double helical in shape. The pinion wheel has 18 teeth of 2 in. pitch, and a 12-in. face; the spur-wheel has 134 teeth.

The motor is wound for 2,600 volts, at 40 cycles, and 390 R.P.M.; it develops 240 B.H.P. normally and 450 B.H.P. in starting. The gear and motor are mounted on the same bedplate. The controller is of the liquid type, with circulating pump and electrically controlled reversing switch.

The total H.P. of the motors installed is 1,645, exclusive of the winding engine, which is of 800 B.H.P., but capable of exerting 1,700 B.H.P.

The colliery is at present ventilated by means of a Capell fan 11 ft. in diameter by 7 ft. in width (erected at St. Hilda colliery), which is direct driven by means of a 300-H.P. Siemens-Schuckert motor, wound for 5,500 volts at 260 R.P.M. With the fan running at that speed, 210,760 cb. ft. of air per minute are produced at a water-gauge of 5 in. A motor of the same make is installed on the other side of the fan shaft as a stand-by in case of breakdown, this motor being rated at 400 H.P. and running at 295 R.P.M.; at this speed the fan will give 250,000 cb. ft. of air at a water-gauge of 6½ in.

An additional ventilating plant is also provided, consisting of a Walker indestructible fan, 26 ft. in diameter by 8 ft. in width, which is driven by compound horizontal engines.

The total horse-power installed at all the collieries of the Harton Coal Co. is as follows:—

Boldon colliery...	1,892 H.P.
Harton colliery...	2,445 H.P.
St. Hilda colliery	1,820 H.P.
Whitburn colliery	2,413 H.P.
Total	8,570 H.P.

The proceedings terminated on Friday, the 17th inst., by a visit to Newbiggin Sinking, another party visiting the Romano-British site of Corstopitum at Corbridge in the county of Northumberland.

Hydro-Electric Power in Canada.

By Cecil B. Smith, M.Am.Soc.C.E.

(*Abstract of paper read before the* American Society of Civil Engineers, *September 1st*, 1909.)

(*Continued from page* 455.)

The Winnipeg Street Railway Co. and its allied companies have in operation a hydro-electric station on the Lee Channel of the Winnipeg River, and a transmission line 67 miles long supplying power to a terminal station in the city.

This generating station was selected apparently without proper investigation and without an eye to the future, and the company is already expending large additional sums on the tail-race channel in order to ensure sufficient hydraulic head and flow of water at low water to operate the machinery now installed, which makes a completed scheme incapable of further expansion and consisting of nine units having a combined rated capacity of 14,000 KW.

The generating station has an open forebay, steel-flume wheel-pits, and five 2,000-KW. and four 1,000-KW. units, each operated by two twin horizontal turbines; the generators are for three-phase, 60-cycle, 2,300-volt current.

The transformation is 50,000 volts, and the transformers are oil-insulated, water-cooled, of 1,800-KW. and 830-KW. capacity per phase, each being in a separate compartment. The total transformer capacity at the generating station is 19,500 KW. The transmission system is on double-circuit steel towers, spaced 500 ft. apart, with protruding pieces of angle-iron on each upper corner of each tower, which act as lightning arresters. It is understood that this protection is very satisfactory, there having been only one shut-down during the first year's service (which commenced in 1906). The capacity of the terminal station in Winnipeg is equal to that of the transforming station at the generating works.

The utilities served consist of the city and suburban street railways, the city house-lighting, and current for the present municipally-operated street lighting. In addition to this, there is a small distribution of power for miscellaneous purposes, and two large blocks of power for flour milling. The capacity of the generating station is already fully taxed during the low-water winter season, and no effort is made to encourage large users of power by offering attractive rates. This power station cannot be looked upon as a serious competitor to the municipal power station now being built.

The three tributaries of the Nelson River, which have just been discussed hydraulically, converge in Lake Winnipeg and there form an enormous reservoir of 9,300 sq. miles at an elevation of 710 ft. above the Hudson Sea.

When it is considered that the drainage area feeding the outlet of Lake Winnipeg into the Nelson River proper is nearly 350,000 sq. miles, and that the water supply comes from three different and dissimilar climatic and topographical river basins, one can appreciate what a large minimum flow there is; and as the route of the river to the Hudson Sea is rock-ribbed, in cascades, pools and waterfalls, all that need be said here is that, should electro-chemical or other demands require very extensive water-powers, where relation to habitation is immaterial, these, to the extent of at least 4 500,000 H.P., can be readily secured on the Nelson River between Lake Winnipeg and the Hudson Sea.

Of the many other extensive rivers flowing into the Hudson Sea and James Bay, there is very little accurate information. It can be appreciated, however, from the physical conformation, that many enormous water-powers exist, because the table-land sources of the rivers abound in lakes at an elevation of from 600 to 1,500 ft. above the sea, with a good rainfall. The first development will probably be at Iroquois Falls, on the Abitibi River.

The St. Lawrence River drainage basin is the chief seat of population in Canada, and naturally the hydro-electric developments of this region are most extensive.

The total drainage area is 565,000 sq. miles, but of this about 90,000 sq. miles comprise the water surface of the Great Lakes, which form enormous compensating reservoirs, their regulation and control, international in character, presenting a very delicate physical and political question, additionally complicated by the rights and needs of navigation.

The first water-power location on the main river is at Sault Ste. Marie, where Lake Superior, with 31,000 sq. miles of water surface, empties into Lake Huron, falling approximately 18 ft., and discharging about 60,000 cb. ft. per sec. at low water, thereby affording opportunity for about 90,000 E.H.P. The Lake Superior Power Co., with allied companies, disposes of 6,500 H.P. on the Canadian side of the river (out of a designed total of 20,000 H.P.) to rail mills, pulp mills and for industrial and municipal purposes in the Canadian city. On the United States side of the river the same company constructed a canal and power house, designed to obtain 45,000 H.P., but machinery for only one-half of this has been installed. A third company, on the U.S. side, has a small hydro-electric development, but it is probable that no further concessions will be granted there, so that the needs of navigation may be fully conserved. Although these canals and locks serve an enormous commerce, their existence has been of little local value, for the life of the two adjacent cities of Sault Ste. Marie depends chiefly on hydro-electric power, and the two Governments interested will be well advised to use every effort to facilitate the power use of all the water passing from Lake Superior which is not required for locking purposes.

Continuing seaward from Sault Ste. Marie, the next location which affords hydraulic opportunity is spoken of familiarly as Niagara Falls.

Lake Erie flows into Lake Ontario by a river route which, from Chippewa to Queenston, is a series of rapids and a cataract; but the cataract of Niagara Falls is barely one-half of the total difference in elevation, which is 327 ft., and that the first great hydro-electric developments have been made there with effective heads of from 136 ft. to 175 ft. can only be looked upon, in the future, as an economic blunder, because there are potential developments which can be made at several locations in the United States and Canada using a net head as great as 300 ft., which, for as large an installation as 200,000 H.P. or greater, would not be as expensive as those now constructed.

This question of utilising the hydraulic power of the Niagara escarpment is, in reality, a world problem, not a local one, because there is there latent 5,000,000 continuous electrical H.P., considering only the low-water flow of 180,000 cb. ft. per sec. at an effective head of 300 ft., and, estimating even so little as 2½ lb. of coal per H.P.-hour, this would be equivalent to a saving of 55,000,000 tons of coal per year, should this great force of Nature ever become so fully utilised; and why should it not be used in increasing amount as required? There will still be available for scenic purposes all the surplus water, which will still pass over the falls, even after the minimum has all been used for power purposes. This location is unique, as it is on one of the greatest highways of commerce in the world, both water-borne and by rail, and it is in the midst of a fertile and populous region, which, for 150 miles in all directions, is becoming more thickly populated year by year. The steady growth in the electric load carried by the present stations leads to the inevitable conclusion that we are only in the infancy of the utilisation of this great gift of the Creator.

There are six large generating stations, two on the United States side and four on the Canadian side of the river, engaged in producing electrical energy for commercial purposes, and numerous small stations.

On the United States side the Niagara Falls Hydraulic Power and Manufacturing Co., the first in the field, has 77,500 E.H.P. installed, and building construction is under way for an additional equipment having a capacity of 70,000 E.H.P. In addition to this, water is supplied to various industries developing 8,000 H.P. of direct hydraulic power for pulp, paper, flour, and other mills. The power from these works is used chiefly for the manufacture of aluminium by the Pittsburg Reduction Co. It is understood that this company contracts for nearly 60,000 H.P. The water is used under a total head of 210 ft. and a net head of about 200 ft., and is led down the side of the cliff in steel penstocks to the power stations at the lower river level, where is installed a heterogeneous collection of direct-current and alternating-current generating units of various sizes from 150 to 1,000 KW. in the older station and from 3,500 to 6,500 KW. in the newer station. The business of this station is entirely local.

The Niagara Falls Power Co. has two generating stations, operated under an average effective head of 140 ft. These stations, heralded at the time as pioneers, have long since been eclipsed by the stations on the Canadian side of the river, and also suffer from certain engineering defects which, no doubt, were unforeseen at the time of construction and have since been cumulative.

The ice difficulties, after years of strenuous effort, have been largely overcome by improvements in the intake works and by the addition of an ice shoot to the tail-race tunnel, but the first station, having a capacity of 50,000 H.P., has unprotected ice racks, and is equipped with free, outward discharge, double runner, vertical turbines. The ten generators are each 5,000 H.P., two-phase, 2,200-volt, with revolving armatures. The second station, having a capacity of 60,000 H.P., has additional submerged-arch entrances and an enclosed forebay for further protection from ice. The turbines are of the single-runner vertical type, with draught-tubes; the 11 generators are each of 5,500 H.P., three-phase, 2,200-volt, and are partly of revolving-field and partly of revolving-armature types. The tail-race tunnels are led from the power stations by very sharp curves to a junction, and this, together with the back-piling in power house No. 1, due to the use of free-discharge wheels, makes it impracticable to run both stations to full capacity. It is understood that 63,000 H.P. is about all that is generated, although the market in Buffalo is being largely abandoned to the Canadian Niagara Power Co., its station being several miles nearer and belonging virtually to the same financial interests.

The power from these stations is now distributed in large blocks, chiefly to local electro-chemical consumers, and the policy of the company in creating a manufacturing district, with railway switching facilities, building sites, &c., and giving long-term power contracts, with guarantees of continuity, under penalty, has created a large and stable industrial centre consuming more than 60,000 H.P. continuously from those two stations. The power is transmitted to Buffalo, Tonawanda, &c., as 22,000-volt, three-phase, 25-cycle current. The pole lines are of ordinary wooden type and carry four three-phase circuits, two on each line, some circuits being of copper and some of aluminium. Until the load was transferred to the Canadian station, all the varied electrical utilities of Buffalo, to the extent of about 40,000 H.P., were operated from these United States stations, as are still the various interurban and scenic electric railways converging at Niagara Falls.

On the Canadian side of the Niagara River four large generating stations have been constructed recently; three of these are at Niagara Falls, and the fourth is at a point 12 miles westward.

The Dominion Power and Transmission Co. (formerly the Hamilton Cataract Power Co.) first commenced to deliver power to Hamilton, Ont., in 1897, from a small station 12 miles westward of Niagara Falls at the foot of the Niagara escarpment, and drawing its water supply from the Welland Canal and thus from Lake Erie.

This hydro-electric development utilises a hydraulic head of 267 ft., and is a very economical one, as excessive expenditures for head-works were not required. This enterprise has a progressive management, and a growing market for power has expanded it until, at the present time, the machinery equipment, including transformers, has a nominal rating of 38,400 H.P.

It is an interesting feature of this generating station that the turbines are entirely of European manufacture and design, being supplied by Italian and German makers, as the earlier experiences with manufacturers in the United States were not satisfactory.

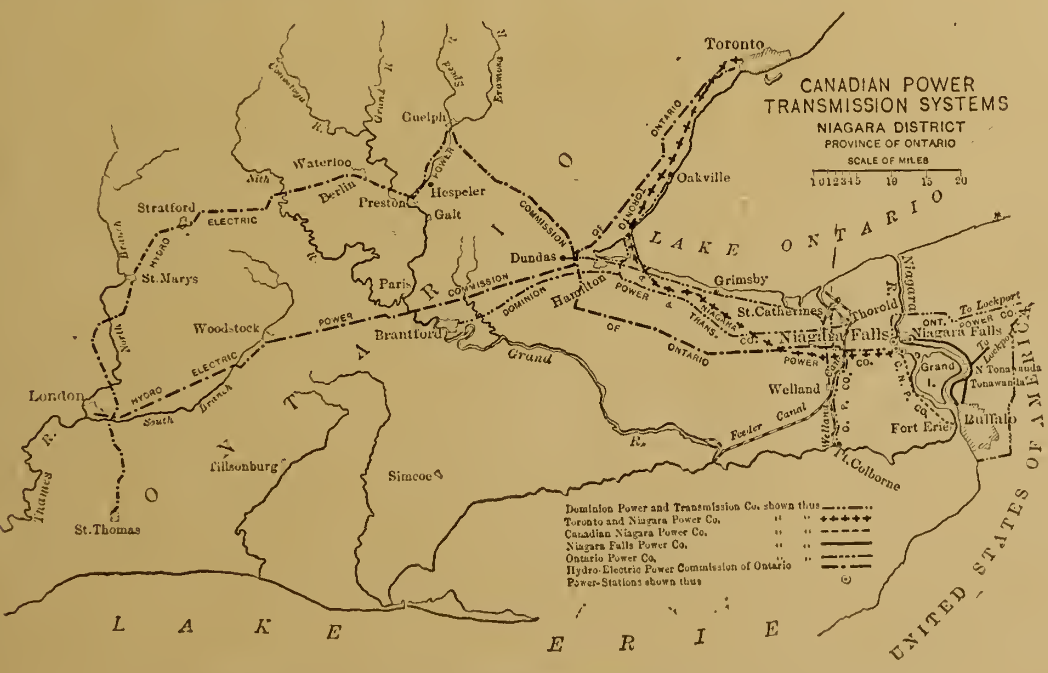
The electric current is generated at 2,400 volts, $66\frac{2}{3}$ cycles, and is transmitted to the surrounding towns and cities at various voltages. The chief market is in Hamilton, 32 miles westward, to which three pole-line, three-phase circuits, two of copper and one of aluminium, carry power at 40,000 volts. In addition to this the company serves a network of street and interurban railways which it owns or controls, and supplies power and light in Brantford, Welland, St. Catharines, Dundas, &c., with a total of 132 miles of transmission line.

This company, owing to its favourable investment and strongly entrenched position, is able to distribute with profit at low rates for power, and has thus built up a large business very rapidly. It is understood that the peak load in Hamilton alone, which is a city of only 60,000, is considerably more than 20,000 E.H.P., which includes current for operating street and interurban railways, owned by this company, and also cotton mills, knitting mills, flour mills, rolling mills, and machine shops; in fact, every phase of a busy manufacturing city is provided for.

This company also owns small hydro-electric generating stations at St. Catharines and Brantford, and may be said to control, almost exclusively, the business of supplying electricity in the Niagara District west of Niagara Falls and Thorold.

The generating station of the Canadian Niagara Power Co. was constructed between 1901 and 1905. This company is practically identical with the Niagara Falls Power Co., and although it distributes some 2,000 to 3,000 H.P. locally to various industries in Niagara Falls, Ont., it has not entered the long-distance transmission field. The generating station is of the wheel-pit type, with a tail-race tunnel 2,200 ft. long, and operates under an effective head of only 140 ft. The water is taken from the rapids immediately above the cataract, and although protecting works, submerged-arch entrances, enclosed forebay room, and sluiceways have been constructed to meet the difficult ice conditions, they are only moderately satisfactory, and a continuous winter service is maintained only by strenuous efforts and with considerable difficulty.

The generating works are complete for 11 units, each having a nominal rating of 10,000 E.H.P., and five of these are now installed. The turbines, of Swiss design, are of the vertical type, with draught-tubes and double runners, and the generators are 12,000-volt three-phase, 25 cycle machines.



Plan showing the Canadian Transmission Systems in the Niagara District.

This station is inter-connected with those of the Niagara Falls Power Co. by a large number of 11,000-volt underground cables, thus warranting great certainty of service; but the chief market for power is in Buffalo. The company has a transformer station, adjoining the generating station, with an equipment of 15 single-phase, 1,250-KW. transformers, all mounted in one room; although these are arranged so as to be operated, if desired, at various voltages up to 60,000, the pressure used at present is 22,000.

The transmission system consists of steel poles, carrying two three-phase circuits of aluminium cable mounted on cellulose insulators, and a third circuit is now being built. The capacity is 12,500 H.P. per circuit at 22,000 volts. At Fort Erie this transmission system has two spans of 1,600 and 2,200 ft., respectively, suspended 130 ft. above the water of the Niagara River, and it is understood that considerable difficulty was experienced in cable breakage until elastic counterweighted suspensions were made at the end towers with suspended insulation at the centre tower.

(To be concluded.)

Water-power in Hungary. — The formation is announced at Fiume of the Adriatic Electricity Co., with a provisional share capital of £166,000, for the purpose of utilising the water-power of the Gaeska River, near Ottosae. It is intended shortly to increase the capital to £416,000, whilst a Paris financial group has taken over bonds representing £832,000. The undertaking is to be carried out under the auspices of French engineers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW UNITED STATES TARIFF.—Below we publish an extract from the new United States tariff which came into force on August 6th, 1909, showing the rates of duty now levied on certain goods in which electrical firms in this country may be interested, together with the rates which were formerly levied under the old tariff. One of the most interesting facts in connection with this new tariff is that, although the rates of duty on electrical and other machinery remain unchanged at the rate of 45 per cent. *ad valorem*, and the rates on glassware, earthenware, &c., are similarly unchanged, reductions have been made in the various rates on iron and steel goods almost without exception. This fact is made all the more interesting since the United States is supposed to be essentially a Protectionist country and to have prospered under its protection system. As regards the remainder of the tariff, it may be stated generally that where any alterations have been made they have been in the shape of reductions in the previous rates.

	Old Tariff.	New Tariff.
Mica, rough, unmanufactured or only trimmed	6 c. per lb. & 20 % ad val.	5 c. per lb. & 20 % ad val.
Mica cut or trimmed, mica plates or built-up mica, and all manufactures of mica or of which mica is the component material of chief value	12 c. per lb. & 20 % ad val.	10 c. per lb. & 20 % ad val.
Common yellow, brown or grey earthenware, plain, embossed or salt-glazed, common stoneware and earthenware or stoneware crucibles, all the foregoing not decorated in any manner	(For altered classification see below.)	25 % ad val.
Yellow earthenware, plain or embossed, coated with white or transparent vitreous glaze, but not otherwise ornamented or decorated, and Rockingham earthenware		40 % ad val.
China, porcelain, Parian, bisque, earthen, stone and crockery ware, painted, coloured, &c. ...		60 % ad val.
Ditto, not painted or decorated ...		55 % ad val.
Common yellow, brown or grey earthenware, plain, embossed or salt-glazed common stoneware and crucibles, all the foregoing not decorated in any manner	25 % ad val.	—
Rockingham earthenware not decorated	40 % ad val.	—
China, porcelain, Parian, bisque, earthen, stone and crockery ware:		
Painted, tinted, stained, enamelled, printed, gilded or otherwise decorated or ornamented in any manner ...	60 % ad val.	—
If plain white or without superadded ornamentation of any kind	55 % ad val.	—
All other china, porcelain, Parian, bisque, earthen, stone and crockery ware not specially provided for in this Act:		
If painted, tinted, stained, enamelled, printed, gilded or otherwise decorated or ornamented in any manner ...	60 % ad val.	—
If not ornamented or decorated	55 % ad val.	—
Articles and wares composed wholly or in chief value of earthy or or mineral substances, not specially provided for in this section, whether susceptible of decoration or not:		
If not decorated in any manner	35 % ad val.	35 % ad val.
If decorated	45 % ad val.	45 % ad val.
Carbon, not specially provided for in this section	—	20 % ad val.
Electrodes, brushes, plates and disks, all the foregoing composed wholly or in chief value of carbon	—	30 % ad val.
Carbons for electric lighting, wholly or partly finished:		
Made entirely from petroleum coke	$0·90 per hundred.	100 ft. $0·35
If composed chiefly of lampblack or retort carbon		„ $0·65

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,340. "Electrical divining rod." A. Watson. September 6th.

20,342. "Means by which the swaying and spinning of electric shades are prevented." G. Clarke. September 6th.

20,378. "Improvements in controller-operating handles for electric cars." E. K. Hofmann. (Date applied for under Sec. 91 of the Act, April 8th, 1909, being date of application in United States.) September 6th. (Complete.)

20,408. "Improvements in electro-thermal garments for therapeutic purposes." B. R. Charles. September 6th.

20,413. "Improvements in controlling devices for magnetic clutches." D. Dusseris. September 7th. (Complete.)

20,435. "High-voltage ceiling rose with a detachable plug connection independent of the cover and base." A. H. Shaw. September 7th.

20,474. "Improvements in and relating to electric motors." A. Lehmann. September 7th.

20,496. "Improvements in electric clocks and like mechanism." G. B. Bowell. September 7th.

20,499. "Improvements in electrical switches." H. W. Cox. September 7th.

20,584. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (J. E. Noeggerath, United States.) September 8th.

20,587. "Improvements relating to systems of marine propulsion." A. G. Livesay. September 8th.

20,596. "Improvements in or connected with electric switches." H. R. Slack. September 8th.

20,656. "Improvements in current distributors for the ignition devices of internal-combustion engines." Firm of R. Bosch. (Date applied for under Sec. 91 of the Act, April 7th, 1909, being date of application in Germany.) September 9th. (Complete.)

20,666. "Improvements in shade holders and the like for incandescent electric lights." C. Arnold. September 10th.

20 706. "Improvements in and relating to electric belts." Kuster & Co., G.m.b.H., and F. Metzger. September 10th.

20,743. "Improvements relating to the control of alternating-current electric motors." M. Milch. September 10th.

20,744. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 10th.

20,785. "Improvements connected with dynamo-electric machines and internal combustion or other engines." C. B. Walker. September 11th.

20,786. "Method of and means for making and breaking electrical circuits or contacts." C. B. Walker. September 11th.

20,810. "Electric comb-bell apparatus." G. C. Holyoake. September 11th.

20,815. "Improvements in and relating to electricity meters." Siemens Bros. Dynamo Works, Ltd., and F. Lydall. September 11th.

20,827. "Improvements in and relating to dynamo-electric machinery for starting purposes." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, January 22nd, 1909, being date of application in Germany.) September 11th. (Complete.)

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20,841. "Selector switch suitable for the automatic and selective switching of telephone lines." J. E. Kingsbury. (Western Electric Co., United States.) September 11th. (Complete.)

20,842. "Automatic selective switching apparatus suitable for use in telephone systems." J. E. Kingsbury. (Western Electric Co., United States.) September 11th. (Complete.)

20,843. "Improvements in and relating to the regulation of electrical distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.)

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Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co.) 18,053. August 27th.

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THE

ELECTRICAL REVIEW.

VOL. LXV. OCTOBER 1, 1909. No. 1,662.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

AT HOME AND ABROAD.

WE are all anxious to know the other man's impressions regarding the industrial outlook. The holiday season in England is over, and we have all got our heads into business again ready to take full advantage of every opportunity that the trade season shall present.

That electrical men of all departments have returned from their perambulations with a keen interest in subjects relating to their profession and industry, is evidenced from the large space that we are called upon to devote to "Correspondence" in this issue. We welcome few things more heartily than we do this willingness on the part of electrical engineers to enter spontaneously into the consideration of the matters, both technical and trade, that we select for their interest and edification. Nothing but good can come to an industry whose representatives take a live writing interest in its various concerns. Sometimes we hear of this or that well-known man who has views worth consideration on a subject of the hour, but he "never writes to the Press," and so, excepting that his opinions sometimes receive attention over a postprandial cup of coffee, he is hiding his light under a bushel. We have more regard for the position of the man who "cannot" (or thinks he cannot) write, but who is bubbling over with ideas that he would impart to others were he possessed of the telling ability. It frequently happens that when "practical" (we believe that is the right term) men of this latter class do put their pens to paper editors find it well worth while to dot the i's and cross the t's because of the value of the ideas they are able to express as the result of their practical experience in intimate touch with machines and apparatus, and those who operate them.

Another reader who is more reluctant to communicate his views than we could wish is the electrical engineer resident in the Colonies or in foreign countries. The whole world is getting nearer together every year, and the news from Home reaches these countries more quickly, so that there is really no reason why those who go out from the Mother Country to posts in foreign parts should feel that they are out of touch with things. Often and often have electrical men on returning from the Colonies complained to us that their several years' residence abroad has put them out of touch with the men at home, and their systems and ways. Sometimes they experience considerable difficulty in getting back into the running again. We put it to them that by engaging in interchange of thought in our pages from time to time, about the questions of the moment, they will be more likely to know and be known when they return Home—if it ever by choice or perforce be their lot to do so. There are some Colonial electrical engineers who would be practically unknown or forgotten by the bulk of their *confrères* in this country but for the medium of the ELECTRICAL REVIEW.

Unfortunately, there is a strange inability—we will not say unwillingness—on the part of some of our friends to do, when they reach their destinations abroad, all that they kindly promise when we bid them farewell. We wonder whether these gentle hints will be a reminder to some old friend who has developed the silent habit of the Colonial? We voice the feeling of the whole electrical trade in welcoming all the news that is of any value regarding the electrical possibilities of the world, and those of our friends who desire to assist the British electrical manufacturer to maintain his position or to improve it abroad, have it in their power to show a preference by throwing off their silent attitude, and in place thereof, contributing their quota to this compendium of electrical information, whether their assistance take the form of criticism administered or advice given. Few matters discussed in our pages are of such ephemeral interest that the foreign reader need feel that his views are not worth sending because of the time occupied in mailing. We want the Electrical Review to be more instrumental than ever before in maintaining the old familiarity between the Briton at home and the Briton beyond the seas. The more that intimate relationship becomes weakened the worse will it be for our chances of doing increased electrical trade, for the allurements of other countries which have already done much to nurse the British Colonies and their engineers, are not imaginary.

But "Correspondence" may be plentiful without being any sort of an indication as to the industrial position. More useful evidence in that connection may be found in the opinions expressed by those who are travelling about in the various centres of industry in the provinces. These are nothing if not hopeful, and we have no doubt that revival would have come in this country far more speedily and more markedly, but for the political unsettlement that prevails, and has prevailed for some months past.

We observe in the *Times* "Electrical Notes" this week, this remark: "The distinct improvement to be observed in the volume of electrical manufacturing business, may cause some qualified satisfaction in that it is mainly attributable to fierce competitive effort to obtain foreign orders." "The Home Trade," the writer proceeds, "continues to be almost hopelessly dull." We are glad, first, that the writer observes a distinct improvement, which is in accord with the news that reaches us, but while we are regretful that the Home Trade is not yet in that much improved position for which we have all hoped so long, we are more pleased than our contemporary appears to be that foreign orders are being secured. We have urged the necessity for the foreign campaign in season and out of season, and the recent articles that we have published discussing new opportunities under "Notes on Trade Abroad" have, we are glad to know from various sources, given an added stimulus to this activity. These articles have been read with interest by the right men, and we shall continue their publication covering other fields where it is necessary for the manufacturers of this country to make bold efforts.

For the Home Trade we shall hope for a more settled political position before long whether there be a General Election or not. Governments that interfere with industry are bound to prolong nervousness and unsettlement. Irrespective of what the actual cause may be that shall clear the political atmosphere, we feel that the clearing up can only be followed by a state of things which shall make more financial support available for legitimate enterprises enabling the already commenced industrial revival to proceed without hindrance. But the political position is far from being the only cause of the present lack of home electrical orders. Only this week it has been suggested to us that we should take a tour of certain parts of this country, noting the bias of some engineers for plant of Continental manufacture in connection with the installation of which the ordinary matter of price does not enter. We are confidently assured that this prejudice, coupled with a deficiency in the matter of salesmanship, loses far more business for us than do prices. As a matter of fact, it is said that British prices for some classes of work are so undercut that the foreigner would not attempt to go below them.

WASTEFUL DRIVERS.

While efforts are being made in every direction to reduce the consumption of energy per car-mile by means of multifarious meters, hardly enough attention is paid to the prime source of the waste—the motorman himself. More frequent, or more widespread appeals to his commonsense, an endeavour to recognise and to encourage a feeling of loyalty in him, might help the meters to do their work more successfully. The inevitable first feeling of the motorman about meters is that they are spies, and, worse still, spies that cannot be circumvented. Signals may do very well to give warning of the whereabouts of a flesh and blood inspector, but the sneaking meter is there all the time, locked up in a cupboard, but all eyes and ears and never popping down a side street for a meal or a smoke.

Now it is very hard to believe—in fact, it is incredible—that more than the tiniest percentage of any body of motormen will drive badly for the pure mischief of the thing. If they were unreasoning children, they might be imagined to do all the acts which waste current and damage the car for fun or from malice; but they are men of responsible age, who may be supposed to have some interest in their vocation and to care a little for the affairs of their employers. It is not difficult to give any body of respectable men that amount of credit, and it is both easier and more pleasant to do so than to brand the whole lot as a set of selfish scamps, whose anxiety is not to deserve praise but to escape punishment. Half the trouble in the world is caused by under-rating the man below one, and a good part of the balance is due to jealousy of the man above. But let us start by understanding the man below. Let us, if anything, rate him too highly, give him credit for virtues which are dormant and undeveloped, make him above all think that we are prepared to trust him.

Let us do this, and ten to one but we shall be surprised to find that he has qualities of much the same *timbre* as our own, shades of quality indeed which we thought no one below ourselves could possess.

Before threatening, shall we try educating; before punishing, something more sympathetic than rules?

Just as no one ever learned grammar or bridge from the rules alone, or law from Acts of Parliament, so no motorman ever was taught his whole duty to his employer by studying the rules and regulations devised by the latter.

Publish rules, by all means, but do not leave them to stick half-way in the driver's brains like whole maize in a chicken's craw. Pound them up, and help him to digest them, by example, demonstration, lectures, examinations of a suitable, not over pedagogic, type. Give him concrete examples of economy and waste drawn from actual practice from his own and from other systems, circularise him with well-chosen extracts from technical journals, put the journals themselves within his reach, and make him feel at last that it is not a shameful thing to improve; that the service of an employer is part of the service of God.

Saving the Pence. How much the smaller economies mean to a business is well exemplified by the calculations concerning material scrapped before its time which appear frequently in all kinds of journals. The matter of brake-shoe waste has been mentioned in these columns more than once, but, probably not for the last time, it arises again out of a paragraph in a recent number of an American contemporary. There, it is remarked that the foremen of different depôts on the same system often have widely divergent ideas about the amount of wear which can be taken out of brake-shoes. In one case the average weight of scrapped shoes was 9·5 lb., while the average weight at a neighbouring car-shed was 17·2 lb., but such extremes must be rare. It is undoubtedly true, however, that engineers and foremen in too many instances do not keep the jealous eye upon the scrap-heap which the possible value of the latter to their employers calls for.

One American company estimated that it would have to carry 40,000 more passengers yearly to recoup the loss which would be occasioned if the car-house foreman scrapped the brake shoes at 10 lb. instead of at 6·3 lb.

The same thing applies to every article which is subject to frequent renewal, and many a lesson has been learned, many a pound saved, and many a mechanical improvement made, by men who have kept both eyes on the scrap-heap.

PROTECTION AGAINST HIGH-PRESSURE DISCHARGES.

Of all the many problems that have taxed to the utmost the ingenuity and skill of the engineer during the evolution of high-pressure transmission of electrical energy, probably none has proved more elusive, or been more earnestly debated than that which forms the subject of this article. In the early days, when 2,000 volts was called high pressure, and both the distributing mains and the generating and transforming plant were of very modest dimensions, oscillatory discharges were unknown as such—they existed, no doubt, but there were so many other causes of breakdown, and so many breakdowns, that their presence was not specifically recognised.

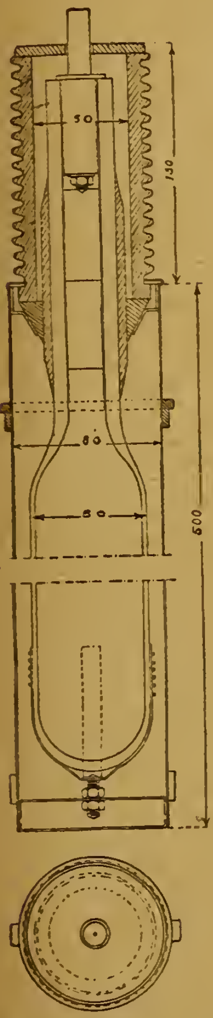


Fig. 1.—Section and Plan of Moscicki Condenser Tube.

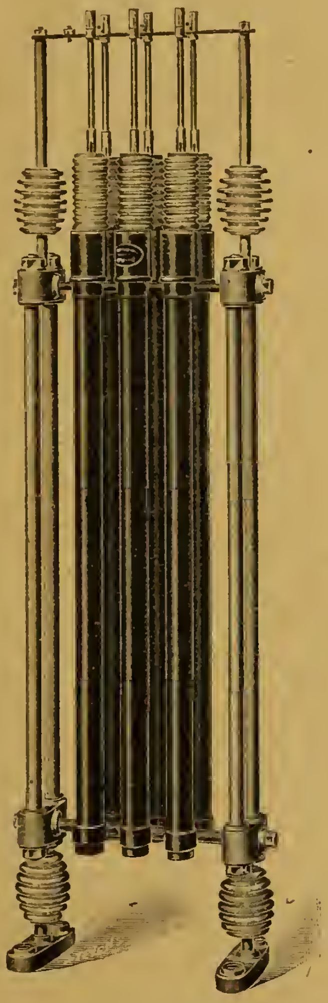


Fig. 2.—Battery of Tubes.

The immense improvement in the construction and insulation of electrical apparatus during recent years, combined with the enormous increase in the pressures employed, has changed all this. Electrical apparatus has been developed to a pitch at which it is as reliable as any other class of mechanism, and all ordinary failures having been eliminated or "marked down" to their true source, the troubles due to oscillatory discharges have been isolated and identified—a process greatly aided by the progress made in a totally different direction, namely, the art of wireless telegraphy.

The identification of the enemy, however, is only the first step; to frustrate his mischievous attacks has proved an even more difficult problem. "At home" in this country, happily, where most of our cables are underground, and lightning discharges are less frequent and less violent than abroad, we have not been greatly inconvenienced by atmospheric phenomena; but in other parts of the British Empire, and in the United States, for example, where overhead lines are the rule, and the climatic conditions are far more severe, protection against lightning discharges and surges due to them is one of the most vital and pressing problems of the day. In visiting foreign installations, it is usual to find most elaborate and costly sets of apparatus in the lightning arrester room, which is regarded as an indispensable part of the equipment. But the wide differences existing between such installations, and their frequent failure to fulfil their function, show clearly that the systems in vogue are still far from attaining either uniformity or a high degree of efficiency.

While we are, as mentioned above, less subject than other countries to trouble from lightning, the almost universal use of underground cables in this country has brought with it troubles of its own, particularly as the length and capacity of the networks have increased; for the sudden interruption or completion of the connection between a system of highly inductive apparatus, such as generators or transformers, and a network of cables possessing large capacity, is capable of giving rise to very violent surges and of producing extreme variations of pressure which may, and often do, result in breakdown. No system can be guaranteed against the occurrence of such sudden changes in the circuit; a short-circuit on the line, or the opening of a switch, may equally lead to the undesired effect referred to, and the only thing that can be done in this case also is to mitigate the risk by making suitable provision for controlling the surges of energy.

Thus there are two principal cases to be provided against —oscillations and surges due to atmospheric phenomena, and those due to sudden changes in the condition of an underground network of cables possessing large capacity.

The apparatus usually adopted to protect against lightning discharges generally consists of various combinations of spark-gaps and high resistances; the former to disconnect the line wholly from earth at ordinary working pressures, and the latter to prevent an excessive rush of power current when the gap is bridged by a spark, and to prevent the establishment of a resonating circuit consisting of the gap, the resistance and the inductance of apparatus connected with the line, which may lead to precisely the fault which it is desired to correct. But the presence of the high resistance unfortunately largely defeats the main purpose of the device, by choking down the current set up by a high-frequency discharge so much that the pressure rises to excessive values. To cope with this class of discharge, capacity is necessary, which, while almost opaque to currents of ordinary frequency, transmits high-frequency currents with

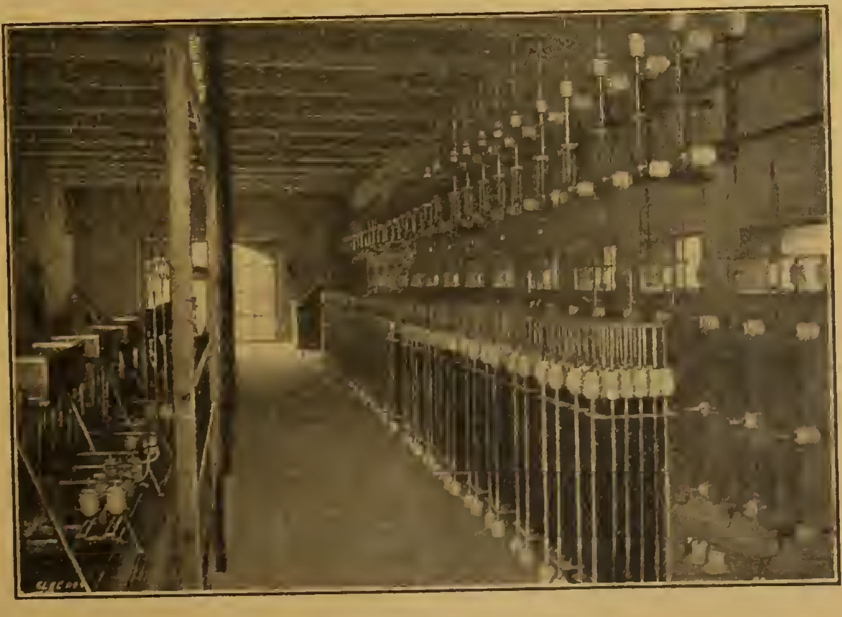


Fig. 3.—A Large Condenser Installation.

practically no obstruction to their flow. In the case of underground cables, what is wanted is a device which will set a limit to the rise of pressure at the end of a cable, but which need not possess much capacity, the frequency in this case being comparatively low. To meet these cases the Moscicki condenser, described in our issue of September 27th, 1907, has been adapted, together with the Giles "electric valve"; both of these devices are controlled throughout the British Empire by Messrs. Isenthal & Co., of 85, Mortimer Street, W., who have lately commenced the manufacture of the apparatus in London.

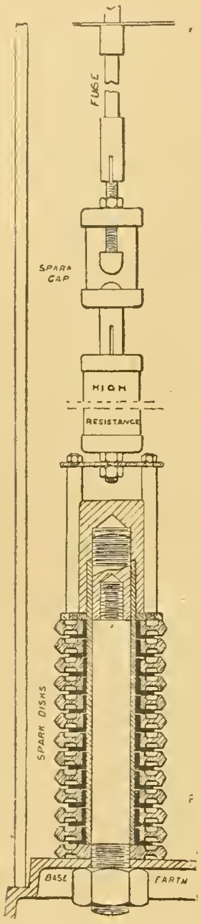


Fig. 4.—Section of Giles Electric Valve.

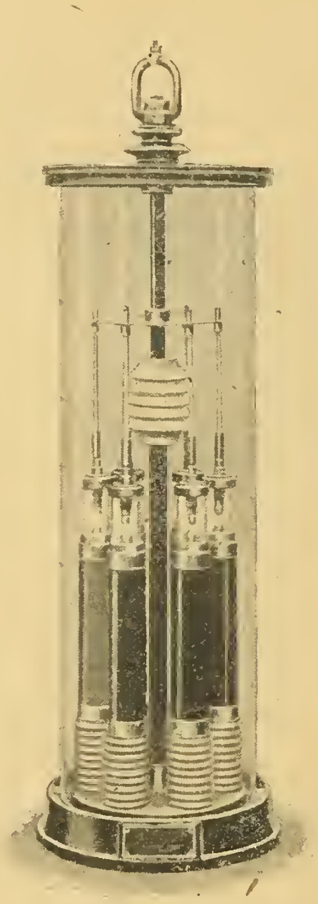


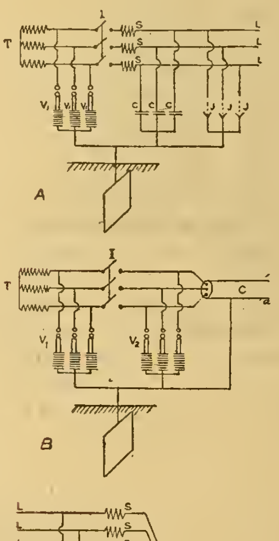
Fig. 5.—Unit Set of Giles Valves.

The construction of the condenser, in its latest form, is shown in fig. 1, p. 523, which gives a section of a condenser of 0 002 mfd. capacity, suitable for a pressure of 60,000 volts. As previously explained, the dielectric consists of a glass tube, thickened at the neck near the edges of the coatings where the maximum stress occurs, and supported by a porcelain insulator within a metal tube. The armatures of the condenser are heavy coatings of silver, the outer being protected by an additional coating of electro-deposited copper, and the space between the latter and the outer tube is filled with glycerine, which cools the tube. Substantial connections are provided, and each inner armature has in series with it a high-tension fuse, which isolates any faulty element without affecting the rest. The tubes—which are made in many sizes—are assembled in batteries, the connections being carefully arranged so as to give the minimum self-inductance; fig. 2 shows such a battery, with the fuses in position, while fig. 3 shows a large installation of similar units in a Continental power station. The number of tubes required may run into thousands, as in several existing stations abroad.

The Giles valve, which fulfils the function of a potential limiter, is illustrated in figs. 4 and 5; the former shows a section of the device, and the latter a set of valves assembled within an outer glass cylinder. The valve consists of a high-pressure fuse, spark gap, high resistance and a series of zinc spark disks, separated by mica, the last disk being earthed. The effect of a rise of pressure at the terminals of this device is first to break down the spark gap and charge the condenser formed by the uppermost disk and the central tube, but the capacity being very small, the current is also small, and the drop of pressure across the gap and resistance is correspondingly small. If, then, the pressure remains high enough to span the gap between the first and second disks, a spark takes place there, producing a further drop of pressure, and so on until the potential difference across the main spark gap is insufficient to maintain conduction and the discharge ceases. The disks, as it were, overflow one after the other, until, in the case of an extremely heavy surge, the spark passes completely from top to bottom—but for a fraction of the whole period only. In any case, the obstruction in the path to earth is automatically adjusted to suit requirements.

It may appear that this device is subject to the objection mentioned above as applying to the horn arrester with a high resistance in circuit—namely, that, if the resistance is high, the apparatus is ineffective, and if the resistance is low, resonance may occur. But, in practice, a number of these small elements are put in parallel, as shown in fig. 5, and as it is impossible, even were it desirable, to make these all of identical dimensions and properties, the individual elements come into action at different instants and resonance never occurs. We are informed that the device has proved its efficacy in numerous installations both in this country and abroad.

It remains now to show how these two apparatus are employed for the protection of cables, transformers, &c. The diagrams in fig. 6 illustrate the three leading cases: (A) the protection of a generating or sub-station connected with an overhead line; (B) the same, with an underground line; (C) the protection of a cable at its junction with an overhead line.



T, Transformer or generator; L, Overhead line; S, Choke coil; C, Condenser batteries; J, Water jets; I, Automatic circuit-breakers; C, Cable; a, Metallic sheath; V_1, Protecting valve for T; V_2, Protecting valve for C.

Fig. 6.—Connections of Apparatus for Protection of Cables and Transformers.

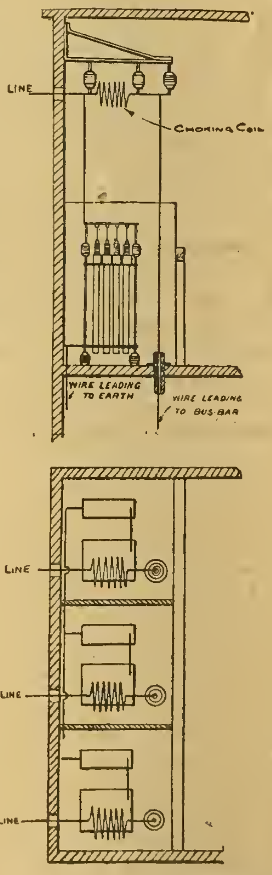


Fig. 7.—Arrangement of Protective Apparatus in Station.

In the first case, steady static charges are removed by the well-known device of a water jet, which, however, owing to its high resistance, cannot cope with impulsive rushes of energy; the Moscicki condensers, which practically earth the line to high-frequency discharges, but are almost impervious to ordinary frequencies, are next in order, and are backed up with inductances which, on the contrary, are impervious only to high frequencies and do not impede the working currents—these are preferably connected on the line side of the switches. Lastly, the Giles valves are inserted between the switches and the transformers (or generators) to provide a by-pass for slow but heavy surges due to short-circuits or the opening of circuit-breakers—surges which in this case are dangerous only to the transformers, and must be dealt with as shown by means of a device which renders excessive rise of pressure impossible.

In the second case, lightning discharges are not usually to be feared, but heavy surges are particularly dangerous, and may come from either side of the circuit-breakers; a double set of valves, therefore, is required to protect the transformers on the one hand and the cable on the other.

Lastly, at a junction between overhead and underground mains, lightning discharges of high frequency must be kept out of the cable, which is therefore protected with condensers and inductances.

Referring back to fig. 3, where overhead mains leave a sub-station as in case (A), the water jets are seen on the left hand, the condensers in the middle, and the inductance coils on the right. Fig. 7 shows the arrangement of a similar installation in section and plan.

In the foregoing we have not attempted to deal at all exhaustively with the theory of the system described; for further details we refer to an article on the electric valve which we published in our issue of January 8th last, page 54. We have, however, said sufficient to show that the system is embodied in thoroughly practical shape, and it is already being adopted on a large scale. For the reasons we have given, it should be of especial interest to users of high-pressure installations in all countries where lightning discharges are common and violent, such as Canada, South Africa, &c., as well as to the owners of high-pressure underground cable networks everywhere.

The use of the Moscicki condensers for the improvement of the power factor in A.C. systems—a need which is making itself felt more and more insistently—has been explained in the article referred to above (September, 1907); but this, as well as the very widely extended use of these condensers in wireless telegraphy, is beyond the scope of the present article.

ENGINEER REPRESENTATIVES IN THE COLONIES.

By E. KILBURN SCOTT, M.I.E.E.

Out in Australia the English specialist firms miss much business by not being represented, or else represented in an ineffectual way. The best kind of agent for an engineering firm is a qualified engineer having good address and some commercial knowledge. Certainly in Australia the man who can talk to a mine mechanic in the back blocks, and the manager of an electricity works in the city as a fellow engineer, stands the best chance, and especially is this so if the representative can take off his coat and start a piece of machinery going. If he can also get up at an engineering meeting and discuss papers convincingly, then so much the better. Australian engineers dislike being "talked at" by the man who has drifted into his job from a clerkship in a shipping office, or from selling crockery, drapery, &c.; and, furthermore, they don't much care about passing orders to shipping houses that have built up a reputation on, say, the exportation of meat and wool and the importation of furniture and dress goods.

The shipping firm's name, address, and letter heading may look well, and the banker's reference be above suspicion, and yet if its legitimate business is on lines remote from engineering, it is best to let it "stick to its last." The feeling which is engendered by a shipping house suddenly blossoming out as engineers in an Australasian city, is much the same as if W. Whiteley, of London, Lewis, of Manchester, or John Barran, of Leeds, fixed an engineer's plate on their door, and tried to sell steam turbines, dynamos and cables, and tool steel. The genuine engineer in England wouldn't like it, and engineers in Australia don't like it either.

Some specialist English firms have foolishly allowed themselves to be represented in that way, whilst many more are not represented at all. The writer used to inform his Australian friends that the keenest buyers at home, such as the railway stores departments, manufacturers, &c., always purchased engineering and electrical plant from specialist firms, motors from motor manufacturers, starters from a firm making nothing else, arc lamps from a lamp firm, and so on. They saw the point of the argument, but they said, Where are the representatives of your specialist firms? Where are their catalogues and price lists? The writer had to admit that many of our best specialists and most truly English firms were quite unknown. He tried to rectify it to a small extent by getting out some hundreds of catalogues, and distributing them to his students; but this only went a little way, and the foolish duty on catalogues which was imposed about two years ago put a stop to it.

The question is, how best to bring the names and manufactures of the English specialist firms before buyers in the Colonies? As they are mostly in a small way, and run their businesses to pay, they are therefore unable to have a representative entirely to themselves. Possibly the best way would be for a group of smaller English firms to get together and appoint an engineer who has been out there some years, or who is "native born," to represent them. In Australia there might be one in each State, counting Tasmania with Victoria, and in New Zealand one in the north and one in the south island.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Russian Trade.

I have been much interested in the very excellent series of "Notes on Trade Abroad," and especially the references to Russia. I take particular interest in that country, because a millwright ancestor, James Kilburn, built and equipped one of the first (if not the very first) woollen mills in Russia. I was also out there some 20 years ago.

In the time of Elizabeth and Peter the Great and for long afterwards, England was practically the only country that did any business with Russia, and a visit to Archangel is very interesting, because of the evidences of our trade through that (at one time the only) Russian port.

For miles the banks of the Dwina are practically English soil taken out as ballast by ships, and it is quaint to come across English types bearing names such as Smith and Jones who are so Russianised as not to be able to speak our language.

The first dockyard that Russia had was established for Peter the Great at Archangel by Englishmen, and it would be a pretty safe thing to say that a Tyneside or a Scotch engineer had something to do with nearly all the early ironworks in Russia, and certainly Yorkshiremen started all the woollen mills.

How comes it, then, that the present machinery and engineering trade of Russia and Siberia is so much in the hands of Germans and Belgians? What are our people doing to let Belgians get such a foothold. One can understand the Germans having a "pull" by reason of easy railway communication.

Some years ago I represented a Liége firm in this country, and it came to my notice that Brussels and Liége people had financed and engineered a number of lighting and tramway concessions and started a good many iron and steel works in Russia.

After the Siberian Railway was completed there was a slump, and some of the 100 fr. shares went down to 30 or so, my own company being heavily involved. I met the manager a few weeks ago, and he informed me that the financial strain passed away long ago, and many of the shares are to-day nearer 300 than 100.

One odd thing about the matter is that the Belgian firms went into the Russian business with the idea of supplying not only the original but also the extension plant; but it has turned out that the managers of the lighting and tramway companies and the iron and steel works are now buying extension plant wherever they can get it cheap and good.

Of course, the Belgian and German firms always have a "big pull," because their machinery is so much in evidence, and their catalogues and price lists, printed in Russian, are sown broadcast. But it is never too late to mend, and especially at this season when the Russian people really show a friendly disposition, and want to get into closer trade relations.

Our English constitution and freedom are the ideals which the people and their representatives in the Duma have in their mind to copy. I had a chat with two Russian engineers a few weeks ago who had come over specially to get into touch with manufacturers on this side, and they pointed out that one result of the new *régime* will be less restriction on the Press.

Before very long Russia, which has now only a few newspapers of the Government *Gazette* type, will have many more newspapers, and it is to England that the proprietors will look for printing machines, and the motor equipments for driving them.

Now the question is, are the English firms alive to the situation, have any of them sales engineers on the road looking up business, is there a single electrical firm in England, other than the Westinghouse Co., which has issued catalogues and price lists in Russian, and if not, why not?

If Englishmen were as well informed about Russian trade as they are about the sensational political events, they would not be so badly off, and that is why your "Trade Notes" are so valuable. The daily Press only retails stories which gives as wrong an impression of Russia, as say the sensational English news in an average American paper gives of English life.

Russia is a great country, and the Russians are amongst the most virile of the world. If all the nations of Europe were to invade Russia in turn they would make practically no impression. It is the least vulnerable of any country; it is the furthest from that bugbear of good business—Socialism—it is a great country to trade with.

The possibilities of trade depend primarily on population and revenue, and here are a few figures which show Russia in very good light:—

	Area.	*Population.*	*Revenue.*
Great Britain and Ireland ...	121,380	43,200,000	£145,000,000
Russia	8,400,000	130,000,000	£210,000,000
German Empire	208,850	56,500,000	£109,000,000
India	1,770,000	300,000,000	£85,000,000
China	1,500,000	400,000,000	£15,000,000
United States	3,623,000	84,000,000	£146,000,000

Germany and the United States are protected against us by tariffs and high industrial development. India and China have immense populations, but the people have few wants, and they are far away. Russia, with many wants, an immense population, and the highest revenue of any country, is at our doors.

I ask, again, how many English electrical firms have sales engineers on the road in Russia, and have catalogues and price lists in the language of that country?

E. Kilburn Scott.

Carbon Brushes.

Referring to the letter in your last issue, I may say I was for nearly two years the chief technical representative of a firm of carbon brush manufacturers with a world-wide reputation, and during that time I think I came into personal contact with nearly every designer of direct-current machinery and almost every central station engineer in this country. The one thing that struck me most was how little attention was paid to the subject of carbon brushes, particularly by central station engineers. It was quite a common thing to be told carbon was carbon, suggesting that there could be but little difference between various brushes, but when I replied that metal was metal, and then asked why people were so foolish as to use copper instead of iron, it began to dawn that there was more in the subject than seemed to be at first sight; and when I told some of my friends there was a range of carbon brushes from samples with a current density of 20 amperes per square inch to samples with a current density of 150 amperes per square inch it set them thinking furiously, particularly when the unsatisfactory working of some generator or motor was recalled.

The subject of carbon brushes is not a very difficult one, but, unfortunately, no definite rules can be laid down, and experience alone must be the guide in the final selection. Carbon brushes have two functions to carry out; they must be able to carry the main current with as little loss as possible, and they must stop the current in the short-circuited coil by just having sufficient resistance to do so. Granted that these two conditions are fulfilled and there are no mechanical troubles caused by vibration and faulty brush-holders, it will be found commutation will be satisfactory in nearly every case.

The great point to be remembered in selecting carbon brushes is to get those with just sufficient resistance to stop the current in the short-circuited coil and as it is impossible to measure either the current in the coil or the reactance voltage in a commercial manner, it will be immediately seen how impossible it is to lay down any fixed rules. Some machines have very high reactance voltages, some low, depending more or less on their working voltages, and in every case the correct brushes will just have sufficient resistance to stop the current in the short-circuited coil. If a brush of too low resistance is used, burning at the contact surface will be the result, accompanied by heating and sparking, while if a brush of too high resistance is used, a greater number must be employed, as the higher the resistance, the less current it will carry, and consequently the size of the commutator and brush gear will have to be increased. Once carbon of the correct resistance is found, principally by the trial and error method, it is only then a question of employing a sufficient number, so that the carbon is working at its correct current density, which is generally well known for each brand.

On the above lines it will be easy to explain why brushes may work well for periods even as long as 10 years, and in other cases why some will not work satisfactorily on any consideration.

Sarsfield W. Martyn.

London, N.W.

Electric Miners' Lamps.

Referring to Mr. Giraldus Jones's letter in your present issue, I understand it to be the "retort courteous" because the colliery data he expected were not forthcoming.

As previously stated, I greatly regret that I am not allowed to publish the details of the costs referred to, but have written to another colliery for sanction to submit the results obtained at their installation. If I obtain permission, I shall be pleased to send the same to you, when, if you think the subject still of sufficient interest to your readers, you may kindly find room for the same.

I thank you, Sirs, for your courtesy in admitting my letters to your columns, but wish to add that, although no one begrudges Mr. Jones the personal advertisement contained in the last clause of his letter, it should, in justice to myself, be made clear that Mr. Jones and I have not been in touch for about nine years, hence his somewhat airy deprecation of my figures, and his assumption that he has had a *more extended experience* than I have had, cannot be based upon definite knowledge on his part, and may not accord with facts.

Fred. J. Turquand.

London, W.C., *September 27th*, 1909.

Not Wanted in Australia.

I think you would be doing a kindness to the many readers of the Review if you would make known the true state of affairs in Australia at the present time.

Scores of engineers are coming out here owing to misrepresentation of the real facts about employment, and on rrival here they find that it is just as difficult to get work as t home—in fact, more so.

Also it is more expensive to travel from one of the few owns to another, the distances being very much greater.

All the men that I have met here complain that they have een "had" by the glowing accounts they heard at home f Australia.

The legislation of this country is so framed that it prevents ny new-comer from taking positions such as mine nanager, borough engineer, mine electrician, and so on.

And if a man would and could fill in some time in any f the few shops, in the capacity of a fitter or machinist, &c., e cannot do so, on account of the trade unions, which ractically run this country.

If he should get a start he is soon got rid of, if he refuses o join the union and become one of the crowd under the eel of union tyranny.

To sum up, it is much more pleasant and far cheaper to be ut of employment at home than in Australia.

This letter must not be taken as the grumbling of a disappointed engineer, or one isolated case, as, personally, I am told I have been more fortunate than the majority.

Milli-Volt.

Sydney, N.S.W., *September 29th*, 1909.

Prospects in Chile.

Might I ask if any of your readers could give me some information as to the prospects of finding work in Chile? Would they be inclined to advise a young engineer with a knowledge of the Spanish language and plenty of grit in him, to go out, say, to Santiago on "spec.," having left on landing only sufficient money to keep him for a few weeks? Would he be likely to find work soon, and if willing to rough it at the start, till he was thoroughly familiar with the language and ways of the country, would there be a higher prospect before him than there is in this country for a poor shift engineer without influence?

Desalentada.

[An article on "Life in Chile" was published in our issue of July 23rd, 1909, p. 157. Another reader wishes for information as to the cost and conditions of living in Rio de Janeiro. Much information regarding commercial and social conditions in Brazil was given in a lengthy article in two instalments, in our issues of April 2nd, p. 571, and June 4th, p. 944, this year.—Eds. E.R.]

Tramway Contributions to Rates.

In your editorial of the current week you remark that the L.C.C. tramways have made no contributions to the rates since they have been worked by the Council. The writer was evidently thinking only of contributions from net profits. The tramways, however, contribute very heavily as ratepayers, not only on their buildings, &c., but also on the permanent way. In the year ending March 31st, 1907, rates on permanent way totalled £40,299, and they are still higher in the two years since, for which I have not the figures at hand. These payments and the maintenance of the track paving are, together, a very heavy subsidy to the rates. No other users of the public highway are subjected to such a toll, and so far from the London tramways being "on the rates," as is frequently asserted, it is the motor-omnibuses, cabs, carriers, and other great users of the highways who are actually "on the rates" as regards the maintenance of that essential part of the plant they employ.

The magnitude of these charges is not insignificant. A few years ago the accounts of the largest omnibus and the largest tramway company in London—both worked by horses at that time—showed the following contrast:—

	Omnibus Co.		Tramway Co.	
	Per vehicle mile.	Per passenger.	Per vehicle mile.	Per passenger.
Rates and taxes ...	0·103d.	0·015d.	0·678d.	0·070d.
Road maintenance ...	—	—	0·581d.	0·060d.
Total ...	0·103d.	0·015d.	1·259d.	0·130d.

Rates and taxes not being separately stated in the accounts, the ratio of rate payments was really greater than appears from the above figures. The totals, however, represented one-sixth of the total working costs for the tramway, and one-seventy-eighth part of the total for the omnibuses. Even with the new petrol tax the difference now can be little or no less. One principle of English highway law, I am told, is that the King's highway is free to all wayfarers, at the expense of the ratepayers, whose duty it is to maintain it in passable condition. It is not free, in fact, to the tramway passenger, who by the anomalies created by applying Elizabethan rating law to modern conditions, and horse tramway law to electric traction, is obliged to contribute to the maintenance of the streets for other users.

It may be right that users should pay; if so, all users should pay *pro rata*. It may be right that the use of the highways should be free; if so, it should be free to all users. That one class only should be charged and none of the others cannot be right on any principle.

Henry M. Sayers.

London, S.W., *September 25th*, 1909.

The Newfoundland Cable Dispute.

As there are some inaccuracies in the editorial in your issue of August 20th last entitled "The Newfoundland Cable Dispute," we feel sure that the editorial was written without your being in possession of the facts.

In the first place, you state that the Commercial Cable Co. has already secured a landing at Port aux Basque for a cable to Canso. We would correct you in this by stating that the Newfoundland Government owns the cable between Port aux Basque and Canso, and, therefore, the Commercial Cable Co. has no landing at Port aux Basque.

In the next place you refer to the Commercial Cable Co. as having "a monopoly of cable traffic passing over the Newfoundland Government lines for a period of 25 years." The contract you refer to as a monopoly is nothing more or less than the usual traffic contract between connecting cable and telegraph lines, and in this case is merely an extension of a prior contract between the Newfoundland Government and the Commercial Cable Co. The Anglo Co. has its own landline system in Newfoundland, and its own cable system to Europe and America. The Newfoundland Government also has its own landline system in Newfoundland, *but no cable connection with Europe and America*, and so it made the above-mentioned traffic contracts with the Commercial Cable Co. Hence your statement that the Commercial Cable Co. is given a monopoly is misleading. The Commercial Cable Co. merely enabled the Newfoundland Government to compete with the Anglo Co., and break up the Anglo's monopoly of the cable traffic.

You state it cannot be unreasonable to permit persons or corporations to compete on an equal footing, inferring thereby that the Commercial Cable Co. has all the advantage. The answer to this is the same as above, namely, that the Newfoundland Government landlines joined to the Commercial Cable Co.'s ocean lines compete with the Anglo Co.'s system of Newfoundland landlines and ocean cable lines. In fact, so far from the Commercial Cable Co. having an advantage in Newfoundland, it is not allowed to compete with the Anglo on an equal footing, inasmuch as the Commercial Cable Co. is prohibited by its contract with the Newfoundland Government from soliciting, receiving or delivering cable messages in Newfoundland. The Anglo Co., on the contrary, always has done this, and is still doing it.

The Anglo Co. has upwards of 500 miles of its own landline in Newfoundland, while the Commercial Cable Co. has none, nor is it allowed to have any.

The statement that by the making of the traffic, repeat traffic, contract between the Newfoundland Government and the Commercial Cable Co., the Anglo Co. is not allowed to compete on an equal footing is absurd in view of the above-mentioned facts.

You state that the Atlantic companies enjoy *practically* equal conditions of working in Great Britain. In reply to this, we would point out that the Atlantic companies enjoy *actually* equal conditions of working in the United States.

We have already made a complete answer to all that the Premier of Newfoundland has stated in his public interviews. We would, however, refer to the statement on page

304 of your journal of the same issue in which your editorial appears, where it is stated that the Government has given them (the Commercial Cable Co.) the land they required. In reply to this, we would say that we made repeated applications to Sir Edward Morris's Government for the grant of land called for by the contract, but without success, until the granting of the land was too late. We could not take the risk of not having the cable building and trench, &c., ready for the arrival of the cable-ship, and so we had to lease a piece of land on which to construct the cable building and bury the shore ends, and the cable is now landed on, and operated from, that land leased from a Newfoundland citizen.

We think in fairness that the foregoing is entitled to the same prominence as was given to your editorial. We especially think so because there is one fact with which neither you nor the general public are familiar, namely, that nearly twice as much English and Canadian money is invested in the securities of the Commercial Cable Co. and the Mackay Companies, at present market values, as is invested in the Anglo-American Telegraph Co. at present market values, even if it be assumed that all the securities of the Anglo-American Telegraph Co. are held by English and Canadian investors, and yet several London newspapers have stated that the contract in controversy between the Newfoundland Government and the Commercial Cable Co. is prejudicial to the interests of British capital without knowing or realising the large amount of English and Canadian money invested in this Commercial Cable system.

Commercial Cable Co.
FRED. WARD, *Manager in England.*

London, E.C., *September 27th*, 1909.

Unemployment.

Several letters have recently appeared in your valuable paper *re* unemployment, and one refers to attempts made last year to organise the station engineers, electricians, draughtsmen, &c., engaged in this country. This is true, and you probably remember me under the *nom de plume* of "Organiser." The scheme entirely failed, and two influential engineers who backed it were disheartened by results. It is impossible to organise those engaged in the electrical profession in this country, and time and money have been lost in trying to do so. Young men having rich parents work for nothing, the station superintendent is jealous of the shift engineer, the draughtsman at 25s. per week considers himself superior to the foreman at £3 per week, and so on. Jealousy and so-called respectability absolutely prevent combination, consequently you can buy a first-class technical man at 30s. per week, and the whole spirit underlying the profession appears to be "please may I be allowed to breathe." I was disgusted with the results. In America many electricians are earning three times the money paid here, owing to the "brotherhood" regulating wages, and not competition. Until my *confrères* in the electrical profession learn from bitter experience to toe the line with the rest of the world's organised workers, and quit their smug respectability, we shall still have high-grade, technical, educated engineers working for the wages of a navvy, and influence and favouritism surpassing brains and experience.

The chaotic state of the whole electrical profession is heart-breaking. An attempt was made last year to remedy this evil, thanks to the assistance of your paper. This attempt failed, owing to lack of adequate support, therefore those who complain have only themselves to thank.

Organiser.

The letter of "Electricity Supply" under the heading "Unemployment" in your issue of 24th inst., seems to refer to the correspondence which appeared some months ago in your paper under the title "Proposed Engineers' Association."

"Electricity Supply" says he has "reason to know the matter has dropped." Will you kindly correct this idea, as I have been in communication with the whole of those who sent in their names in connection with the "Proposed Engineers' Association," and in the course of a month they wil have certain literature placed before them, as has alread been promised.

Status.

Magnetising Current of an Induction Motor.

The current taken by an induction motor is composed o two components:—

1. The energy current, which performs useful work, an varies in proportion to the output of the motor.

2. The idle magnetising current, which is 90° out of phase with the energy component and performs no useful work; this idle current is approximately constant at all loads.

If the motor is run without load at normal voltage and readings are taken of the watts and volt-amperes input, the magnetising current can be calculated by either of the following methods:—

(*a*) The no-load power factor $\cos\phi = \dfrac{\text{watts}}{\text{volt-amperes}}$, and the magnetising current $=$ no-load current $\times$ sine ϕ.

(*b*) Magnetising current $= \sqrt{\text{Total current}^2 - \text{energy current}^2}$, the energy current being $= \dfrac{\text{watts}}{\text{applied volts}}$.

The 15 amps. observed by "Troubled" would not represent the true magnetising current, as part of it would be energy current overcoming hysteresis and eddy-current losses; these could be separated as above if the watts and volt-amperes were taken, but in this case each quantity would be less than above on account of the rotor being open-circuited and at a standstill.

The losses in an induction motor are—

(*a*) Copper losses in the stator and rotor windings.
(*b*) Friction and windage losses.
(*c*) Stator iron losses.
(*d*) Rotor iron losses.

(*a*) The copper losses increase in proportion to the square of the current taken by the motor, and could be determined as follows:—

Clamp the rotor so that it is unable to rotate, and apply a low voltage to the stator windings, the rotor being short-circuited; then the power taken will be practically all copper losses in the two windings. If sufficient voltage is applied to give full-load current, then the wattmeter will show the full-load copper losses of the machine.

(*b*) The friction and windage losses depend practically on the speed, so may be taken as constant.

(*c*) The stator iron losses are independent of the load, as they depend on the saturation of the iron and the magnetic changes.

(*d*) The rotor iron losses are proportional to the slip, therefore there is very little increase up to full load, and for all practical purposes they can be considered constant.

The losses (*b*), (*c*) and (*d*) will be given by the no-load test, as the power taken will be nearly all due to iron and friction losses, excepting a small portion which will be due to copper losses; this should be subtracted from the wattmeter reading to give the true iron and friction losses.

I trust the above will be of service to "Troubled"; of course, the results obtained will not be sufficiently accurate for experimental purposes, but will do very well for an ordinary workshop test.

W. D.

What is an Electrician?

Referring to the correspondence in your issues of September 10th and 17th, *re* above, this matter was of interest to me, inasmuch as in the number of your paper in which this question was raised, I had an advertisement for an electrician, and it may be interesting to the applicants to know the number and class of men who evidently consider themselves entitled to be styled electricians.

In the first place, I may say that I fully agree with the editorial definition of an electrician, and the man who has had the training and experience mentioned therein is the man suitable for the post advertised.

The number of applications received was 170, and they ere made up as follows :—

Electricians (as above) who have had charge of a works' plant	26
Manufacturing engineers' erectors or workmen (one of these being a B.Sc.)	34
Central station men	30
Wiring contractors' men...	32
Men in charge of hotel or private house lighting ...	12
Men who obviously had written on the "off chance"	28
Wiring contractors who wish to give up their business for a permanent job	8
Total =	170

In selecting a man for any given position, there is no oubt that much depends on the manner in which the appliation is written, and probably many a good man has missed situation by the ill construction of his letter, and certainly in the present instance—even taking into consideration the moderate wage offered and the class of men likely to be ttracted—many of the letters condemned the applicant at once. A good number of applications were written on odd pieces of paper torn out of copy or memorandum books, and hese from men in apparently steady work. I can undertand that to men out of work, the cost of notepaper even is a consideration, but I think it would be well if, when they were in work, they would think of the time when their job would be finished, and lay in a little stock of suitable paper and envelopes for future applications. Perhaps some will think that this is of trifling importance, but in these days nothing which will forward the chance of obtaining a job should be neglected.

Five of the applications—one of them from apparently a suitable man—were so badly written that the address and/or the signature could not be deciphered, and life is too short for spending a lot of time in studying handwriting of this sort.

A question which has often been put to me is :—" Is it of any advantage to enclose a stamped addressed envelope ? " Personally, I do not think it is, for if an employer considers an applicant is likely to suit him, he will not object to spending a penny on a stamp ; on the other hand, I know from personal experience that one does not always receive a reply by enclosing a stamped addressed envelope. In the present instance six applicants enclosed stamped envelopes, and these have been posted.

It was a matter for surprise to find that in spite of the notice at the head of the "Situations Vacant" column, no less than four enclosed original testimonials. This is a very risky thing to do, for originals are likely to be mistaken for copies, and, in the case of unsuitable applications, subsequently destroyed. I might mention that each of the four omitted to enclose a stamped addressed envelope for the return of their papers. They have, however, been posted.

Two young fellows, both of whom are employed in the stations of different power companies, stated that "they were not afraid of the juice" ; and while I do not altogether disbelieve them, I am afraid the statement would not be taken as a recommendation. The Employers' Liability Act is a serious matter, and one cannot afford to engage persons who profess not to have much respect for voltage.

In conclusion, I would advise men who are applying for situations of the class indicated above to write their applications on foolscap paper, and to write on one side only. True, foolscap is usually sold at ½d. per sheet, but for this purpose it is worth it.

W. H. B.

September 27th, 1909.

The Measurement of the Insulation Resistance of a Live Three-wire System.

In your issue of the 17th inst. Mr. Stuart A. Russell described Prof. Rousseau's method of obtaining the separate values of the three components in the combined insulation resistance of a three-wire network to earth.

I have employed this test personally on several occasions, but have not found it satisfactory except during periods of *very* light load. The variable results obtained at other times have been due, I think, to the unreliability of the assumed ratio of the voltage of one side of the system to that of the other. It does not necessarily follow that, because a certain ratio exists between the voltages at the central station, for example, this ratio is a constant throughout the system. I have found on several occasions when testing that the neutral has had a positive potential to earth at one point, and at the *same* time a negative potential to earth at another point of the system.

Referring to his formula for obtaining the combined insulation resistance to earth of a live system, Mr. Russell states—" This method can be applied at any point of the system, and it is not necessary to interrupt the earthing connection when making the test, &c.," but he omits to point out that if the earthing connection be not interrupted during the test, the result obtained will be the combined insulation resistance of the network and the earthing connection in parallel with it. Mr. Russell probably thought that the necessary correction was obvious, and for the moment forgot that a mains engineer is often too busy to verify the formulæ he may wish to employ.

Daniel Shirt.

Birmingham, *September 27th*, 1909.

Electric Laundry Irons with Indicators.

With reference to your correspondent's letter from Adelaide on the above matter, we think that the plan we have adopted in this connection (which was shown by us at the Franco-British Exhibition last year) would probably meet the case.

Our experience is that the best point from which to feed electric irons is overhead, and not from a wall-socket at table level. We therefore arrange a ceiling rose with a ceiling switch alongside, operated by two cords hanging at a convenient height over the centre of the ironing table, with a small red lamp connected in parallel with the ceiling rose, so that this is always alight when the switch is turned on and the iron in circuit. A light spiral spring attached to the flexible cord serves to take up the slack and enables the furthest corners of the ironing table to be reached by the iron, with an entire absence of any slack flexible in any position. The red lamp need only be a 5-C.P. lamp, and can be under-run to the extent of some 20 per cent. or 30 per cent., in which case the current consumption is quite trifling and the life of the lamp exceedingly prolonged. This removes any possible objection from the supply authority on the score of obtaining light from the heating circuit. We have found this plan answer admirably in practice.

Rashleigh Phipps & Co.

London, W., *September 28th*, 1909.

Water-Power Development.

I was interested to see in your last issue the statement that orders for large water-power plant for Canada had been secured by Messrs. Jens Orten-Böving & Co., the bulk of which they would have manufactured in Sweden.

But your remarks in "Notes on Trade Abroad" might lead your readers to infer that there are no "hydraulic specialists" in this country, with the exception of imported Continental engineers, which, to say the least of it, is hardly correct.

Water-power engineering has been carried on in Britain by a number of firms for 50 years ; some of these firms in the North of England and Scotland have most successfully designed and constructed water-power plants, and although most of these are not nowadays considered large as compared with what you described, they require nearly as much technical knowledge and experience to carry out ; and, therefore, the designers are entitled to be called "hydraulic specialists."

It seems a great pity to me that you should publish a statement that if any water-power development work has to be designed or carried out in this country, it is necessary to import foreign engineers to do so.

My own firm certainly claim to be "British hydraulic specialists," as they have for years past devoted special attention to the design and construction of plant of this nature, and have carried through a number of good-sized contracts in which the whole of the work was designed by

Englishmen, a very considerable portion manufactured in the British Isles, and only certain portions, which at the present time it is nearly impossible to get manufactured in this country, have been purchased abroad.

In one case I supplied a 3,000-B.H.P. unit for direct coupling to A.C. generator, complete with steel pipe line, expansion joints, and all usual accessories, which has been installed abroad as an extension to a Continentally designed and constructed power station, and the reports which I have received regarding the working of this plant, in comparison with the existing Continental sets, conclusively prove that the successful design of water-power plant is not exclusively confined to foreign engineers.

James Gordon, A.M.I.M.E.

London, E.C., *September 28th*, 1909.

[We can only imagine that our correspondent has not carefully read—if at all—our comments on "Hydro-Electric Possibilities" in "Notes on Trade Abroad" (see Electrical Review, September 3rd). We think that careful reference to these will show that he is labouring under a misapprehension as to what we have said. We quoted our "visitor's" remarks as showing the impression that is held by some engineers at home and by authorities abroad who have the placing of business in their hands. We never have shut our eyes to the achievements of home manufacturers of hydraulic plant; indeed, we referred to these in the course of our article, and said that we British engineers "must not let it be imagined that we are by no means ignorant of hydro-electric engineering matters." Does Mr. Gordon desire to hold editors responsible for opinions expressed by their correspondents?—Eds.]

Testing Condensers for Leakage.

I do not wish to discourage a newcomer to our profession, and should have left "Harbee's" letter unanswered, but for the fear that it might mislead some of our younger engineers. Let me, therefore, briefly point out that the effect of a given quantity of salt water passing into a bank of boilers with the feed water, depends chiefly on three conditions of service: the class of boiler, the nature of the load, and the rate of evaporation.

I have in my own experience found the maximum allowable amount of salt per gallon in the boiler to vary 1,000 per cent., from 200 to 2,000 grains per gallon, the worst conditions being when water-tube boilers with a very small steam disengaging surface and capacity have to supply a heavy and fluctuating load.

In such circumstances, I have found that the lesser quantity mentioned above is sufficient to cause violent priming. I can assure "Harbee" that it does not take "a good sized gap" to pass enough salt water in half an hour to bring the density in the boilers up to this limit. As a matter of fact, I have found that a hole of ¼ in. diameter in a single tube will do it, and such a hole will occasionally show up suddenly through the tube becoming thin and then bursting through.

Such a gap will not need a chemical test to locate it (as "Harbee" rightly claims) but it will show itself up in a most unpleasant fashion. It is, however, advisable to adopt some less clumsy method of detection.

In conclusion, let me beg "Harbee" to remember that in engineering, as elsewhere, "circumstances alter cases."

R. Somerville Bayntun, A.M.I.C.E., &c.

Mersey Railway Power Station, Birkenhead,
September 28th, 1909.

Views on a Review.

May I be permitted to make a few remarks in reference to a—I will not say *your*—criticism on Mr. Ibbetson's little book?

The reviewer avails himself freely of his opportunity of using the majestic or editorial plural in order to lend weight to his remarks, but, not content to hide his light permanently under a bushel, condescends to sign his initials—perhaps not caring to adorn his lucubration with his full name. I should like to suggest, with all due deference, that his—I apologise—their views on prefaces affect the value of a book not at all, and are of little interest to readers apart from their recognition of the possible existence of "a friendly and competent reviewer," while the quotation is a very dangerous one to use. It has a nasty spike at both ends. The remarks on the book itself are a series of brief commendations of whole chapters at a time mixed with lengthy exposures of generally minor errors, some of which are probably undetected compositors' mistakes, and not one is likely to seriously mislead.

Take, for example, the reference to page 97: "The golden flame . . . is due to vapours . . . produced by the heat of the arc." Does your critic infer that the vapours are *not* produced by the heat of the arc? Does he wilfully or ignorantly misread the sentence? Or is he merely splitting hairs about "Terminological inexactitudes?"

If your reviewer should be unfortunate enough to stop a boot travelling at a somewhat high speed, would he be understood if he stated that the resulting discoloration and aggrieved state of mind were produced by the kick, or would he think it necessary to talk about "congested capillaries," "nervous impulses," &c., connecting cause and effect?

True, there *are* "more things mixed than flame arcs" (pretty phrase), and vapouring is not their monopoly.

C.C. joints! Yes, I have had to deal with these "high-speed" joints, after erection, too. Like the steel, they may work hot, but woe unto them when in damp places, and woe unto the man in charge. There are joints and joints, just as there are competent as well as carping critics.

There is very great need of a book, in less than three volumes, dealing with the subject in question, and the writer, in common with many others, has welcomed Mr. Ibbetson's little work, and this in spite of its faults. May there soon be a second edition with these rectified.

Readers of the Electrical Review are used to seeing fair criticisms, but one cannot feel that this book has been dealt with in an impartial or even fair, let alone friendly, manner.

Fair Play.

[While the taste of our correspondent's remarks might be criticised, we will content ourselves with pointing out that his quotation regarding the flame arc, by omitting words essential to the point made by our reviewer, completely begs the question. We have satisfied ourselves that the review is fair, while we are certain that the reviewer was not actuated by malice; of his competence there can be no question.—Eds. E.R.]

Tramway Power Tariffs.

As to whether the assumptions in my comparison of Glasgow and Manchester traction costs are questionable, I am quite content to leave unbiased readers to judge.

You say I increased the Glasgow loan charges to a hypothetical amount. Quite so. The hypothesis, however, was based on a sure foundation. Glasgow obtained a longer term than Manchester for repayment of debt. Is then the caprice of Government departments in sanctioning loans not to be taken into account in comparing costs, when those costs include loan redemption charges?

Further on you state that I make no allowance for overhead equipment at Glasgow. You are in error. The capital outlay taken from Glasgow's accounts (page 24) is obviously exclusive, and properly so, of overhead equipment, which, in towns like Manchester, is found by the Tramways Committees. Proof of this can readily be seen in the detailed statement of capital account.

Regarding your remarks on rates, &c., I quite admit that Scottish undertakings generally pay more, proportionately, in rates than English undertakings. The allocation in Glasgow, however, as between generation and distribution on the one hand and tramway operation on the other, is so glaringly incorrect, apart from percentages on capital, that it is a waste of time to pursue this further.

Again, I fail to see that there has been a "significant silence" as to the traction proportion of Manchester's depreciation. In your earlier comments you said definitely there was no counterpart in Manchester to Glasgow's provision for depreciation. Now that you are shown to be incorrect on this point, you still throw doubt on the allocation as between lighting and traction.

I feel compelled to say that the accounts rendered against the Manchester Tramways Committee have always, and particularly in recent years, been subjected to very searching examination, notably by the general manager, who thought that Manchester might possibly have done better with a separate traction station. At last, however, after exhaustive discussion they were fully convinced that combination had been justified. Facts and figures were produced to an extent which is impossible in a newspaper controversy, and I submit that in the case of Manchester the tramway manager is of necessity a better judge of the questions discussed than anyone can possibly be writing away from the locale.

Finally, I note that you make no rejoinder to my comment on your assumption of costs being equal, despite differences in physical conditions, financial policies, &c.

Mr. Yerbury, in his comments on tramway power tariffs, completely misses the point at issue. He says my observations respecting Sheffield's costs may be open to incorrect interpretation, and he somewhat irrelevantly notes that Sheffield's accounts are drawn up in the standard form. That is not disputed. Whether I have brought Manchester's costs down to Sheffield's basis, or raised Sheffield's to that of Manchester, is immaterial, provided that I use the correct data for making an equitable comparison. As it is shown below that there are certain omissions from the Sheffield basis, I consider the truer comparison is obtained by bringing Sheffield into line with Manchester. The point is that the latter's charge for traction energy in the Bloom Street area (this being the area fairly comparable with Sheffield) is on the basis of inclusion of all charges incidental thereto, and is for net quantity delivered, whereas Sheffield's accounts, as published, do not, according to Mr. Fearnley, the general manager, include all items corresponding to those in Manchester, and they further show that Sheffield's cost is not calculated on the net quantity delivered, the figure used as a divisor being the gross quantity generated.

To particularise, Sheffield's cost for the year, 1908, as published, amounted to £36,730, and to these, for comparison with Manchester, must be added (1) local rates on ducts, feeders, cable, &c., £1,547, and (2) income-tax, £418 (both as estimated by Mr. Fearnley), £1,965; making a grand total of £38,695.

On the exclusion of items (1) and (2) from the published costs I offer no comment, but insist that if included in Manchester's charge they ought, during comparison, to be put against the Sheffield costs, instead of being left against the general operating expenses of the tramways. Having now arrived at a total expenditure, it is necessary to put the quantities of energy in Manchester and Sheffield on a common basis.

Manchester sells current at the D C. traction bus-bars, and its Bloom Street area is so compact that the losses in transmission do not exceed 6 per cent., whereas Mr. Fearnley puts the Sheffield figure at 10 to 12 per cent.

The total units generated in Sheffield during the year 1908 were 13,192,575, and the units used in works were 1,003,714. The units lost in transmission in Sheffield over and above those in Manchester's Bloom Street area were, say, 6 per cent., or 791,554. Adding these together we have 1,795,268, which taken from the gross quantity generated leave a figure, comparable with Manchester, of 11,397,307.

Dividing the above-named total cost of £38,695 by the 11 million odd units just shown, we have a cost of ·81d. per unit, instead of the oft-quoted figure of ·668d.

Mr. Yerbury's remark as to Sheffield's costs being raised arbitrarily, according to my own judgment, is pointless, seeing that I have merely taken published data, and supplemented that by further data kindly given by his own general manager.

Surely both parties to this discussion are anxious to arrive at the truth, and when it is known that the proportion for rates and taxes shown in Sheffield's costs does not include certain items clearly attributable to power supply, then such items ought for fair comparison to be admitted at once. Also, if, in one case, gross generated figures are used, and in the other net figures, no valid reason can be given against putting them into line.

As to the subject-matter of Mr. Yerbury's forthcoming paper, which will, no doubt, be both interesting and helpful, I will only say that there is nothing debatable in the inclusion of such items as Sheffield's rates on ducts, cables, &c.

S. L. Pearce.

Manchester, *September 27th*, 1909.

[While it is clear that we shall not agree with Mr. Pearce's system of comparison between the Manchester and Glasgow tramways power costs, nor that the Manchester tramways undertaking could not have produced energy since 1902 more cheaply than it has purchased it—everything considered—other matters arise which directly affect the points raised in our original article.

Manchester, with its 67 million units output, its 40,000 KW. of plant in large and economical sets, its all day and all night power load, cannot apparently afford to supply traction energy on a 32 per cent. load factor at less than 1d. per unit.

Mr. Lewis Slattery, of Oldham, in a report of November, 1908 (when the prices were somewhat higher) included two tables, which we reproduce below; one shows the terms on which towns in the neighbourhood of Manchester were supplying much smaller quantities on worse load factors; the other gives some statistics regarding tramway undertakings having their own power plants.

Tramway Undertakings within a radius of, say, 30 miles of Oldham supplied by combined Lighting and Traction Stations.

Town.	Price paid per B O.T. unit.	Gross annual consumption.	Load factor.	Feeder cables belong to and maintained by
Ashton ...	1·25d.	622,913	—	Tramways Dept
Bury ...	1·00d.	2,639,874	21 %	Tramways Dept
Bolton ...	1·10d.	4,110,085	26 %	Tramways Dept
Burnley ...	1·25d.	2,485,800	24·51 %	Electricity Dept
Blackburn ...	1·40d.	2,023,577	—	Tramways Dept
Halifax ...	1·38d.	3,487,643	18·6 %	Electricity Dept
Manch'ter ...	1·143d.	29,955,070	32·7 %	Electricity Dept
Salford ...	1·30d.	8,575,959	—	Electricity Dept
Stockport ...	1·25d.	2,041,084	26·22 %	Electricity Dept
Rochdale* ...	1·00d.	2,064,318	19·2 %	Tramways Dept
Oldham ...	1·50d.	3,888,404	27 %	Tramways Dept

* For every 100,000 units over 700,000.

Tramway Undertakings having their own Power Stations

Town.	Gross annual consumption.	Works costs.	Total cost inc. estab. charges.	Load factor.
Belfast ...	7,402,175	·70d.	·83d.	21·6 %
Birkenhead ...	2,506,392	·74d.	1·037d.	25·44 %
Bournemouth...	2,643,399	1·06d.	1·626d.*	—
Cardiff ...	4,470,748	·368d.	·62d.	37·1 %
Glasgow ...	29,150,391	·353d.	1·191d.†	38·3 %
Huddersfield...	4,097,370	·38d.	·65d.	48 %
Hull	3,617,096	·74d.	·93d.	31·16 %
Leeds	13,231,781	·391d.	·80d.	38·23 %
Leicester ...	5,276,670	·385d.	·628d.	27 %
Preston ...	1,350,828	·384d.	·7d.	52 % approx.
Sheffield ...	12,188,861	·394d.	·668d.	40 %

* High works costs attributable to price paid for and heavy freight charges for coal. † Due to inclusion of £47,500 depreciation.

Mr. Slattery, with an intimate knowledge of Oldham conditions, considered that tramways energy (less than four million units per annum) could be profitably supplied at 1d. per unit, and in view of the tabulated figures given (even though they may not be strictly comparable) one can hardly doubt that there was some justification for his conclusion. Even the Portsmouth tramway plant, using fuel at an average price of 20s. per ton, succeeded last year in supplying 2,590,000 units at ·924d. per unit, inclusive of capital charges.

Mr. Pearce suggests that we ignore the varying conditions of tramway operation; we submit that in the load factor and capital charges these conditions are largely represented. As regards the rating of tramway power plant, we think Mr. Pearce will find that the Glasgow plant is not the only one which can show a comparatively small assessment.—Eds. E.R.]

The Coefficient of Self-Induction.

In your issue of August 6th there appears a review of our book "Vectors and Vector Diagrams," which unfortunately escaped our notice at the time, owing to the holidays. While we do not wish in any sense to call in question the fairness of your reviewer's comments, we think that he has raised one point of considerable importance to electrical engineers, which should not be allowed to remain as an expression of individual opinion only.

We refer to your reviewer's statement that he is unable to accept our treatment of the coefficient of self-induction as outlined by Maxwell, which we have expressed as a complex quantity when it occurs in vector equations. The definition of Maxwell's coefficient, as quoted by your reviewer, is as follows: "That length which, multiplied by half the square of the current in the coil, gives the electromagnetic energy due to that current, stored up in the field." This definition does not appear to us to be inconsistent with the use of a complex number to express the coefficient. For, in the case of an alternating-current circuit in which iron losses affect the value and phase of the current, the ratio between that current and the magnetic flux undoubtedly involves a complex number. By excluding iron losses our form of this coefficient at once reduces to a simple number, as is shown on page 84.

If our view is not correct, it would seem that the use of this coefficient by writers of more importance than ourselves (for instance, Dr. Kapp) has been a mistake, since in ordinary electrical engineering formulæ these writers appear to include in the coefficient the relationship between current and flux. For this reason we think that this matter is of material importance to the electrical engineering profession, and we hope that your reviewer will clear up for us his misgivings on the point.

C. F. Smith,
William Cramp.

Municipal School of Technology,
Manchester, *September 27th*, 1909.

I have read with much interest the above letter. I entirely agree with the authors that the question is one of great importance. Taking warning from the fate of Satni in "False Gods," I must decline the invitation to become an iconoclast. The high priests declare that copper coils near masses of iron have "self-inductance." A "little wisdom" shows that it is practically impossible to calculate this self-inductance. Even if it were possible it would be a far too complicated function of the current to be of any use. "Great wisdom" may show that it is advisable to inculcate a belief amongst youthful electricians in the horrible fetish of a constant self-inductance near masses of iron. If this be the case, I have not yet attained to "great wisdom," and still attempt to teach the young why the assumptions generally made by the priests in order to simplify theory often give results which are approximately true.

I fail to see how the ratio between current and flux can ever be a complex number. If it is, then, surely, either one or both must be imaginary, and if so, why bother about them?

Your Reviewer.

Mining Apparatus.—During the recent session of the Institution of Mining Engineers at Newcastle, a quantity of apparatus designed for use in mines was exhibited. Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, showed their standard safety ironclad switchgear, box-type wrought-ironclad switchgear, the Merz-Price system of protection for cables, and various oil-break switches, gate-end boxes, &c. A demonstration was given of the ignition of a mixture of gas and air in a cast-iron box with wide metal-to-metal flanges, showing that no emission of flame oocurred, though a similar experiment with a box having a defective rubber ring joint was shown to result in the ignition of a gassy atmosphere surrounding the box. Mr. T. C. Futers, 26, Cloth Market, Newcastle-on-Tyne, exhibited a portable hand air-compressor used for blowing dust out of the windings, commutator lugs, &c., of dynamos and motors; this consisted of an air reservoir and pump on a wheeled frame, with which a pressure of 15 to 25 lb. per sq. in. could be maintained, with a nozzle having an aperature of $\frac{1}{32}$ in., attached to a 10-ft. length of hose.

THE ENGINEERING SECTION OF THE BRITISH ASSOCIATION AT WINNIPEG.—II.

[By our Special Commissioner.]

We mentioned in a previous article that a large part of the proceedings were occupied with papers on the working of the grain industry in the Western provinces, and the development of their communications, especially those eastward by water. To make clear our account of this subject, and the bearing on it of these papers, we append a rough sketch map of the country. Canada consists broadly of five sections: A, the Laurentian area; B, the rich Cordilleran region along the Pacific Coast, including the Rocky Mountains to its eastern foothills; C, the district south and east of the great fault which runs through Cabot Strait along the St. Lawrence nearly to Montreal, and then due south through Lake Champlain and the Hudson River to New York; D, the southern promontory of Ontario between Lakes Ontario and Erie on the east, and Huron and the Georgian Bay on the west; E, the great fertile plains lying between A and B which form the provinces of Manitoba, Saskatchewan, and Alberta. To complete the country, the arctic region of tundra and ice should be added, and for administrative purpose the waterways of the St. Lawrence and the lakes, giving water access to the heart of the continent, may be treated as a separate province or department.

Of the above divisions A, called the shield of Canada, is, in the main, an immense wilderness of streams, lakes and forests. It lies all round Hudson's Bay as a centre, and is bounded by a chain of great waters, Baffin's Bay, the Gulf of St. Lawrence, the great lakes, Winnipeg, Athabasca, and the great Slave and Bear Lakes to the Arctic Ocean. It has been swept bare of all recent deposits by glacier ice, leaving vast areas of iceworn Laurentian rocks, and masses of moraine, except where beds of later Archæan or Palæozoic deposits remain over the Laurentian, or igneous rocks have been extruded from below. The principal localities where beds later than the Laurentian rocks remain, and the soil is cultivable though not highly fertile, are in the region round Cobalt, the district S.W. of Hudson's Bay, and that along the north shores of the Upper St. Lawrence and Lake Ontario.

Section B is a mountainous region 350-400 miles wide along the whole of the Pacific Coast, continued southwards through the United States and northwards into Yukon. The valleys and Pacific shore are highly fertile, and the hills contain great mineral wealth. It will become an important market and exporting base for the agricultural products of the wheat growing country.

With Sections C and D we are not immediately concerned.

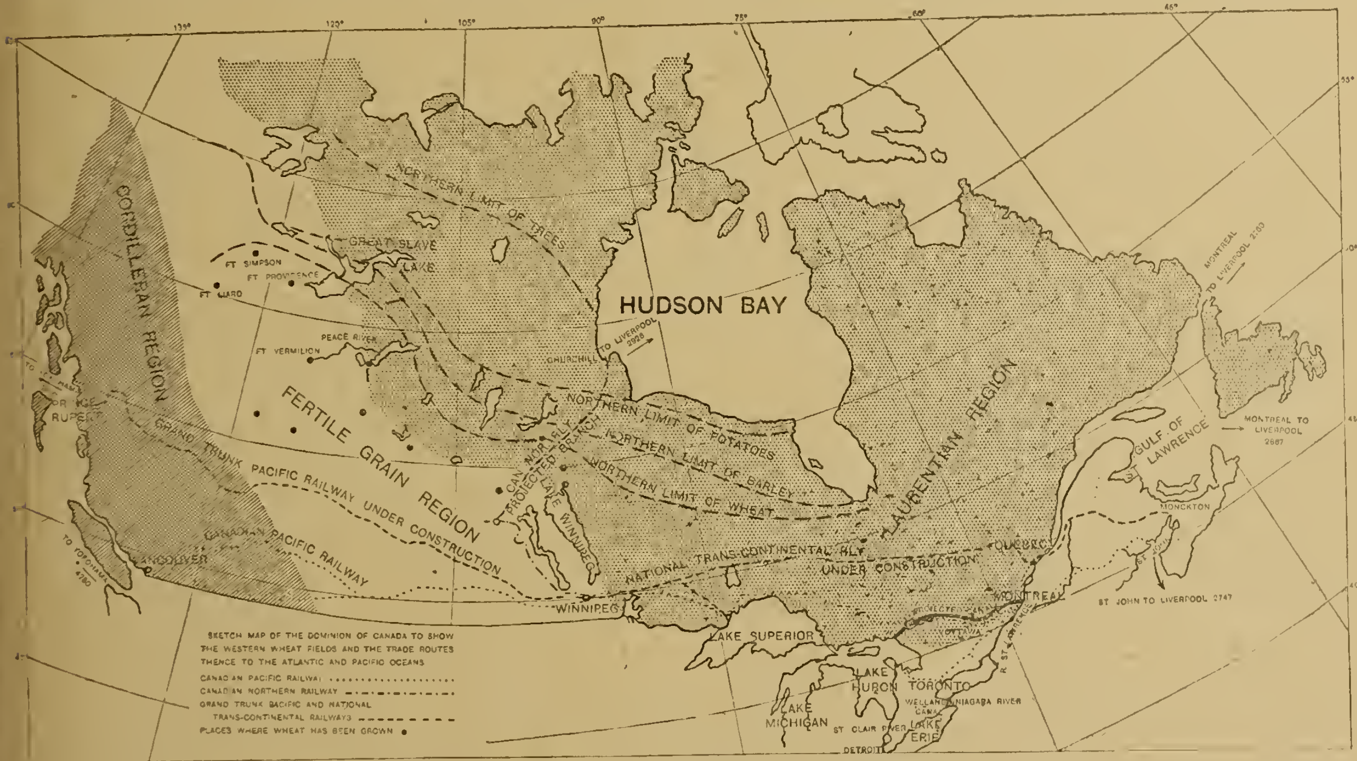
Section E contains the three provinces of Manitoba, Saskatchewan and Alberta, whose wealth and rapid development are occupying so much attention. Geographically, this section is the northern part of the great central plain whose southern part is the valley of the Mississippi, deposited in the Mesozoic period by an inland sea which stretched from the Gulf of Mexico to 60° N. Lat., or to Alaska. Though there is no elevated divide, there is a watershed between streams flowing into the Missouri and Mississippi and those flowing into Hudson Bay, near and along the international boundary line and the 49th parallel. The natural course for eastward communication and transport from this region to Eastern Canada, the eastern cities of the United States and the Atlantic is by the shortest route to the great lakes, and this route is kept north of Lake of the Woods by the political boundary. The eastward traffic passes necessarily between that lake and Lake Winnipeg, and here at the junction of the Red and Assiniboine Rivers, near where the fertile lands march with the barren Laurentian region, is built the City of Winnipeg. For communication with the southern markets of the United States, the present route is by rail from Winnipeg to Minneapolis and St. Paul on the Mississippi. Four hundred miles of railway connect Winnipeg to Port Arthur and Fort William on Lake Superior. All eastwise traffic must pass those places, but Winnipeg is the actual market of the fertile region and Port Arthur is merely a port of transit and shipment, just as later on Winnipeg will be a place of transit to the great cities which will rise farther north and west.

The soil of large areas of these provinces is a peculiar black clayey earth, called in the United States gumbo, and is believed to be a vegetable formation of lacustrine origin. It is very widely distributed in the eastern parts, but less so as the ground rises in the west towards the foothills of the Rockies. To its extraordinary fertility, and to the climate, is due the enormous capacity of the district for growing grain, and especially wheat. The total rainfall is low, averaging about 17 in., too low at first sight for very large crops, but of these 17 in., 13 in. fall in the growing months, April to September. Not only are the crops large, but the quality produced is extraordinarily high. To quote Mr. George Harcourt: "The great stretch of land lying for 1,000 miles along the international boundary from the Red River to the Rocky Mountains enjoys a climate peculiarly its own. The long days of bright sunshine, together with the abundance of nitrogen in the soil, seem to supply just the right combination necessary to produce a clear hard flinty grain possessing a high percentage of gluten." And Mr. Miller writes: "The marvel increases when one learns that at the present time scores of farms that have been cropped continuously for 28 and 30 years (excepting every third and fourth year for a rest), without the aid of artificial fertilisers, are still very fertile. Some idea of the fertility of the soil may be gained from the fact that with few exceptions the oldest farms must when fallowed be tilled only sparingly, lest the next crop grown thereon should fail of too rank growth."

The present output of grain by the three provinces is 240 million bushels (over 6 million tons), a quantity double of the output three or four years ago. But the land so far taken up is only 11¼ million acres, just 5 per cent. of that part of the area of the provinces which is known to be suitable for growing wheat. But those whose business it is to follow these matters are convinced that the area can be extended greatly beyond that, especially to the north. Wheat has been ripened successfully in 62° N. latitude, far north of the area mentioned above, a result due to the Chinooks or warm western winds, blowing off the Pacific and across the Rocky Mountains, which are lower in those latitudes than further south. The isothermals take a strong bend northwards in that region. Wheat grown at the Peace River in N. latitude 56° (Edinburgh) took first prize in the Chicago Exhibition in 1893, and that grown at Chipewÿan in N. latitude 59° (Orkney Islands) took first prize at Philadelphia in 1876. In 1908, 6,000 bushels of wheat raised on a farm in 58½° N. latitude sold at $1·25 the bushel. It is said on the authority of Prof. Macoun, of Ottawa, that wheat can be ripened as far north as 66° N. latitude. Improved agriculture and new kinds of quickly ripening wheat will still further increase the production. It would seem that in the near future the annual yield of these provinces and the territory north of them will much exceed 5,000 million bushels of grain. Much was said in the papers read before the Section at Winnipeg of the organisation for handling the grain, the regulation of the elevators, and the maintenance of standard grades. The machinery for this is organised, works well, and can be extended as required.

But how is this output to be transported away from the country?

Ultimately much of it will go westwards over the Rocky Mountains to the Pacific ports; and when the United States become buyers of wheat instead of sellers, Canadian wheat will go south to the Missouri and the Mississippi. But it seems as if most of it must, in any case, go eastwards, and the bulk is so great that it must travel by water as much as possible, so that provision for water transport to and from these provinces is an urgent question for the Canadian Government.



135°
120°
105°
90°
75°
60°
45°
55°
50°
45°
40°
CORDILLERAN REGION
NORTHERN LIMIT OF TREES
GREAT SLAVE LAKE
FT SIMPSON
FT PROVIDENCE
FT LIARD
PEACE RIVER
FT VERMILION
HUDSON BAY
CHURCHILL
TO LIVERPOOL 2923
FERTILE GRAIN REGION
NORTHERN LIMIT OF POTATOES
NORTHERN LIMIT OF BARLEY
NORTHERN LIMIT OF WHEAT
LAURENTIAN REGION
PR RUPERT
GRAND TRUNK PACIFIC RAILWAY UNDER CONSTRUCTION
CANADIAN PACIFIC RAILWAY
VANCOUVER
TO YOKOHAMA 4280
WINNIPEG
NATIONAL TRANS-CONTINENTAL RLY UNDER CONSTRUCTION
QUEBEC
MONTREAL
MONTREAL TO LIVERPOOL 2760
GULF OF ST LAWRENCE
MONTREAL TO LIVERPOOL 2667
MONCTON
ST JOHN TO LIVERPOOL 2747
LAKE SUPERIOR
LAKE HURON
TORONTO
LAKE MICHIGAN
ST CLAIR RIVER
DETROIT
LAKE ERIE
WELLAND CANAL
NIAGARA RIVER
SKETCH MAP OF THE DOMINION OF CANADA TO SHOW THE WESTERN WHEAT FIELDS AND THE TRADE ROUTES THENCE TO THE ATLANTIC AND PACIFIC OCEANS
CANADIAN PACIFIC RAILWAY ....
CANADIAN NORTHERN RAILWAY -.-.-.-.
GRAND TRUNK PACIFIC AND NATIONAL TRANS-CONTINENTAL RAILWAYS - - - - -
PLACES WHERE WHEAT HAS BEEN GROWN ●

Map Showing the Industrial Features of Canada. Copyright.

The present position is as follows: All grain going eastwards passes by rail *via* Winnipeg to Fort William or Port Arthur on Lake Superior: that is to say, the nearest point for water carriage is 400 miles by rail from the nearest point of the grain-growing provinces. So far, no scheme is proposed for reducing that, and the ports on Lake Superior are the head of navigation at present in view. For Atlantic ports, the grain is shipped from Montreal. The St. Lawrence now carries ships drawing 27½ ft. of water up to Montreal at all states of the tide, and the dredging necessary for a depth of 30 ft. is nearly completed, and that depth will be available next summer. Then the work of increasing the depth to 35 ft. will be begun, which when completed will make the port available for all ships, excepting a very few.

We have now to deal with the lake route between Montreal and Lake Superior. There is no passage for ships on the St. Lawrence above Montreal, owing to the rapids, but ships not exceeding 270 ft. in length, 45 ft. in width, and 14 ft. draught, can pass from Montreal to Lake Ontario by a series of canals on the Canadian side having 21 locks and rising 206 ft. From Ontario into Erie ships of the same dimensions can pass by the Welland Canal parallel to the Niagara River on the Canadian side. Lakes Erie and Huron with the Georgian Bay are on the same level, and the Detroit River between Erie and Huron will carry ships drawing 20 ft. of water. At the Soo between Huron and Superior, locks on both the Canadian and American sides will take ships 600 ft. long, 60 ft. wide, and

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drawing 20 ft. of water. Thus the present navigation provides for ships drawing 20 ft. between Lake Superior and the American ports of Duluth, Chicago, Milwaukee, Detroit and Cleveland, but only much smaller ships, drawing less than 14 ft., can reach Montreal. Either then the grain travels all the way by rail on the C.P.R. to Montreal, there to be delivered through the elevators to the holds of ocean-going steamers, or it travels the whole or part of the way by small boats and undergoes several transhipments.

Clearly the development of the wheat country will be choked unless better means of communication can be provided.

Two schemes are proposed. One is to enlarge the canals and locks between Montreal and Kingston on Lake Ontario, and also the Welland canal between Ontario and Erie to take vessels of the same size as those which can now pass the Soo. The other is to construct a new channel between Montreal and the Georgian Bay by way of the Ottawa River, Lake Nipissing, and the French and Pickerel rivers, this also to take vessels of the same size as can now pass the Soo locks. The distance from Montreal to Georgian Bay would be 440 miles, the rise to the summit level of Lake Nipissing from Montreal would be 659 ft. in 23 locks, and the descent to Georgian Bay 98 ft. in 4 locks. Of the 440 miles, 346 would pass through rivers and lakes, 28 miles would be excavated, and 66 miles would be dredged. The time of passage is estimated at 70 hours for a lake steamer of 12 knots, and the route would be open for seven months of the year.

The latter scheme is likely to be adopted, on the ground that the former plan gives a route liable to be interrupted in the event of political difficulties with the United States. The cost is put at 100 million dollars, and as a set-off against this it is estimated that water powers of a one million horse-power will become available, and could be brought into use at a cost of $50 per horse-power. In addition a large new tract of land will be opened up for settlement. In point of time saved there is not much difference between the two routes, but the Ottawa is a magnificent river, and the new waterway will be a noble addition to the resources of the Dominion when it becomes a regular route for large vessels. The effect of the construction will be that ocean-going steamers of 7,000 tons of the ordinary tramp type will be able to load grain to nearly their full capacity on Lake Superior and complete their cargoes at Montreal for any Atlantic port; while foreign cargo and coal will be carried to the very heart of the Continent in ocean steamers without trans-shipping.

The opening of the Georgian Bay Canal may have another important effect on the Dominion trade. An enormous traffic, 40 million tons per annum, now passes the Sault Ste Marie locks by lake boats carrying iron and copper ore from Lake Superior to Cleveland on Lake Erie for Pittsburg. These boats are of a very peculiar type. They resemble very long barges, being undecked, except at the stern where they have engines and boilers, and at the bows where the crew live in a kind of elevated castle. They are as much as 600 ft. long, and carry loads of 10,000 or 12,000 tons. They are well adapted to lake traffic, but are probably not suited for ocean traffic. Their dimensions, however, have fixed those of the Georgian Bay Canal locks. There is no coal in central Canada (excepting beds of lignite in Manitoba and Saskatchewan), and these lake boats, which are run primarily to carry ore to Pittsburg, bring return cargoes of Pittsburg coal to Lake Superior, and it is from this source that all that part of the continent and the lake steamers get their supplies. The opening of a deep water route from the St. Lawrence may enable Cape Breton to send coal to Lake Superior as return cargo for the grain ships. This will remove the disadvantage under which the Canadian lake boats at present suffer, viz., that they have no return cargo for the westward voyage, while the American boats carry coal from Cleveland. Similarly in the West, the British Columbia, and Rocky Mountain mines can supply Alberta and Saskatchewan.

Besides the Georgian Bay Canal another route to the Atlantic is contemplated—that by Hudson's Bay, and a branch line 550 miles in length has been surveyed connecting the nearest point in the grain district on the Canadian Northern Railway to the mouth of the Churchill River on Hudson's Bay. The value of this route will depend no doubt upon the average time during which it would be closed by ice in Hudson's Strait or by shore ice at the port. There is, moreover, more than one continuous waterway between Lake Winnipeg and Hudson's Bay, and the Saskatchewan River runs from the Foot Hills of the Rockies into Winnipeg. Canadians look to some of these routes being made navigable in the future, so that grain can be shipped from the heart of any of the provinces.

For the development of the provinces, water transport is necessary for the heavy grain cargoes; but, as in the past so in the future, the railways must open up new lands, carry on communications, and collect and distribute the trade of the ports. Western Canada has grown up with the C.P. Railway, and Lord Strathcona is king in Winnipeg. But Canadians intend that the development of the country shall not be hindered by the establishment of commercial monopolies, and partly with the idea of opening competition with the C.P. Railway, partly from Liberal party motives of having something to set off against the great work of the Conservative party in building that line, but largely no doubt from the sheer necessity of providing more railway facilities, a new line is under construction from Monckton at the head of the Bay of Fundy to a new port, Prince Rupert, on the Pacific. The route runs more or less parallel to the C.P. Railway, crossing the St. Lawrence above Quebec, where the great cantilever bridge has failed under construction, passes through Winnipeg, and connects with Port Arthur, but except at Quebec running wide of the St. Lawrence and Ontario ports through new country. From Monckton to Winnipeg, about 1,900 miles, the line is being constructed by the Dominion Government, and is called the National Trans-Continental Railway; and beyond Winnipeg to the coast by the Grand Trunk Pacific Railway Co. Both the C.P.R. and this new line look to competing with the water routes for the carriage of grain, and at certain rates will no doubt obtain their share of the traffic. The essential condition for economical working of the heavy train loads is that the gradients shall be easy. The Trans-Continental Railway—we take our figures from Mr. Duncan MacPherson's paper—look to drawing single train loads of 4,290 tons gross, 2,860 tons net (nearly 100,000 bushels of wheat) behind one engine (Mallet articulated compound) by keeping the gradients to a maximum of ·4 per cent., compensated for curves; and they have maintained this throughout the whole distance except in two places of 12½ and 10 miles in length respectively, where gradients of 1·1 per cent., adverse to east-bound traffic, are permitted in view of the very large economies in construction obtained thereby. They reckon on carrying wheat profitably from Winnipeg to Quebec, 1,351 miles, for 4·25 cents per bushel, 1s. 5d. per quarter, or, say, 17 ton-miles for 1d.

Similarly an elaborate paper by Mr. T. E. Schwitzer contained an account of two great works on the C.P.R., near the Rockies. One is the Lethbridge Viaduct, more than a mile long and over 300 ft. high, and the other the grade revision in the Kicking Horse Pass. The viaduct is a piece of economical reconstruction, which will pay immediately for itself, but the grade revision is a costly piece of work, involving two long spiral tunnels, and is only justified by the prospect of economy in hauling the heavy traffic anticipated in the future. The present 4·5 per cent. grade over 3·7 miles is reduced to a 2·2 per cent. grade over 7·5 miles, which allows two engines to draw 980 tons, where four engines are now required to draw 700 tons.

The papers on Canadian problems, of which we have attempted to give a general account, were the following:—

Sir W. H. White, K.C.B.—Presidential Address.

Lt.-Col. W. P. Anderson, M.Inst.C.E., Chief Engineer of the Department of Marine and Fisheries.—"Improvements in the Navigation of the St. Lawrance."

Report of the Commission on the Georgian Bay Canal Scheme—Abstract prepared for the Section.

Major G. Stephens.—"The St. Lawrence River, the Great Imperial Highway."

T. E. Schwitzer, Assistant Chief Engineer, C.P. Railway.—"Recent Engineering Works on the Canadian Pacific Railway."

Duncan MacPherson, M.Inst.C.E.—"The National Trans-Continental Railway."

George Harcourt, Deputy Minister of Agriculture, Province of Alberta.—"The Development of the Grain Industry of Western Canada and its Future Possibilities."

W. H. Lanigan, Assistant Freight Traffic Manager, C.P. Railway. —"The Transportation of Grain."

John Miller, Experimental Farm, Indian Head, Saskatchewan.—The Development of the Grain Industry in the West, and Grain Storage."

W. A. P.

The Municipal Hydro-Electric Works of the City of Winnipeg.*

THE present Public Utilities Co. which is operating in and around he City of Winnipeg, has a monopoly of such a nature that the municipal authorities have decided not to await the expiration of the present franchises, which would enable the city to assume control either of these present properties, or to arrange new agreements for further control of rates. The only other course logically open was to create competition, for the reason that the cost of fuel in Winnipeg is excessive and does not offer effective means of competition in itself by the private production of electric energy. This competition might have been created by chartering a second company for the production and sale of hydro-electric energy, but the history of such efforts has usually been that of amalgamation, and a repetition of monopoly. Whether or not such or any monopoly is, or is not, when regulated, for the best interests of a city, need not be discussed here, but the decision was reached in 1905 to construct municipal works, for the purpose of creating the competitive condition desired.

In that year a careful examination was made of the hydraulic resources of the Winnipeg River, which has its chief gathering grounds in the lake country of Western Ontario, and which flows through the eastern portions of the Province of Manitoba and empties into Lake Winnipeg, after passing through a rock-ribbed country very suitable for such works as were contemplated. The report presented justified the city authorities in making contour surveys of the most promising power sites, which were performed during the following winter, after which followed engineers' estimates of cost in April, 1906, and a popular vote of $3,250,000 in June, 1906, which indicated clearly the then desire of the property owners of the city, which was to expend the above-mentioned sum on municipal hydro-electric works.

In October, 1906, the designs for works were begun, and it was then contemplated to complete the same in 2½ years; the financial stringency of 1907 caused a set back of over a year, but the construction is now being vigorously prosecuted, over $500,000 has been expended, and further contracts of over $1,000,000 are now in process of completion, whilst further contracts for equipment and distribution are soon to be placed, and it is contemplated to have the works in operation ready for delivering power within the next 18 months.

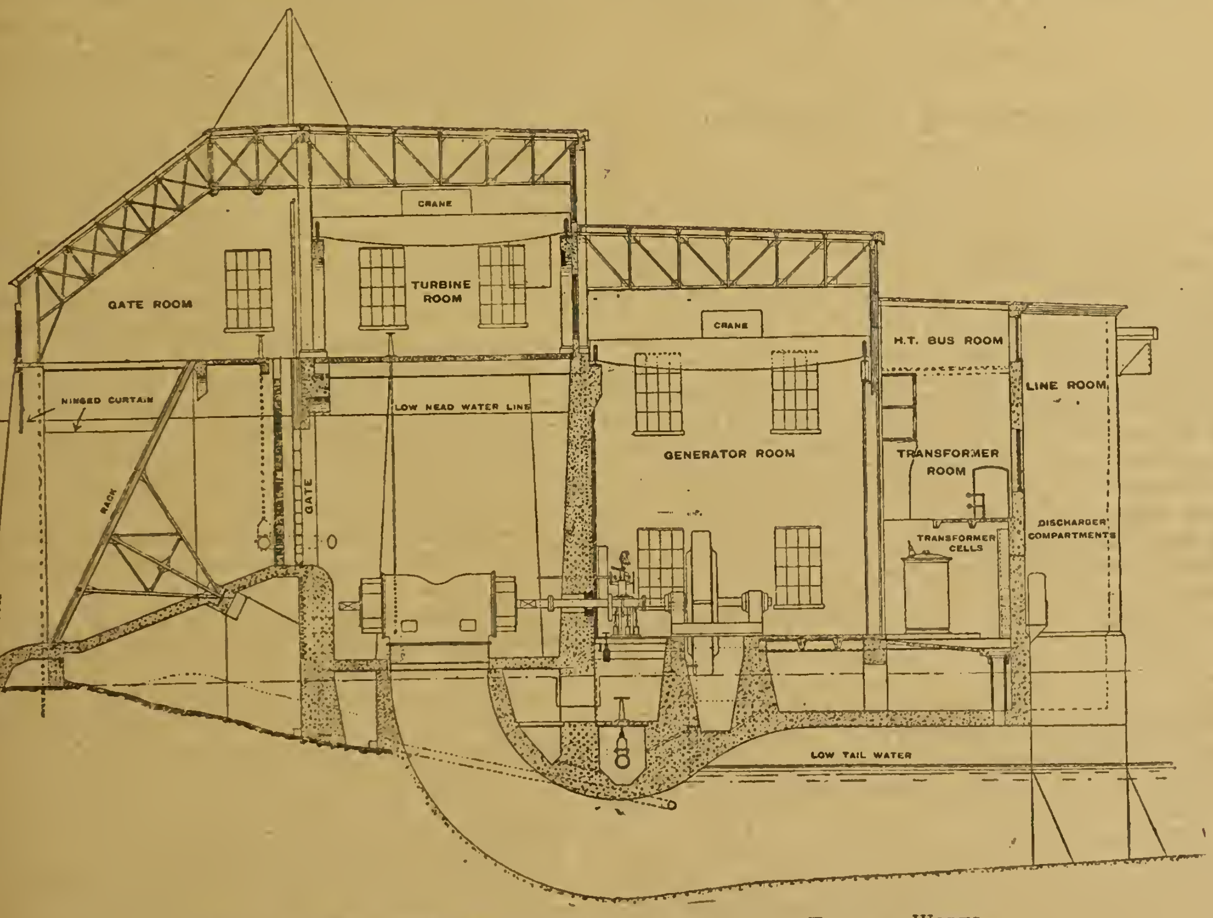
The undertaking will consist, when completed, of the following :—

A 60,000-H.P. generating station, operating under 45 ft. to 46 ft. of hydraulic head; a 77-mile transmission, consisting of four three-phase circuits carried on two series of double-circuit steel towers with concrete footings; a terminal station in the city, at which the pressure of the current transmitted will be reduced to 11,000 volts. An underground cable distribution to three or more sub-stations, where the pressure will be reduced to 2,200 volts and or 550 volts; and a secondary underground and overground distribution to customers. The distribution has not yet been studied in detail.

At Point du Bois there is a large lake adjacent to the head gates, a contour favourable to economical works, rock foundations for all constructions, and a difference of hydraulic level which will be practically constant. The water is free of silt and other objectionable matter.

After studying various possible designs, it was decided to build concrete overflow walls, a rock-filled dam, and a power house with wheel pits built as an integral part of the head block, and a transformer station, also integral with the power house itself. Further consideration of cost and climate gave as a result an enclosed forebay room, and double runner turbine units of 5,200 H.P. capacity each, at a speed of 164 R.P.M., also motor-operated head gates protected by stop log arrangements; the whole power house is again protected by head-gate piers in the canal, by which the canal can be unwatered by the use of stop logs.

The generating room will ultimately contain two turbine-driven exciters of 250 KW. each, two motor-driven exciters of the same capacity, and 16 main generator units of 3,000 K.V.A. each, operating at 6,600 volts, 60 cycles, three-phase; of the above, five main units and two exciters are to be now installed. These generating units will be so arranged as to be operative in groups of three per bank in accordance with a similar grouping of the step-up transformers. Electric travelling cranes of suitable capacity will be installed in the generator and turbine rooms.



Sectional View of the New Winnipeg Municipal Hydro-Electric Works.

The generating station will be built throughout of reinforced concrete upon plain concrete tailrace walls. A cross-section of the building is shown upon which will be observed the natural arrangement of the equipment and the resulting simplicity of the station design.

The transmission system will be constructed upon a 100-ft. private right-of-way, and by the shortest feasible route. The towers are built up of structural shapes in an economical design and are of two types—braced (in which the spread of the base is about one-fourth the height of the tower) and flexible, consisting of channel irons supported in a plane normal to the axis of the wires; both types will be supported upon rigid concrete footings. Each line of towers will support two three-phase circuits of aluminium cable mounted upon pin type insulators.

A single-circuit telephone line will parallel the transmission line upon cedar poles.

The terminal station in Winnipeg will receive power at 60,000 volts, and will deliver it to sub-stations at 11,000 volts, by means of a three-conductor underground cable system.

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* Abstract of brochure issued at the B.A. meeting at Winnipeg.

The transformers will be of the water-cooled type in both generating and terminal stations, but of the water circulating class in the former, and of the oil circulating type in the latter station.

The high-tension bus-bar system in both stations will be of the open type. In both stations a very complete system of switching will afford the maximum of flexibility.

Twenty-five miles of standard-gauge railway were constructed from Lac du Bonnet to the power station site. A small equipment, the property of the city, is now in operation thereupon.

Upon the completion of the plant, there will be an immediate market for a considerable block of the generated power, as the city is widely spread and is rapidly growing. Its street lighting and public building services will be supplied, and it will use its own electric power for pumping its water supply. This supply is obtained from a series of artesian wells, each already equipped with electrically-driven pumps. The problems of sewage disposal will also require the use of a pumping system before many years.

In addition to the municipal and other public services, there is a rapidly growing demand for electric power for manufacturing, and to this market the city supply will be offered at attractive prices. Even now there are in operation in Winnipeg steam plants whose aggregate demand approximates 15,000 H.P.; and the development of the vast country to the west of the city, combined with the very high freight rates from the east to Winnipeg, and the consequent cost of fuel, all tend to force a rapid increase in the application of electricity here.

The authorities placed the design and construction in the hands of Mr. Cecil B. Smith, Ma.E., of Toronto, Ontario, now of the engineering firm of Smith, Kerry & Chace. The City Council also retained as a board of consulting engineers Messrs. Col. H. N. Ruttan, C.E., of Winnipeg; William Kennedy, junr., C.E., of Montreal, and Prof. L. A. Herdt, E.E., of Montreal, Canada.

DAMAGE BY LIGHTNING.

[COMMUNICATED.]

If the storm wreckage of the past few months is any criterion for the remainder of this year, the number of buildings damaged by lightning will be well above the average.

Anyone glancing through the morning papers, or, better still, who is in touch with some newspaper-cutting bureau, may keep himself posted concerning the disasters that occur with unfailing frequency—first in one county and then in another. Reliable data, with observations thereon, are published from time to time, which, if generally studied, would be the means of dispelling superstition and of disseminating information. Firmly established theories always die hard, false though they may be, and this statement is particularly true in regard to the protection of buildings from the damaging effects of lightning. Suppose the whole of the disasters—say for one year—were recorded in the columns of the Electrical Review, detailing the circumstances from a scientific point of view without regard to journalistic trimming, what useful purpose would be served? Many good lessons would undoubtedly be learned, but the record would be valuable chiefly as an illustration of the fact that the demolition of buildings, due to lightning stroke, was in every case preventible.

Whilst it is true that the ingenuity of man has not yet devised a scheme whereby the severity of a lightning storm can be controlled, it is quite possible to mitigate and even nullify its dire effects. The only known means of ensuring safety to property is the system propounded by Dr. Benjamin Franklin more than 150 years ago, namely, the placing of metal rods a foot or so above the loftiest pinnacles, continuing the lines of conduction into moist ground, and there extending them as circumstances may dictate, so as to obtain a low resistance.

There is a limited sense in which the severity of a lightning storm can be minimised, this being possible when buildings are liberally supplied with pointed conductors in the vicinity of a storm cloud. These tend to prevent a disruptive discharge when the sky is overcast and the elements become charged with electricity. Hence the more lightning rods there are below a thunder cloud, the less severe will be the storm. Some writers have gone to the extent of asserting that a perfect conductor ought never to be struck. This is, of course, untenable, but it may safely be maintained that every lightning conductor in the storm zone is making a persevering effort to effect equilibration before the tension has attained a dangerous magnitude.

In this respect the function of a lightning rod may be likened to that of a safety valve which enables the steam to escape from the boiler before it has risen to an explosive pressure.

Present day knowledge of the laws governing the phenomena of lightning, though yet meagre enough, is far in advance of the knowledge possessed by the famous Philadelphian printer; indeed, it is no exaggeration to say that much light has been thrown upon the subject during the past 10 years. Whether that knowledge is sufficiently diffused to bring about a diminution in the number of buildings damaged by lightning is another question. It may be taken for granted, however, that whenever a lightning conductor system has failed, a competent authority could have predicted the result as easily as a journalist could have described the accident afterwards. Some glaring defects must have existed, either in its initial application or through subsequent deterioration, that would fully account for the accident.

Is it not a fact that plumbers, building contractors, and steeple jacks, secure a large number of contracts for the protection of buildings, while the man who proposes to install a conductor system based upon a long experience, and who would apply that system in a scientific manner, is ruled out of consideration because his estimate does not happen to be the lowest? Sometimes one comes across limestone chippings that have been sprinkled about a copper earth plate *to keep it dry!* In others the conductor rope is terminated in an earthenware drain *to keep it wet!* A third contractor points with pride to the perforations he has had made in the earth plate, so as to afford a readier means for the "electric fluid" to escape! A fourth gentleman in this line of business makes it his boast that every conductor installed by him continues in a high state of efficiency, the secret of his success being due in no small measure to his having discarded the use of solder!

Another person in the building trade responsible for the protection of a six-storied building had read somewhere that "a copper conductor is not so good as an iron one; it does not damp out the oscillations; it lets the current down too suddenly, and is liable to side flashes." Hence a brilliant idea passed through his fertile mind. Seeing that there was an iron fire escape fastened to the wall side, why not forego the expense of a copper conductor, and fasten the finial rod above the apex in the usual way, connecting the lower end of it to the iron fire ladder by means of a short length of metal tape? In this ingenious fashion he tried to convert the fire escape into a lightning conductor.

The multitudinous dry joints down the zigzag iron ladder seemed no objection to this enterprising contractor, and when the work was finished the resistance, which was variable, measured 1,600 ohms. Truly a little learning is a dangerous thing. "False science," says Arago, "is no less dangerous than complete ignorance, and it infallibly leads to consequences which there is nothing to justify."

The marvel is that only about 2 per cent. of the buildings fitted with conductors are ever damaged by lightning stroke. This proportion, compared with that in the case of structures left entirely unprotected, is at least a valuable testimony to the usefulness of conductors, even though improperly applied. Yet it is beyond dispute that the practice of guarding against the effects of lightning is not so general as was the case some years ago. The question naturally arises, what is the reason that so many people owning valuable property seem disinclined to avail themselves of the recognised protective devices? Perhaps the two following instances, culled from the daily papers, may afford a clue to the mystery, and since both mishaps are typical of others that could be cited, a perusal of the same should give rise to reflection and speculation:—

1. During a heavy thunderstorm the parish church . . . was seriously damaged by lightning, the weather-vane and a portion of the spire being demolished. Masses of masonry fell through the roof of the church, which was wrecked, and considerable damage was done to the belfry. It is feared that the steeple will have to be rebuilt, as there is a bad crack extending towards the base. The church was recently restored, but owing to lack of funds, a lightning conductor was not then fixed.

2. One flash of lightning more vivid than the rest, quickly followed by a heavy peal of thunder, caused a

gentleman at . . . to exclaim : "That's hit something !" A minute later, the telephone bell rang, and the gentleman referred to was informed that his works chimney, 120 ft. high, had been almost shattered by lightning. On going to the workshops a scene of wreckage presented itself. Broken brick work was strewn up and down, some of which had been hurled a distance of 50 yards, causing much damage to neighbouring property. So bad is the rent from the chimney cap downwards that the chimney will have to be razed. A lightning conductor had not been provided.

One cannot but express regret at reading of a church being damaged by lightning, especially when owing to economical considerations a lightning conductor had not previously been installed. Churches and chapels not being dividend-making concerns are often burdened with debt ; and even if free from pecuniary embarrassment, the ecclesiastical authorities are usually busy in the promotion of schemes that will involve them in debt. Nevertheless, it is a false economy to disregard the possible effects of lightning as many church officials know to their regret. If the provision of lightning conductors to buildings were postponed because of the initial cost, or on account of indifference, such a state of affairs would indicate the need for pioneer work on the part of those qualified electrical engineers who make a speciality of the business. In soliciting orders, it should not be difficult to prove that in rendering their clients secure they are conferring a benefit on them commensurate with the benefit derived from them.

It is surprising how many people neglect the provision of lightning conductors because the importance of the subject has never been brought before their notice. To appeal to the instinct of fear is neither desirable nor necessary, as such an appeal would merely exert a disturbing influence of a temporary character upon the mind. A scientific presentation of the situation will, in many cases, induce the clergy, property owners, &c., to realise the danger they are running, and to inquire how that danger may be averted.

Reference has been made to indifference as a reason why people do not instal conductors to a greater extent than could be desired. Indifference is due to a variety of causes. In its crudest form it arises through ignorance ; but this cannot surely be the general reason why so much apathy prevails respecting the subject under consideration. A state of indifference is sometimes the result of an intelligent inquiry. After reading the conflicting opinions of those who "know," an impression is formed upon the mind of the inquirer that the subject is remote from anything that matters.

How many authors have been responsible for leading their non-technical friends to assume an attitude of indifference concerning the value of lightning conductors, it would, of course, be impossible to say. Some writers have a style so lucid that the reader is carried away with rhetorical music.

As an instance, it has often been asserted that "if a conductor is faulty it constitutes a menace to property." In order to present the cases fairly, a few *bonâ fide* extracts are appended. The number could be multiplied without difficulty did time and space permit.

"(*a*) It is better for any building, factories in particular, to be without any lightning conductor at all than to be fitted with such as are defective or badly planned."

"(*b*) In judging the danger from lightning, the following local conditions should be taken into consideration :—The danger is heightened by the presence of old and useless conductors."

"(*c*) It may be taken for granted that a building, if fitted with an imperfect conductor, is in a more unsafe condition than if none existed."

"(*d*) It has been conclusively proved that lightning conductors are worthless as a safeguard against lightning."

Some of these sentences sound like decrees ; there is an authoritative mannerism about them which is apt to dominate the uncritical mind. In determining their collective value an elementary test should be applied, namely, the test of accuracy. In this connection it is a curious feature that those who regard a building with a faulty lightning conductor as being in a more unsafe condition than it would be without one, do not attempt to justify their statements. Personal investigation into the circumstances "of damage by lightning" leads to a conclusion the opposite of those before mentioned. Consider the following case :—A lightning flash struck the vane of a country church, the spire of which had been fitted with a conductor 30 years previously. Owing to long neglect, or perhaps to theft, the conductor was severed above the porch ; below that point it was missing. Apparently the flash had struck the vane, traversed the metal rope until it was "side-tracked" above the doorway, whence it ran along an iron rain-gutter, tearing the latter from its fastenings. Then it followed the metal down spout and afterwards crashed through the wall with explosive force, igniting a composition gas pipe on the other side, eventually causing—as a secondary effect—a fire among some furniture.

To argue from the particulars furnished that the church would have been safer without a conductor would be contrary to sound reasoning. Notwithstanding the palpable defect already referred to, the *presence of the conductor from the vane downward saved the church spire from destruction*, and if only the lower part had been metallically continuous to the earth, it may be safely surmised that no harm would have befallen the edifice.

In the month of May, 1751, a pamphlet was published in London, entitled "New Experiments and Observations on Electricity," made in Philadelphia, in America, by "Benjamin Franklin." One of the incidents recorded in that old-time essay is quite relevant to the question at issue, and should, therefore, be of special interest :—

"The second conductor which Franklin constructed was placed upon the house of Mr. West, a wealthy merchant of Philadelphia. A few months after this had been erected, a storm burst over the town, and a flash of lightning was seen to strike the point of the conductor and to spread itself out as a sheet of flame at its base. It was afterwards found that about 2½ in. of the brass point had been dissipated into the air and that immediately beneath, the metal was melted into the form of an irregular blunt cap. The house, nevertheless, was quite uninjured.

The sheet of flame seen at the base of the conductor, Franklin correctly ascribed to the ground having been very dry, and to there not having been a sufficiently capacious earth contact under the circumstances. He nevertheless shrewdly and quite justifiably assumed that in this case nature had itself pronounced an unmistakable verdict in favour of his invention.

Speaking generally, thunderstorms are much more severe in the United States than in this country. Yet the principle involved is the same here as elsewhere. Lightning is not erratic ; it is governed by law. A flash will take the path of low resistance in preference to a high one, whence it follows that a building is far safer with a metal conductor fixed thereto—even though it may be defective in certain particulars—than if no conductor existed.

In an interesting letter to the Electrical Review, dated August 31st, 1907, Mr. Alfred Hands, F.R.M.S., very properly maintained that a lightning conductor might be in such a bad state that the upper and lower parts were missing ; but to assert that it was worse than none at all would be to argue that partial damage would be necessarily greater than complete wreckage of the building from top to bottom. He regarded almost any conductor as better than none, though it might be so bad as to be almost useless.

Seeing that there is no foundation for the erroneous theory so often propounded that a defective conductor is a menace to property, it is extremely unfortunate that technical writers are occasionally found stating as true what science and experience has shown to be false. Hence there need be no surprise at the indifference of the general public. The latter, being unacquainted with the technique of the business, will incline to the view that if their buildings are only safe while the conductors are perfect, the time may come when they will get out of order, and the last end will be worse than the first.

Let it not be assumed that we are under-rating the importance of a properly-planned conductor system. Unless this is seen to in the first case, there is a risk involved—and a risk that need not be incurred if the precaution is taken of having (1) an installation fitted by a recognised expert, and (2) by insisting upon a periodical inspection and test afterwards.

The value of a periodical inspection is, perhaps, scarcely appreciated. Rain spouts are cleaned and painted at regular intervals, but a lightning conductor is expected to continue in a perfect condition without attention through an indefinite period. To be more precise, the existence of the lightning conductor is entirely overlooked when once it is installed.

A conductor system may have been fitted in a perfect manner; it may have been tested regularly twice per year, and the resistance, compared with previous readings, found unaltered, and yet in the meantime some alteration to gas or water supply pipes—inside or outside the structure—may have been made which has rendered the system inefficient, notwithstanding the satisfactory tests. These faults can only be discovered by a periodical inspection, and a careful consideration of the problem in its altered phase. That this is no fanciful theory unsubstantiated by fact, could be easily shown. Petroleum barrels are sometimes stacked in a corner where the conductor is cleated to the wall, the iron hoops encircling the barrels being inadvertently left within sparking distance of the lightning conductor; in others, gas pipes have been fastened to the chimney brickwork for support, and left in metallic contact with the conductor. Mistakes of this kind are generally caused by yard labourers or by gasfitters, who are unfamiliar with the precautions that ought to be taken. Men in humble positions, however, are not alone in arriving at wrong conclusions, as may be gathered from what is hereafter stated.

A number of gentlemen interested in the science of lightning once formed the opinion that Sir Oliver Lodge, F.R.S., had identified himself with those who regarded a faulty conductor as being worse than useless. A meaning had evidently been given to his words, different from that which he intended them to express; but that distinguished scientist issued a disclaimer in language the most emphatic.

REVIEWS.

The Design and Construction of Induction Coils. By A. F. Collins. New York: Munn & Co. Price $3 net.

Coming at the end of a fairly long sequence of books on the induction coil which have been published from time to time, this latest addition by an American author is far and away the most practical and useful treatise on the subject that we have seen. With the advent and rapid development of radiography, and, later, wireless telegraphy, the old rule-of-thumb system as applied to coil construction in this country has given place to exact methods of design and construction, in which the underlying principles of the induction coil as a means for producing currents of high potential have been carefully studied and properly applied.

In this matter of coil construction the American system differs materially from that in favour in this country, American coils being of less expensive design and construction, whilst at the same time equally as efficient as the higher class productions of our leading manufacturers.

The book under notice takes the form of a carefully-detailed specification for the construction of eight different sizes of coils, of capacities ranging from a ½-in. to a 12-in. spark length. These are covered by three separate and distinct designs, according to the size of the coil, and every conceivable detail is included and its dimensions recorded for the guidance of both amateur and professional coil builder.

The first two chapters, dealing with historical and theoretical considerations, are commendably brief, having regard to the fact that most prospective makers of such coils are already familiar with the elementary principles of the subject. Chapter III discusses preliminaries, and includes some useful hints and advice bearing on the ultimate purpose for which the finished coil is intended. The author's plaint on p. 25, concerning the present unsatisfactory method of rating induction coils according to spark length is well founded, and at the present stage of the coil-making industry it might well be amended. Instructive features of this chapter are the curves illustrating the effect of varying the quantity of iron in the core, and the capacity around the break respectively.

From this point, commencing with Chapter IV, the general scheme of the book, which has been most efficiently carried out, consists in devoting a chapter to each stage in the process of coil building, as, *e.g.*, "Forming the Soft Iron Core," "Winding the Primary," "Insulation between Coils," "Winding the Secondary," &c. Each of these chapters includes a table or tables, giving the exact dimensions, weight, or any other data necessary, of each and every detail for the whole series of eight coils; from this it will be gathered that very little is left to the imagination, and, in point of fact, the most unskilled amateur should experience little difficulty in building a very serviceable and efficient coil with the aid of this book.

On p. 73 is described a method of plotting the maximum field of force as a guide in graduating the secondary winding. Although by no means original, we do not recall having come across it before in a text-book on the subject of coils; the author has, however, ignored the trembler which, when in action, has the effect of distorting the field to some extent at one end of the coil.

In the treatment of coils after winding, we are pleased to note the inclusion of a chapter on vacuum drying and impregnating apparatus; it is, however, somewhat brief, and conveys only a rough idea of this now almost universal system of treating coils. In the section on interrupters, we are rather surprised to find no reference to the higher frequency mercury and electrolytic breaks, the subject being dismissed in a subsequent chapter with a few words relative to their heavy current consumption. Only three of the simplest spring interrupters are described in Chapter X, as most applicable to the whole series of eight coils. The subject might have been enlarged upon with advantage.

As regards the condenser, we commend the sub-divided principle of construction, as recommended for the larger coils. This section is particularly well written, and should be of great assistance to the coil builder in helping him over what often proves the most troublesome detail of the whole equipment. The final chapters on wiring diagrams and sketch plans for assembling the coils are also particularly clear.

Chapter XIX, on the cost and purchase of materials, is an ultra-refinement, which, whilst rendering the book complete in every detail, is calculated soon to become obsolete, owing to fluctuations in the market. Of far greater value is the final Chapter XX, comprising over 30 pages of most useful tables and formulæ bearing on every branch of induction coil design and construction.

We have nothing but praise for the publishers' share in the production of this book; the printing and illustrations are commendably clear, and afford evidence of careful revision, whilst the various tables of contents are particularly thorough as aids to ready reference.

The Gas, Petrol, and Oil Engine. Vol. I. New and Revised Edition. Thermodynamics of the Gas, Petrol, and Oil Engine. By Dugald Clerk, F.R.S., M.Inst.C.E. London: Longmans, Green & Co. 1909. Price 12s. 6d. net.

The first edition of this work appeared in 1886, under the title of "The Gas Engine," and later, with considerable additions, in 1896, as "The Gas and Oil Engine," but owing to the rapid development of the science and practice of the internal combustion engine, the present edition has practically been re-written and divided into two volumes. The first 50 pages of Vol. I give an historical sketch of the gas, petrol, and oil engine up to 1908 in a condensed and practical manner, which will be found interesting and useful to internal combustion engine students and designers.

The modern large-power gas engine is shown to have resulted from the successful working of gas of low heating power, combined with increase in compression pressures.

A notable advance in gas engine proportions was the Cockerill engine of 1899, a single cylinder of 51·2 in. diameter, developing 600 H.P. with blast-furnace gas, and since then the scope of this system of power development has rapidly advanced in directions quite outside those previously commanded by gas and oil engines. The rest of the volume is chiefly devoted to the thermodynamics of the internal combustion engine, including the principal experiments upon the causes of loss in gas engine cylinders; combustion and explosion under various conditions, and with different mixtures of combustibles with air; and the cooling of the products of explosion in closed vessels, and behind a moving piston. Mathematics are only introduced to a minimum extent necessary to apply the laws involved, and this enhances the value of the work as a ready reference book, for while all the most recent experiments are recorded, the results arrived at can be consulted without having to wade through a mass of figures. Appendices include much valuable information, including the Report of the British Association Committee on Gaseous Explosions, Dublin, 1908.

Seeing that the time occupied by a single complete stroke of the piston in small cylinders ranges down to less than 0·02 second, and that the maximum pressure due to the explosion may be about one-fifth of the stroke, this allows 0·004 second in which complete (?) combustion has to be effected, and on page 113 we find that the velocity of flame propagation for hydrogen (2 vols. H + 1 vol. O) is 34 metres per second, which is equivalent to 5·46 in. in 0·004 sec.; however, this rate is much increased at constant volume (page 116), and the least time to reach maximum pressure of any combustible experimented with was 0·01 second, while petrol and air in a closed vessel occupied 0·058 second, from which it would appear that the conditions obtaining in gas engine cylinders are not in line with those under which the experiments reported were made, or that only partial combustion results from high speeds of revolution.

While a study of the volume shows that there is still much to be found out in relation to the thermodynamics of the internal combustion engine, it also, in an admirable manner, shows what valuable work is being done in this direction.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Cable Suspender.

A new suspender for heavy cables has just been brought out by Messrs. W. T. Glover & Co., Ltd., of Trafford Park, Manchester,

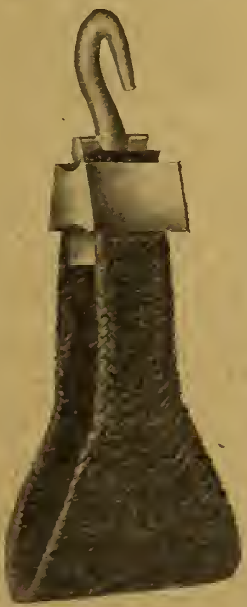

Fig. 1.—Glover's Cable Suspender.

in which the eyelet principle has been abandoned in favour of the wedge, as shown in fig. 1.

The sling is of sheet lead braided with compounded yarn, and shaped to give a wide bearing for the cable; the hook and collar are of galvanised steel, carefully designed so that the ends of the sling are not bent where they enter the collar, and the strain is uniformly distributed over the whole sectional area of the ends of the sling. The hooks slide readily along the span wire, but the slings do not slip along the cable, so that there is no fear of their getting out of position when erecting the latter; neither will the slings come adrift from the hooks. The design is evidently mechanically sound, and the suspender appears admirably adapted to its purpose.

Jandus Regenerative Arc Lamp.

A new and improved pattern of their "regenerative" flame arc lamp has been brought out by the Jandus Arc Lamp and Electric Co., Ltd., of Hartham Road, Holloway, N. As explained in our first notice of this lamp (March 6th, 1908, page 415), it is of the enclosed type—the only enclosed flame arc made, we believe—and the globe is provided with side tubes for the purpose of circulating the fumes and gases generated, with the view of preventing their deposit on the mechanism or globe, and of subjecting them repeatedly to the action of the arc in order to increase the life of the carbons. The positive, or lower, carbon, is of star section, the grooves between the eight rays of the star being filled with a composition of calcium fluoride and tungstate, and salts of sodium and

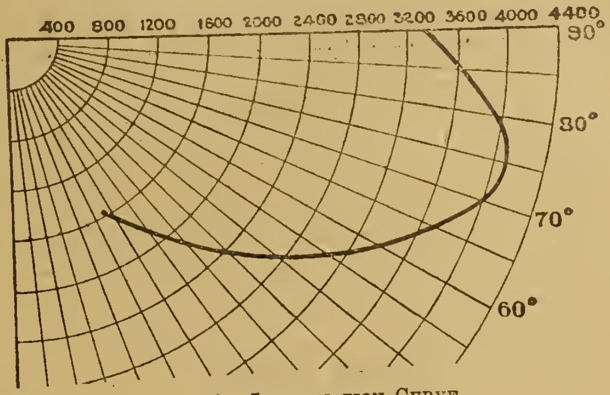

Fig. 2.—Illumination Curve.

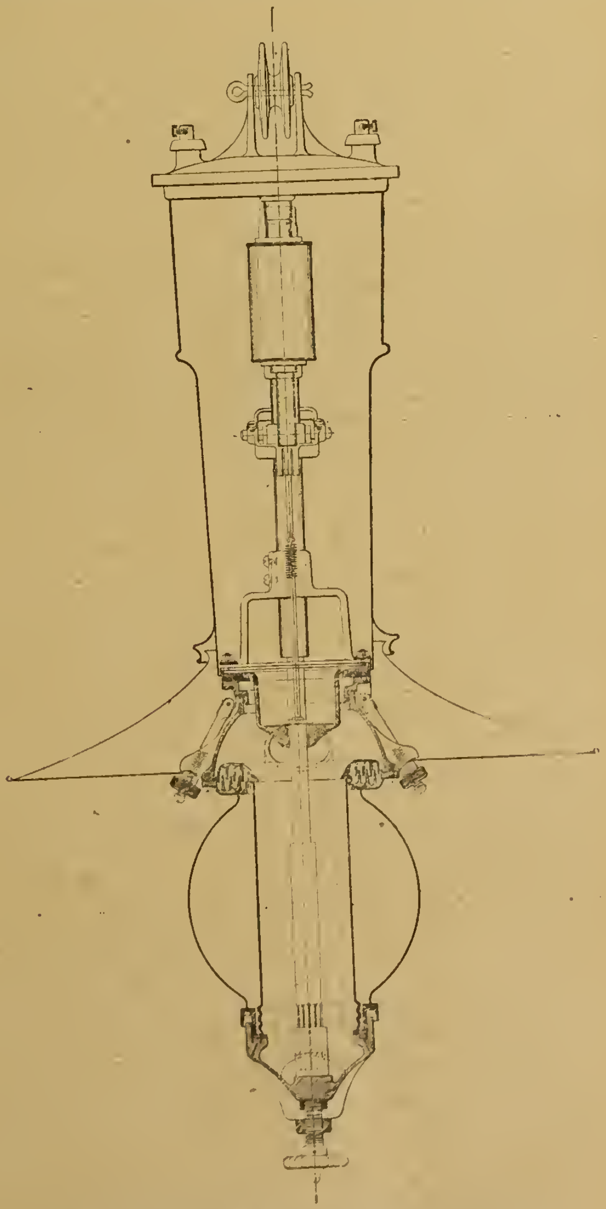

Fig. 3.—Section of Jandus Flame Arc Lamp.

potassium. The negative is a high-grade carbon sliding vertically in the central tube of the lamp. Special advantages are claimed for the use of vertical carbons on the score of simplicity and reliability, and the accompanying sectional view, fig. 3, shows that the mechanism of the new pattern is extremely simple; it is provided with patented ball bearings, giving extremely sensitive control and steadiness of burning. Only 15 grains of the chemical composition are volatilised per hour, and the lamp burns for 70 hours with a single pair of carbons; we are informed that carbons giving 3,000 mean hemispherical candle-power have shown a running cost of less than $\frac{1}{10}$d. per hour on large installations.

The curve of illumination given on p. 539 shows that the maximum C.P. is over 4,000 at an angle of 15° below the horizontal, an exceptionally favourable feature for uniformity in street lighting; with 460 watts at the arc, the M.H.C.P. is 3,160, giving an efficiency of ·166 watt per M.H.C.P. The lamp can be burnt on direct or alternating current, taking normally eight amperes and burning two in series on 110 volts or four in series on 220 volts; it is equally efficient with five amperes direct on 110 volts or two in series on 220 volts. The company have made extensive additions to their factory and plant for manufacturing the lamps and special carbons, and have been enabled to reduce their prices in consequence of these improved facilities and increased output.

BUSINESS NOTES.

Manufactured Bitumen.—A novel invention has been brought to our notice, which will probably have important results in connection with the laying of underground mains on the "solid" system. Hitherto it has been necessary to employ the highest quality of Trinidad Lake refined bitumen for this purpose, in spite of its high cost; cheaper compounds have been tried, for the sake of economy, but with more or less unsatisfactory results. Mr. Thomas Marriott, of Kingston-on-Thames, however, has patented a system of manufacturing from pitch and an inexpensive mineral a compound which is physically and chemically analogous in almost all respects to the best Trinidad Lake bitumen, at a very much lower cost, and we understand that it is being supplied to central station engineers in large quantities, being found in every way suitable for the purpose of embedding electric cables.

The manufacturing process is carried out in the ordinary course of a tar distiller's business, and with the ordinary appliances; crude tar is refined, to free it from all substances deleterious to electric cables, such as naphtha, phenols and creosote, and the resulting pitch is mixed with a proportion of the last heavy distillate or other suitable flux; while the molten mixture is very hot, the mineral above-mentioned is added and thoroughly mixed with the bituminous matter. The resulting product, we are informed, is almost indistinguishable from lake bitumen, and its properties are under perfect control during manufacture, so that compounds suitable for either joint-box or trench-filling are readily produced to any specification. The artificial compound is called "Vulcobitumen," but is, of course, free from sulphur. No doubt it will soon be extensively adopted for laying mains, filling joint-boxes, and kindred purposes.

B.T.-H. Contracts.—The following is a list of some recent orders secured by the power and mining department of the British Thomson-Houston Co., Ltd., of Rugby:—

Braidwater Spinning Co., Ltd.—Fourteen three-phase motors, main switchboard, &c.
Purex, Ltd., Greenford.—One each 56 and 20-KW. generators; six D.C. motors, starting gear, lighting material.
Corlett Electrical Engineering Co.—Five D.C. motors and spares.
Carrongrove Paper Co., Ltd.—One 300-KW. D.C. generator; three three-phase motors, switchboard and wiring, &c.
Bennett Bros., London.—Twenty-seven D.C. motors and rheostats; eight A.C. motors and rheostats.
Williams, Harvey & Co., Ltd., Cornwall.—Five D.C. motors from 6 to 30 H.P., switchgear, &c.
Walter Somers & Co., Ltd., Birmingham.—Three each 30 and 15-H.P. D.C. motors and rheostats.
Steel, Peech & Tozer.—Thirteen motors from 5 to 100 H.P.
Scott's Shipbuilding and Engineering Co., Ltd., Greenock.—Eight D.C. motors from 10 to 120 H.P., with controlling and switchgear.
Glasgow Corporation, Glasgow.—Three D.C. motors from 40 to 80 H.P. and switchgear.
Powell Duffryn Steam Coal Co., Ltd., Aberdare.—Ten three-phase motors from 5 to 30 H.P.
G. Whitehead & Co., Ltd., New Eltham.—Two three-phase 25 and 110-H.P. motors, switchgear and wiring.
Clarke, Chapman & Co., Ltd.—Two three-phase 100 and 200-H.P. motors and switchgear.

Reavell Compressors.—Amongst many recent orders received by Messrs Reavell & Co., Ltd., is one for an electrically-driven compressor for the Borough of Rotherham, for supplying air to the various pneumatic sewage ejectors in the borough. The machine has a large range of variation in speed, which is controlled by hand. It is also fitted with two special air relay devices, one set for the maximum pressure and the other for the minimum pressure, which automatically operate a whistle when the pressure reaches either limit. The firm are also supplying a large machine of the quadruplex double-ended type to the order of the General Post Office for pneumatic despatch at the Central Post Office. Each end of the machine has a device for automatically controlling the volume, and may be used for either vacuum or pressure.

Brussels Exhibition, 1910.—Mr. F. B. O. Hawes, the secretary of the National Electrical Manufacturers' Association (Incorporated) writes as follows:—"I beg to inform you that the chairman of the Committee of this Association has just returned from Brussels, and desires me to point out to you the importance of this Exhibition commencing in April next year. This will be the most important Exhibition which has been held on the Continent since that at Paris. I would remind you of my letter of July 28th last, in which attention was drawn to some of the directions in which this Association can be of use to exhibitors, and beyond those mentioned is the matter of insurance, regarding which our expert wishes me to point out to members the necessity of making special arrangements jointly."

Catalogues and Lists.—Messrs. J. Tylor & Sons, Ltd., Belle Isle, York Road, London, N.—20-page pamphlet containing fully illustrated particulars and prices of their petrol engines for commercial vehicles, pumping, and other purposes, including electric lighting installations. An 8½-KW. Tylor petrol-electric plant is shown. A testimonial from a user in Bangkok concerning one of these sets is quoted.

British Thomson-Houston Co., Ltd., Rugby.—Price list No. 222, in the firm's standard style, giving descriptive particulars, together with tabulated sizes, speeds, prices, weights, &c., of a new line of continuous current motors and generators, which they are introducing to the market.

Messrs. W. Geipel & Co., St. Thomas's Street, S.E.—Notice of increase of prices of high-grade v.i.r. cables, consequent upon the rise in rubber.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Circular describing a household apparatus (the Lahmeyer) for the ozonisation of drinking water. A sample apparatus may be seen working in Mr. Braulik's showroom.

The Electrical Co., Ltd., Lamp Department, 121/125 Charing Cross Road, W.C.—Price leaflet of Aegma miniature lamps for use with accumulators.

Messrs. Laurence, Scott & Co., Ltd., Gothic Works, Norwich.—List No. M 40 (12 pages) containing full specification particulars with tabulated data, prices and dimensional information, of their adjustable speed motors, semi and totally enclosed, 200 to 500 volts. The firm have specialised for some years in adjustable speed motors for direct-driven tools, and the information has been specially prepared for the convenience of machine-tool makers.

The Rugby Lamp Co., Ltd., Lower Hillmorton Road, Rugby.—Eight-page list just issued describing and giving prices, and showing actual size illustrations, of the Rugby metal and carbon-filament incandescent lamps, which are made in the specially-equipped factory at the above address.

General Electric Co., Ltd., 71, Queen Victoria Street, London, E.C.—The never-failing fertility of the G.E.C. publicity genius has yielded another crop of literature relating to Osrams. One of the picture postcards strikes home very forcibly with the information that Osram lamps save three-quarters of your electric light bill—it used to be 70 per cent., but a little more or less matters not, so long as you get the fact home that the saving is substantial. A second card tells us not to worry about the Daylight Saving Bill when the Osram is at hand to save our electric light bill. A folding leaflet tells of the reduced prices for the lamps, and many useful points concerning them, and the trade customer can have his own name and address printed on copies of these. The G.E.C. portable cost indicators, for showing at a glance in £ s. d. the saving effected, form the subject of another card. The other item in this batch is a 12-page pamphlet (No. S1,340), in which appear views of public buildings in London, Manchester and elsewhere, which are using Osram lamps. Reduced prices are indicated here also, and some testimonials showing economies effected by consumers are published. Some idea of the popularising campaign of the G.E.C., and the demand that exists for Osram circulars, may be gained from the fact that during September over 600,000 of these folders were printed, while further matter of a similar kind has had to be prepared for October.

The Electrical and Engineering Supplies Co., Ltd., 36/37, Upper Thames Street, E.C.—Neat binding cover containing pamphlets giving full particulars of the construction, efficiency, weight and price of their "Lloyd" continuous current dynamos and motors, the frames of which are of cast-steel, and the pole-pieces of laminated steel. Illustrations of complete machines of various types and of parts are included, showing method of construction, connection and dimension diagrams, &c. Prices and particulars of starters, shunt regulators, &c., are also given. Further lists for inclusion in this cover are shortly to be issued of larger direct-current, and single, two and three-phase machines.

Messrs. Chas. Joyner & Co., Ltd., Birmingham.—Illustrated leaflet, showing in colour their cord absorber fittings and giving prices of same; also a price list of the "Premier" switch.

Mr. E. Atkinson Smith, 70, Victoria Street, S.W.—Leaflet containing brief description, with prices, of the "Primus" stationary vertical type crude-oil engines.

The Cable Accessories Co., Ltd., Britannia Steel Works, Tividale, Tipton.—16-page pamphlet, giving prices and numerous illustrations of their cast-iron water-tight electric light fittings, &c., for collieries, factories, mills, and so on.

Messrs. Imeson, Finch & Co. Ltd., Bridge Works, Stockton-on-Tees.—Leaflet giving an illustrated description of Imeson's improved "Tell-tale" for collieries.

Messrs. Cutting Bros., Ltd., Park Works, Stamford.—Price card of electric motors of from ½ to 30 H.P.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Circular briefly describing and showing oil-break circuit-breakers combined with A.C. starters for motor panels; also one of his monthly attractive publicity cards which always interest us.

Messrs. Drake & Gorham, Ltd, 66, Victoria Street, London, S.W.—A new catalogue has been issued by the firm this week, consisting of a large number of pamphlets describing the numerous electrical lines which they manufacture or in which they trade. The principal contents of the book, which is well a produced and all and bulky publication, are as follows: Tantalum lamps, "Osram" and carbon-filament lamps, flame and enclosed arc lamps, andus lamp accessories, auto-transformers, conduits and fittings; witchboards, switchgear and accessories; fuses and fuseboards; Nevile automatic accumulator switches; Quartz (Bastian) electric adiators. A good variety of electric light fittings for inside and outside purposes in all classes of buildings, glassware, reflectors, and o forth, occupy the concluding portion of the catalogue. The manufactures are all effectively illustrated.

The Tudor Accumulator Co., Ltd., 119, Victoria Street, S W New illustrated export catalogue of Tudor accumulators (72 pages), n the compilation of which special ffort has been to provide all the data necessary to enable intendng purchasers to prepare the preliminary work connected with he Tudor battery plants without previously referring to the company. As a guide in preparing stimates, examples are given ontaining all items essential for complete and up-to-date battery plant, and they also show the manner in which prices are made up. Further, to enable clients o calculate approximately the reight of a battery from English o foreign port, tables of approximate weight and cubage of bateries, composed of 60 cells, includng accessories and spares, packed or shipment, for all the diferent types contained in the list, re given. A finger index divides he catalogue into sections. The different types of cells, with drawings of plates, showing sizes nd method of mounting, are first overed, and particulars of accessories and spares, erection notes, cid, &c, follow with tabulated details concerning the J. and J.S. ype cells and the Readyburnt ells. Remaining sections cover ntermediate capacities and the dimensional, estimate, and hipping information to which allusion has already been made. The pictures at the opening of the book show the exterior view of he factory at Dukinfield, an illustration of a large Tudor cell as applied to Stockholm Electricity Works, and an interior view of he battery room at the Kolar mines power station, Oorgalum, India.

International Time Recording Co., 151/155, City Road, E.C. —Sixteen-page booklet, giving descriptive results of the use of their ystem of automatic time recorders in a number of different classes of business.

The Reason Manufacturing Co., Ltd., Lewes Road, Brighton. —36-page catalogue, fully describing, and illustrating with neat alf-tones, and in some cases with diagrams, the Clark Fisher galvanometers and some other manufactures. The contents include he Column D'Arsonval galvanometer, the Stump, Wall, Pivoted nd Broca and Kelvin galvanometers. There is a table of galvanometer sensibilities, and particulars are given of galvanometer accessories and shunts. Flux standards and condensers, standard cells, lanterns, brackets, testers, single-pivot indicators, reversers, appers, &c., are also in the list.

Time Switches.—We reference to the tenders recently eferred to in our pages for street lighting equipment for Swansea, we understand that Messrs. Venner & Co. are sub-contractors o Messrs. Lucy & Co. for the time switches for controlling this new treet lighting scheme. For the Leyton street lighting contract, o which allusion was made in our last issue, 100 Venner time witches are also included as a sub-contract.

France.—A new company has just been formed in Paris, with a capital of £6 000, and the title La Société des Accuateurs et Lampes "Trin," to acquire and exploit the French patent rights in the Trin accumulator.

Blériot and Hoffman's Bearings.—We learn that the 50-H.P. engine which secured the world's record for speed for Mons. L. Blériot's monoplane at Rheims on August 28th was fitted with Hoffmann ball bearings. In spite of the engine being burnt after the accident which occurred, the bearings were in perfect condition, and it was therefore possible to fit the engine on a new monoplane.

Australia.—The Australian Customs authorities have recently given a decision to the effect that "Insulation stripbitite a preparation of oxidised and vulcanised oils, with asphalt or pitch, but no rubber, used by electricians as an insulating tape) is dutiable at the rate of 5 per cent. *ad valorem* in the case of foreign material, that of English manufacture being admitted free of mport duty."

Malay Rubber.—A Reuter dispatch from Singapore states that the value of the rubber exported from the Federated Malay States for the last eight months amounted to $3,500,000, as compared with $2,000,000 in the corresponding period last year.

Norwegian Ironworks. — A company, named the Norwegian Electrometall, has just been registered at Christiania with a capital of kr. 300,000 (£16,666) for the purpose of erecting a combined iron and steelworks in the near future, using an electrical process for the smelting of the ore.

The Tantalum Lamp Works at Dalston.—When lamps are the subject of conversation everywhere in electrical circles, and lamp factories for the manufacture of metal-filament lamps are getting to work, it will probably interest many of our readers to see the accompanying view of important premises, where a very large number of lamps is handled in the course of a year, in the North of London. They are the English Tantalum lamp works of the firm of Siemens Bros. Dynamo Works, Ltd, of Tyssen Street, Dalston, and are a few steps from the Dalston Junction station of the North London Railway. As on the occasion of a recent visit we were impressed by the extent of the premises required for the company's tantalum operations in London, we publish this view in the belief that our readers will be similarly impressed.

Tantalum Lamp Factory at Dalston.

Trade Announcements.—The Adnil Electric Co., Ltd. (late Marples, Leach & Co., Ltd.), have appointed Mr. J. B. Chambers, engineer and representative for the Yorkshire district. Mr. Chambers has been connected with the engineering department of the firm for some years past, and he will advise on, and quote for, electric power and lighting installations in the district mentioned. His present address is 76, Hill Top Mount, Roundbay Road, Leeds.

Messrs. Arthur L. Gibson & Co, announce that in order to concentrate all departments of their business, they have removed their offices and warehouse to the works at Twickenham. All communications should now be addressed to the firm at Radnor Works, Strawberry Vale, Twickenham.

The works of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, are closed to-day and to-morrow for stocktaking purposes.

The Beck Flame Lamp, Ltd., have removed their offices to Suffolk House, Laurence Pountney Hill, Cannon Street, E.C., and all communications should be addressed there, except advice notes of goods dispatched or empties returned, and replies to letters emanating from the works, which should be addressed to the company at their works, Hayes, Middlesex.

Messrs. J. & H. Grevener have now taken over the Electromotor and Dynamo Co, of 15, Gray's Inn Road, dating from October 1st. Communications relating to the business of the Electromotor and Dynamo Co. should now be forwarded to Messrs. Grevener. The new branch of their business is still being conducted under the supervision of the late manager of the Electromotor and Dynamo Co. In addition to their "Arcoflame" lamp, Messrs. Grevener are supplying motors, generators, transformers and controllers.

Book Notices.—"Les Essais Mécaniques du Caoutchouc et des Tissus." By P. Breuil. Paper presented to the International Congress for Testing Materials, Copenhagen, 1909. Paris: Le Caoutchouc et la Gutta-Percha. In this paper the author describes the apparatus which he has invented for testing the mechanical properties of rubber—namely, a dynamometer and an "clastodurometer." With these instruments a variety of tests can be made in the minimum of time. M. Breuil is to be congratulated on his praiseworthy endeavours to place this difficult subject on the scientific basis of exact measurement.

Engineering Units of Measurement. By John Ramsay, A.M.I.C.E. Glasgow: John Smith & Son. Price 1s. net. 1909.—This booklet brings together in convenient form the units employed in engineering, physics, &c., with definitions and brief explanations of their uses and relations. The treatment includes in many cases the definition of the quantities with which the units are connected, and covers a great deal more than might be inferred from the title, such as physical laws, symbols, abbreviations, British and metric equivalents, and a number of useful tables of physical data, &c. Insufficient attention has, we think, been given to thermal units, which are found only in a table; the properties of steam might also be inserted, though not strictly included in the subject. We note that the author wrestles manfully with the confusion between gravitational and absolute units, with fair success, though we fear that the young student will meet with difficulties in disentangling the two systems. Why introduce the poundal at all? It is never used—except to puzzle young brains (and not seldom old ones, too). The booklet may be commended as a very useful production.

We have before us a copy of the Special Diamond Jubilee number of the *Iron and Steel Trades Journal.* We congratulate our contemporary on its great age, and on its success, as we do also upon the production of a very interesting commemorative number.

Another contemporary which can justly claim our congratulations, and one with which we are perhaps more familiar, is the *Ironmonger*, which, with its issue of September 4th, began its fifty-first year. The occasion was celebrated by the publication of a special issue containing a great deal of interesting matter regarding the past history of the paper, its proprietors and other *personnel*, its policy, and so forth.

Our contemporary, *Concrete and Constructional Engineering*, which has hitherto appeared as a bi-monthly, will in future be published every month. The change began with the September issue, and marks the rapid progress that has recently been made in the science and art of this important subject. One of the articles deals with a reinforced concrete engine room at Frankfort.

"Elementary Electrical Calculations." By T. O'Conor Sloane. London: Crosby Lockwood & Son. Price 9s. net.

Liquidation. — General International Wireless Telegraph and Telephone Co., Ltd.—A meeting is to be held at 110, Cannon Street, E.C., on October 26th, to hear an account of the winding up from the liquidator, Mr. W. H. Dove.

Bankruptcy Proceedings.—E. F. Jones, plumber and electrical engineer, Hartlepool.—First meeting, October 6th; public examination, October 7th; both at Sunderland.

L. W. de Grave, electrical engineer, Derhy.—First and final dividend of 4s. 3½d., payable at the Official Receiver's Offices, Derhy.

Model Engineering Exhibition at Westminster.—This Exhibition, which opens at the Royal Horticultural Hall, Westminster, S.W., on Friday, October 15th, will, we are informed, contain some exceptionally interesting exhibits. There will be a number of model aeroplanes on view, including the machine designed by Mr. G. P. Smith, which won the gold medal in the recent contest at Wemhley Park. Working model steam and electric railways, electric clocks, light machine tools, model motor boats, a model engineers' workshop in operation, and a working demonstration of wireless telegraphy by the latest Marconi apparatus, are some of the numerous attractions which will be presented; while in the competitions for engineering and electrical model making over 100 entries have been received. The Exhibition will remain open for eight days, from 12 noon till 10 p.m., closing on Saturday, October 23rd.

LIGHTING and POWER NOTES.

Acton.—At the last meeting of the District Council, the following motion was passed:—"That the maximum demand system, based on the load factor for power and heat, would be fairer to the Council and the consumers than the flat rate now in force, and that it be referred, together with the engineer's report, to the Electricity Committee to fix the charge." Mr. Monson, the chairman of the Electricity Committee, said that it was quite clear they must not continue to sell at the prices they had been doing if they wished to make the undertaking pay. The great loss last year was caused, to a large extent, by some of the consumers taking current when the load was at its greatest. Mr. Schultess Young proposed that negotiations be re-opened with the Metropolitan Electric Supply Co. for the taking over of the undertaking, and that in the event of certain replies of the company being favourable, a referendum of the ratepayers be taken on the question of disposing of the undertaking. Six voted for the motion and six against; it was, therefore, not carried. An application was considered from Messrs. Warren & Beck for a supply of current for power purposes in connection with their compressed gas plant in High Street. The firm is to be informed that the Council is prepared to give a supply, but that the rate of charges must be considered at the next meeting of the Electricity Committee.

Australia.—The Inverell (N.S.W.) Municipal Council has adopted a report recommending the provision of an electric supply at a cost of £10,840. This would provide 25,700 c.p. for street lighting, and the price for public supply would be 6d. per unit for lighting and 3d. per unit for power. The Sydney (N.S.W.) Council has under consideration a system of charging during certain fixed hours of the day, viz., 1½d. per unit for a minimum of 20,600 units per annum. The engineer explained that the system applied to consumers who were prepared to install accumulators for use during the peak load, which would be charged during the day.

Bedford.—The T.C. has decided to apply to the L.G.B. for a loan of £630 for a scheme of street lighting by electricity.

Bexhill.—The Council has appointed a sub-committee to consider the question of holding an electrical exhibition in the autumn. An exhibition held some years ago resulted in many new customers being obtained.

Bispham.—The U.D.C. has instructed Mr. J. W. Speight, of St. Anne's, to submit a scheme of electric lighting for the district.

Brazil.—The Rio de Janeiro Tramway, Light and Power Co. has opened a new sub-station at Meyer for supplying electricity to the new Caxomby tramway system and for general use. Another sub-station is being erected at Cascadnra, and a supply is to be given to the cotton mills at Bangu and the military town of Sapopemba. A judicial decision has been given in the action brought against the company and municipality by Guinle and Co., asking that the privileges given to the company by the municipality should be declared void. Messrs. Guinle have for some time been endeavouring to obtain authority to distribute electrical energy in Rio de Janeiro, but the decision recently recorded confirms the concessions of the Power Co. until 1915; after that date the municipality can concede similar rights to others if it should care to do so.

Brompton.—The Council schools at Brompton, near Northallerton, are to be lighted by electricity. Mr. J. P. Yeoman has offered to install the light if the Committee pays him 6d. per unit for energy, and this offer has been accepted.

Castleford.—The U.D.C. has decided to apply for a prov. order for electric lighting. This step has been taken in opposition to a monopoly being secured by the Electrical Distribution of Yorkshire, Ltd., which is applying for an extension of time for supplying the district, which is promised a supply early next year.

Chester.—Having considered the electrical engineer's report as to the effect of the present rule of allowing discount on the aggregate consumption of energy to persons or firms having two or more installations, the T.C. has decided to adjust the discount in these cases, and as from March 25th, 1910, each installation will be treated as a separate account, and discounted accordingly. In support of the Council's action in disturbing existing arrangements, on the faith of which, doubtless, many customers have become users of electric light, it may be stated that the present price is only 3½d., as compared with 5d. or 6d. when the discount arrangement was entered into.

Congleton.—The B. of G. has decided to ascertain the cost of lighting the workhouse by electricity.

Continental Notes.—Norway.—In the Norwegian Storthing, a proposition was recently submitted by the Government asking for a sum of 185,000 kroner (£10,300) for the purchase of the rights of the Tafjords river in Norddalen in Ramsdalen, in the western part of Norway. The total power in the river is estimated at 20,450 h.p. in five waterfalls. The expenditure in connection with harnessing these falls is estimated at 1 million kroner (£55,555), in addition to the cost of the generating plant, &c.

The municipality of Kragero has decided to erect municipal electrical works, receiving power from the Norwegian Electrochemical Co.'s generating station at Slitnastangen, not far from the town. The estimate for the whole plant amounts to 150,000 kr. (£8,333), for which sum a loan is to be raised.

The Norwegian Metalindustry Co. has applied for a concession to take over the present Sundlökken Zinc Smelting Works, situated in Borge. The new company, which has a capital of 500,000 kr. (£28,333) intends to exploit Norwegian ore deposits and mines, and has already made a contract with the Hafslund Electrical Works for 2,000 h.p. at a rent of 90,000 kr. (£5,000) per annum.

Sweden. — The Västerdalälfens Power Co. is erecting a power station in the neighbourhood of Moekfjärd with the view of utilising 16,000 h.p. from the waterfalls of Lillstup and Storstup in the Västra Dalriver. For a start it is intended to install two generators with a capacity of 4,000 h.p. each, which in the future will be connected with two others of similar size. The bulk of the energy will be transmitted to the large manufactories of the Grängesberg, and the Stora Kopperhergs companies in Bergslagen by means of three-phase current at 50,000 volts. The contract for the electrical plant has been given to the Nya Förenade Electrical Co., and the amount in question is said to exceed £50,000.

Coventry.—The City Council on Tuesday approved the following system of charging for the use of radiators from lighting circuits:—The accounts of consumers having radiators and taking energy from the lighting circuit to be averaged for a period of two years, this average to be taken as the lighting account and charged at the ordinary rate, and all units in excess of this to be taken as the heating account, and to be charged at the power rate.

Doncaster.—The R.D.C. has accepted the offer of the T.C. to light Bentley Road by electricity at £3 per lamp per annum, and £1 19s. extra where double lights are necessary.

Gillingham (Kent).—The T.C. has appointed Mr. J. F. C. Snell, of Westminster, at a fee of 150 guineas, to investigate the working of the electricity undertaking, in accordance with the suggestion of the L.G.B.

Gravesend.—The T.C. has referred back for further consideration a proposal to extend the mains to the adjoining parish of Denton. The Electricity Committee had recommended that the extension should not be undertaken at present owing to the heavy cost.

Greenock.—An exhibition, inaugurated by the electricity department, was held in the Town Hall last week. Complimentary tickets were issued by the department, but owing to the great demand for them, a charge was imposed on the last day. Nearly 10,000 people visited the exhibition, which has resulted in numerous inquiries and substantial orders for electrical apparatus.

India.—According to an American paper, the possibility of supplying hydro-electric power to Calcutta is being reconsidered in view of the survey of a series of falls in the State of Mourbhanj, 140 miles from the city, where it is considered that up to 70,000 H.P. could be obtained.

Kingsbury.—Mr. Jose Diaz, the Chairman of the local Council, reported at the first meeting after the recess that he had written to the North Metropolitan Electric Power Supply Co., to the effect that he had ascertained that a large number of the residents were anxious to be supplied with energy, and some had actually had their houses wired and fitted up for that purpose.

Leicester.—A loan of £7,000 for cables and works in connection with the supply of energy from the tramways generating station for power, &c., has been applied for by the Council.

Leyton.—The estimates for the half-year ending March 31st next having been reconsidered, the estimated deficiency for the six months on the electricity undertaking has been reduced from £419 to £393, which latter amount will be met from the surplus of £2,353 from the preceding half-year, leaving an estimated net surplus for the year ending March 31st next of £1,960. Of this amount, £500 is to be placed to the credit of the reserve fund and the balance of £1,460 is to be applied in relief of the rates.

London.—At the meeting on September 23rd of the Court of Common Council, the County of London Electric Supply Co. gave notice of its intention to commence the laying of extra high-pressure electric mains and iron conduits across London Bridge and the City to the boundary of Finsbury. Mr. Wilkinson said the work would cause a great disturbance in the eastern part of the City. He asked what was the power of the company in the matter. —The City Solicitor (Sir Homewood Crawford) said if the route suggested was disapproved of, the Corporation would have to submit an alternative one, and if that was not accepted by the company, an arbitrator, appointed by the B. of T., would have to be called in to say what route should be taken. Mr. Turner said the question had been under consideration by the Streets Committee, and that Committee was so impressed with the importance of the matter, that it was going to call a special meeting of the Committee shortly. The subject then dropped.

Hampstead.—The income from the electricity undertaking for the year ending Lady Day amounted to £63,197. At the last meeting of the Council, Alderman Pritchard said he considered the foregoing figures were quite satisfactory. The deficiency caused in the income owing to the general introduction of metallic-filament lamps had now almost been made up by the increased number of new consumers. There had also been an increased number of consumers of current for heat and power, and this increase was, of course, especially gratifying.

Malvern.—At the Malvern College and College Master's Houses, an installation comprising over 600 metallic-filament lamps has just been installed upon the advice of Mr. W. J. Rendell Baker, electrical engineer to the Council, who prepared all specifications, &c., the work being carried out by the local firm of Mr. A. Sparkes.

Melbourne.—The P.C. has under consideration an electricity scheme, proposed by Mr. John Jardine, of Nottingham, who intends to erect large works in the parish, and from them to supply electricity under a suggested prov. order.

Mexico.—According to reports from the Mexican Government, the damage to the Necaxa Dam by the accident of May 20th last, can be rectified by the expenditure of £50,000; the work of repair is so far advanced that the power company's supply is maintained from the hydro-electric plants.

Newport.—It was reported at a meeting of the Electricity and Tramways Committee on Tuesday last that it had been decided to call in Mr. Parkes to investigate and report upon the electricity undertaking. It was decided at the same meeting that the engineer should make inquiries from the B. of T. as to whether trailers could be attached to the cars at Newport. It is hoped that, by the use of trailers, the revenue of the cars may be considerably increased by a proportionately small capital expenditure. Mr. Parkes will report upon this and other suggestions for increasing the net revenue.

Plymouth.—The Electricity Committee of the T.C. has received from the borough treasurer the financial statement of the electricity undertaking for the year ended March 31st last. It shows a total income of £23,596, of which £23,331 was received from the sale of current. On the debit side the expenditure amounted to £12,394. After meeting this charge, there remained a gross profit of £11,562, which was carried to the net revenue account. Out of this account, payments were made for dividend and interest and stock redemption, leaving a net profit of £2,232, of which £1,991 was paid over in relief of rates, and £241 carried to the reserve fund. At the end of the financial year, the reserve fund stood at £10,193. On capital account during the year, £8,504 was raised by new loans, and £6,912 spent on machinery, plant, and mains, leaving a balance of £1,592 to be carried forward.

Runcorn.—The Castner-Kellner Alkali Co., Ltd., which is applying for a prov. order for electric supply in the area of the U.D.C. and the township of Weston in the area of the R.D.C., has submitted to the U.D.C. a draft of the order. This states that the whole of both towns is scheduled, and the proposed charges for supply are:—Up to 20 units 10s., and 6d. per unit beyond. The U.D.C. has referred the matter to a special committee.

Southampton.—The T.C. has received from the L.G.B. sanction to loans of £2,300 for mains and £700 for services.

Southend-on-Sea.—The T.C. has decided to apply for a loan of £13,715 for the provision of two sub-stations, with cables, batteries, &c., near Chalkwell Park and the Thorpe Hall Estate.

Extensions of mains have been authorised, including feeders and cables to the district between High Street and Southchurch Avenue, the latter at a cost of £2,400.

Tonbridge.—The U.D.C. has decided to utilise electricity for pumping purposes at the sewage disposal works. Energy will be supplied by the Electricity Committee of the Council at ¾d. per unit.

Walthamstow.—The Lighting Committee having gone into the question of public lighting, has decided in favour of an application being made to the L.G.B for sanction to borrow £9,036, the estimated cost of converting 921 gas lamps to electricity. During July and August 502,748 units were generated, as against 457,054 in the corresponding period of last year. There was a decrease of nearly 8,000 units for traction, but there was a great increase in other directions.

West Ham.—An agreement has been entered into to supply energy to the works of the Avenue Press, Ltd., including the hire of motors and apparatus, for a period of five years, with the option of renewal for a further five years; also for a bulk supply to the Bradford Rubber Co. for five years, renewable at termination to seven, 14 or 21 years. The last-named company has agreed to hire the motors from, and for the necessary works to be carried out by, the Council. Negotiations have taken place with the chief engineer to the Port of London Authority for a bulk supply to the Royal Albert and Victoria Docks. Having regard to the Electric Lighting Acts Amendment Bill now before Parliament, the town clerk has been authorised to communicate with the East Ham and North Woolwich Councils with a view to obtaining their consent to the supply of current by the West Ham Council for use within their respective areas.

TRAMWAY and RAILWAY NOTES.

Bradford.—The Tramways Committee has for some time had under consideration the question of bringing the depôts for the accommodation of the cars thoroughly up to date, and it is faced with the task of having to erect permanent buildings in place of some of the present temporary structures or of adopting the scheme of the manager, Mr. C. J. Spencer, for the provision of a large depôt near the centre of the city. A suitable site in the Longlands area is available for this latter purpose, and Mr. Spencer has calculated that if a depôt were erected there, a saving of 56,394 car-miles per annum of "dead mileage" would be effected. At present there are nine depôts, and they provide storage for 275 cars. If the present policy is continued an outlay of £22,468 on new depôts will have to be provided for, and it is claimed that the saving in dead mileage and in administration with a central depôt would amount to £1,787 per annum, which represents a capital sum in providing interest and sinking fund of £29,783. This, added to the £22,468, amounts to £52,251, whilst the acquisition of the Longlands site (over 9,000 yd., at £1 per yd.) and a building to accommodate 150 cars, would cost £46,500. Mr. Spencer's scheme would entail the abandonment of the Bolton, Lidget Green, Fairweather Green, and possibly the Duckworth Lane depôts, which would mean, of course, that the cars would not run nearly so late on those sections as at present. The Tramways Committee visited some of the depôts and considered the scheme, and we understand that it decided to recommend the City Council to adopt it.

Continental Notes.—Russia.—According to the *Financier*, nearly all the Russian tramway enterprises are in the hands of Belgians. Out of 40 tramway systems either at work or under construction 34 belong to Belgians, and three only to the French. Out of 1,312 versts (about 875 miles) of tramway track in Russia 1,086 versts, or over 80 per cent., belong to foreigners, and the remaining 226 versts are either worked by municipalities or by Russian concessionaires. Five Belgian trusts exist, which have bought up 23 Russian tramway systems. These trusts operate in Taschken, Astrachan, Kischeneff, Kazan, Moscow, Odessa, Kieff and elsewhere.

The municipal authorities of Suchum are considering a project for the construction of an electric tramway in the town.

Greece.—According to a daily paper, all the tramway employés in Atheos are on strike, and no cars are running.

Dublin-Dalkey.—Last week Col. von Donop, of the B. of T., made an inspection of the line of the Dublin United Tramways Co. from the city boundary of Duhlin to Dalkey, over portions of which the company is seeking powers to run some of its cars at increased speed. Representatives of the company, the city and the township were present.

Dundee.—The Council is considering the question of acquiring a petrol-motor tower wagon for use in connection with the maintenance of the overhead conductors of the electric tramways.

Dunfermline.—It is expected that the Dunfermline and West of Fife tramways will be running next month. The laying of the track has almost been completed, hut the overhead wires have still to be placed.

Haslingden.—The T.C. on September 23rd considered the great inconvenience to the tram-using puhlic, and the serious loss occasioned to the Corporations of both Haslingden and Rawtenstall by the necessity imposed upon passengers travelling between the two towns, a distance of two miles, to change cars at Lockgate, on the boundary. The Tramways Committee recommended that a further effort should be made for the solution of the deadlock by seeking a joint conference of three representatives from the three boroughs of Accrington, Haslingden and Rawtenstall with a view to devising means to put an end to the present state of affairs. If no mutual and satisfactory agreement could be arrived at, it suggests that the B. of T. should be asked to adjudicate, and that the three authorities should be asked to abide hy the Board's decision. The representatives attending the proposed conference should have full power to deal with the matter of through running.

Leeds.—The Tramways Committee has instructed the town clerk to take steps to promote a Bill for the equipment of certain routes on the railless trolley system. The present idea is to establish a route from the city square to Farnley.

London.—A scheme is under consideration for linking up the Crystal Palace with Victoria by a tuhe railway, having a capital of £3,500,000. The distance to be covered is about eight miles, and it is suggested that the net construction cost, including land and equipment, will he about £340,000 per mile, as compared with from £600,000 to £800,000 per mile in the case of some recently constructed London tubes. Needless to add, the estimates are of a favourable kind.

The L.C.C. proposes to proceed immediately with conduit tramways from Rainton Road, Greenwich, to Woolwich Dockyard. It was also proposed to extend the trolley line from Beresford Square to the Ferry, but the Astronomer Royal having withheld his consent owing to the proximity of the Observatory, it appears that some other system will have to he adopted.

The date of opening of the Brighton Co.'s London Bridge-Victoria electrical section has been further deferred until Decemher 1st. The postponement is stated to he due to a necessary rearrangement of the signals into London Bridge. Experimental trains are heing run daily hetween Peckham Rye and Battersea.

Hampstead.—At the first meeting of the B.C. this session, a memorial signed hy 1,800 residents was presented, asking the Council to oppose the proposal of the L.C.C. to lay tramways along Adelaide and Finchley Roads. The matter was referred to the General Purposes Committee for consideration.

A new goods receiving depôt is being opened by the Metropolitan Railway at Farringdon Street, and it is intended to inaugurate a through goods service for market garden produce from Verney Junction to the City over the electrified lines.

At the annual meeting of the Holloway Ratepayers' Association recently, a resolution was passed protesting against the proposed L.C.C. tramway extension from Seven Sisters' Road *via* Tollington Park to Crouch Hill.

Musselburgh.—The recent alterations in fares by the tramway company have aroused great opposition in the town. A puhlic meeting of protest attended by 700 persons was held on September 23rd, when a resolution requesting that the old fares may be reintroduced was passed.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions and Repairs :—

	Interrupted.	Repaired.
Tangier-Cadiz	May 19, 1909	September 21
Tourane Amoy	June 17, 1909	
Assab Perim	July 8, 1909	
Dakar Conakry	Aug. 20, 1909	
Balikpapan Kwandang	Sept. 2, 1909	
Cheikh Said Perim	Sept. 15, 1909	
Hong Kong Macao	Sept. 25, 1909	

Wireless Telephony.—An installation of wireless telephony, invented by Mr. Andrew Burns, Portobello, has been erected at Portobello Pier, and last week a practical demonstration was given. The stations on the pier are a quarter of a mile apart, and speech was heard quite distinctly.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Victoria.—Accumulators for the P.M.G. See "Official Notices" to-day.

Telegraph and telephone material for the P.M.G., Melhourne. See "Official Notices" Septemher 10th.

Common-battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" Septemher 24th.

Brumby and Frodingham.—October 16th. Public lighting by electricity for the U.D.C., with 55 50-c.p. lamps, poles, wiring, switches, &c.; direct-current, 220 volts, availahle. Mr. J. Green, surveyor to the Council, Frodingham, Scunthorpe, Lincs. Returnable deposit, 10s. 6d.

Dartford.—October 13th. Wiring the Council Chamber and offices for the U.D.C. Electrical Engineer, Electricity Works, Dartford.

Dundee.—The Corporation electrical engineer has been instructed to draw up specifications and obtain quotations from manufacturers in connection with the proposed motor-repairing wagon.

France.—October 11th. The municipal authorities at Meudon are inviting tenders for the supply of four sets of engines and dynamos for the Military Balloon Station at that place.

Glasgow.—October 4th. The Corporation invites tenders for the general supply, delivery and erection of mains, switchboards, distrihution boards, cables, switches, &c., wiring and accessories for transmission of electrical power to motors, &c., and for lighting at their Shieldball sewage purification works. Specifications from the Office of Public Works, 64, Cochrane Street, Glasgow.

Keighley.—October 16th. Two boiler feed pumps, high-tension switchboard and transformers, 300-kw. motor-generator, and mains for the Electricity Department. See "Official Notices" to-day.

London.—October 4th. Electric wires and cables, lamps, carhons, switches, fuses, telephones, cells and electrical insulating materials for the Metropolitan Railway Co. for a year. W. H. Brown, secretary, 32, Westbourne Terrace, W.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 kw. each, for disposal. See "Official Notices" Septemher 24th.

Walthamstow.—Cable for interconnecting the large feeder at Higham Hill with the Blackhorse Lane feeder, for the Council's electricity department.

Worthing.—October 11th. Cables for the Corporation. See "Official Notices" to-day.

CLOSED.

Belfast.—From seven tenders received for the electric lighting of Purdyshurn Lunatic Asylum, the Committee of Management has selected for acceptance that of Messrs. John Dowling and Sons, Belfast, at £460.

Bexhill.—Messrs. Siemens Bros.' tender of £121 for the supply of 1,000 yards of cahle to Bexhill Corporation has been accepted.

Burnley.—At the meeting of the Board of Guardians on Septemher 23rd, the half-yearly tenders were confirmed. These included electrical requirements by Messrs. Carter & Co.

Bury.—The Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., for the erection of the new switchboard gallery at the new power station at Chambers' Hall.

Cape Colony.—A contract has been signed between the authorities of H.M. Naval Yard, Simons Town, and Messrs. Cunningham & Gearing, engineers, of Cape Town, for the complete internal equipment for lighting and power of the new workshops at Simons Town. The lighting includes the installation of 48 arc lamps, and the approximate wiring of 35 motors; the whole work to be carried out in cold-drawn galvanised steel conduit. All fuses, automatic cut-outs, meters, main switches, &c., will be enclosed in cast-iron boxes, manufactured by Messrs. Cunningham & Gearing in their works at Cape Town. In addition, the firm were also successful in securing the contract for the electric light installation of about 24 private residences attached to the Naval Yard. The whole work will be carried out under the personal supervision of Mr. R. Wightmann, electrical engineer, H.M. Naval Yard, Simons Town.

Hanley.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for a motor-generator for the Town Hall lift, at £144.

Leyton.—The U.D.C. has accepted the tender of the Electrical Joint Box Co., at £307 10s, for 100 public lighting lanterns with clock switches. The list of tenders appeared in our pages last week.

Liverpool.—The D.P. Battery Co., Ltd., has received an order for the renewal of the large batteries at Waterloo owned by the Liverpool District Lighting Co., and their maintenance for a period of eight years.

London.—BATTERSEA.—The B.C. has accepted the following tenders (as per schedule prices) for the wiring and fitting-up of consumers' premises with arc lamps for electric lighting, and for the supply of goods in connection with the high-purchase scheme:—

Flame arc lamps.—Beck Flame Lamp, Ltd.
Enclosed arc lamps.—Brockie-Pell Arc Lamp Co.
Open-type motors.—British Westinghouse Electrical Co.
Arc lamp installations.—G. A. Gunn and Phillips & Co.
Motor installations.—Stegmann & Co., Phillips & Co. and J. W. Gunn.

ISLINGTON.—The B.C. has accepted the tender of the Steeplejack and Engineering Co., Nottingham, at £275, for repairing the shafts at the generating station.

Plymouth.—The T.C. has accepted the tender of the Brush Electrical Engineering Co. for a turbo-generator, at £2,244. The highest tender was £3,617.

Swansea.—The Executors of the Harbour Trust have left the tenders for the King's Dock Power Station and sub-stations in the hands of the chairman (Sir Griffith Thomas) and the officers, to settle after communication with the electrical firms tendering.

Tenders for the erection of a 3½-ton electrical crane for the larger warehouse at King's Dock were considered, and it was resolved to recommend the acceptance of that of Messrs. H. Morris & Co. (?), Loughborough, subject to that firm agreeing to sundry alterations.

West Ham.—The T.C. has placed the following orders for coal for the electricity undertaking:—

Messrs. E. Foster & Co.—5,000 tons Grangerigg Dry Peas for delivery between January and October next.
Messrs. Cory & Son.—33,000 tons of coal at a price not made public; also 800 tons of Lynwood Rough Slack, 11s. 6d. per ton.
Messrs. Speakman & Sons.—120 tons Yorkshire coking smalls, 11s. per ton; 70 tons Yorkshire nuts, 11s. 6d. per ton; 400 tons Shafton Yorkshire smalls, 10s. 4½d. per ton.

The Council has further placed an order with the Armorduct Manufacturing Co., for certain sizes of cable to cover the estimated requirements up to March 31st next.

FORTHCOMING EVENTS.

Institution of Mining Electrical Engineers.—Saturday, October 2nd. At 2 p.m. Council meeting at the Royal Victoria Station Hotel, Sheffield. A general meeting will be opened at 2.30 to report progress and announce preparations for the forthcoming winter session.

Society of Engineers.—Monday, October 4th. At 7.30 p.m. At Caxton Hall, S.W. Prize essay on "The Status of the Engineering Profession," by G. A. Thomas.

Civil and Mechanical Engineers' Society.—Thursday, October 7th. At 8 p.m. Presidential address by Mr. W. Noble Twelvetrees.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 9th, 1909:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, October 4th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, October 5th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, October 6th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 7th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, October 8th.—"D" Company. Technical drill, 7 to 9.30 p.m.

(Signed) P. H. CAMPBELL,
Capt. R.E. and Adjutant,
For O.C. E.E. (L.D.)

NOTES.

Inquiries.—Correspondents wish to know the addresses of the makers of "Wakefield's patent vaseline insulating oil"; of glow lamps fitted with Cleminson's patent porcelain caps; and of water-distilling apparatus.

Appointments Vacant.—Railway telegraph foreman for Ceylon Government Railway (£200). See our advertisement pages for particulars.

Miners and Electricity.—Mr. John Wilson, M.P., in his monthly report to the Durham miners, makes a very long reference to the Stanley disaster, and comments at length on the report of the Government Mine Inspectors. After quoting from the report, he says:—"With this cloud of witnesses and volume of testimony in favour of the Busty seam being the place of origination, then the assumption becomes a certainty and electricity a more likely first cause than any of the other alternatives which might present themselves as being causes of the explosion. If that be so, what, then, is our duty? If there were only a probable danger of electricity playing such a dangerous part in such a holocaust of human life with its consequent misery, is it not the duty of all to inquire closely into, and seek to provide against a recurrence of a similar, or any calamity of the same nature, if not in the same degree." Mr. Wilson added that all he was asking for was for an inquiry as to whether that new danger was real or not. The mind of the mining community was unsettled on that subject. This applied not only to the men but to the managers. It was that unrest that he wanted to allay. He welcomed any appliance, electric or otherwise, but let them have safety with it. If he had written on the subject it was with the desire to incite further inquiry, and he felt confident that none would be more ready to join in that desire than the gentlemen whose names were appended to the report. They knew the life of a miner, and were willing to make it as safe as the circumstances permitted, therefore the miners might hope that they would assist in procuring the inquiry he had suggested.

"Electrical Football League."—A Council meeting of the above was held at 19, Carnaby Street, on the 22nd ult., when the resignation of Mr. Fraser, the honorary secretary, was accepted, and a vote of thanks passed to him for the businesslike way in which he had conducted the League since its foundation in 1907. Mr. H. W. Roberts, of 71, Queen Victoria Street, E.C., has now taken over the duties of honorary secretary, assisted by Mr. Fraser as honorary referees' secretary. Future communications should be addressed to Mr. Roberts. The League comprises clubs attached to the various manufacturing and supply companies within a radius of 15 miles of Charing Cross; it is stated to be the only Football League which is exclusively attached to a particular industry, and it is hoped that it will receive hearty support from the trade, seeing that it has the object of promoting friendly rivalry and sociability amongst the employés of the various Companies and Municipal Electric Supply Stations. The season opens on Saturday next, the 2nd inst., when the County of London Electric visits the St. James' and Pall Mall Electric.

Curious Lightning Incident.—During the storm which did a considerable amount of damage in various parts of the country on Friday last week, three cows were struck dead by lightning in a field connected with Broomhall Farm, Sunningdale, Berks. It has now been asserted that the lightning was attracted to the spot by a piece of disused wire, put up many years ago for either telephonic or telegraphic purposes. This wire was stretched along the tops of three oak trees, and was not properly earthed. The tree at one end was split almost in two, and the cows were standing under the middle tree, which was also struck, when they were killed.

Robertson Fire Brigade Successes.—The first part of the Eleventh Annual Tournament of the London Private Fire Brigades' Association was held on Saturday, September 25th, on the Parade Ground of the Royal Hospital Schools, Greenwich, when 25 brigades drawn from London and the provinces competed for the "Nestle" Challenge Cup for the Private Fire Brigade Championship of the United Kingdom, and for other trophies, including the "Dewar" Challenge Shield and the "Marshall" Challenge Cup for London Private Fire Brigades. In the above events the Robertson Electric Lamps, Ltd., Fire Brigade was successful in winning the Championship of the United Kingdom, and the "Dewar" Challenge Shield, the winning times constituting records for drills of this class. They also carried off First Prize in the four-men drill, First Prize in the five-men drill, and secured a substantial lead of 18 points towards the best aggregate for the "Marshall" Challenge Cup. The second part of the tournament will take place some time in November.

Educational Notes.—UNIVERSITY COLLEGE.—In connection with the opening of the Session in the University College Faculty of Engineering, a public introductory lecture will be given on Wednesday, October 6th, at 5 p.m., by Prof. J. A. Fleming on "Electrical Inventions and the Training of Electrical Engineers." The chair will be taken by Mr. W. M. Mordey, president of the Institution of Electrical Engineers. The special and post-graduate courses for engineers in practice and graduates in engineering for the first term will begin as follows:—"Railway Engineering," by Mr. H. Deans, Thursday, October 7th, at 5 p.m.; "Recent Methods and Instruments in Surveying," by Mr. M. T. Ormsby, Friday, October 15th, at 4 p.m.; "Electrical Design," by Mr. H. M. Hobart, Wednesday, October 27th, at 11 a.m.

Rifle Shooting.—Two very keenly-contested and interesting matches were fought by the Electricity and Tramways Departments of the Leyton U.D.C. on September 9th and 23rd. The first match was contested at the Electricity Works by teams of six on each side. Seven rounds were fired by each competitor at two ranges, 15 and 25 yards, with Bisley targets. The total scores were—Electricity Department, 281; Tramways Department, 214; the Electricity Department thus winning by 67. The return match was held at the Tramway Depôt, with teams of six on each side; ten rounds were fired by each competitor at three ranges, viz., 15, 25 and 35 yards, decimal targets being used. The rivalry was very keen, and the scoring very close. Total scores—Electricity Department, 1,016; Tramways Department, 993; the Electricity Department thus again winning, by 27. The hon. sec. of the Leyton Electricity Works Rifle Club will be pleased to arrange matches with other electricity works rifle clubs. Secretaries are requested to communicate with Mr. J. W. Gibbins, hon. sec., Electricity Works, Cathall Road, Leytonstone.

Amber-Tinted Spectacles for Arc Lamp Operators.—In the *Standard* of Tuesday last mention is made of Dr. Cook's discovery that goggles with amber-tinted glass were immensely superior to smoked or blue glasses in affording protection to the eyes from the blinding glare of the sunlit snows. In this connection, it strikes us as a singular fact that it is customary to use dense blue glasses for examining the electric arc, with the result that absolutely nothing but the arc and the glowing tips of the carbons can be distinguished through them, to the great inconvenience of the operator, who either dispenses with the glasses and takes the consequences, or is obliged continually to put them on and off. Blue glasses present little obstruction to the actinic rays of light, which in all probability are responsible for the excruciating pain resulting from exposure of the eyes to the arc light, and why they should be employed in these enlightened days it is impossible to understand.

Our Mr. Gatehouse, and other pupils of the late Robert Sabine—a scientist of no mean order, though he thought too little of his achievements to claim for them the credit that was his due—well remember how, at his suggestion, they wore amber-tinted glasses while experimenting with the Serrin, Duboscq and similar lamps in the days when arc lamps were regulated by clockwork, and each was fed by a single Gramme dynamo. With these glasses they were able to examine the arc with perfect immunity from after-effects, while the glasses presented no obstacle to the perception of the mechanism of the lamp itself, and therefore could be worn continuously without any inconvenience. Why use dense—almost opaque—blue glasses, when transparent amber affords equal protection without any drawbacks?

Institution Notes. — American Association of Car-Lighting Engineers. — The annual meeting of the Association of Car-Lighting Engineers is to be held from October 4th to 7th at the new La Salle Hotel, Chicago. The question of changing the scope of the Association will be brought up at this meeting. It is thought advisable to change the name to "Association of Railway Electrical Engineers," as most of the electrical engineers and chief electricians of the railroads have to do with general railway electrical work and are not confined to car-lighting work.

The Poplar Disinfectant Plant.—In view of the low cost of production of electrolytic disinfectant fluid and its efficiency, it has been decided to duplicate the Poplar plant at an estimated cost of £430. The new plant is to be as follows:—Four patent electrolysers, good for an output of 25 gallons of fluid at a strength of 4 grammes of chlorine per litre, and suited for a 240-volt circuit; one electric motor suited for a 240-volt circuit, arranged to hang vertically, and suited for driving two stirring machines; two stirring machines running on ball bearings, and fitted with suitable grooved pulleys; two ebonite stirring rods fitted to machines; one constant head flow regulating tank, suitably coated with preservative paint; one flow regulating cock, with vernier; one mixing tank of latest pattern; one switchboard equipped with D.P. main switch in cast-iron case, D.P. fuse in cast-iron case, one amperemeter, one voltmeter, provision for the Council's meter, and one series rheostat.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The electrical engineer of West Ham reports that in addition to Mr. H. H. Holmes, sales manager, Mr. K. A. Boshell, chief clerk in the general office, and four members of the sales department staff, have resigned their posts to take up positions under the Marylebone Council. The principal vacancies so caused are to be filled up as follows:—Mr. Farndon, at present assistant sales manager at £150 per annum and commission, is to be promoted to the position of sales manager at £250 per annum, rising to £300 at the end of 12 months' satisfactory service. Mr. Edgerton, at present meter superintendent at £150 per annum, is to be appointed assistant sales manager and meter superintendent at £200 per annum, rising to £250 after one year's satisfactory service. The clerical staff of the general office and sales department is to be amalgamated and re-arranged, and Mr. Johnson, at present in the accounts department at £125 per annum, is to be appointed chief clerk at £150 per annum, rising on satisfactory service by annual increments of £10 to £180 per annum.

Mr. J. Wright, shift engineer of Heston and Isleworth U.D.C. electricity works, has resigned, in order to take over a better appointment. Mr. J. Fletcher, jun., of the Nottingham and Derbyshire Power Co., has been appointed to the vacancy.

Mr. L. L. Horrell has been appointed by the Pretoria Town Council to the position of assistant electrical engineer at a salary of £500 per annum, with £60 extra for locomotive expenses.

Mr. Cuthbert W. Bentley, engineer and manager of the Wilmslow and Alderley Edge Electrical Supply Co., has been appointed manager to the Cromer Electricity Supply Co.

The Sydney (N.S.W.) City Council has, by 15 votes to 4, confirmed the appointment of Mr. Cochrane, of Ballarat, as chief assistant electrical engineer.

Mr. W. L. Trenery, of the staff of the Camborne and Redruth Urban Electric Supply Co., who is leaving for South Africa, has been presented by the staff and employés with a gold watch.

Tramway Officials.—Mr. J. H. Shepherd, manager of the Broughty Ferry Tramways, was, on the 23rd ult., presented by his staff with a suit case and an umbrella, on the occasion of his leaving the service of the company to take over the management of the Dunfermline and West of Fife Tramways. Mr. F. D. Scott, engineer of the company, made the presentation. Mr. Shepherd thanked the men for the gifts in suitable terms.

General.—The retirement is announced of Mr. E. J. Houghton, electrical engineer to the London, Brighton and South Coast Railway, after a service of 52 years. Mr. Houghton carries with him the good wishes of many friends, including the Electrical Review, which, during his long service, has been on several occasions indebted to him for courtesies shown. His chief assistant (and son) Mr. R. H. Houghton, B.Sc., A.M.I.C.E., A.M.I.E.E., has been appointed electrical engineer in his stead, with sole charge of telegraphs, electric lighting, power and electric traction.

Mr. W. H. Booth, artesian and steam engineer, has removed to Caxton House (West Block), Westminster, S.W.

The Glamorgan Education Committee have appointed Mr. R. E. Michael, of Tylorstown, a travelling lecturer in electrical engineering, at a salary of £150, increasing to £200.

The foremen and staff of Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford, have presented a basket of cutlery to Mr. A. J. Beckett, a member of the staff, on his marriage.

Mr. W. B. Shaw, who has been the electrical engineer at the Hulton Colliery Co's collieries at Chequerbent, near Bolton, for several years, was presented by Mr. J. Tonge, general manager, on behalf of the officials and electrical staff, with a gold hunter watch, on Friday September 24th. The presentation took place at the Chequerbent Men's Club.

Mr. S. E. Bastow, of Messrs. Bruce Peebles & Co., Ltd., was entertained to dinner recently by a number of his friends in Edinburgh, preparatory to his leaving this country for a tour round the world on behalf of his firm. Mr. Bastow left by the *Tunisian* from Liverpool last week for Canada, and will proceed from there to Australia, New Zealand, and South Africa. He expects to be away for at least six months, and his many friends will wish him a safe and prosperous journey.

Owing to the lease of 2, Queen Anne's Gate, S.W., having changed hands, Messrs. Lacey, Sillar & Leigh have removed to Iddesleigh Mansions, Caxton Street, Westminster. Their telephone number and telegraphic address remain unaltered.

Mr. Sidney Sharp, M.I.Mech.E., M.I.E.E., notifies that in consequence of the acquisition of 34, Great George Street, S.W., by the Government, he has removed to 13, Victoria Street, S.W.

Mr. T. C. Martin has resigned the co-editorship of the *Electrical World*, of New York, in order to assume the position of General Secretary of the National Electric Light Association, of which he was one of the founders, and with which he has always been closely associated. The appointment was necessitated owing to the great growth of the Association membership. In entering upon his new work in the interests of the American central station industry, Mr. Martin carries with him the hearty good wishes of the London Electrical Review.

Obituary.—We regret to record the death of Mr. John Rance, jun., which occurred at Deal on September 16th. In his early days Mr. Rance was a successful student at the City and Guilds of London Institute, and afterwards a pupil at the Anglo-American Brush Electrical Works. He was employed by Messrs. Johnson & Phillips as engineer to put down the transmission of power plant at the Sheba Gold Mines, S.A., and a similar plant at the Raub Gold Mines, Malay States. His last appointment was with Messrs. Jessop & Co., Calcutta, and this he resigned in February last owing to a breakdown in his health. He returned home to recruit, but gradually got worse until a fortnight ago, when he passed away. Mr. Rance was an M.I.E.E., and was only 41 years of age.

CITY NOTES.

Willans & Robinson, Ltd.

The accounts for the half-year ended June 30th, 1909, show a loss of £3,501. Deducting this sum from the balance of £9,517 brought forward, leaves £6,015 available for distribution. The directors recommend the payment of a dividend at the rate of 3 per cent. per annum on the preference shares, which will absorb £4,999 19s., leaving a balance of £1,015 to be carried forward. There is no rofit available for payment of interest on, or redemption of, unding certificates, and it is not possible to pay any dividend on he ordinary shares. The regretable result shown for this half-ear is due to the scarcity of work and to the low prices prevailing. The actual loss on the half-year's working at Rugby is £2,331. To this has to be added £1,170, the cost of keeping the Queen's Ferry Works in proper order and repair. The whole of the debenure interest is now charged against the Rugby account, and in onsidering the loss of £2,331 on that account it must be borne in mind that this result is arrived at after charging the Rugby profit and loss account with £4,824, the amount of the debenture interest or the half-year. The sum shown in the profit and loss account s written off against depreciation of premises, plant, machinery, patents, &c., viz., £4,203, is considerably less than in past half-years. The deficiency, however, in this provision is apparent and not real. A number of the working costs of the business, such as drawings, patterns, tools, and other appliances, which in past half-years have been charged against capital account and subsequently written off by depreciation, have in this half-year been charged direct against the profit and loss account. Although, therefore, the sum shown in the accounts as written off for depreciation this half-year is less than in the past, there are direct charges against profit and loss account to counterbalance this deficiency, and the actual provision made for keeping capital values on a sound basis is as ample as formerly. Debenture stock to the amount of £8,767 has been redeemed during the half-year out of the late fire insurance fund. This has been purchased at prices considerably below par. The difference between the face value and price paid, amounting to a sum of £1,761 and the balance of the fund itself, have been added to the main reserve fund, which, after deducting therefrom the amount paid on Mr. Robinson's retirement, stands at £62,630. The full preference dividend for the half-year might have been made up by drawing on the reserve fund. The directors, however, in view of the continued depression in business, do not feel justified in recommending such a course. The board are continuing their efforts for the disposal of Queen's Ferry Works, and although no sale has yet been effected, there is good reason to hope that negotiations now in progress will result favourably. A lawsuit, which has been hanging over the company in connection with one of their gas engine contracts has, since the books were closed, been settled by the payment of a sum of £15,000. This liability is provided for by the reserve fund, and the settlement of this case leaves the probable loss on the final disposal of Queen's Ferry as the only serious outstanding liability arising out of matters which were inquired into by the Advisory Committee in 1904. There is a considerable quantity of Diesel engine work in the shops at the present time; but the Diesel Co. have, so far, been able to place only a small proportion of the orders due under their agreement. It is hoped that, before long, there will be a revival in the demand for electrical generating machinery, and the company is now in an excellent position for securing a good proportion of the business when the revival takes place. Meanwhile, every effort is being made to push new developments such as turbo-pumps, water turbines, and condensing plant, so as to widen the base of the company's operations and make it less dependent on one class of manufacture. The first of the high-lift turbo-pumps has successfully passed its trials, and there are a number of these and of the water-turbines under construction in the shops. The directors do not for the present propose to make any addition to the board, or to fill up the vacant post of chairman. These matters have their earnest attention, and as soon as they are able to put forward proposals which will fully meet the best interests of the company, these will be laid before the shareholders.

Dick, Kerr & Co., Ltd.

The ordinary general meeting of the shareholders of the above company was held on Tuesday at the Cannon Street Hotel, Mr. John Kerr presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., Sept. 24), said that there had been a very considerable diminution in the profits during the past 12 months' trading, as they only amounted to £28,168. Out of this had been paid debenture interest and trustees' fees, and in addition a sum had been reserved to provide for the premium payable in connection with the redemption of the present debenture stock. These items absorbed £12,693, leaving a balance of £15,475, and if they added the profits brought forward from last year, £81,567, they arrived at a total available for appropriation of £97,041. Turning to the balance-sheet, the ordinary and preference share capital was the same as in the previous year. They had, as usual, set aside £6,000 for redemption of debenture stock, and of this amount, £1,000 was redeemed prior to June 30th, and the trustees held an additional sum of £5,067, which they applied to redemption of debenture stock by drawings on July 31st. The total amount of debenture stock which had now been redeemed was about £34,000. There was very little difference in the liabilities to creditors; the reserves were exactly the same as in the previous year; the capital expenditure at the works had been reduced by a sum of £14,252; stocks in hand and work in progress, by about £7,500; debtors, exclusive of contract balances, by about £9,000; and the contracts due for work, stock of materials, &c., was increased by about £14,000; sundry investments had been reduced by about £43,000, and the cash balances were more or less the same as in the previous year. These figures called for no special comment. In the years 1907 and 1908 the directors in their reports stated that severe competition had prevailed in all departments, and they foreshadowed that this competition would become keener daily, and business more difficult to obtain. He regretted to say the year under review was the worst the company had experienced for many years, for not only had they had to contend with very severe home and foreign competition, but there had also been a serious diminution in the amount of work offered. Their tale was not different from that of most of the industrial companies in this country, for it was common knowledge that competition in their class of business had been even keener than in any of the other branches of manufacture. In nearly every department they had suffered a serious shrinkage, and although every effort had been put forth by the directors and the staff, they had not been able to secure profitable business, partly because there was not enough work to go round, and partly because of the difficulty in getting money for enterprises calling for their special manufactures. The directors foresaw this state of things some years ago, and therefore took the opportunity of dealing with the accounts in a very conservative spirit; so much so, that they built up reserves amounting to £216,000, and if they included the present year's carry forward the total reserves amounted to £279,000. In dealing with the accounts for the year under review they had adopted the same policy as they had always followed, *i.e.*, depreciated to the same extent—perhaps even a little more than in the previous year—and reserved against all manner of contingencies; so that although they showed a very diminished profit, everything had been done on the same scale as in previous years when they were making large profits. Their works in Preston and Scotland had been maintained in the highest state of efficiency, and all that was wanted was a revival of business. They heard that business in America and Germany was improving very rapidly, and it was reasonable to hope that if those countries continued to show progress we in this country should get some of "the crumbs which fall from the rich man's table." It was hopeless for them to expect much more than crumbs having regard to the industrial conditions under which they were working, and judging from past experience a revival in trade generally began in America and Germany before it reached us. He was not there to make a political speech, but he thought most of them would admit that this fact was worthy of investigation even by the members of the present Government. He regretted to say it was impossible for the directors to hold out any bright hopes for the current year. They were doing their best in the shareholders' interests, and they might rely that nothing would be left undone to improve matters, and should business take a turn for the better within the next few months, they were quite ready to take advantage of it. He thought it right, however, to add that they were for the moment living in hope only, and that whatever might happen in other trades, he did not see that in this particular branch of business there was any likelihood of any great improvement for the next few months. They were gradually extending their connection in foreign markets, and were hopeful that when competition became less keen they would be able to get better prices and make more profit. The reputation of their manufactures and work generally stood as high as it ever did, and even now, although prices were cut to nothing, they were still maintaining the same quality all through.

Mr. R. H. Prestwich seconded the motion, and the report was adopted.

Mr. J. B. Glenn, in moving a vote of thanks to the chairman and directors, remarked that when competition was keen it necessitated the directors working harder than ever, and he was sure that the board of Dick, Kerr & Co. must have worked very hard last year, otherwise the result would not have been so satisfactory as it was, although they would naturally have liked to have seen a bigger profit.

Mr. Barningham, in seconding the motion, which was agreed to, said that when they looked round at other electrical concerns, he thought they had reason to be perfectly satisfied with the year's working. They ought to be very thankful that the directors had been able to pay a 6 per cent. dividend on the ordinary shares.

The Chairman, in acknowledging the vote, said that all the directors had worked hard, and had been very ably assisted by the staff. They intended to continue those efforts, and looked forward to better times.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 6½ per cent. per annum, for the half-year ended June 30th last, payable on November 15th.

Babcock & Wilcox, Ltd.—The directors announce an interim dividend of 8 per cent. on the ordinary shares for the past half-year.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ending 30th ult.

Lisbon Electric Tramways, Ltd.—The directors have declared an interim dividend of 2½ per cent., free of income-tax, on account of the current year.

Eastern Telegraph Co., Ltd.—A dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter to September 30th, and the second quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax, are announced.

Continental.—Switzerland.—The balance-sheet of the Oerlikon Co., of Oerlikon, near Zurich, for the last financial year shows a net profit of £17,867; a dividend of 4 per cent. is being declared, the same as for the preceding 12 months.

Germany.—The Stettiner Electricitätswerke Gesellschaft, of Stettin, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

MARKET QUOTATIONS.

Wednesday, September 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£11	£1 dec.
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
„ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £136	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	7¼d.	⅞d. dec.
c „ „ (solid drawn)	„	8¾d.	1¾d. inc.
c „ Wire, basis	„	6½d.	..
c Copper Tubes (brazed)	„	8⅝d.	..
c „ „ (solid drawn	„	8⅝d.	..
g „ Bars (best selected)	per ton	£72	£1 inc.
g „ Sheet	„	£72	£1 inc.
g „ Rod	„	£73	£1 inc.
e „ (Electrolytic) Bars	„	£60 10	..
e „ „ Sheets	„	£77	..
e „ „ Rod	„	£65 10	..
e „ „ H.C. Wire	per lb.	7⅞d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	9/1	8d. inc.
j Iron Pig (Cleveland warrants)	per ton	52/6	1/6 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 7 6 to £13 10	7/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£12 12 6	£4 5 inc.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1½	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	105/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£137	£1 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 10	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Prospectus.—*Sialang Rubber Estates, Ltd.*—This company, which is offering an issue of 100,000 shares of £1 each at par, will acquire, amalgamate and further develop as rubber-producing properties the Estates Sialang, Batoe Gingging and Tebing Tinggi, on the East Coast of Sumatra.

Johnson-Lundell Electric Traction Co.—The annual meeting of the shareholders of this company was held on Tuesday at the Cannon Street Hotel. A representative of the Electrical Review, who attended to report the proceedings, was informed that the meeting was private, and a request for a copy of the directors' report was refused.

Grassington Electric Supply Co., Ltd.—Mr. J. S. Fielden presided at the statutory meeting held at Skipton on 23rd ult. He said that it was hoped that the company would be in a position to supply by the end of October.

STOCKS AND SHARES.

Tuesday Afternoon

With money-rates tending to become a little harder, the Investment departments remain rather under a cloud. The prospect of a General Election has no attraction for the Stock Exchange, members lamenting that the chances at present are none too bright for the Tariff Reformers, whose advent to power would, it is supposed, lead to improvement in confidence and prices.

Amongst the Electrical departments the most animated section is that concerned with the Mexican Light and Power group. The Mexican Government has been moved to take up the cudgels on behalf of the Mexican Light and Power Company, and by official reassuring messages the price of the Common shares was run up 3 points, the 5 per cent. Gold bonds also improving. The 5 per cent. bonds of the Mexican Electric Light Company have recovered their decline of last week.

Mexico Trams are ½ lower. Sao Paulo Trams rose to 152½, and Rio Trams at 93½ kept steady. Canadian General Common is 124½ and the 7 per cent. Preference stock 121.

As regards the value of the championship by the Mexican Government of the Power Company, full weight must be allowed, of course, to the statements of the experts who have been consulted. There are many people, however, who have a great dislike to anything which looks like an attempt to bolster up either confidence or quotations. Nevertheless, times occur when denial of adverse rumours may be necessary, and the students of such matters have to determine for themselves whether it is justifiable and judicious.

The financial writers in the newspapers are making a good deal of "copy" out of the Willans & Robinson report, which is certainly a poor one. The prices of the shares and Debenture stock, however, have not moved. Manufacturing descriptions are very quiet generally, but British Aluminium shares are looking up again, and the Ordinary at 15s. show a nominal rise of 5s.

The principal gamble amongst industrials just now is in rubber shares, where the Stock Exchange vies with Mincing Lane—or *vice versa*—as to which shall be considered as the true market. Prices are very well maintained. Shrewd cynics point out that it pays well to hold up the price of rubber at a high figure what time the printing presses turn out share certificates at a rate so rapid as that to which we have been accustomed for many weeks past.

Railway stocks remain sunk in depression. Paragraphs have been appearing as to a new tube being constructed from London to the Crystal Palace, and Brighton Railway stock gave way on this rumour, the improbability of which being true is abundantly evident on the face of it. But railway stocks are hopelessly out of fashion, and any stick is good enough to whack a dead donkey.

Metropolitans fell a point, Districts remaining steady. The Central London and City and South London issues have not moved. Underground Electric Railway 4½ per cent. and Income bonds are both 1 lower.

The little excitement aroused over British Columbia Electric Railway stocks has subsided, but the Preferred stock gained another point. Anglo-Argentine Tramways 4 per cent. Debenture is a shade easier, while Calcutta Trams Ordinary shares and the Debenture stock show small advances. British Electric Traction Preference receded ⅛ to 2⅛, and the second Debenture stock drooped to 64.

All kinds of reports, mostly denied, has been current concerning the possibility of an important consolidation of American cable companies. The very centre of the rumours is the Mackay, and the Common shares have risen no less than 6, making 12½ points during a fortnight. New York is alone responsible for the movement, the business over here in the issues being of the most retail description. Submarine Cable Trust certificates are 1 up, and a similar rise lifted American Telephone and Telegraph capital stock to 148. Direct United States Cable shares are 2s. 6d. to the good, although Anglo-American Telegraph Deferred shrunk a little.

United River Plate Telephone shares have shot up, recovering the deduction lately made for the value of the rights. The new shares are quoted at a premium of 1¼, and buyers had little opportunity for picking up any at a cheap rate. National Telephone varieties have not altered, and Marconi's at 16s. 3d. show no change.

Electricity Supply shares are quiet and mostly featureless. Kensingtons pursue their steady upward progress in which Notting Hills have joined this week. Perhaps the coming of the winter may direct attention to the market; it wants something badly enough to unveil its attractions and potentialities.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Sept. 21st.	Closing Quotations Sept. 28th.	Business done week ended Sept. 28th, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞— 3⅜	2⅞— 3⅜	..	..	..	Nil.
136,700	Do. do. 6 % Debs., Nos. 1 to 1,250 Red.	100	6 %	5 %	6 %	6 %	93 — 96	93 — 96	..	..	..	6 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146 —148	147 —149	147½	..	+1	5 7 5
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	61½ — 63½	61½ — 63½	..	..	..	6 2 8
3,230,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	104 —105	105	104⅛	..	5 14 3
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	22 — 22¼	21⅞— 22⅛	22 1/16	21 1/16	— ⅛	1 16 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	91½	90¾	..	4 7 0
16,000	Cuba Telegraph	10	6 %	6 %	6 %	6 %	8½— 9¼	8½— 9¼	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17¼— 18¼	17¼— 18¼	..	..	..	5 9 7
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 11 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½— 8⅝	8⅛— 8⅝	..	..	..	5 15 11
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13⅛— 13⅝	13¼— 13¾	13 9/16	13⅛	+ ⅛	7 4 8
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —131	129 —132	131	129¾	..	5 6 10
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 — 87	85 — 87	86½	85½	..	4 0 6
1,396,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104 —106	105	..	— ½	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12 1/16	11 15/16	..	5 14 3
762,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 6
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼— 10¾	10¼— 10¾	10⅝	10 17/32	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾— 14¼	13¾— 14¼	..	..	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	26¾	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51½— 53½	51½— 53½	53⅛	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	89 — 92	95 — 98	91⅞	90	+6	4 1 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	79 — 81	79⅛	78	+2	4 18 9
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	¾— ⅞	¾— ⅞	16/-	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝— ⅞	⅝— ⅞	..	..	..	6 17 2
86,492	Do. do. do. 6 % Pref. ..	1	6 %	6 %	6 %	6 %	⅝— ⅞	⅝— ⅞	..	..	..	6 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 - 107½	106 —107½	106⅝	106¼	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	121 —123	121 —123	122¼	121	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10½	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	5½	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 — 100	98¼	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 6
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 13/32— 1 17/32	1 13/32— 1 17/32	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 5/32— 1 9/32	1 5/32— 1 9/32	..	..	..	4 15 3
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 — 102	100	..	..	3 18 6
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7¾— 8¼	7¾— 8¼	7¾	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	131 —134	..	..	+1	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅜— 6⅝	6 11/16— 6 15/16	6 15/16	6⅝	+ 5/16	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5¼— 5⅝	..	..	..	4 8 10
80,008	W. Coast of America, 1 to 30,000 & 58,001 to 63,008	2½	Nil	2½%	2½%	2½%	1⅜ — 1⅝	1⅜— 1⅝	31/3	30/-	..	3 16 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 6
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13¼— 13¾	13⅜— 13⅞	13¾	13½	+ ⅛	5 0 10
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	104½	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	8 %	6 %	6 %	8½— 9	8¾— 9¼	8 15/16	8⅞	+ ¼	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8¼— 9¼	8½— 9½	..	..	+ ¼	15 15 10
30,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝— 4⅞	4⅝— 4⅞	95/7½	92/6	..	5 2 4
500,000	Do. 6 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4½— 4¾	4½— 4¾	..	..	..	6 17 8
978,250	Do. 4 % Deb. Stock	..	..	..	..	4 %	92½—93½	92¼— 93¼	92¾	92¼	— ¼	4 5 10
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4½— 4⅝	4½— 4⅝	92/6	91/3	..	4 6 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¼— ¾	½— 1	..	..	+ ¼	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞— 2⅛	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 — 98	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	144 —149	147½	146	..	5 7 5
400,000	Do. Pref. Ord. Stock	100	6 %	6 %	6 %	6 %	117 —122	118 —123	121	..	+1	4 17 7
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
183,301	British Electric Traction	10	8 %	Nil	Nil	Nil	½— ⅞	½— ⅞	14/-	10/-	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2 — 2½	1⅞— 2⅛	45/-	37/6	— ⅛	6 9 9
1,173,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	85	..	..	5 14 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼— 7⅝	7¼— 7⅝	..	..	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,0[illegible]6,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
60,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
60,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 5 % Pref.	2	5 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	4½%	4¾— 5¼	4⅞— 5⅜	5¼	5 3/16	+ ⅛	4 3 9
46,304	Do. 6 % Cum. Pref., Nos. 1 to 29,830..	5	6 %	6 %	6 %	6 %	4¾— 5	4¾— 5	..	..	..	6 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	98 —101	..	..	+1	4 8 8
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅝— 11⅛	10⅝— 11⅛	10⅞	10⅝	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5¾	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	105¼	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 — 2⅛	41/3	..	..	5 17 8
210,168	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	105 —108	..	..	..	3 13 6
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3¼%	61 — 63	61 — 63	62	61¼	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86	85	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44	..	..	5 11 1
1,4[illegible]	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	81 — 82	81 — 82	81¾	81½	..	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	⅝— 1⅛	⅝ — 1⅛	..	..	..	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sept. 21st.	Closing Quotations Sept. 28th.	Business done week ended Sept. 28th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1¼	1 — 1¼	21/9	21/3	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 14 1
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/16 — 5/16	3/16 — 5/16	..	..	..	24 0 0
17,139	Do. "A" shares, 01—017,139 ..	5	4⅛%	4⅛%	2½%	2½ %	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	10/-	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	8 1/16	..	..	6 1 3
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13¼	12½ — 13¼	..	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛ — 5½	5 7/16	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	106	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14¾— 15½	14¾— 15½	..	..	..	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4¼— 4¾	4½— 5	..	..	+ ¼	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	8 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	3 %	8 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2¼— 2¾	49/4½	..	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	67 — 70	68	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	39¼— 39¾	38¼ — 38¾	39¼	88¼	—1	1 5 9
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 —67	65 — 67	66	65½	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	16 — 16½	16⅜	16	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	..	..	..	..
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 96½	94½ — 95½	95¾	..	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	126½—129½	125 —128	127¾	125¼	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	90 — 92	92	90	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½— 36	34½	..	..	5 0 0
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ -102½	101 —103	..	..	+ ½	8 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½—103½	102½—103½	103	102⅜	—1	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	87 — 89	88¾	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	36 — 38	35 — 37	36⅛	..	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝— ⅞	⅝— ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝— 3⅛	2⅝— 3⅛	58/9	..	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Sept. 21st.	Closing Quotations Sept. 28th.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4¼— 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7¼— 7¾	7¼— 7¾	..	..	..	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½— 8	7½— 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	82/6	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½— 5	4½— 5	91/3	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅜	3⅞— 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	8 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	72/6	..	..	5 12 6
175,000*l*	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10½— 11	10⅝	..	+ ⅛	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	12⅜	..	..	4 12 4
400,000*l*	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½% 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3 — 3½	3 — 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7 23/32	7⅝	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10⅞	10 25/32	..	5 7 10
400,000*l*	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅜— ⅞	⅜— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	..	..	..	7 7 7
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	84 — 86	91 — 94	84	..	+7	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½— 5	4½— 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	7⅛— 7⅝	7½	..	..	5 11 6
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	98 —101	100	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6¾— 7¼	7 — 7½	..	..	+ ⅜	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞— 2¼	1⅞— 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5 — 5¼	5 — 5¼	..	..	..	5 17 1
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	4 — 4½	86/10½	85/-	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	..	..	..	4 0 11
$3,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	79 — 81	80 — 82	81¾	79½	..	6 3 5
18,585,000	Do. Light and Power Co Ltd., Common ..	$100	..	..	..	3½%	67 — 71	70 — 74	72¼	68½	+3	4 14 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	103 —106	103½	102¼	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	83 — 85	83½— 85½	85½	82	+ ½	5 17 0
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 4
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	2 14 0
187,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	..	..	..	4 16 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12 — 13	12½— 13½	..	..	+ ½	5 6 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000*l*	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	8 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	21/10½	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	102—105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½— 1	½— 1	..	..	..	25 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅜— 1⅞	1⅜ - 1⅞	..	..	..	18 8 8
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	77 — 81	..	..	..	5 11 1
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	27/32 — 29/32	27/32 — 29/32	..	..	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8½— 9	8½— 9	..	..	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909

SOME NOTES ON THE ERECTION OF POLES FOR OVERHEAD LINES.

By "WIGWAM."

To those inexperienced in the erection of poles and lines, the work may appear comparatively easy and so straightforward that mistakes would be exceptional; but there is a good deal to be learnt, even from the humble "ganger" on the subject, before the pole-line shows the mark of the workman rather than that of the novice.

The following are some points that should be useful to those who have to undertake such work for the first time, and they may also be useful to many who wish to improve some of their present methods.

In this country practically all the poles used are creosoted to preserve them against climatic conditions. This process of creosoting consists of injecting creosote oil into the fibres under pressure; the poles are placed in a long cylindrical tank which is filled with the oil and, after closing up all the doors, further oil is forced in by means of pumps so as to give a pressure of 10 lb. per sq. in. inside the tank. This pressure is maintained until the oil has found its way into the poles.

It will be easily understood that the oil, under pressure, will find its way into the weak places in the wood fibre, fill these readily and so preserve them whilst, where the timber is hard and seasoned, the oil may only partially penetrate. The fact that the oil has only partly got into these places proves that the wood is sound and does not require the preservative. If the pole has to be cut, as for the fixing of the arms, and the cut extends through the creosoted portion into the white wood, the oil will run into the opened portion and the wound thus becomes self-healing. Most of our readers will have observed workmen placing timber protection over the signal wires and points on the railways, and that, as the timber is cut up, the white interior is exposed, but after a day or two the oil has run into the exposed parts, and these have the same appearance as the rest of the timber, *i.e.*, the wound has healed up.

A similar process takes place with creosoted poles, and we need not be unduly alarmed if we find, on cutting into a pole, that some parts of it do not appear to have been thoroughly treated.

In countries where the poles are subject to the attention of insects, it is further advisable to char them from the butt up to about 2 ft. above the ground level; this is easily done by rolling them above a broad fire and smearing them with tar to make them burn. It is convenient also, whilst the pole is still on the ground, to fit it with the arms, cap, earth wire or any other fittings, and then to remove them except the earth wire during erection, so that they are easily replaced when the pole is in position. This is a far quicker and safer method than to dress the pole and attach the fittings after erection.

If the poles are heavy and a portable derrick can be used, this is the quickest way of planting them, but poles of average size and weight, such as are most commonly used, can be readily planted, as shown in fig. 1, with no other appliance than a couple of ladders and two short ropes. The writer has erected poles up to 40 ft. in length and about 7 in. in diameter at the top in this way. It will be seen from the sketch that the hole is long and narrow, and that as the pole is lifted at the top, it tends to slide itself into position. A stout flat piece of timber is placed, as shown at the front end, and the butt of the pole slides down this; if the ground is soft, flat boards may also be fixed at the sides to prevent their being broken in. These boards are, of course, removed when the pole is erect, and the earth is firmly rammed round the base. Poles are usually placed about 45 yards apart (*i.e.*, 40 to the mile) and $\frac{1}{6}$th of their total length in the ground, but, where the conditions are favourable, the spacing is frequently increased up to 60 yards. In public roads, or where the lines cross public roads, the Board of Trade conditions must be complied with, and the Post Office also places certain restrictions where its lines are crossed. Printed particulars as to height and guard wires can usually be obtained from the local post office engineer. On private land the spacing is usually governed by the weight of wire to be carried and the number of angles in the line, and also by the degree of exposure to storms and wind pressure, but, only in exceptional circumstances, is it necessary to have them closer than 40 yards.

Stays must be provided to support the pole where there is side pull, but if this is only slight, as where the line diverges a little from the straight, a stay may be avoided by giving the pole a slight "rake" in the opposite direction to that of the pull. The amount of "rake" required so that the pole may be perpendicular after completion can only be judged from experience, but a little practice soon teaches this. Stays should be of stranded galvanised-iron wire about $\frac{7}{10}$ or $\frac{7}{8}$ S.W.G., fitted with an adjustable swivel for altering the tension after erection. A piece of railway sleeper or a long stone makes a good anchorage. If an iron stay rod is used, the former is more convenient, since a hole is more conveniently made through it for the stay rod. If the stranded wire is used in the ground, the anchorage may be either the sleeper or stone or a short piece of railway metal; but it should not be of such a nature that it will rot in the ground; otherwise, as the anchorage rots away, the stay becomes useless.

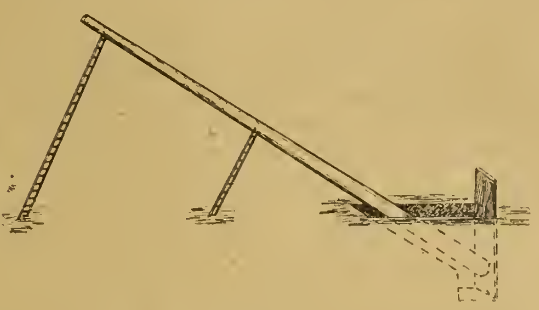

Fig. 1.

The earth wire is, perhaps, one of the details most frequently neglected. It should be a stout galvanised-iron wire, about No. 8 S.W.G., securely stapled to the pole, and projecting well above the highest conductor, as shown in fig. 3. One frequently sees the earth wire cut off short at the cap, below the level of the top insulator, so that it is practically useless as a lightning conductor.

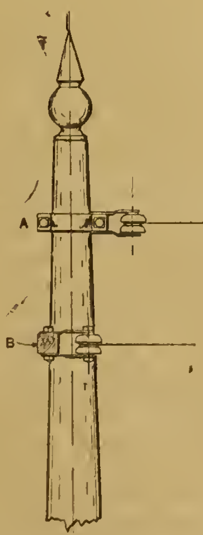

Fig. 2.

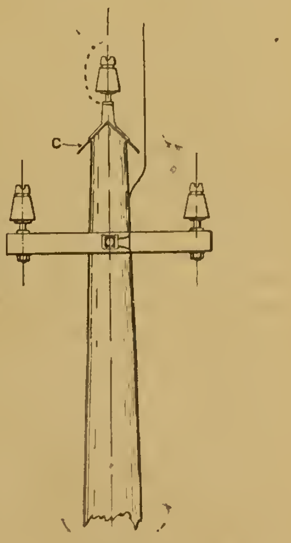

Fig. 3.

For light lines a wire guard, shown in dotted lines in fig. 3, is sometimes used, and is placed so that it will catch the line if the binding wire breaks. In this case the earth wire should be properly connected to the guard wire, which then forms the finial of the lightning conductor. The arm bolts and, if of metal, the arms also should be connected to the earth, as also must any guards or guard arms.

A galvanised iron roof or cap (C, fig. 3) is used to protect the top of the pole from the weather, and should be amply large to more than cover the pole. The galvanised saddle bracket carrying the top insulator is fastened by four coach screws, or two coach screws and two clout nails driven through the pole roof. The whole of the iron work fittings should be galvanised to protect them from the weather. The arms are usually seasoned oak 2½ in. × 2½ in. for average size lines, and proportionately larger for heavy lines. The pole is notched to a depth of about 1 in., and the arm driven in tight, as shown at B, fig. 2, so that it will remain horizontal.

Fig. 2 also shows another point which is frequently overlooked, and this is, that the pull should be against the pole and not on the bolt as would be the case if the arm were on the right-hand side instead of on the left hand. This sketch also shows an arrangement for straining off the top wire by means of an iron clamp bent to fit the pole and double-ended if required to strain off in both directions. The finial shown on the same sketch add considerably to the general appearances, and for village or road lighting where appearances have to be considered, is well worth the slight extra cost. These finials can be bought at about 2s. to 2s. 6d. each, according to the size and quantity, and from this the cost of the pole roof may be deducted.

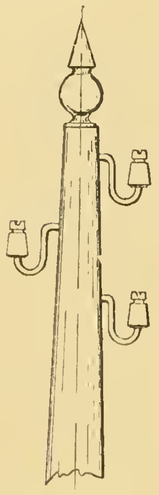

Fig. 4.

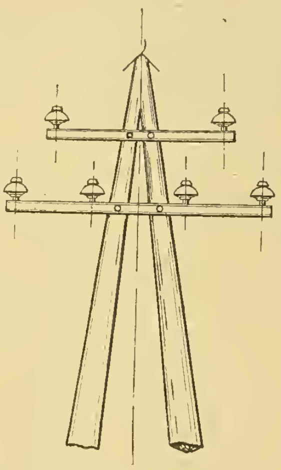

Fig. 5.

For this class of work, swan-necked insulators are frequently used instead of arms and bolts, and in some districts the supply companies are using them for power transmission at medium pressures (see fig. 4), and for both direct-current and three-phase transmission. Whilst it is generally to be recommended that for three-phase work the conductors should be equi-distant from each other, it is found in practice that spacing them at somewhat unequal distances does not make any appreciable difference to the losses under the conditions to be usually met with in this country. The use of swan-necked insulators may, however, be carried to extremes as anyone who has travelled on the French railways and observed the telegraph lines can testify; here one frequently sees 15 to 20 insulators with swan-necked bolts of various lengths and sizes carried by a short slender pole, and the arrangement falls far short of the solid construction to which we are accustomed in this country where arms carrying four, six, and even more wires are the rule.

For heavy construction, two poles joined together in the form of an "A" are to be recommended, and this arrangement has great stability, and will stand considerable side strain without staying; it is frequently used for high-tension lines where heavy guards are necessary. The poles are cut to fit each other at the top, and the arms form a further bracing, as shown in fig. 5. They also require bracing together at the butts, at any rate during erection.

In districts subject to lightning discharges, a galvanised barbed iron wire is often run on the apex of the poles, and forms a continuous earth wire as well as an effective lightning conductor running parallel to, but higher than, the transmission lines. It should be connected to the earth wire of each pole and earthed, by means of a copper plate about 2 ft. sq., at intervals of about ½ mile.

PROCEEDINGS OF INSTITUTIONS.

Hydro-Electric Power in Canada.

By Cecil B. Smith, M.Am.Soc.C.E.

(*Abstract of paper read before the* American Society of Civil Engineers, *September 1st*, 1909.)

(*Concluded from page* 908.)

Under the franchise conditions existing between this company and the Provincial Government, and having in view the water limitations now being reported on and recommended by the International Deep Waterways Commission, it would appear to be inevitable that this company will soon be forced to enter actively into exploitation of the Canadian market, in order to enable it to increase its output sales beyond the present, which amounts to about 40,000 h.p. from its own station, to which must be added some 5,000 h.p. obtained from the Electrical Development Co. and exported.

The combined output of the three stations of these allied companies, *i.e.*, the Niagara Falls Power Co. and the Canadian Niagara Power Co., is more than 500,000,000 kw.-hours per year, and the load factor is more than 70 per cent., owing to the large number of electrochemical customers.

Between 1902 and 1906 the Ontario Power Co. constructed, immediately below the cataract, a station which is equipped at present with six horizontal units, each of 10,000 or 12,000 e.h.p., generating three-phase, 25-cycle, 12,000-volt current, at 187½ r.p.m., under a net head of 178 ft. The turbines are of German design and manufacture. The water is brought to the station by an 18-ft. steel pipe, 6,500 ft. long, which is embedded in concrete just below the hydraulic grade line, and buried in Queen Victoria Park a few feet beneath the surface.

This company selected a favourable location for its entrance works and forebay, which are located at the head of the rapids and are completed for a capacity of 180,000 h.p., and, as far as ice troubles are concerned, it may confidently expect to give a continuous service.*

In several other features these works are interesting, particularly in respect of the methods of control. To handle successfully an 18-ft. column of water, 6,500 ft. long, moving at 15 ft. per sec., under ordinary commercial electrical conditions, was no mean task, but it is understood that, by means of a spiral overflow structure, this has been accomplished. The electrical control is centred in the transforming and distributing station, which is 600 ft. from the generating station and on the high bluff overlooking the cataract. At this point all the current from the generators to the high-tension lines is controlled. The transforming station is equipped with 18 single-phase, oil-insulated water-cooled transformers, each of 3,000 k.v.a., each bank being in a separate compartment. This company has created several allied companies which distribute 62,500-volt and 12,000-volt current in the United States and Canada. Its extreme eastern delivery is at Syracuse, N.Y., 161 miles distant, and it distributes current westward to St. Catharines, Welland and Port Colborne; but in view of the contract it has now entered into with the Hydro-Electric Power Commission of Ontario for the supply of from 25,000 to 100,000 h.p., at from $9.00 to $9.40 per h.p. per year for 12,000-volt continuous power, it appears evident that its sphere of influence in South-Western Ontario is in the near future to become very considerable, and the output of its station increased to at least 50,000 h.p. At present its maximum load is 25,000 h.p. in the United States and 5,000 h.p. in Canada, sales being at the rate of 110,000,000 kw.-hours per year.

This company's transmission lines are very extensive and varied in character, and comprise several hundred miles of double-circuit and single-circuit aluminium lines, chiefly mounted on steel towers carrying one circuit each. Some of the branch lines and 12,000-volt lines, however, are on timber A-frame towers or cedar poles; the various constructions have been carried out substantially and scientifically, but are subject to the criticism of transmitting at only 60,000 volts for distances up to 160 miles, whereas, at the present time, 80,000-volt transmissions are in use and 100,000-volt projects are under construction; however, it is true that the suspended insulator has not yet been fully developed to unquestioned satisfaction, and, at 100,000 volts, air emanations from conductors, line troubles, &c., are certain to be considerable.

In 1903 the Toronto and Niagara Power Co. was formed by parties interested in the Toronto Street Railway Co. and the Toronto Electric Light Co., and, after negotiations to buy electric current from other Niagara companies had failed, a lease was secured from the Provincial Government to build a generating station in Queen Victoria Park at Niagara Falls, at a site lying between those of the Canadian Niagara Power Co. and the Ontario Power Co., the works of both these companies being then under construction. The location chosen was notable in two particulars, the intake being almost wholly in the surging rapids above the cataract, while the tail-race tunnel was located so as to emerge beneath the cataract itself. The construction of these works proceeded from 1903 to 1907.

Preliminary to construction, it was most difficult to construct the coffer-dams and keep them watertight, and, together with the extensive overflow dam, &c., afterwards constructed, this made a heavy investment necessary. The wheel-pit is constructed for

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* The author wrote before the troubles with ice last spring, when this station was flooded by an unprecedented rise in the water level.—Eds. E.R.

11 units, each of 8,000 KW., and four of these units are now installed. The operating head is about 140 ft., and the station is equipped with Francis double-runner turbines, constructed by United States manufacturers on Swiss models. In various items, however, these turbines differ from previous constructions. The draft-tubes are carried outward to twin parallel tail-race tunnels, and emerge from underneath so as to maintain the water seal. The penstocks are alternately right and left, in groups of two, thus economising in wheel-pit length. The supporting structures for the vertical main shafts of the units are concrete arches instead of steel girders. Altogether, these works give evidence of advance in the art of wheel-pit construction. The power house is a most ornate structure; indeed, this company has carried on all its operations with a lavish hand, and a resulting large investment. Its generating company is known as the Electrical Development Co., and the three-phase, 25-cycle, 12,000-volt current generated is delivered outside of Queen Victoria Park to a transformer station, whence the Toronto and Niagara Power Co. transmits it at 60,000 volts to Toronto, 80 miles distant (population 300,000), over a double-circuit steel-tower line. This line is carried across Hamilton Beach and Canal and the Welland Canal by pairs of very high and heavy towers; otherwise the transmission line passes through a level cultivated country without serious transmission difficulties, although including various spans across small valleys of more than 1,000 ft. each.

The transforming stations are built apparently with a great effort to attain safety, each single-phase transformer being in a separate compartment, and there is a very extensive concrete-cell construction for bus-bars, lightning-arrester compartments, &c. The Toronto terminal station also has an auxiliary water-tower for supplying water to transformers, in addition to the water service from the city mains. The current delivered at this station at 55,000 volts is stepped down to 11,000 volts, and is then carried by underground feeders to various sub-stations in the city, where it is transformed into 600-volt D.C. and various voltages A.C.; also, the frequency is changed from 25 to 60 cycles. Altogether, from 20,000 to 22,000 E.H.P. are used by the two subsidiary companies, in addition to sales at Niagara Falls to the Canadian Niagara Power Co. for export, as before mentioned, and there are also subsidiary companies formed to distribute eastward in the United States.

This brief description of the capacities of the various Niagara generating stations, amounting to 450,000 E.H.P. in Canada, when the stations described are fully equipped, and the fact that several other companies own charters and water rights, and are anxious to enter the field, if given opportunity and encouragement, at first would suggest that electrical energy can now be obtained in this favoured district at very low rates; and, comparing the rates offered with the cost to any given consumer to produce power or light by steam-driven prime movers, certainly the rates do improve these conditions somewhat, as is shown by the steady growth of electrically-operated industries in Hamilton, Ont. Moreover, from $20,000,000 to $25,000,000 have already been invested by these four companies in generating stations and transmission systems, which must find a return by the sale of the electrical output; but for the last ten years the people of South-Western Ontario have steadily asserted that, to create a great industrial area in that part of the province, still cheaper power ought to be and could be obtained.

Boards of Trade began to agitate in 1900, and in 1902 a committee was formed to take concrete action, which, by pressure on the Provincial Government, induced the passage of an Act in 1903, enabling two or more municipalities to appoint a Commission and, after investigation, to carry out, if desired, the construction of the necessary works at Niagara or elsewhere for generating, transmitting and distributing electrical energy.

This municipal Commission made a very exhaustive investigation, and reported in 1906 to the seven municipalities then represented in the movement, but there has been no specific outcome from this report.

In 1905 the Provincial Government, becoming more fully alive to the importance of this question, appointed a Government Commission to study and report on the hydraulic possibilities in the province, the industrial demand then existing for electrical energy, and the prime cost of generating and delivering the same to the various industrial centres and customers. The reports arising from the investigations were presented, in due course, to the Legislature during the session of 1905 6; but, although the facts elicited furnished a comprehensive idea of the industrial conditions then existing, and the cost of satisfying the same, and also, by comparison, set forth the rates offered by distributing companies, it has only been after a subsequent protracted struggle that definite results have been obtained and the evident will of the people carried out.

The vested interests immediately attacked the reports and the *bona fides* of those who drew them up, but the Provincial Government, recognising the demand made upon it, passed a very comprehensive Act, appointing a permanent Government Commission. In this commission were vested the rights of the Crown, and it was authorised to act in response to the demands of the municipalities and on their behalf.

This commission, after 2½ years' existence, has justified itself; and a group of sixteen municipalities has made a demand upon the Commission to secure electric power, to construct transmission lines from Niagara, to transform the electrical energy thus transmitted at the various sub-stations, to administer the construction, and to operate the works for a period of 30 years, over which period a sinking fund will be created out of the rates to repay the investments. The amount of power to be distributed immediately is approximately 30,000 E.H.P., but it is confidently expected that this will increase very rapidly to probably 100,000 E.H.P. in five years.

The various municipalities have voted the money necessary for local distribution, and the Government has recently contracted for the construction of 300 miles of transmission lines, and this work is to be followed immediately by the construction of the necessary sub-stations and local distributions.

This popular movement has yet to be justified by capable and honest administration, deficiency in which is the weakness of many municipal movements in America, and it is to be hoped that the ægis of the Government Commission will render the inherent merits of the project effective.

The large area of country to be covered, and the necessary anticipation of a still wider area as soon as the first installation has justified itself, have forced on the Government engineering staff a consideration of higher voltage, and, according to present plans, the ultimate voltage of transmission now being provided for is 100,000. This advanced practice, however, has been adopted by reason of the necessary provision for further extensions of the Hydro-Electric Commission's system to points still more distant from the generating station than London and St. Thomas (140 miles). The world will, doubtless, watch closely the results obtained in carrying out this huge municipal-provincial distribution of electrical energy.

The St. Lawrence River, between Lake Ontario and Montreal, may be considered as having its navigation interests paramount, and, although attempts have recently been made to obtain permission from the Canadian Government to devote the whole river to power development, it is not likely that such permission will ever be granted.

In the meantime, along the ship-canal system, many small installations have been permitted, but they are chiefly local in character and are devoted to operating mills and factories. They amount roughly to 10,000 H.P., and, in addition to this, hydro-electric stations having a capacity of about 5,000 H.P. supply the various near-by towns with light and power, and light the ship canals during the navigation season.

The whole river, if available, would be a great source of power, as it is capable of developing at low water 1,500,000 H.P. of electrical energy at the various rapids.

In the vicinity of Montreal (population 400,000), several interesting constructions have been made at various times by various companies, but finally all these interests have been merged into the Montreal Light, Heat and Power Company, which controls the situation at present, although a rival company has recently been organised to develop power on the abandoned Beauharnois Canal of the St. Lawrence system and transmit to Montreal and distribute in opposition to the Montreal Light, Heat and Power Company. The latest construction by the latter company is at Soulanges, on the Soulanges Canal of the St. Lawrence River, 27½ miles west of Montreal, where 40,000 cb. ft. per sec. are available under a head of 54 ft. The equipment now being installed consists of three units, each of 3,750 KW., which will generate three-phase, 60-cycle current at 4,000 volts. The transmission will be on one circuit at 44,000 to 40,000 volts, and the transformation will be made by banks of single-phase, water-cooled transformers having a rated capacity of 2,500 KW. per phase.

At present this company owns two water-power stations and four steam stations, the latter having a capacity of 9,000 H.P. The company also purchases 16,000 H.P. delivered in Montreal by the Shawinigan Water and Power Co.

The station at Lachine, on the St. Lawrence River, is an example of daring but mistaken construction, carried out 12 years ago, when the transmission problem had not been as fully worked out as at present. The works are really constructed as a part of the river, and, therefore, in operation they are subject to troubles from frazil in the head and tail-races; but after excessive expenditures, made for the purpose of creating quiet conditions above the power house and protecting the tail-race from back-water, the station can be reasonably depended on to give continuous winter service.

The dependable hydraulic head is only 14 ft., and the eight generators, each having a rated capacity of 750 KW., are operated by groups of six turbines each, driving jack shafts.

The current generated is three-phase, 60-cycle, at 4,400 volts, and is transmitted over 11 circuits at this voltage direct to Montreal (6½ miles), where it is stepped down to 2,400 volts for distribution. The station was designed for a capacity of 16,000 H.P., but it has never been equipped with machinery beyond 8,000 H.P.

At Chambly, on the Richelieu River, a branch of the St. Lawrence, 18 miles south-east of Montreal, the company owns a generating station which has also had a history interesting to engineers. The concrete dam, constructed to create a head of 34 ft., failed soon after completion, and the first year's operation was much disturbed by frazil; but a new dam has since replaced the faulty structure, and the station now operates normally.

The equipment consists of eight units, each of 1,800 KW., driven by four turbines per unit, the total generating capacity of the station being 20,000 E.H.P.; but the average load carried is 15,000 E.H.P. The current, which is 2,200-volt, two-phase, 66-cycle, is stepped up to 25,000 volts, three-phase, by 2,750-KW. single-phase air-blast transformers, and is delivered over four circuits to Montreal, where it is transformed into the city distribution systems.

The complexity of distribution at Montreal may be appreciated when it is noted that the current is of three different frequencies, namely, at 30 cycles from Shawinigan, at 60 from Lachine, and at 66 from Chambly, to which must be added the ordinary conversions to D.C., and to various distributing voltages, A.C.

The total distribution of power in the city from the various stations of the company varies from, say, 30,000 H.P. in the summer to as much as 53,000 H.P. at peak load in the winter, and this amount will be supplemented soon by delivery from the Soulanges station now under construction.

The St. Lawrence River Basin is traversed by many large tributaries, which will be discussed briefly in respect of such developments as have been carried out, but it may be stated briefly that, although many small towns and mining and milling centres have hydraulic and electric stations of modest proportions satisfying present needs, there yet remains opportunity for developing millions of horse-power on such rivers as the Ottawa and its tributaries, the St. Maurice, the Saugenay, the Trent, Spanish, Nepigon, &c., and projects innumerable of greater or less merit are being studied carefully by engineers and financiers with a view to meeting industrial needs as they arise, and creating new centres and industries to consume the available power.

The Kaministiqua Power Co. has constructed a generating station at Kakabeka Falls, on the Kaministiqua River, and transmits power to the City of Fort William (population 15,000), at the head of Lake Superior, where grain elevators, flour mills, foundries and municipal utilities consume some 6,000 or 7,000 H.P. at the present time.

The equipment consists of two 4,000-KW., three-phase, 60-cycle, 4,000-volt units, driven by German-built turbines, and the current is raised to 25,000 volts and transmitted 19 miles to Fort William.

In 1904 the Canadian Copper Co. (otherwise the International Nickel Co.) constructed a generating station on the Spanish River at Turbine, from which current is delivered to its mines and smelters at Copper Cliff, near Sudbury. Two 2,000-KW. units are installed, and a third is now under construction. The current as generated is three-phase, 25-cycle, at 2,400 volts, and is stepped up to 35,000 volts for transmission. It is carried 29 miles to Copper Cliff. The mines and smelters, it is understood, turn out more than one-half of the world's consumption of nickel.

The Mond Nickel Co. is installing a 1,500-H.P. hydro-electric station for similar purposes on the Vermilion River, and the current is to be transmitted 11 miles to the Victoria mines and smelters, 25 miles south-west of Sudbury.

The town of Orillia (population 6,000) has constructed a power station on the Severn River, and transmits some 1,600 to 1,800 H.P., at 22,000 volts, a distance of 20 miles.

The city of Ottawa (population 75,000) is in the midst of many developed and undeveloped water-powers, and the latter, in the event of the construction of the Georgian Bay Ship Canal, would become readily available at low investment costs. Within a radius of 75 miles of Ottawa City there can be developed on the Ottawa River and its main tributaries 500,000 H.P. at low water, which amount would be increased materially by the construction of the ship canal.

Near or in the city of Ottawa there are 10 hydraulic and hydro-electric developments operating under various heads, but chiefly on the Chaudière Falls at from 22 to 35 ft. These developments form the industrial centre of the city, and operate very extensive pulp and paper mills on both sides of the river. There are also cement mills, carbide furnaces, and other industries, and power for street railways, lighting, and general city use is also produced. About 35,000 H.P. is now developed, and, as many conflicting interests were contending for their respective shares of the flow of the river, it became evident that some improvement was imperative, so that an agreement to construct a proper dam at Chaudière Falls has been entered into and the work is in progress.

In the near future more power will be required, and it is proposed that the city itself develop the splendid powers quite near it on the Gatineau River, where a head of more than 80 ft. can be secured at a point within 8 miles of the city, and where 50,000 H.P. can be developed at one location. Considering the vast timber and mineral resources tributary to Ottawa, and its position as Capital of the Dominion, it may be considered certain that the availability of unlimited hydro-electric power assures the industrial future of the city.

The Ottawa is only one of many great rivers flowing into the St. Lawrence from the north between Montreal and the sea, and, as all these rivers rise in unbroken forests on the Laurentian highlands, and are well supplied with splendid storage facilities, they are all valuable sources of power. However, the sparse population has been a deterrent, and the only large works north of the St. Lawrence, and devoted to the generation of electrical energy for transmission purposes, is on the St. Maurice River at Shawinigan Falls, where the Shawinigan Water and Power Co. has created a large industrial town and also generates a large amount of power for transmission to Montreal, Sorel, Three Rivers, Thetford, &c., and will doubtless soon enter the field at Quebec in opposition to the present companies.

The hydraulic conditions at this place are most favourable, as the head-works consist of a natural lake, which prevents trouble from frazil in the winter. The drainage area is some 18,000 sq. miles, and a flow of 10,000 cb. ft. per second is considered the minimum. This, at a hydraulic head of 130 ft., provides more than 100,000 E.H.P. at all seasons. The works have been carried on partly for the generation of electrical energy and partly to operate local industries hydraulically. The products of these industries are pulp, paper, aluminium, carbide, &c.

The electric station has three 4,000-KW. and two 7,000-KW. units, generating two-phase 30 cycle current at 2,200 volts, and this is transformed to 50,000 volts by banks of 1,100-KW. and 2,200-KW. single-phase water-cooled transformers having a total capacity of 32,000 KW.

The transmission circuits are of aluminium cable on wooden poles. The Montreal service (85 miles) has been in operation for the past 10 or 12 years, and has given good satisfaction.

The delivery in Montreal is by two circuits, and amounts to 16,000 H.P.; besides which, the company serves the asbestos and other mineral districts on the south side of the St. Lawrence at Danville, Thetford, &c. The accomplishments of this company within the last 10 years have been considerable; indeed, its works form the basis of many large industries, and it can be confidently expected that the whole 100,000 H.P. available at this one water-power will be made use of in the near future.

In the vicinity of Quebec City (population 90,000), the installation on the Chaudière River, south of the St. Lawrence, has a hydraulic head of 114 ft., and is laid out for 6,000 H.P., but the equipment, thus far, is for not more than one-half this amount. The current is three-phase, 66-cycle, and is generated at 11,000 volts. It is transmitted to Levis and also to Quebec City by insulated cable laid on the bed of the river.

The Montmorency works, having a capacity of 4,000 H.P., have five units operating under a head of 220 ft., and generate two-phase current at 5,000 volts, which is transmitted direct over four circuits to the city sub-stations.

The Jacques Cartier works have 2,000 H.P. installed, and the current is transmitted 18 miles at 20,000 volts over two three-phase circuits to the city limits, where the company has a steam auxiliary station of about 2,000 H.P. to carry peak loads.

A careful consideration of the electrical data contained herein will indicate the trend of activity in Canada in hydro-electric investments and the reasons therefor. In general, it may be said that on the Atlantic Coast and over the western and central portions of the great plains very little benefit is to be derived from such constructions, but over all the Provinces of New Brunswick, Quebec, Ontario, Eastern Manitoba, Western Alberta and British Columbia the continued construction of additional hydro-electric stations and the distribution of electric current to the practical limits of transmission may be confidently predicted. The resources of Canada in minerals, timber and agriculture are so varied and so immense that the growth of industry as a legitimate outcome of the development of these resources, and the corresponding increase in population, may be looked on as a foregone conclusion, and it is as certain that, in this industrial growth, low-priced power will form a large factor.

At present the hydro-electric developments serve to a greater or less extent such industrial centres as Montreal, Quebec, Ottawa, Peterborough, Toronto, Hamilton, Winnipeg, and Vancouver, besides a great number of smaller ones; but only a beginning has been made. Probably the 500,000 H.P. now hydraulically developed would include only stations of 1,000 H.P. or more, and there are literally many millions of horse-power available for development within easy reach of the present population; but, apart from the increased industrial demand, there are specific demands of great importance. Already, as noted, several mining interests are served by hydro-electric power, and with the growth of mining investments the importance of such service will increase. Then again, pulp and paper (with the depletion of United States supplies) will become a much more important industry than at present, and consequently much hydraulic and electric power for 24-hour service will be thus consumed.

Particular attention is directed toward the enormous opportunities for electrochemical industry. At Niagara Falls, N.Y., a large group of such industries is now well established, and in Canada a modest beginning has been made at Shawinigan, Ottawa, and Niagara Falls, Ontario; but Canada has in its great rivers sources of power as cheap as any in the world, except that the labour item may increase slightly the investment per horse-power beyond that of a similar construction in Europe. The whole question rests on transportation and markets; the latter, artificially restricted by the United States tariff, must seek an outlet in Great Britain, and as it is well demonstrated that $10 per H.P.-year, continuous power, at the low-tension switchboards, is a remunerative price for large installations, and will cover all fixed charges, depreciation and attendance, there would appear to be a good field for investment.

The financial condition in Canada at present as regards hydro-electric enterprises is worth considering. Some 10 or 15 years ago many of the brighter minds in the country seized the idea that, by securing valuable long-term franchises on the one hand for electrical service, and on the other for water privileges on near-by rivers, a splendid opportunity existed for profitable exploiting.

The net result at present is that, in almost all the large towns and cities, these services are administered by companies whose charges for power and light are only regulated by two things: either the exigency of the occasion, or the cost of a similar service produced by the customer from coal usually imported from the United States; and as a good quality, run-of mine, bituminous coal costs from $3.50 to $4.00 per ton in Ontario and Quebec and $6.50 per ton in Manitoba, it is evident that such competition is harmless, and the electrical companies were and are able to do business at very profitable rates.

In recent years, however, the municipalities have become active, and several smaller towns and cities have constructed municipal hydro-electric stations. The movement is very active at present in the Province of Ontario, and to a less extent in other provinces.

The struggle is bound to be prolonged and bitter; indeed, much bad feeling and resort to disreputable tactics have already been exhibited. Municipal and provincial credit has been attacked in the London market, and all the influence which heavy vested interests can exert is and will be directed against further municipal action.

The ultimate result is evident; the public mind will become more and more inflamed by the obstruction of the electrical companies, and, undoubtedly, in the end, the municipalities will carry out the expressed wish of the majority; but in the meantime public credit is unsettled, the manufacturers are playing a waiting game, and no one is benefited, because the expansion of the market, with consequent advantage to everyone, including the electrical manufacturing companies, has not taken place.

It would appear advisable to consider the appointment of a Public Service Commission by the Dominion Government to regulate the rates which may be charged by companies already in operation, so as to secure that benefit to the public which the presence of abundant water power warrants, because it is not probable that, at the most, more than a majority of the industrial centres will be served municipally, and, judging by the results obtained by the Dominion Railway Commission, much satisfaction might be obtained and the public mind be set at rest, if a rate-regulating commission for electric utilities, with wide powers of action, were appointed.

Concurrently with the distribution of electric power for utilisation in cities, &c., it is to be anticipated that very large constructions will be undertaken in the near future to furnish power for the operation of railways over heavy grades where coal is expensive or traffic dense, and that at the same time the natural resources of the country will develop to an increasing extent, and that in mining work, pulp and paper manufacture, electric smelting, and general electrochemical service will be found the most attractive fields for the enormous and not fully appreciated sources of cheap and widely-distributed power which is now wasting in so many districts of Canada.

THE AUDIT OF THE ACCOUNTS OF TRAMWAY UNDERTAKINGS AND TRAMWAY FINANCE COMPANIES.

By "ACCOUNTANT."

(*Concluded from page* 516.)

Sometimes a tramway company may own a few investments, though somewhat nominal. Verification is effected in the case of registered securities by the production of the certificates in the case of bearer securities, by the production of share warrants to bearer or any other form of bearer certificate, and in the case of inscribed stock a note or certificate from the bank or house in whose books the stock is inscribed will be available.

The investments should be shown fully and conspicuously in the balance-sheet, and they are generally exhibited at cost. Market value is not of much importance, owing to the manipulation and devices of bulls and bears and frenzied quotations, though it is an excellent custom to value investments at market price (when they have a quotation) or cost, whichever happens to be the lower.

Premiums paid upon the leasing of property or sums paid for leasehold property as well as expenditure therein incidental to acquisition and consequent improvements, are sometimes incorporated in the balance-sheet with other expenditure covering quite a miscellaneous description of items. Such expenditure should be disintegrated, and provision made therefor, as well as for any necessary dilapidations by a leasehold policy of insurance, or any other form of redemption which meets the circumstances.

It is also necessary in some instances to make provision in respect of freehold property, but this can only be determined by the precise circumstances. When operating companies are constructing additional lines and works, and do not desire to raise further capital by way of issue of shares, or to incur, or increase, debenture debt, it is not an infrequent experience for them to be denuded occasionally of working capital, and it is upon the occurrence of such events that we may anticipate outstanding loans in the balance-sheet with the concomitant appearance of interest thereon in the profit and loss account.

On occasions in the past some companies have charged to capital interest on temporary loans and proportion of debenture interest on unproductive outlay, a proceeding which generally points to dire circumstances on revenue account. The Companies' Consolidation Act provides that where any shares of a company are issued for the purpose of raising money to defray the expenses of the construction of any works or buildings, or the provision of any plant which cannot be made profitable for a lengthened period, the company may pay interest on so much of such share capital as is for the time being paid up for the period and subject to the following conditions and restrictions, and may charge the same to capital as part of the cost of construction of the work, building or plant.

No such payment is to be made, however, unless the same is authorised by the company's articles of association, or by special resolution of the company, nor without the previous sanction of the Board of Trade. The payment may be made for only such period as may be determined by the Board of Trade, whilst the rate of interest is not to exceed 4 per cent., or such lower rate as may, for the time being, be prescribed by Order in Council. The payment of the interest will not operate as a reduction of the amount paid up on the shares in respect of which it is paid, and the account of the company must show the capital on which, and the rate at which, interest has been paid out of capital during the period to which the accounts relate.

It may be noted that the Companies' Clauses Consolidation Act, 1908, provides that the total amount of the sums paid by way of commission in respect of any shares or debentures or allowed by way of discount in respect of any debentures, is to be stated in the summary made under Sec. 26 of the Companies' Act, 1862, next after the payment of the commission or the allowance of the discount, and the total amount thereof, or so much thereof as has not been written off, shall be stated in every balance-sheet until the whole amount has been written off.

There are, of course, combined undertakings—that is, a company possessing both a tramway order and an electric lighting order. The Electric Lighting Acts provide that distinct accounts must be kept of each lighting order, which are rendered to the auditor on behalf of the Board of Trade. The lighting accounts are therefore kept separately from those of the tramway undertaking, a tariff or charge being made by the electric lighting section to the tramway section for the current supplied.

The basis of calculation in the operating costs of a tramway undertaking is the car-mile, it being the usual practice to prepare the cost statement every four weeks. The detailed information for this is readily obtained from such sources as the salaries and wages allocations, and the allocated stores issued, an estimated sum for head office and general expenses being included therein. The cost and traffic experiences are frequently exhibited in the form of a graph; but in a tramway undertaking the auditor is not concerned with costs except as a matter of personal or general interest.

The object of a Tramway Finance Co. is to finance approved existing undertakings and propositions, and thus acquire controlling power therein, and also to promote subsidiary companies. In short, their memoranda enable them to do almost anything electrical—tramways, lighting, power, and manufacturing. There are usually numerous agreements between the Finance Co. and its subsidiaries which require considerable attention on the part of the auditor.

A Tramway Finance Co., the financial year of which generally terminates some three to six months subsequently to that of its subsidiary companies, derives its income from, amongst other things, the following:—Interest on debentures; dividends on shares; interest on loans; underwriting and over-riding commissions; sales of securities; services rendered to subsidiary companies; profit on shares and debentures underwritten; rents, transfer fees, &c.; the postings being checked and the entries vouched in the ordinary way. Interest on loans to subsidiary companies is at times a fruitful source of income to a Tramway Finance Co. At other times it comes about that the subsidiaries have to lend to the Finance Co. In the former case they are loans, and in the latter case they are sometimes called deposits.

Let us suppose, with the object of providing a cursory sketch of a single phase of one type of the transactions of such companies that the Financial Co. X obtains an order for the construction of tramways in the town of Y. The work of construction may be done by either administration or contract, and if by contract, a proportion of the profit earned by the contractor may be provided for in the contract with him. The whole of the cost of construction, including that of the promotion of the order, legal and all other expenses and outlay in connection therewith, are kept quite distinct, and with possibly a profit thereon charged to the Y tramways. In due course a company is formed, called the Y Electric Traction Co., Ltd., and at a propitious time a public issue may be made. The Financial Co. thus controls the Tramways Co., appoints the secretary and staff and nominee directors, who may be paid either a salary or directors' fees—that is to say, they may either receive a salary from the Financial Co. (to whom, in which case, the fees are paid), and if not a salary, they may receive the fees from the Tramway Co. direct.

Some of the persons appointed, having been qualified by the Finance Co., are consequently removable at will; besides, there is little or no independent administration. The policy of the subsidiary is that dictated by the Finance Co., and it is well to note this significant feature.

The amount of the share capital depends primarily, *inter alia*, upon the original capital cost, otherwise the bill of the financial company, and the denomination of the shares upon varying circumstances. The denomination, however, should not exceed £1, and prior charges—such as the result of debentures and preferential shares—should be avoided whenever possible. A preference share is like a perpetual loan without security, and a 4 or 5 per cent. return on a tramway ordinary is not for the class of share and nature of the undertaking by any means a tempting inducement to the investor.

The subsidiary is formed, therefore, primarily for the purpose of contributing its quota to the dividends of the financial company. The purchase price may be payable as to so much in cash and so much in shares, whilst a substantial sum may be left upon loan at interest with an option to convert into debentures or shares, and so on. The determination of the mode of payment depends, however, upon a variety of circumstances, including the existing or prospective profit-earning capacity of the company, probable succcess or otherwise of public issue, and other factors of the particular situation.

In due time other companies are promoted, and, of course, they are all for the benefit of the electrical industry, whilst, as already pointed out, they are for the most part created for the purpose of founding primarily the revenue required by the finance company for the carrying on of its undertaking and the payment of interest and dividends on its debentures and shares.

The ordinary shares, at any rate of tramway companies controlled by a trust, are better avoided by the investor. The large blocks of subsidiary shares owned by a tramway finance company are to a large extent unsaleable, which is due to low yields, control by a trust which the public do not like, while many of them may not be quoted on the Stock Exchange, and there is not a free market and consequently little or no speculation.

In course of time a tramway finance company is condescending enough to be willing to dispose of many of its acquired and low yield shares, the idea being to get rid of them and only retain a sufficient monetary interest in the subsidiary to ensure the maintenance of paramount control. The Tramway Finance Co. only sells its "refuse," so to speak, and frequently cloaks its identity in the offer for sale of large blocks. It, of course, only parts with its better paper in times of financial stress. Other finance companies have predilections for high interest bearing securities, the presumption being that the larger income enables an insurance fund to be created against potential loss of capital; but there are few high dividend or high interest-bearing securities in the tramway world. Sometimes the ordinaries are divided into preferred and deferred. Tramway deferreds are not infrequently the result of sops—like an article thrown in with a parcel of weak tea; a device to assist in the acquisition of a controlling interest.

When a tramway finance company is promoting and constructing, it, of course, requires capital, and profits, paper or otherwise, so that it may pay as high a dividend as possible, in order to attract or command capital issue premiums. A 9 or 10 per cent. can only be accomplished with the aid of precarious promotion profits, and when the time comes that they are not available or unrealisable, we experience the passing of dividends and huge depreciation in capital values.

Care should be taken to see that preference dividends are not paid what is commonly called "free of income-tax," it being *ultra vires*, except where authorised by the articles.

It is not unusual to take credit in the profit and loss account for unrealised paper profits, which means a drain upon working capital, and involves the risk of paying or distributing that which may never be partially or wholly received in cash, and which may eventuate in a loss which would have to come into profit and loss in future years. Credit for such paper profits should be noted on the accounts, or find expression in the auditors' certificate.

It will be remembered that in the case of the London Globe Finance Corporation, Ltd., which, by the way, was not a tramway finance company, the inflation of profits was effected by taking credit at par for shares received for properties transferred or sold when the cost of the property disposed of was considerably less, which may be exemplified in the following manner:—The X Finance Co. has a property upon which it has incurred an expenditure of, say, £10,000, and sells it to a subsidiary Y for £60,000, payable as to £5,000 in cash, and £55,000 in £1 fully-paid shares.

The proper way of stating the account is as follows:—

PROPERTY ACCOUNT.

Sundries ...	£10,000	Cash	£5,000
		55,000 shares of £1 each in Y., Ltd. (fully paid)	5,000
	£10,000		£10,000

55,000 shares of £1 each (fully paid) in Y., Ltd.

Property account £5,000

Here the shares stand in the books at cost; but if they are brought in at par there will be a paper profit of £50,000. Of course there is no realised profit, and until the shares are sold there has occurred only an exchange of assets. When any of the shares are sold at a price in excess of £5,000 the excess is a cash profit and one to be taken to the credit of profit and loss account.

Of no little importance is the duty of agreeing the debit and credit balances of the accounts of the subsidiary companies in the books of the finance company with the credit and debit balances of the finance company in the books of the subsidiary companies.

The principal asset in the balance-sheet of a tramway finance company is that of investments, and some of the points to which the auditor must give due prominence after the performance of the usual verification are:—

1. Basis of valuation.
2. Value and nominal amount, together with book values of securities at middle market prices—those quoted on the London and Provincial Stock Exchanges.
3. Expression of opinion, if any, as to market value of remaining securities, together with nominal amount.
4. Yield of nominal amount of securities and book values.
5. Nominal amount and book values of securities upon which there may be no return.
6. Uncalled liabilities.

Interesting problems will arise when the local authorities exercise their power of purchase, or when it is agreed for the Tramway Co. to sell its undertaking to the municipality.

There are many other important matters in the audit of the accounts of tramway and tramway finance companies, which have not been overlooked, but which have been passed over for the present owing to considerations of space.

Condensing Plant Contracts. — The MIRRLEES WATSON CO., LTD., have recently secured the following contracts:—Low level counter-current jet condensing plants per D. Selby Bigge and Co., consulting engineers, for Niddrie & Benhar Coal Co., Ltd.; Fife Coal Co., Ltd., Mary pit; Fife Coal Co., Ltd., Kinglassie pit; also surface condensing plant, for Aktiebolaget de Lavals Angturbin, Stockholm; barometric condensing plant, for Okura and Co., for Formosa, third repeat; and two sets of large three-throw air pumps for Henry Tate & Sons, Ltd., Silvertown, E.

THE USE OF ELECTRICITY IN AGRICULTURE.

IN the year 1903 a number of German agriculturists formed a syndicate to establish electric power stations. In order to produce electrical energy at the lowest possible price, they endeavoured to utilise the water-powers in their immediate neighbourhood. Three large stations have been erected by the Allgemeine Elektricitäts-Gesellschaft: the Vangerow-Lottin and Bartin-Besswitz in Pomerania, and the Birnbaum-Meseritz-Schwerin in the Province of Posen.

The Vangerow-Lottin station has a water-power plant of 300 H.P., and steam plant of about 180 H.P. as a reserve. This station supplies 61 agricultural undertakings and five townships, together with 41,200 acres of arable land. The network of connecting wires is 137 kilometres in length, supplying an area of 270 sq. kilometres. There are 102 consumers, with 150 motors, equal to 1,115 H.P., and about 5,000 incandescent lamps. During last year about 440,000 units were supplied at an average price for energy of 12 pfg. (1½d.) for power, and 27 pfg. (about 3¼d.) for light per unit.

The second station, Bartin-Besswitz, which commenced operations last year, started with a transmission line of 180 kilometres, but 40 kilometres have been added, and this station now supplies 170,000 acres, of which 80,000 are ploughed land. There are 180 motors and about 5,000 incandescent lamps, representing together approximately 1,300 KW. The price of energy for lighting is 25 pfg.; for power there is a sliding scale of 11 to 15 pfg. Each member of the syndicate has to guarantee a minimum consumption of 5 KW.-hours per acre of arable land. An estate of 2,000 acres of ploughed land must, accordingly, consume 10,000 KW.-hours per annum.

The Birnbaum-Meseritz-Schwerin station has also begun operations, and already supplies 10 estates and 14 villages. After the completion of the works there will be about 162,000 acres of arable land and five townships, the length of cable being 316 km. Judging by the short time that the present stations have been erected, it will not be long before the country will be overspread with wires emanating from the same source of power. Three-phase overhead wires conduct the power for miles through field and forest, over meadows and rivers, to the consumers. Guard nets protect men and animals from broken wires; lightning conductors are also provided to protect the network from damage caused by atmospheric disturbances. Transformers convert the high-voltage current to a lower pressure such as is required for use on estates and in villages.

The transformers are generally housed in a small building; for field work, however, where the power is required in various places, portable transformors are used. By means of a flexible connection the primary of the transformer can be joined to the overhead wires at any desired point, whilst the secondary is connected to the motor. Thus the agriculturist is in a position to make use of the power in any portion of his land.

There is a great future in Germany for the use of electricity in agriculture on large estates. The question of the transport of goods on the property itself, as well as communication with the nearest railway station, is also naturally of great importance. In consequence of the possibility of obtaining cheap electric current from these central stations, the use of the electric locomotive becomes practicable.

A notable contract of this kind was carried out in the year 1905 by the A.E.G. on the Barfeld Estate, in Neumark. The estate had already for 10 years a branch line to the Ringenwald State Railway station, with a gauge of 600 mm., working on the Spalding system, with rails weighing 6·5 kg. per metre. The introduction of electricity required no alteration in the gauge; the only thing that had to be taken into account was the construction of the locomotives. The work is effected by means of two electric locomotives each of about 58 H.P., running at a speed of 25 km. per hour. The weight of the engine amounts to about 6,000 kg. In consequence of the distribution of this weight over eight wheels the wheel pressure does not exceed that of the existing cars. The locomotives can easily draw weights of about 50 tons on inclines of 1 : 40. For the last three and a half years this work has been carried on, with the best results. Formerly it required 60 horses to do the work which is now done by these two locomotives. The track was originally designed for an annual traffic of 160,000 cwt.; after three years' working it was carrying 450,000 cwt. per annum.

It is hoped that the use of electric field railways will be more widely extended, and that agriculturists will not be afraid of spending their capital on the work, which will amply repay them.

Another interesting contract carried out by the A.E.G. is the drainage of the newly reclaimed delta of the Memel over an extent of about 70,000 acres, which was undertaken in 1896. Six "scoop wheels" of 8 m. diameter are driven by electric motors, which are switched on or off from a central station, requiring no attention.

A similar plant of ten electrically-driven centrifugal pumps was installed in the year 1899 at the mouth of the Maas, in Holland. The motors are automatically controlled by floats. As soon as the surface of the water reaches a certain level, the motors are disconnected and the pumping is stopped.

The foregoing notes are derived from a lecture delivered by Chief Engineer Lewin to the A.E.G. staff, of which an abstract appeared in the *A.E.G. Zeitung* recently.

MUNICIPAL TRAMWAYS ASSOCIATION.

THE eighth annual conference of the above Association held ast week in London was in every way a success. It was ttended by representatives of practically every municipal ramway undertaking in the country, the Council Chamber t the County Hall being well filled both on Wednesday and hursday. Reference was made in our last issue to the nteresting address in which Sir Melvill Beachcroft, the hairman of the London County Council, welcomed the elegates, and also to the address which Mr. A. L. C. Fell, he chief officer of tramways to the London County Council, elivered, as President of the Association. Following these, paper was read by Dr. A. W. Chapman, the vice-chairman f the Manchester Corporation Tramways Committee, on The Medical Examination of Tramway Employés." As the aper is referred to on another page, it is sufficient to say hat the writer urged the necessity of a thorough indepen-ent medical examination of each employé, both on engage-ent and at stated intervals thereafter. This was demanded, n the writer's opinion, on the grounds of public safety, and f the protection of the undertaking from excessive claims nder the Workmen's Compensation Act.

After luncheon, at the Trocadero Restaurant, at the nvitation of the Chairman of the London County Council, he conference proceeded to discuss Dr. Chapman's paper. he first speaker was Mr. Nance, of Belfast, who stated that e looked at the matter from a utilitarian point of view. he special inspection advocated in the paper would cost a ood deal of money, and he doubted if there would be a orresponding return. The principal health requirements were perfect eyesight and good hearing, and these could be ested by a member of the tramway staff as well as a doctor. He engaged all men on three months' trial, and thought hat a reference to the daily reports before making the ppointment permanent amply guarded the undertaking gainst other risks.

Dr. Collie, the medical officer for the London County Council Tramways, then gave some valuable and interesting figures. Pointing out that the public safety depended upon the health of ramway conductors and motormen, he said that out of 100 men examined he had found 13 wholly unfit for employ-ment as drivers, six being entirely and seven partially colour blind. At another time, out of 2,733 men examined, 65 proved to be colour blind, while 2,486 were thoroughly atisfactory, the remaining 182 failing for other reasons. He hen described the manner in which the tests were made, remarking that railway companies not only demand perfect vision, but insist on a driver being re-examined at all stages of promotion. As to the importance of a thorough examina-tion of all applicants for employment, he stated that out of 1,681 men examined as they would be for insurance purposes, 1,502 passed, 10 were deferred for re-examination, and of the others, 10 were rejected for heart disease, 16 for varicose veins, 91 for defective vision, 13 for kidney disease, and the other 39 for other causes. He then instanced the practice of the London County Council and the steps he had found it necessary to take to prevent malingering, concluding by stating that when dealing with thousands of men, independent medical inspection does pay, and the doctor's fees are fully justified.

Mr. Smithson, the chairman of the Leeds Tramway Committee, said that the subject had been fully considered by his committee, who had decided to have each applicant for employment examined by a general practitioner at a cost of 3s. 6d. per case. He felt that in future the public would insist upon medical examination of all persons placed in charge of tramcars.

Mr. J. Dalrymple, the general manager of the Glasgow tramway system, was in agreement with the principle of medical examination, but thought that the preliminary tests could be made by members of the tramway staff, only doubtful cases being referred to the medical officer for detailed test.

Mr. McElroy, of Manchester, wondered why the Board of Trade, who were so particular in other respects, were so indifferent to the human factor of safety on a tramway system, and did not insist on medical examination.

Dr. Chapman, in reply, stated that the discussion had confirmed him in the view that not only should medical examinations be made, but that they should be carried out by independent specialists.

Mr. W. E. Ireland, rolling stock superintendent of the London County Council, then read a paper descriptive of "The Central Repair Depôt of the London County Council." Owing to the late hour, discussion on this paper was deferred till Thursday morning. The Association dinner was held in the evening at the Garden Club, Imperial Internationa Exhibition, Shepherd's Bush, and proved very enjoyable.

On the reassembling of the Conference on Thursday morning, Mr. Yerbury, of Sheffield, Mr. Spencer, of Bradford, and Mr. Rayner, of Doncaster, spoke on questions arising out of Mr. Ireland's paper, but in view of the visit to the depôt, which had been arranged for the afternoon, any detailed discussion was by general consent deferred.

Mr. A. R. Fearnley, the general manager of the Sheffield tramways, then read a paper entitled "Some Comparisons of Continental and British Methods of Operating Tramways." The discussion centred on the question of type and size of car overloading of cars, the use of trailers, provision of shelter and bow form of collector *versus* trolley.

Mr. F. Ayton, of Ipswich, considered the bow collector superior to the trolley on account of the lessened wear of the trolley wire at the ears, and also in that no time need be lost in reversing at terminals.

Alderman Smith, the deputy-chairman of the Liverpoo Tramways Committee, said that they had tried single-deck cars of the type used both in America and at Hamburg, but they were not liked, and had been abandoned. They had not found any serious difficulty due to delay in getting in and out of the double-deck car, and they were adopting this type wherever possible.

Mr. Mozley, the general manager of the Burnley tramway undertaking, opposed the proposal to use trailer cars, regarding it as retrograde and reminiscent of old steam practice. He considered the suggestion to use vestibule cars good, and, in fact, was adopting it in combination with the reversed staircase in all new rolling stock for his line; he created some amusement by reminding the Conference that he had designed a reversed staircase before Liverpool had had one made.

Mr. A. Blaylock, the deputy-chairman of the Birkenhead Tramways Committee, said that the shelters they had erected had cost £60 to £80 each, in place of the £30 or £40 mentioned by Mr. Fearnley.

Mr. Hamilton, general manager, Leeds Tramways, pointed out that when the Glasgow system was first electrified they tried to popularise the single-deck car, but were unsuccessful. The people were used to double-deck cars, which afforded convenient accommodation for smokers, and as a result the use of the double-decked car was now universal on the system. He disagreed with the view that vestibule cars were desirable, and thought that in certain circumstances the rail-less trolley system might be found useful.

Mr. C. J. Spencer, general manager, Bradford Tramways, asked if it was necessary to confine the use of trailers to routes laid throughout with double track? He was in favour of compulsory stopping places, as their abandonment would decrease the average speed by 25 per cent. In view of the low average fare in this country, he did not think that they could afford such luxuries as waiting rooms, as these to be properly kept, needed an attendant.

Bailie J. Macfarlane, convener of the Glasgow Tramway Committee, agreed with Mr. Hamilton that the single-decked cars at Glasgow had been consigned to the scrap heap, and was of opinion that for general use the covered double-deck car was the best. He would, however, strictly forbid overcrowding. In busy centres he did not think shelters were necessary, but at suburban termini, where there were only three or four cars per hour, they might be provided, an attendant being required. He might remind the Conference that cities did not exist for tramways, but tramways to minister to the needs of the city. He suggested that in any applications which might be made to Parliament for powers to run railless trolley lines, local authorities should be forbidden to charge rates on the poles and overhead apparatus.

Mr. S. C. T. Neumann, deputy-chairman of the Bradford

Tramway Committee, did not think attendants were needed to be constantly on duty in shelters, and raised the question as to whether overcrowding should be allowed on tramcars. Pleading for the comfort of passengers, he remarked that at Bradford they seemed to have one rule permitting standing on single deck, and another forbidding it on double-deck cars.

Mr. P. Fisher, general manager at Dundee, showed how they had got over the difficulty of finding attendants for their shelters by allowing the attendant in return for keeping the room clean to sell papers, stationery, postcards, &c.

Mr. Fearnley then replied to the various questions raised, and regret having been expressed that there was no time for Mr. Pilcher's paper on "Current Consumption," the Conference adjourned for luncheon at the Holborn Restaurant, on the invitation of the chairman and members of the Highways Committee of the London County Council.

A large party afterwards assembled on the Embankment opposite the new building of the Institution of Electrical Engineers, and were conveyed in three special tramcars of latest type to the Car Repair Depôt at Charlton. The route taken was *via* the new line over Blackfriars Bridge, Old Kent Road, New Cross and Greenwich. Arriving at the depôt, complete arrangements had been made for inspecting the workshops in groups personally conducted by responsible officials. Much interest was felt in the systematic manner in which the work is carried out at the depôt, and the way in which the workshops have been equipped. The utility of the visit was greatly enhanced by the detailed description which had been presented to the Conference in Mr. Ireland's paper.

The party were then taken in the special cars to the Greenwich generating station, about a mile distant, when, after partaking of tea on the invitation of Mr. A. L. C. Fell, the President of the Association, a pleasant time was spent in inspecting this well-known power house. The cars were again requisitioned and the party taken *via* New Cross, Kennington and Westminster to the Embankment, where they dispersed in anticipation of again meeting at the reception given by the Lord Mayor of London at the Mansion House later in the evening.

The business meeting of the Association was held on Friday morning, after which an excursion was made to Windsor, where, after an inspection of the Castle, the party were received in the Guildhall by the Mayor of Windsor, and subsequently entertained at tea.

The annual report of the Executive Committee for the past year mentions that the question of depreciation allowances for wear and tear of tramway and light-railway undertakings has been settled with the Inland Revenue Department; the report of the Special Committee on Brakes has been issued to members, and a short supplementary report has been drawn up comparing the conclusions with those in the report of the Tramways and Light Railways Association.

A special committee is investigating the question of rail corrugation, and the services of Mr. C. A. King, B.Sc., have been retained to aid in this work.

The Committee has appointed a special committee to report on a scheme for the measurement and charging for energy supplied by combined stations to tramways departments; the matter may be jointly considered with the Municipal Electrical Association.

Tramway Problems.

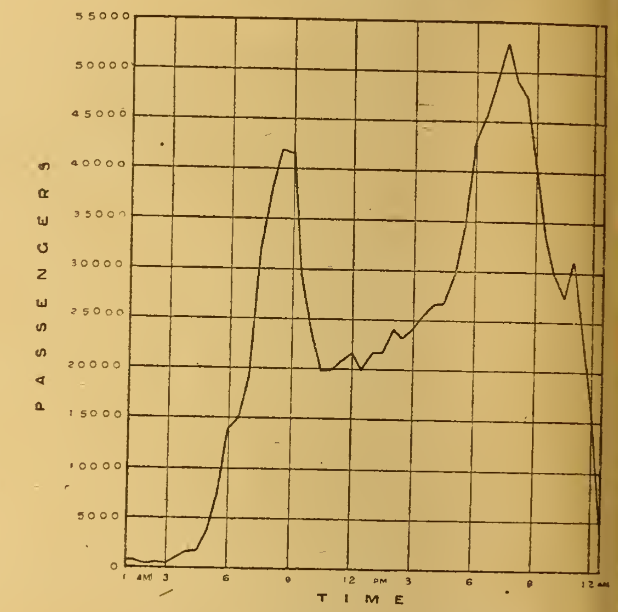
In the course of his Presidential address last week, Mr. A. L. C. Fell tonched upon several interesting matters to which we could only briefly refer in our leader. Drawing attention to the unfair burden of cost laid upon the tramway authority for paving the roadway, he pointed out that the local road authority could stipulate what paving should be used, and generally selected wood and soft granite paving which reqnired constant attention and renewal, with consequent interference with all classes of traffic. Besides bearing the first cost and maintenance of the roadway, the tramway anthority has to pay rates based on the earning capacity of the line, while competing companies have the free use of the roads and pay rates only on their stables and depôts, so that the latter are practically snbsidised by the ratepayers.

Mr. Fell maintained that the introduction of tramways, contrary to the popnlar belief, relieved the congestion of traffic, the slow traffic being diverted to the side of the road, while the fast traffic followed the tramway.

The tramcar took up less space per passenger seat than any other type of public street vehicle, and thanks to the roof cover, was enabled to carry its full complement of passengers in all weathe In wet weather one car could carry as many passengers under cov as five motor-omnibuses, which, even if no space were left betwe them, would occupy a length of 115 ft., against 33 ft. 10 in., tak up by the car.

The President claimed that tramways were in every way mo suitable than railways for dealing with short-distance traffic, a gave data for the larger cities, showing that ont of near 1,000,000,000 passengers, over 78 per cent. paid ½d. or 1d., a travelled less than two miles. Railway companies, therefore, shou confine their attention to the long-distance suburban passenger (t London tnbes were not included in this connection). Tramw authorities shonld co-operate with the railways, rather than co pete with them.

Regarding the rail-less trolley system, he thought it might useful in certain cases, but that in ordinary service the cost of mai tenance would be too high. It was not likely to be of muc service for experimenting on new routes, for people would not settl down on a new ronte unless a tramway were laid, which woul enconrage a feeling of permanency and secnrity.



Traffic Load Curve, L.C.C. Tramways.

Mr. Fell strongly emphasised the necessity of standardisatio wherever possible—not only in the parts of the cars and equipments but also in the annual reports and accounts of tramway undertakings. The "car-mile" was a most unsatisfactory unit, owing t the wide variations in conditions of size, weight, speed and nnmbe of stops of the cars. The "seat-mile" should be given in al comparative figures.

On the use of trailer cars, there was a division of opinion; h thought that if double-decked trailers were nsed, the maximnm benefit would be realised, and he had made arrangements for trailer to be employed experimentally on one route in London.

The conditions of labour on tramways, as regarded the working hours, depended on the habits of the community; in London, unfortunately, there was a very high peak for a short time in the morning, and again in the evening (fig. 1), so that a large number of cars had to be run at those times only, 40 per cent. of the cars being laid off between 10 a.m. and 4 p.m. (see fig.). In places where the tramways passed through the centre of the city, a considerable mid-day traffic was obtained, and in the provinces many people went home to dinner, so that a more uniform service conld be run. The only remedy for the slackness in the middle of the day appeared to be the introduction of a heavy-goods service in conjunction with the railway and dock undertakings, which would relieve the congested traffic in the main streets, and, in many cases, remove the necessity for street widenings.

Conciliation Boards had been organised in connection with the L.C.C. undertaking, with the approval of the great majority of the men. Four Sectional Boards had been elected, respectively connected with the traffic, rolling stock, electrical and permanent way departments, and the machinery for dealing with difficulties wonld soon be in working order. Matters of discipline, however, shonld not be dealt with through this channel; the manager shonld be given full authority to deal with such questions—it was a fatal thing if any employé were allowed to approach a Committee without his knowledge.

In 1902 he had strongly advocated the adoption of steel wheels, on the ground of his experience in Sheffield, but at the time his remarks were subjected to many adverse criticisms; now, with a few exceptions, steel wheels had been adopted throughout the country. According to replies from 53 municipal tramways, out of 35,600 wheels in use only 2,536 (7 per cent.) were of chilled iron. The life of modern steel tires exceeded the most sanguine expectations of seven years ago.

The President condemned the adoption of halfpenny fares on the smaller tramway systems, though he thought they were justifiable on the large city systems; yet he questioned whether these extremely low charges were compatible with the proper discharge of their financial obligations, the due conduct of the services, and e adequate maintenance of track and equipment, and he depreted the hasty adoption of the halfpenny as a standard fare. It as a valuable asset on large systems if short stages were adopted, it there was a tendency to lengthen these stages until they came unprofitable; tramways should not only serve the public ell, but also pay their way.

British tramway installations, he said, were now looked upon all er the world as examples of solid permanent work. Twenty ars hence tramways would predominate, motor-omnibuses would curiosities, and railways would deal only in long-distance affic, leaving all internal pick-up traffic to the tramways, which ould act as feeders to the railways.

The Medical Examination of Tramway Employés.

PAPER with this title was read by COUNCILLOR A. W. CHAPMAN, B, C.M., J.P., Deputy-Chairman, Manchester Corporation Tramays Committee, and in every respect it tallies with the views hich we have expounded from time to time.

The value of this paper cannot be lightly estimated, and its nportance arises from several causes. First, the paper is the ork of an eminent physician; secondly, the contents of the paper present the views of one of the chief Corporations in the country; d lastly, the author declares openly that the necessity for strict edical examination has become urgent since the Compensation cts have piled legal responsibilities and heavy monetary burdens employers, threatening, for the same reason, to become still more ressing.

The last two factors in this estimate of the importance of the aper are the most interesting, for they indicate a reactionary ndency. For a decade or more our municipal bodies have been lucating themselves in a school of progressive socialism, with the atural result that their actions and policies have been greatly fluenced by their ever-growing staffs. We are not now conrned with the whole range of consequences, but merely with the ne deplorable fact that the fear of the wrath to come from their wn employés has prevented a municipal body many a time from xpressing opinions or proposing reforms or new projects, which ore any semblance of interference with the privileges of the new aste.

Nothing but this has stood in the way of compulsory medical xamination of all those employés of a tramway committee who some measure have the safety of the public in their hands.

Something has been done to remedy this degrading state of ffairs in very recent times, for Dr. Chapman refers to 21 underakings which have all car-crews medically examined before enterg the service, but there has been nothing like a general adoption f this precaution.

But this paper sounds a call to which no one can be deaf. It ill help to rend the veil which is drawn across the shrine of bour, and by its aid the blindest will see that the combination of orkmen's compensation, increased pay, shortened hours, holidays ith pay, and general pampering and pandering, is not compatible ith a prosperous undertaking, unless the efficiency of the staff is ncreased in something like proportion to the expenditure.

Dr. Chapman holds strongly that all employés should be edically examined before being received into service, and reexamined every five years. In his opinion, the examination hould be of the most searching character, and should include special attention to sight and hearing, which brings the xamination even higher than that of a life insurance office.

Dr. Chapman does well to reproduce the emphatic declarations f the two Brakes Committees on this point, and it will do no arm to refresh our readers' memories from the same sources:—

MUNICIPAL TRAMWAYS ASSOCIATION.

"No man ought to be appointed a driver of an electric tramcar who has not first passed a careful medical examination. A rigid nd careful examination as to fitness in handling a car should be ade by a responsible officer, after the man has been thoroughly rained in his duties. The supervision in the training of drivers hould, where practicable, be done by one man, in order to secure niformity. Periodical testing (medical and practical) of men is a ecessity of safety."

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

"*Physical Unfitness.*—The Committee wishes to lay special mphasis on this point. In their opinion it is essential that all notormen should undergo a medical examination and eyesight tests, nd they would also recommend periodical re-examination."

Most people will agree with Dr. Chapman that the Workmen's Compensation Act and the Employers' Liability Acts have rendered t necessary for the better protection of any business undertaking, uch as a tramway, to extend the medical examination over the whole staff, although, apart from these Acts, there would appear to be little call to examine any but drivers.

Medical examination was instituted in the Manchester tramways department in June, 1908, and 16 per cent. of those who applied for employment and of those employés who were considered otherwise fit for promotion, were rejected for medical reasons, by far the greatest number failing through defective eyesight.

An appendix to the paper reproduces the categoric statement which has to be answered by every candidate, and the form of report sent in by the doctor to the general manager. The former has the advantage of briefness over many American declarations which we have seen, and it is of no less value on that account.

Before the next Conference meets, there should be many more adherents to this sound policy of getting as good value as possible for the money paid.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW UNITED STATES TARIFF (*concluded*).

	Old Tariff.	New Tariff.
Porous carbon pots for electric batteries, without metallic connections	20 % ad val.	20 % ad val.
Glass articles composed wholly or in chief value of glass, ornamented or engraved	60 % ad val.	60 % ad val.
Iron or steel wire rods, whether round, oval, flat or square, or in any other shape:		
Valued at 4 c. or less per lb.	$\frac{4}{10}$ c. per lb.	$\frac{3}{10}$ c. per lb.
Valued over 4 c. per lb. ...	$\frac{3}{4}$ c. per lb.	$\frac{6}{10}$ c. per lb.
NOTES.—(1) All round iron or steel rods smaller than No. 6 wire gauge shall be classed and dutiable as wire.		
(2) All iron or steel wire rods which have been tempered or treated in any manner or partly manufactured shall pay an additional duty of	$\frac{1}{2}$ c. per lb.	$\frac{1}{2}$ c. per lb.
Iron or steel wire, round:		
Not smaller than No. 13 wire gauge	$1\frac{1}{4}$ c. per lb.	1 c. per lb.
Smaller than No. 13 and not smaller than No. 16 wire gauge	$1\frac{1}{2}$ c. per lb.	$1\frac{1}{4}$ c. per lb.
Smaller than No. 16 wire gauge	2 c. per lb.	$1\frac{3}{4}$ c. per lb.
* NOTE.—All the foregoing shall pay duty at not less than 35 % *ad valorem.*		
* The Note in the former tariff read as follows:—"All the foregoing valued at more than 4 c. per lb. shall pay 40 per cent. *ad valorem.*"		
All wire composed of iron, steel, or other metal except gold or silver, covered with cotton, silk or other material, and all flat wires, and steel in strips, not thicker than No. 15 wire gauge and not exceeding 5 in. in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls, or otherwise produced, and all other wire not specially provided for in this section shall pay a duty of not less than ...	(See below.)	35 % ad val.
Iron or steel or other wire not specially provided for, and sheet-steel in strips, $\frac{25}{1000}$ in. thick or thinner; any of the foregoing, whether uncovered or covered with cotton, silk, metal or other material, valued at more than 4 c. per lb. ...	45 % ad val.	—
Iron or steel wire coated by dipping, galvanising or similar process, with zinc, tin or any other metal, in addition to the rate imposed on the wire from which it is made	$\frac{2}{10}$ c. per lb.	$\frac{2}{10}$ c. per lb.
Articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph, in addition to the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles	$1\frac{1}{4}$ c. per lb.	1 c. per lb.
NOTE.—No article made from or composed of wire shall pay a less rate of duty than 40 per cent. *ad valorem.**		
* This provision did not appear in the former Tariff.		
Telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials ...	(Not specified.)	40 % ad val.

	Old Tariff.	New Tariff.
Axles or parts thereof, axle bars, axle blanks or forgings for axles, whether of iron or steel, without reference to the stage or state of manufacture, not otherwise provided for in this section, valued at not more 6 c. per lb.	1 c. per lb.	¾ c. per lb.
Note.—When iron or steel axles are imported fitted in wheels, or parts of wheels, of iron or steel, they shall be dutiable at the same rate as the wheels in which they are fitted.		
Cast-iron pipe of every description	$\frac{4}{10}$ c. per lb.	¼ c. per lb.
Lap-welded, butt-welded, seamed or jointed iron or steel tubes, pipes, flues or stays, not thinner than No. 16 wire gauge:		
If not less than ⅜ in. in diameter	2 c. per lb.	1 c. per lb.
If less than ⅜ in. and not less than ¼ in. in diameter ...		1½ c. per lb.
If less than ¼ in. in diameter ...		2 c. per lb.
Note.—No tubes, pipes, flues or stays made of charcoal iron shall pay a less rate of duty than 1½ c. per lb †		
Flexible metal tubing or hose, not specially provided for in this section, whether covered with wire or other material, or otherwise, including any appliances or attachments affixed thereto	(Not specified.)	30 % ad val.
All other iron or steel tubes, finished, not specially provided for in this section ...	35 % ad val.	30 % ad val.
Wheels for railway purposes, or parts thereof, made of iron or steel, and steel-tired wheels for railway purposes, whether wholly or partly finished; and iron or steel locomotive, car, or other railway tires or parts thereof, wholly or partly manufactured	1½ c. per lb.	1¼ c. per lb.
Ingots, cogged ingots, blooms, or blanks for the same, without regard to the degree of manufacture	1¼ c. per lb.	1 c. per lb.
Note.—When wheels for railway purposes, or parts thereof, of iron or steel, are imported with iron or steel axles fitted in them, the wheels and axles together shall be dutiable at the same rate as is provided for the wheels when imported separately.		
Manufactures of metal not separately mentioned in the tariff including machinery, &c.	45 % ad val.	45 % ad val.

† This note did not appear in the former Tariff.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,857. "Improvements in or connected with the trolleys of overhead electric traction systems." G. Hill and F. Hill. September 13th.

20,867. "Improvements in motor-generators, boosters, balancers, auto-transformers, and generators for direct currents." A. M. Taylor. September 13th.

20,869. "Apparatus that will automatically regulate and keep a constant and even voltage on any number of electrical machines running in parallel and supplying current to an electric circuit and prevent current passing between the machines other than that supplied to the circuit." W. J. Walters. September 13th.

20,882. "Improvements in portable electric lampholders." H. B. Jenkins. September 13th. (Complete.)

20,899. "Improvements in and relating to the excitation of commutator generators." Act.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, November 9th, 1908, being date of application in Germany.) September 13th. (Complete.)

20,908. "Method of and means or apparatus for automatically controlling two or more electric circuits." G. C. Fricker. September 13th.

20,990. "Improved electro-magnetic buzzer operated by means of alternating current." L. P. Hutt. September 14th.

21,002. "Improvements relating to telephonic apparatus." E. A. Graham. September 14th. (Complete.)

21,008. "Improvements in arc lamps." L. L. D. Cibie. September 14th.

21,021. "Improvements in the installation of electrical conductors." J. S. Highfield. September 14th.

21,012. "New or improved controlling device for reversible direct-current electric motors." A. J. Hurst. September 14th.

21,065. "Electric alarm thermometer." R. Stericker and G. Tindale. September 15th.

21,070. "Improved magnetometer." J. C. Bagot. September 15th.

21,090 "Improvements in and relating to electric signalling apparatus for railways and the like." J. Goldschmidt. September 15th.

21,093. "Improvements in electric incandescence lamp fittings." J. H. Cunnington. September 15th. (Complete.)

21,101. "Improvements in and relating to signal systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 15th.

21,109. "Improvements in means for securing electric incandescent lamps." C. Damey. September 15th. (Complete.)

21,113. "Improvements in electrical regenerative control apparatus and systems." Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. (Date applied for under Rule 13, March 3rd, 1909. An invention comprised in Application No. 5,168, March 3rd, 1909.) September 15th. (Complete.)

21,156 "Improved electrical advertising arrangement." E. Brown. September 16th.

21,157. "Improvements in motor-generators, boosters, balancers, and auto-transformers for direct or alternating current circuits." A. M. Taylor. September 16th.

21,161. "Improved burglar alarm." A. W. Windsor. September 16th.

21,179. "Improvements in and relating to homopolar generators and motors, and other electrical machines having a large number of collector wings." R. H. Barbour. September 16th.

21,180. "Improvements in and relating to flexible electrical brushes or collectors." R. H. Barbour. September 16th.

21,190. "Improvements in electric telegraphs, particularly applicable to transmitting signals on board ships." W. F. Grafton. September 16th.

21,219. "Improvements in or relating to systems for the distribution of electric energy." W. F. Anderson, S. A. Russell and W. E. Gray. September 16th. (Complete.)

21,222. "Improvements in the manufacture of iron poles for telegraphs, telephones, and the like." J. H. Skinner. September 16th. (Complete.)

21,230. "Improvements in the methods of charging and discharging secondary batteries or electric accumulators." A. M. Taylor. September 17th

21,249. "Improvements in alternating-current motor-controllers." G. A. E. Kohler. September 17th. (Complete.)

21,261. "Improvements in drums or reels for coiling or transporting electric cables, wire, ropes, and the like." September 17th.

21,285. "Improvements in metal-filament incandescent electric lamps." H. Zschocke. September 17th. (Complete.)

21,303. Improvements in and relating to selective switch systems applicable to electric traction systems and for other purposes." British Thomson Houston Co., Ltd. (General Electric Co., United States.) September 17th.

21,340. "Improved locking device for electric incandescent lamps." J. H. Halliwell. September 18th.

21,343. "Improvements in switches for breaking electrical circuits." W. C. Kirwan and K. Quaney. September 18th.

21,357. "Improvements in electric motor-starting and speed-controlling apparatus." A. C. Heap. September 18th.

21,374. "Improvements in electrodes for arc lamps." Gebruder Siemens and Co. (Date applied for under Sec. 91 of the Act, October 5th, 1908, being date of application in Germany.) September 18th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of and Apparatus for Compounding Alternating-Current Generators. J. E. L. Barnes. (M. Breslauer.) 11,558. May 28th.

Electric Cells. J. Spiliotopol. 18,115. August 28th.

Sparking Plugs for Internal-Combustion Engines. H. Ducros. 18,120. August 28th.

Thermo-electric Piles. A. Ritterhaussen. 18,277. August 31st.

Electric Sounding Fork Vibrator for Therapeutic and like Purposes. 1 Muller. 18,326. September 1st.

Electrical Fuses. H. J. Fuller. 20,830. October 3rd.

Adjustable Non-portable Electrically-Driven Machines for Grinding, Sawing, Milling, Boring, Drilling and the like. G. Robson and R. Marshall. 20,988. October 5th.

Electrical Commutators for Use in Ignition Systems of Internal-Combustion Engines. E. G. Cleverly and F. L. Anderson. 21,740. October 4th.

Electrical Connections with Rods of Silundum or the like having Comparatively Poor Conducting Qualities. G. Cooper and F. Sharp. 22,627. October 24th.

Method of and Apparatus for Controlling Electric Cranes. E. M. Holme. 23,111. October 30th.

Portable Electrically-Driven Drilling Machines. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges., 26,685. November 5th.

1909.

Safety Box for Packing Incandescent Electric Lamps. M. I. Cooper. 241. January 5th.

Electromagnetic Systems for Controlling Lights on Railway Trains, applicable also to the Control of Valves or Taps for other Purposes. Siemens Bros. Dynamo Works, Ltd., Broadhead & Hawkins. 4,425. February 23rd.

Accumulator Plates. Accumulator-Fabrik Akt.-Ges. 6,248. March 16th. (Date applied for under International Convention, December 31st, 1908.)

Signalling Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 6,985. March 23rd.

Telemotor Gear. J. MacKintosh. 7,048. March 24th.

Electrical Switches. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg 7,938. April 5th. (Application for Patent of Addition to No. 6,899/07.)

Method for Regenerating Blackened Carbon-Filament Electric Lamps. E. A. Krüger. 8,283. April 6th. (Date applied for under International Convention, April 6th, 1908.)

Electrical Switches. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg 8,429. April 7th.

Electric Signalling Systems for Railways and the like. J. D. Taylor. 1,788. January 25th. (Date applied for under International Convention January 30th, 1908.)

Electric Switches. W. H. Flood. 8,628. February 13th.

Electrical Relay. M. S. Conner. 4,399. February 23rd.

Protective Devices for Alternating-Current Systems. Allgemeine Elektricitäts Ges. 4,705. February 25th. (Date applied for under International Convention, February 25th, 1908.)

Systems of Electric Motor Control. H. E. White. 6,567. March 18th. (Date applied for under International Convention, May 18th, 1908.)

Terminals for Switchboards. H. Brand. 11,267. May 12th.

THE

ELECTRICAL REVIEW.

VOL. LXV. OCTOBER 8, 1909. No. 1,663.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

ELECTRICITY AND MINERS' PANIC.

IN a previous issue of this journal we had occasion to refer to the resolution which was brought before the Durham Miners' Association with regard to the use of electricity in collieries. That resolution called for the removal of electrical apparatus, and presumably the complete system in each case, from mines, on the ground that it was considered a source of great danger. The resolution was shelved, upon the intimation that the matter was to be considered by a Select Committee; it must be pointed out, however, that this course of action by no means indicates a restoration of confidence in electricity on the part of the miners. It rather shows that they have confidence in the power of the Committee to sift the matter to the bottom, and in the willingness of the owners to assist in this action. The problem is not disposed of, but only postponed; if quietness has supervened, it may be only the lull before the storm.

As a matter of fact, however, the affair does not rest here. The Durham miners' resolution was valuable in the same way that a straw shows which way a stream is running. Following the analogy, the volume of the stream of opinion is now sufficiently large to carry a haystack. On October 5th the annual meeting of the Miners' Federation of Great Britain was opened at Newcastle-upon-Tyne, and at that meeting a resolution was to be presented to the effect that, in view of the dangers of electricity in dry and dusty mines, Parliament should be called upon to enforce the removal of electricity from such mines.

In order that not one of our readers may fail to weigh up the true significance of this development, it may be worth while noting that the Federation consists of authorised delegates from the whole of the district or county miners' unions included in this Federation. Practically speaking, a resolution passed at this meeting represents the consensus of opinion of the whole of the pitmen of the country. If such a resolution as is given above were adopted, it would be a very grave and potent factor which, by arresting the growth of electric applications in one of their most promising fields, would affect, directly or indirectly, almost every member of the electrical profession.

It is not likely that the resolution has been passed; it was too drastic even for panic-stricken men. Even if it had been passed, it is in the highest degree improbable that Parliament would be persuaded to give effect to its meaning. But the moral effect upon the men themselves—the men who must do so much to co-operate in the making or marring of the reputation of electricity—would be enormous. The growing panic would be crystallised into a definite expression of opinion shared by every section of the country, which it would take years to eradicate. Even the very fact that such a resolution was put forward at a National assembly is a very disturbing matter.

This being the case, is it not advisable to attempt to do something to allay the panic, and so to "stop the rush" pending examination of the question by the Select Committee? The confidence of the miner is a thing to be striven for, and in these days, when business-getting methods in electricity supply are so loudly advocated, such a simple and necessary matter as going to some trouble and expense to convince the actual users of electricity of its safety under proper conditions should hardly require advocacy. Probably, however, it will not be done because it is so obvious.

For example, it is evidently the large power supply companies who would stand to lose most heavily if supply were terminated. Why cannot they combine with the manufacturers of reputable electrical plant in order to establish, to the satisfaction of representatives chosen by the men themselves, the safety of electricity by suitable demonstration and explanation? The cost of assembling apparatus and supplying energy for such a purpose would be negligible compared with the advantages to be gained.

Again, it is obviously to the advantage of every electrical manufacturer, supply authority, and consulting engineer interested in mining work to do all in his power to educate the man down the pit to the proper use of electrical plant, and to improve his intellectual status in this direction. Such a course should also have the benediction of colliery managers and engineers as improving the common conditions of safety. In such a connection the aims and objects of the Institution of Mining Electrical Engineers can be commended; and it is well worth the effort of the electrical fraternity to develop the mental capacity of the mine electrician.

With such simple palliatives as these, the present inflamed state of feeling among miners can speedily and easily be reduced. The ultimate test will, of course, be the decision of the Select Committee, but much will have been gained if, in the meantime, steps can be taken to meet the emergency.

THE ARBITRATION CLAUSE.

Of the clauses in engineering contracts which demand the attention of contractors, there is none more important than that which relates to arbitration. The clause which substitutes a self-appointed tribunal for the courts of justice has become common form in most contracts for works of any magnitude; and howsoever the contractor may object, it is almost impossible for him to secure the deletion of the clause.

The ostensible reason for an arbitration clause is to provide that disputes of a technical nature shall be settled by a technical man. But that is not a sufficient reason, as it is quite easy for both sides in any action to agree to refer the matter in question to arbitration. Further, it is common practice for judges who are asked to decide cases full of technicality to say: "This is a matter which must be referred to an official (or special) referee." If an official referee is appointed, he probably hears the case, fortified by the knowledge acquired in countless similar cases which have been before him; if a special referee is selected by the judge, he is chosen because of his special skill and knowledge of the subject under discussion.

But, it may be asked, is there no way out for the contractor? Will the Court allow an arbitrator to act who is known to be biased?

Procul, O, procul este Profani! should be the cry of Justice against arbitrators who set out to act partially in the discharge of their duties.

Fortunately the Courts have a discretion in the matter. If it is shown that the chosen arbitrator is, *without the knowledge of one of the parties*, in such a position that he cannot be expected to act impartially, the Courts will remove him. The words in italics are, however, important; for if a contractor submits to having disputes settled by an engineer who is employed by the other side, he must abide the consequences.

Why cannot the determination of all technical disputes between contractors and local authorities be submitted to the arbitrament of persons appointed by the Court? One reason, at any rate, will occur to the mind of the contractor. It is that, by following the ordinary procedure, and by relying on the arbitration clause in the contract, the local authority or other employer may virtually choose their own tribunal; may even secure the appointment of their own engineer or surveyor as arbitrator. We have frequently shown how regrettable it is that contractors should have to submit to such treatment, but the fact remains that only very seldom is a contract signed with a local authority in this country which does not contain a clause providing for reference of disputes to the paid servant of the local authority.

When parties enter into a contract they must be taken to appreciate its meaning. If a firm who enter into a contract know that the work must be carried out to the satisfaction of the engineer employed by the other party to the contract, they must understand that an expression of that satisfaction will be a condition precedent to their right to recover on the contract.

A case which is quoted in a recent legal text-book* may be cited in support of the proposition that the mere fact that an engineer acting as arbitrator is the paid servant of the corporation, is not sufficient to disqualify him. In Jackson *v.* Barry Railway Co., 1893, 1 Ch., 238, a contract by which the plaintiff undertook to construct a dock for the defendant company provided that disputes should be referred to the company's engineer. A dispute arose as to whether the contractor was entitled to use marl instead of stone for a certain embankment. In a letter addressed to the contractor, the engineer expressed the view that the contractor was bound to use stone. The matter was then referred to the arbitration of the engineer, who, after the commencement of the arbitration, again expressed the same view in a letter. In these circumstances the contractor sought to have the reference to arbitration stayed on the ground that the engineer had shown himself to be biased. It was held by the Court that considering the position of the engineer who, as an engineer of the company, must necessarily have expressed an opinion on the point in dispute, his writing the letter after the commencement of the arbitration would not disqualify him from acting as arbitrator unless on the fair construction of the letter it appeared that he had made up his mind so as not to be open to change it on argument.

This is a strong case to show how the contractor is tied and bound by the decision of the engineer.

We now come to a case which was heard in the Court of Appeal at the end of July last, which has a very important bearing on the subject under discussion, inasmuch as it suggests a way of escape which may sometimes be available.

Assume that the point at issue between the contractor and the corporation is one which closely affects the conduct of the engineer himself, can he be called upon to arbitrate? The facts of the case in question were very simple. Messrs. R. Blackwell & Co. had contracted to do certain tramway work for the Derby Corporation. A certificate was given by the engineer of the Corporation, but a sum of £1,500 had been deducted under a penalty clause in respect of delay. Messrs. Blackwell objected to this penalty on the ground that the delay was really caused by the Corporation, through their engineer, in not allowing proper facilities for proceeding with the work. The contention of the company was that the borough surveyor, who was appointed engineer under the contract, acted improperly and unfairly towards them. He did not, according to their view, distinguish between the duties of an impartial engineer under the contract and what he would like to do as borough surveyor.

The contract contained a very wide arbitration clause providing that all differences should be referred to the engineer. Ignoring this clause, the company brought an action against the Corporation in order that the dispute might be settled in the ordinary way by the ordinary tribunals of the land. The Corporation took out a summons to stay the action, on the ground that the dispute must be decided by arbitration. It was contended, on the part of the company, that to allow the matter to proceed to arbitration would really be to allow the engineer to be the judge in his own cause, as his conduct was to be called in question. Counsel for the company argued as follows :—" I say that, whoever the arbitrator was, if, as a matter of fact, he was the particular person attacked, there is such a strong probability of *bias* that justice could not really be done." He pointed out that this case differed from all other reported cases in this respect—namely, that the engineer would have to be a witness on the other side.

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* "The Law Affecting Engineers," by W. Valentine Ball. Constable & Co.

Upon the case going to the Court of Appeal, their Lordships unanimously came to the conclusion that the engineer should not act as arbitrator, and that the company were entitled to have the decision of the Court. " Each case," said Lord Justice Moulton, " must be decided on its facts, and, in my opinion, where the nature of the dispute arising from facts which were subsequent to the contract is such that we are of opinion that the tribunal is not likely to be able impartially to deal with the dispute, it is open to us, and it would usually be the duty of the Court, to refuse to enforce the arbitration clause. . . . Corporations are, in my opinion, often too fond of putting officers of theirs in the position of engineers under a contract, and they forget that, as they are performing other duties to the Corporation, there may arise a conflict between their duties in these other offices and their duties as engineers under the contract, which may give rise to unfair treatment to the contractor by reason of the zeal with which officers perform their other duties."

The point was very clearly summarised by Lord Justice Buckley, when he said : " The fact that the Referee was the officer of the Corporation was not sufficient ground, but the point here is that the contractor's case—whether true or not is a matter to be determined—is this : I could not complete my contract in time, and the reason why I could not complete it in time was that you, the contractual referee, were an unreasonable person ; you hindered me in every conceivable way ; you would not let me deposit any material in such a way as it is usual to allow me to deposit my material—in advance of my work—you placed all sorts of impediments in my way . . . . How could you expect him to say, if he is a person of any character at all, that the acts which he did were unreasonable acts ? It is not human nature to suppose that he can properly determine that he himself is an unreasonable person. That is the subject matter of the dispute . . . . I think that there is sufficient reason why the matter should not be referred, being such as this is, to this particular gentleman."

So far as we can see, this marks a considerable advance towards the emancipation of contractors from the rigours of an arbitration clause. If it can be shown that the point at issue is whether the engineer has allowed his duty as engineer to his employers to conflict with his duty as engineer under the contract, to the detriment of the contract, it ought to be possible to obtain a stay of the arbitration proceedings.

The Newfoundland Cable Dispute.

In our issue of 1st inst. there appeared a letter signed by Mr. Ward, the manager in England of the Commercial Cable Co., to which it was impossible to reply last week owing to its late arrival. Mr. Ward takes exception to various points made in an article on the above subject printed in our issue of August 20th. It may be mentioned *en passant* that it has taken Mr. Ward 38 days to answer them, so that his replies may be stated to be well considered.

Perhaps it would be well to take the last paragraph of Mr. Ward's letter first, as it is supposed to lay bare the ignorance of the Press and to give the public an idea that his company is, after all, really British ! It is done in a *Quod erat demonstrandum* style, which might easily convince those who do not know better ; but, unfortunately, the Mackay Companies—an American trust company—has already anticipated Mr. Ward, for the reports of this combine state that " the Mackay Companies still owns the whole or part of the capital stock of 102 prosperous cable, telegraph and telephone companies in the United States, Canada and Europe, including the entire *capital stock of the Commercial Cable Co.*" Mr. Ward may be able to explain, if the entire Commercial stock is held by the Mackay Companies, how much is left in the hands of the British investors, for these statements do not agree.

The mere fact that English investors hold a certain amount of stock in the Mackay Companies does not make the control British, and in this respect, the appearance of a Reuter telegram in the Press of the 4th inst. is rather opportune, for it contains the statement that the Cable Co. (Commercial Cable Co. owned by the Mackay Companies) has decided to ask the United States Government to intervene in the cable dispute.

In his second paragraph Mr. Ward says that his company does not own a landing at Port-au-Basque. The cable to this place is, of course, owned by the Newfoundland Government, but the Commercial Cable Co. controls the Canso end, and in its tariff mentions the cable among its connections. From a traffic point of view, therefore, Mr. Ward's company has a landing, and the statement in the article was made with this point in view, as it is there stated that the cable was " worked in conjunction with their system," not that it was owned by the company.

With reference to paragraphs 3, 4 and 5, it was not stated in the article that the Commercial Co. had a monopoly, but merely that the Newfoundland Government was unwilling to grant it. Moreover, nothing can be gained by calling a monopoly pretty names. The Colony already owns an outlet *via* Port-au-Basque, and, in case of interruption, it perhaps does not matter much whether the 1s. per word is handed to the Anglo or to the Commercial Co.; presuming, of course, that the latter company has not granted a reduced rate to the Government.

From Mr. Ward's letter it would appear as if his company were merely benefiting the Colony without regard to its own advantages ; but, as stated in the article, by the diversion of one of its cables to Newfoundland (it is the intention of the company apparently to similarly divert others) the Commercial Cable Co. has increased its speed by 35 per cent., and if the Colonial Government is so anxious to be hostile to the Anglo Co.—it would appear from Sir Edward Morris's action that this is not quite the case—all messages collected by its landline system would be transmitted by the Commercial Cable Co.

Why, if the Government is so active a competitor of the Anglo Co., is it necessary for Mr. Ward's company to have direct dealings with the public ? The company would obtain all the traffic and would be saved all the expense of its collection.

Coming now to paragraph 6, Mr. Ward's mathematical deduction " which is absurd," is not so, for the traffic contract, if passed, excludes the Anglo Co. from all traffic collected by the Government lines, with which the Premier does not agree. The tendency nowadays is for Governments to own or acquire all telegraph lines, and if this be done in Newfoundland, where would the Anglo Co. be ? Sir Edward Morris possesses the foresight of a statesman.

The object of Mr. Ward's reply in paragraph 7 is doubtful, as the article did not call into question conditions of working in the United States, but as he mentions them, perhaps he can state whether the Anglo, Direct United States, German or French companies would be allowed to own or lease their own landlines, as is done in the United Kingdom, to important traffic centres ?

In regard to paragraph 8 Sir Edward is, judging by events, not in accord with Mr. Ward, and has drawn attention to *ex parte* statements.

The point made by Mr. Ward about the land is comparatively trifling. What does it matter who owns the land ? Mere ownership does not convey a title to land cables on it, and had not the authority of the Newfoundland Government been obtained, the land leased from a private citizen would have been absolutely useless for the purpose for which it was acquired.

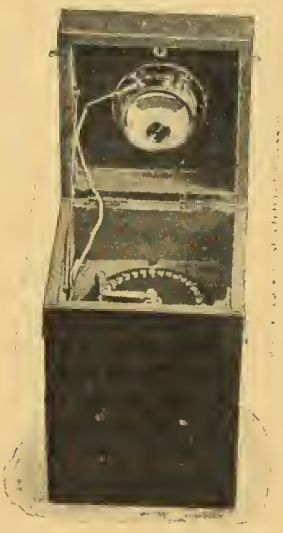
CURATIVE ELECTRICITY.

By R. M. M.

Electricity as an aid to the medical profession has lately come very much to the fore, and an assortment of apparatus varying between a cautery instrument taking 1 ampere and a Finsen light set or high-frequency coil taking 40 amperes, has been connected to public supply mains. Where the doctor can treat patients at his own house, or at an infirmary, the supply of current is a simple affair, but when the patient has to be treated out of reach of the supply mains, special apparatus—a portable battery—has to be brought into use.

For faradisation, galvanisation and electrolysis—the last two more particularly—the usual practice is to have a set comprised of cell selector switch, reversing switch, milliammeter and battery of dry cells assembled in one case; with an alternative of a separate box for wet cells of the so-called plunge type in which one element is removed from the solution when the battery is not in use. When, however, the set is designed for all three processes, it is customary to use the dry cell type of battery.

In the electrolytic treatment, by which a drug is conveyed to the affected part electrically, the current is small, mostly a maximum of 5 milliamperes, but as the resistance of the patient is naturally high, 20 to 40 volts are required for the process, depending, of course, on the patient's skin, size of contacts, and the drug employed. Many patients can be treated with a smaller voltage, and therefore one problem, similar to the regulating cell trouble in station work, presents itself—namely, the last cells tend to get the least work to do. In some sets a double selector switch, by means of which any cells can be included in the circuit, obviates this trouble, but the disadvantage of such an arrangement is that it doubles the chance of accidentally leaving a cell short-circuited.



Medical Battery of Accumulators.

The next trouble met with is that the dry cell has only a short life under usual working conditions, although on test it may give very good results. The consequence is that one or more new cells have to be substituted from time to time, and in most cases the complicated connections are such that the owner usually prefers to send the whole set away to the makers to have the renewals made. A further disadvantage is that with the ordinary cells used the terminals can be accidentally short-circuited very easily.

Bearing these weak points in mind, a set for faradic and electrolytic treatment was recently designed for a doctor by Mr. S. T. Allen, Carlisle. For the battery 18 small accumulators of a type put on the market not long ago were fitted at the bottom of a case 6 in. × 6 in. × 10½ in. inside dimensions. Connections from the cells are made by means of a wooden board carrying a number of brass pins fitted below with countersunk nuts, and on the top with lock nuts and connecting wires going direct to the selector switch. The pins can thus be first adjusted to make good tight connection with accumulator spring contacts, and then the board may be removed entirely from the box to have the selector wires attached, thus removing all danger of accidental short-circuiting.

As the cells are designed to give 0·2 ampere for four hours, the life at one charge for medical purposes can safely be put at a long period, with the additional advantage that the cells can be charged up again during the night by connecting them in series with an 8-c.p. lamp. At definite times the contact board and selector can be lifted out of the case, and the cells removed, examined and replaced in *any* order by anyone with common sense, thus giving the advantage of making each cell do equal work. The bottom of the contact board is carefully coated to prevent any damage being done by acid fumes during charging; the cells are of such design that the acid cannot be spilt, and, therefore, it seems that the majority of the disadvantages of the old type sets have been overcome successfully.

A milliammeter is fitted in the lid of the box, and provides one of the terminals for the electrode connections, the other terminal being on the selector switch. For charging purposes connection is made on the off side of the instrument and on the selector switch.

The comparison between the dry cell and the accumulator type is :—

	Size.	No. of cells.	Volts.	Weight.
Dry cell ...	4½ in. × 9½ in. × 11	18	18 to 23·4	16 lb.
Accumulator...	6 in. × 6 in. × 10½	18	36 to 40·5	15 lb.

From time to time correspondence occurs on the subject of portable batteries for mains testing purposes, the usual requirement being high voltage, low current and portability. As all three can be obtained from the small accumulator with a decrease in the total weight for equal volts, it is likely that several batteries as described above may come into use at an early date, and thus save the poor cable engineer many a swear word.

NOTES ON TRADE ABROAD.

(*Continued from page* 492.)

The Knowledge of Tongues. In a good deal of the advice that has been given from time to time in regard to strengthening British relations with countries where there are already, or ought before long to be, greatly improved chances of doing business, emphasis has been laid upon what we may describe as the language difficulty. The average Englishman knows very little of, say, Russian, Chinese, or the languages of Turkey, and probably the commercial men of these nationalities know as little of the English tongue, or coinage, or weights and measures. So far as the electrical trade is concerned, the probability is that the man who knows sufficient concerning electrical affairs, though he may be possessed also of that excellent quality salesmanship ability, is lacking in the linguistic attainment, and too often we meet men who have set themselves to the study of a number of foreign tongues to the exclusion of cultivation of other kinds, so that, excellent as they may be as office translators of correspondence, they are not the men one would select to send into the foreign field on a campaign of negotiation or business-getting. We should think that, given a man of fair knowledge of the trade, a reasonable acquaintance with commercial affairs, some experience "on the road," and a good knowledge of some of the at present rarely acquired languages, there should be a promising sphere of operations lying before him in the next ten years in securing business for British electrical manufacturers.

A Point to Consider Before "Changing Over." It is better, perhaps, for some men that they should find their way to the lands of the Golden West, labouring under the open canopy of Heaven until they find the development of the vast country so far advanced as to stand in need of their electrical assistance. They never will lose their interest in electrical engineering matters in which they have received six or seven years of training, and though they may get more or less out of touch with electrical advance if they do not read the Electrical Review as they rest 'tween whiles from their tilling and their ingathering, the elements are there to be turned to good account when electrical engineering becomes as prosperous a calling as that of farming or fruit-growing. Others may leave the calling of their youth and "take orders," while yet others enter the brewing and cognate industries, and seek solace in vending licensed liquors at a wayside inn or petrol spirit for motorists at a roadside store. If these things are not to their liking, there are businesses of quite another kind in the West End where they may find a remunerative outlet for their irrepressible electrical energies. To all who see wisdom, in the present state of things, in embracing such callings, we bid our fond and may be temporary adieus, and wish them more power to their elbow with more grist to their mill; but there are young men of spirit and ability who would do well to look into this foreign language question and this salesmanship ability matter before they abandon the pursuits of their youth and seek a field where they hope to have a less competitive fight and a greater scope than they believe electricity to be able to present to them in England. The men who take these sudden plunges from one calling to another are the men who live for to-day, and often enough we believe—we may be wrong—that they have not adequately pondered the vista of future electrical possibility. If there is the foreign business to be got, and other electrical manufacturing nations are sending their technico-commercial agents to the necessary countries to secure some of it, and, like Caleb and Joshua, they are returning with examples of the spoils that may be there for the rightful getting, why, in the name of all that is electrical, cannot our own "live" electrical men, who know the home manufacturers and have an aptitude for finding out and meeting the requirements of the foreigner, add to their already excellent attainments of an educational and personal nature a complete conversing knowledge of the tongues of those countries where there will be electrical requirements to be met for a score of years yet to come?

A Travelling Personality and Reliability.

With the existence of the right men, possessing the qualifications that we have but lightly touched in the foregoing, we believe that more of our manufacturers would be willing to launch out into the deep, in spite of what they say sometimes about not being able to afford it. Some of them cannot afford it, perhaps, because of their "once bitten, twice shy" attitude, owing to their having been "done" by the man they sent, or to the representative being a man whom they ought to have known better than to send. We have heard enough complaints of fruitless journeys, the failure of which has been due to the unsuitability of the haphazardly selected traveller. We do not do this sort of thing in a panic as a rule if we are manufacturers of standing who expect to continue in the business, and there are plenty of men about of unquestioned technical ability and unfailing moral reliability if we can only get them to couple thereto the business way and linguistic knowledge.

We do not ignore the fact that that important quality personality is more a matter of natural endowment than of practical attainment, but we have seen raw, unfinished, recluse sort of men with a little practice develop a wonderful business-getting way—not merely hustling; while reticent sort of men have developed an interesting talking ability which sometimes counts in selling against a trans-Atlantic rival, and unpolished careless sort of hang-together men have evolved a manner and a style which carry an air of success. We are not attempting to pen a Smiles's "Self Help" or other such guide to the young, but we think it right to suggest to the younger men in the electrical industry, many of whom seem just now to be allowing their hands to hang down and their hopes to fail, that they have a part to play in battling the British Battle in the foreign markets of the world, by studying the matter of their own fitness in the directions named. Let them remember that every man who goes abroad and secures business for our factories is making occupation, not for himself alone, but for many fully-trained electrical engineers who stay at home, and for an army of workmen. In doing a good thing for himself, he is acting as a public benefactor too, helping to solve the country's problems.

Turkey Moving.

For nearly a couple of years past the British Chamber of Commerce of Turkey, which was established in 1887, has been issuing from Constantinople a *Quarterly Trade Journal*. The September number that recently reached us contains a good deal of matter that is of value to the British exporter. Consequent upon the establishment of constitutional government, a new era has dawned which, in a country so remarkably unequipped with modern facilities, must call for great railway extension and other transportation systems and means of communication and general progress, which shall lead to increased exchange of commodities between Great Britain and Turkey. The introduction of foreign capital will, of course, be an inevitable factor in the development, and in this connection great importance attaches to the establishment of the National Bank of Turkey, with our own Sir Henry Babington Smith as its presiding genius. It is to be hoped that this will lead to a wise co-operation of British and Turkish capital, giving British enterprise free play, and British manufacturers useful business. The British Chamber of Commerce of Turkey is doing valuable service in endeavouring to promote a community of interests between the business men of the two countries, and it desires closer intercourse, such as that which was enjoyed a few weeks ago when representatives of the Ottoman Chamber of Deputies made a stay in London, followed by a tour of the principal English commercial centres, visiting Newcastle, Manchester, Liverpool and Birmingham.

Promoting Good Relations.

Another effort that is being made to bring the two peoples into closer touch is the attempt in Constantinople and England to spread the knowledge of the Turkish language amongst Englishmen, and the knowledge of English among the younger generation of Turks and other Ottoman subjects. The issue of the *Journal* before us contains a full list of members of the Chamber, and we are pleased to note among the English membership such names as Crompton, W. T. Glover & Co., Mather & Platt, Robey, Galloway, and Musgrave, British Insulated & Helsby, and Ruston Proctor. The copy contains a translation of the new Customs Regulations which came into force in August last, and these may be perused by any interested member of the electrical trade who makes personal application at the Electrical Review offices.

Improving Her Ways.

There is also an interesting article on tendering for Turkish Government contracts, which indicates that while Government departments have improved their system of doing business in recent years, one still sees a trace of the old methods. "Their requirements are generally published in the local papers, but too short notice is given," and sometimes adjudications take place in a few days, before anybody save one or two individuals is aware of the fact. Friends are called in to "reduce the price by a centime or two," and the order is placed, to the disadvantage of the Government and to the exclusion of would-be tenderers. This, the writer good naturedly suggests, is "when goods are wanted in a hurry." The War Office, however, is conducting business in a far more orderly manner, and has recently introduced the system of sealed tenders. There is also sometimes laxity in compelling all tenderers to comply with the conditions respecting deposits with tenders, according to the writer of the article named. A number of French firms have sometimes combined in putting up the requisite 10 per cent. deposit money, and the same course has been followed in the case of German tenderers; the writer suggests that British firms might consider the wisdom of doing likewise where big sums are involved.

A Cromptonian Success.

It is mentioned that Crompton and Co., Ltd., secured an important order for projectors for the Army, to the value of £18,000, their price being £500 per set lower than that of the French and Germans. "This order was only obtained after a long stay (in Constantinople) of their representative, and after tedious negotiations." It is added that, notwithstanding troubles of the kind indicated above, the Turkish Government is "a better client than any merchant in Stamboul." "The British manufacturers are prepared to give any Stamboul merchant credit, but hesitate to give the same credit to a Government whose annual *revenue* is more than the *capital* of all the merchants combined." We gather that foreign commission agents are helping British trade as much as or more than are local Englishmen, who display "a lack of interest . . . in this work."

A Good Thing for Somebody.

The foregoing is all more or less by way of preliminary generalising. Let us go into a little more detail. Next week (October 14th) the Government is going to consider sealed tenders submitted to the Ministry of Finance for the installation of the telephone by private enterprise in Constantinople and its environs. It is stated that none of the tenders will be opened before the date named, and that they will all be opened on the same day before a technical commission, and the concession will be granted "to the tender offering the best conditions to the State." We shall be very much interested to learn, in the course of a week or two, whether any British parties are bidding for this very substantial and valuable concession, which presumably will carry with it a great deal of good business for everything required in a telephone system for the country which succeeds in securing the undertaking.

Other Concessions.

Undoubtedly electric lighting and power and traction and other like concessions will be ready for us to "put in for" ere long. In Asiatic Turkey, Jerusalem and Damascus are provided with electric lighting and tramway services.

It is already known that there is a German-French combination of financiers (with certain Swiss and Belgian bankers also) in existence for the purpose of promoting electrical enterprises in Turkey and the East.

A British Consul at Adana said not long ago that electric light had been installed (water power) in Tarsus by a Swiss engineer, and that a big scheme was under consideration for light and power to all three towns of Adana, Tarsus and Mersina. The Board of Trade in this country received details of the scheme as soon as they were obtainable. It seems that a rival 3,000-H.P. water-turbine scheme for Tarsus, promoted by the owner of a new cotton mill there, has already led to a provisional sort of contract for the machines being given to a Swiss engineer if the concession be secured. It is timely to note the coming of new projects and to be as ready as may be for them. Germany has had things far too much its own way in the matter of electric appliances in Adana in the past, and "there is no reason why British firms should not enter this market."

A Constantinople correspondent of a Washington newspaper in writing on the opportunities opening up for the promotion of trade in Turkey, described the country as being so old, and so far behind, that it is "practically a virgin field for engineers and capitalists."

> China is not less cut by railways or marked with other western improvements. In Constantinople are 1,750,000 people within a radius of 10 miles from Galata Tower, without electricity in any form and with less than eight miles of car tracks. An American contractor, representing a combination of various interests, has recently applied to the Turkish Department of the Interior for the telephone rights of the city, and is at work on plans for several street railways. Another American here talks of harnessing the waterpower in the various rivers and streams about the capital in order to use it in electrical projects which he has in hand. The Government has already drafted projects for more than 3,000 miles of railways, the construction of which is desired at once. Almost all the proposed lines are in Asia Minor, in the richest regions of the Empire.
>
> It is the Turks' intention to give no more absolute concessions to foreign companies, which in every case hitherto has tightened the grip of some European nation upon the land. They intend to invite foreign capitalists to do work for them. Comprehensive bids will be received and the best proposition accepted. Though the railways will be held by the foreign companies for a number of years as a guarantee for investments and as a measure of compensation, everything will be from the beginning nominally Ottoman. The scheme, in other words, is, for the present, at any rate, very much that of a homestead building society.

Turkey in General.

The American Consul-General at Smyrna strongly recommends the establishment of a branch house, for the reason that Smyrna is the gateway to Asia Minor, and in a few years the whole trade of the interior will pass through Smyrna instead of Constantinople. The Smyrna Province is by far the richest in the whole Empire. "Asia Minor has, as yet, been entirely unexploited, but will not long remain so." Another Consul, at Aleppo, in writing on the methods required in trying to secure markets in more particularly northern Syria, shows the folly of expecting to do good business with a people with whom you never come into contact, and with whose manners and customs and languages and methods of doing business you have practically no acquaintance. American firms have sent to the Consul for free distribution batches of circulars relating to articles totally foreign to the country, and of which the people possess absolutely no knowledge, the lists being printed in English notwithstanding that the commercial language of the place is French. This Consul deplores the manner in which American travelling men ignore the Consulate, pointing out that a little conversation might give him valuable light regarding the manners and customs of the people, which might make all the difference between a success and a failure. This writer emulates the methods adopted by European exporters in handling the market, and if it be true that there is "hardly a line of American manufactures . . . that could not find a market here," it is equally true that British electrical manufacturers have a greater chance in the future than in the past as the development of the country proceeds along the normal course.

In Turkey, as in some other countries, it is next door to hopeless to look for securing orders merely through the mail with correspondence and printed matter. "The native will not purchase an article unless he first sees it." The mail-order system is also shown to be a very unfavourable way of conducting business in Asia Minor. Americans sometimes inquire whether it could not be used as a means of sending American goods in small parcels to the market, but the Smyrna Consul says :—

> Catalogues would have to be printed in at least four languages, namely, English, French, Greek and Turkish, and correspondence would have to be carried on in the same languages. It costs money to get up attractive catalogues in Greek and Turkish, and yet this would have to be done if it were intended to do any business with the interior of the country. The expense entailed in sending parcels from New York to Smyrna, and especially to the interior of the country, would be large. Although there are six foreign post-offices in this city, namely, English, French, Austrian, German, Italian and Russian, I am not aware that there is any especially developed mail-order system in use by any of them. . . . On the other hand, it would be impossible to send parcels through any of these post offices into the interior of the country, for the reason that they only exist in the seaport towns of the Empire. Then, again, the numerous Custom House formalities necessary to clear small parcels would greatly militate against the mail-order system as a means of trade expansion.

"Advice to those about to—"

It seems that few or no British commercial travellers find their way to Mersina, while many foreigners do so, and British goods are imitated cheaply by some of those who do sell. Then again, in Crete very few "commercials" arrived at Canea in 1908, whilst experienced men from Austria, Germany and Italy are continually visiting not only Canea, but Candia and Rethymo. It is advised that travellers should visit Crete on their way to or from the Levant, but they should be men able to speak either Greek, Italian or French. "British commercial houses are still apparently unconvinced that the mere despatch of their ordinary English catalogues, in which the measurements are given in yards and inches, and the weights in cwts. and lbs., while prices are quoted in sterling, is sufficient for the needs of the small local firms"—then follows the now usual statement that our competitors are doing very different therefrom. "How long, O Lord, how long?" Here is a summary of suitable advice to those about to try to push the importation of British goods into Crete :—

> (1) The appointment of a thoroughly trustworthy agent, with plenty of samples.
>
> (2) Leniency in granting credit. The ordinary terms are : Cash on receipt of goods less from 2½ to 5 per cent. discount, or acceptance of drafts of from four to six months from the date of arrival in Crete. Previous information can always be obtained at a Cretan bank as to the financial standing of clients.
>
> (3) Promptitude of execution of orders and care that goods sent correspond with what have been ordered.
>
> (4) Give special attention to careful packing.
>
> (5) Quotations for British goods should be made c.i.f. Crete, inclusive of packing and insurance charges.

(6) Small orders not to be despised; see what they may lead to.

(7) English is very little understood in Crete. The local language of commerce is Greek, French, and sometimes Italian. Quote as far as possible in the local currency and give metric measurements.

Give Long Credit Generally.

An American, who imports a good deal of trans-Atlantic material into Smyrna every year, wrote to an American Consul-General not very long ago, setting forth a point for closer consideration by those anxious to develop their trade connections there. We print the following extract as showing the desirability of British manufacturers stretching a point, wherever possible, in making convenient terms as to payment :—

> One of the most serious drawbacks to the development of American trade with Turkey seems to be the rather unusual mode of reimbursements asked by the American manufacturer, of remitting the cash with order. While I do not wish to be interpreted as advocating easy terms of payment for the consumer in Turkey, yet I think that a certain latitude in the way cash payment is made would materially encourage business. The American manufacturer is very eager to have his goods introduced into new markets, and would be very glad to find buyers in Turkey, yet he is not prepared to meet the buyers in the matter of reimbursements, for he shows himself too strict in the matter of cash payments to make any business possible. He should at least content himself with the condition of selling his goods for cash against shipping documents upon arrival of the steamer carrying the goods at the port of destination, instead of requiring a remittance of the amount ordered two or three months in advance of the delivery of the goods—a system much objected to by the buyer and not in use in this market.
>
> I think the American manufacturer could be easily induced to make a concession in this direction which, besides, contains no real danger to his interests, if the facts of the case were officially brought to his notice, and in view of the beneficial effects which may result from such course.

Of course this point is not a new one, and in every business which has dealings with a country which has not stood on the most lofty pedestal for commercial rectitude, such considerations must arise again and again in the course of the year. The above writer, however, has an intimate acquaintance with the people and their ways, and he suggests that it is unwise to pay too great a heed to the risks.

But sometimes none at all !

But before the ink of this is dry we cannot forbear alluding to the fact that business houses have suffered loss through dishonest methods of parties in that city. It transpired that in and around Smyrna an organisation existed purely with the object of swindling foreign merchants. Sending bills of lading in excess of real value of shipments, shipping raw materials from Turkey of lower quality than ordered, and short weights, were among the methods employed in the swindling operations. The organisation was known locally as the "Black Band" and consisted of men released from prison after serving sentences for frauds practised on European (English and German) firms. They obtained £50,000 from such firms in the course of ten years. The Governments published through our Chambers of Commerce the names of the persons forming the "Band," and the warnings given had a salutary effect; with the aid of the shipping companies the "Band" was practically boycotted and could ship no goods to Europe. When this occurred in England and Germany our electrical firms were not thinking much about doing electrical business in Turkey. Now if they contemplate doing trade there, they will find it worth while to ascertain the names of the offenders from our Chambers of Commerce. These men were apparently engaged in *exporting* only from Smyrna, but the existence of the "Gang" is sufficient to remind one that fraudulent practices are capable of variation for importation also, and names may be changed to suit any purpose you please, so it will be as well to weigh up the pros and cons and feel one's way with discretion. Of course there are sharks everywhere, more or less, and every now and again "long-firm" swindles are discovered in the best of countries—sometimes they lie even at our very doors.

Many reforms in the Customs have been introduced during the service of Mr. Crawford as adviser to the Government, and the Porte has asked for his services to be permitted by the British Government for a further three years, in order to ensure the success of these reforms.

Turkish Travellers.

An American Consul at Constantinople advises that quotations for any goods should be made c.i.f. the destination, or if the inquiry comes from an interior city, c.i.f., the nearest important Turkish port—Constantinople, Smyrna, or Beirut. On the importance of the commercial traveller as a trade builder, this Consul cites an interesting and telling case :—

> A number of firms addressed this office in reply to a report mentioning an opening for certain goods. All except one are still in the correspondence stage, the exception being a firm who sent their European traveller a copy of the Consul-General's letter giving names of likely agents. This traveller came to Constantinople, visited one or perhaps several of the parties whose names were mentioned in the letter from this office, became satisfied with the standing of one, took an order for 15 machines from this person, appointed him agent for Turkey, and left by the same steamer, without breaking his journey. This may be an exceptional case, but it proves that what can be achieved in an hour by personal interview may not materialise with months of correspondence, and also that if a business is worth having at all it is worth going after.
>
> French, German and Italian firms, although they may have been established here for 20 years and their business be on a firm footing, send their travellers regularly twice each year. These visit their old customers, with their agent, take note of any complaints or changes in requirements, and in the former case, if the complaint is well founded, with an expression of regret and judicious expressions to show goodwill, give a rebate on the last order, or even an extra discount on a new one. By such means they are able to retain a customer who had made up his mind to place his orders elsewhere. This can all be done by personal interview, with a direct representative of the firm; whereas correspondence, often heated, or an agent without full powers to act, would have failed. Of course it is part of the travellers' duties to canvass for new orders, which they are better able to secure than even the most active agents.

One of the United States Consuls advises American people to undertake excursions to Turkey in periods of commercial dulness at home. Not only Turkey, but many other countries, he suggests, might be embraced in one trip. He adds that "a good way would be to have a number of excursions organised at the same time, with competitive lines avoided. It would be best to limit the number in each excursion to 50, arranging a systematic tour to reach special markets for special goods." This is similar to the foreign tours that we advocated in these notes in our issue of September 10th, page 410.

Many a Mickle Makes a Muckle.

Consul-General Harris writing to Americans on the trade outlook recently said that this was just the time for American merchants and manufacturers to make a thorough study of Turkey, and gradually wedge in so that they might be able to get a good share of the trade "when the boom comes on, which is sure to be the case as soon as the financial world gets accustomed to the new order of things." He advised that wherever possible Americans should establish their own agents in Smyrna, employing American citizens if possible, but failing that, European firms should be given the preference "for the reason that disputes can be settled in the respective Consular court of which the agents are subject," "American houses should give a credit averaging three months if they are sure of their representatives." Small beginnings must not be thought of contemptuously, as we have said above, and as Mr. Harris shows in the following interesting remarks on the electrical trade :—

"One Smyrna firm informed me that an attempt had been made some years ago to get the agency of an American electrical firm. The reply was that unless half a million dollars worth of business could be done in the first year, it would not suit to enter the field. A German agency was then secured, which was willing the first year to install an electric plant costing $15,000. To-day the two largest electrical companies in Berlin are ably represented in Smyrna. They began several years ago by accepting every proposition whether large or small. Just now when all restrictions against the importation of electrical appliances into Asia Minor have been removed, and a great tidal wave of electrification, so to speak, is passing over the country, it is not difficult to prophesy who will get, not only the large concessions for trams and lighting in the cities, but the trade attendant upon supplying all the necessary wires, machines, apparatus, &c., as well. If that American firm had been willing to make a small beginning a few years ago, it would now be in a position to get a good share of the trade. As it is, not a single American electrical establishment is represented in Smyrna."

We hope that any reader who was inclined to imagine that the past trifling electrical connections between this country and Turkey did not justify us in devoting much space to the subject has now changed his mind. It is because Turkey, like China, is now being borne on the wave of modern awakening, because that awakening will cause enormous strides to be taken to make up for lost time in getting into line with other nations, because there is already a real electrical opportunity well above the horizon, and because some British firms have lately shown what they can do there, that we have endeavoured to bring out the importance of a market which, in view of the present position of affairs and our favourable financial relations with the Turk, should yield business for the electrical employers and employed of the United Kingdom.

(*To be continued.*)

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

Introduction.

Nearly six years ago a series of articles by the writer met with kindly acceptance on the part of the Editors of the Electrical Review, and from August 14th, 1903, till April 1st, 1904—inclusively—duly appeared in the columns of that journal.

The said articles began with a summarised re-statement, based on a uniform and systematic nomenclature, of various cable-break localisation methods and formulæ, and went on to deal in detail with graphic methods especially as connected with the Raymond-Barker calculator-board.

Most of the articles above-mentioned have since reappeared in booklet form.* The reprint, if one may judge by its sale, has been cordially received by the submarine cable community and others to whom, therefore, the writer feels very grateful.

It so happened that in August, 1903, the writer ventured to bring the Electrical Review article descriptive of the calculator-board to the attention of the editor of another leading technical journal with a view to mention, and, possibly, criticism. The editor of the latter journal, quite within his rights, politely expressed inability to see that any object would be served by reference in his journal to the calculator-board, whatever he might subsequently do when the thing should be further developed, and "results of some actual tests on cables" should be available. The writer, though at first disappointed, on second thoughts became convinced that this editor was perfectly right, and allusion is now made to the incident solely by way of point to the introduction of a further series of articles on graphic methods.

A period of well-nigh six years has slipped by since what has been described happened. During that time much additional matter has been collected and useful experience gained; also fresh light has been thrown on graph possibilities as applicable to modern localisation methods and geometrical proofs.

Thus the "results of some actual tests on cables" foreshadowed in a way by the editor, have now not only come into being, but have accumulated so prolifically from the hands of friends—not to speak of tests perpetrated by the writer himself—and are so varied in their nature that, in certain classes of examples, it becomes difficult to choose from an *embarras de richesses* that number of examples which, without undue diffuseness, will adequately represent results achieved in this interesting line of work. In any case, this pleasant task will be attempted in the following articles. These will comprise also much original matter, the result of personal observation, and not without its usefulness in supplementing information given in the text-books.

This will more especially be so in the writer's graph routine for Mr. E. S. Heurtley's exposure test, the polarity of test currents under various circumstances, graphs illustrating the effect of telluric currents in cable break localisation, &c.

Here and there in these articles graphs may appear which, in connection with the writer's name, have already appeared in recent new editions of well-known text-books. This fact is solely due to the kind initiative of the authors of the books in question who have had welcome access to the writer's portfolio of blue prints.

Since the completion of the present series of notes in MS., a new edition of Mr. H. D. Wilkinson's well-known work, "Submarine Cable-Laying and Repairing," has appeared, in which the author, in his usual lucid style, has dealt with certain fresh matters which happen to have been touched upon also by the writer of the articles to which these remarks are by way of introduction, such, *e.g.*, as those relating to the relative suitability of *zinc* and *carbon* currents for localising purposes under various conditions. This particular matter, by the way, the writer some time ago had the advantage of bringing to the attention of Mr. Wilkinson, especially as relating to the paucity of information up to then given in the text-books regarding the frequent instances, in practice, of the impracticability of using for break localising purposes the *zinc* or *negative* current. Indeed, amongst not a few writers it seemed to be a generally received axiom that localisation tests must be made with the negative current, and no explanations were forthcoming as to the exceptions which, under certain conditions, must arise in contravention to the aforesaid otherwise excellent rule. Mr. Wilkinson has certainly added considerably to the somewhat sparse information on this subject hitherto found in the text-books.

The writer's treatment of these matters will be found to be chiefly by graphs, and to follow the lines of his graphic proof of the false zero method of testing conductor resistance contained in an article by him published in the Electrical Review of October 10th and 17th, 1885, an article which, in regard to one matter in which the writer was not sufficiently explicit, drew from Mr. C. E. Rimington a useful criticism and a valuable addition to the writer's graph proof. These were acknowledged and replied to from Madeira by the writer in the Electrical Review of December 12th, 1885.

Since his completion of the MS. for the present series of articles, the writer has had his attention drawn by his friend, Mr. C. W. Schaefer, to a communication published by Messrs. G. K. Winter, M.I.C.E., and G. B. Winter in the *Journal* of the Institution of Electrical Engineers in June, 1893: "On a Graphic Method of Studying Behaviour of Exposed Ends of Broken Telegraph Cables, and of Means of Eliminating the Effect of Earth Currents and of Polarisation at the Fault."

It so happened that the said valuable article was published in London during an absence of many months from England on the part of the writer, who, until Mr. Schaefer's kind reminder, has remained unaware of Messrs. Winter's work. As, however, in the writer's method of treatment, there are several considerations and points of detail not referred to in Messrs. G. K. and G. B. Winter's most interesting communication, the writer will venture to leave his own work as it is, and he submits the same respectfully to all interested in these matters whether masters—in the scholastic sense—or fellow students.

The numbering of the figures in the following notes will follow on in regular sequence from fig. No. 37, which was the last diagram in the writer's former series of graphs completed in the Electrical Review for April 1st, 1904, and afterwards reprinted in pamphlet form.

Graphs in Practice.

Fig. 38 shows a reduced facsimile of a tracing from the Jona graphs as left recorded on the writer's calculator-board in the testing-room of a well-known cable ship on her return from a long repairing charter for a foreign Government, and a number of cable repairs.

The writer was not on the staff of that particular ship, so the fact that the localisation curves which happened to have been left by the electrician on the celluloid sheet of the calculator-board were only a few out of the many obtained during cable operations and used as definitive, speaks volumes for the confidence inspired in minds other than the writer's own by the use of the calculator-board for Jona and other graphic methods.

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* "Hand-Book in Cable-break Localisation." By E. Raymond-Barker. H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London.

A cable-ship electrician taking part in a long series of cable repairs in quick succession, and busy with all the rapidly accumulating work that mounts up so quickly on those occasions, is the last man in the world to waste time by using a device he does not like and does not feel at home with. He would jettison it sooner. . . . !

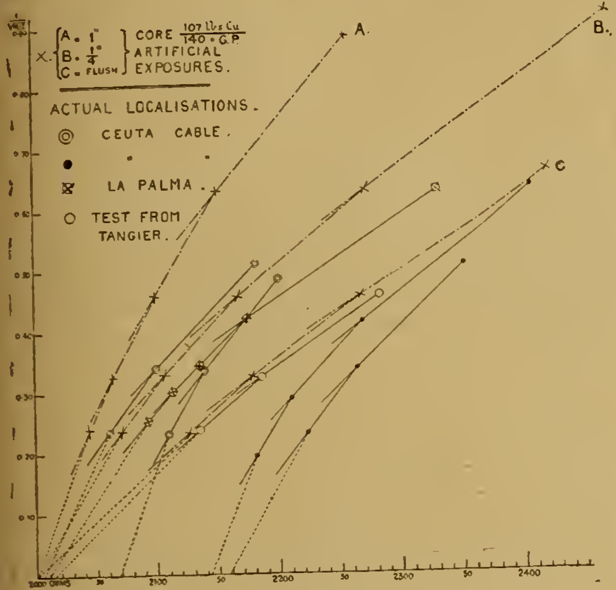


Fig. 38.

In fact, experience not only on the ships, but also at cable stations, goes to show that once a man adopts graph methods, he becomes so pleased and interested, and finds them such an excellent corroborative check on the style of his testing, and general accuracy of his work, that he wonders he never took to graphs before.

Fig. 38 shows a number of Jona graphs obtained according to the routine explained in connection with fig. 27 of the earlier series.

A B C are check curves—indicated by *cross* plottings—obtained on artificial exposures of core 107 lb. Cu./140 lb. G.P., with the same battery and apparatus as used for the actual localisation tests successfully made on the various cables in need of repair.

The other six curves, with various circular plottings, as shown in the explanatory table included with fig. 38, severally belong to certain definitive localisation tests (to breaks) made during repairs on the Centa, Tangier and Tenerife-La Palma cables.

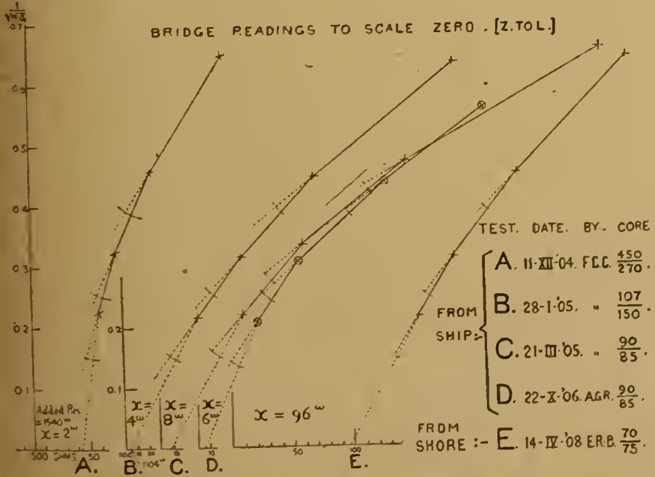


Fig. 39.—Actual Localisation Tests.

All the said tests were made through an inserted extra resistance of 2,000 ohms, which, of course, represents the point of origin of the artificial exposure curves, and which naturally has to be deducted from the various resistances indicated by the cable test curves.

Dotted lines have been drawn in fig. 38 from the several curves as given by scale-zero bridge tests to those points on the line representing resistance up to break, which subsequent recovery of cable from ship's cut-in proved to have been correct.

For example, in fig. 38 the first curve from the right with black plottings, which was a test made from shore, shows the resistance to break to be 2,158-2,000 = 158 ohms from shore—the true result, which almost coincided with that previously estimated on evidence afforded by curve trend.

Having dealt with the foregoing examples more or less *en bloc*, we find similar matter in fig. 39 treated more in detail.

In fig. 39, tests A, B, C, D are all from ship's cuts-in to broken ends, the intervening conductor resistances, as subsequently ascertained on picking up, being severally 2, 4, 8 and 6 ohms, after deduction of the extra resistances added for the adjustment and steadying of the testing currents.

Test E—the only test in fig. 39 made by the writer—was observed from shore, and shows the graph localisation of a fault in an unbroken cable, which not only entirely interrupted telegraphic communication, but gave next to no difference in shore's tests, whether distant end was "free" or "to earth." Notwithstanding the serious nature of this fault, the exterior mechanical condition of the cable at the fault—on the ship picking up—was found to be normal, excepting for a kink of long standing in which the sheathing wires were intact. The actual fault was found to be a caked-up hole in the gutta-percha, about the size of an average pin's head. This particular example will receive further attention in these articles in connection with Mr. E. S. Heurtley's exposure test. At present it suffices to know that the graph E indicated at approximately 100 ohms, a resistance up to the fault eventually proved to be 96 ohms, after due deduction of the extra inserted resistance—on that occasion 1,162 ohms.

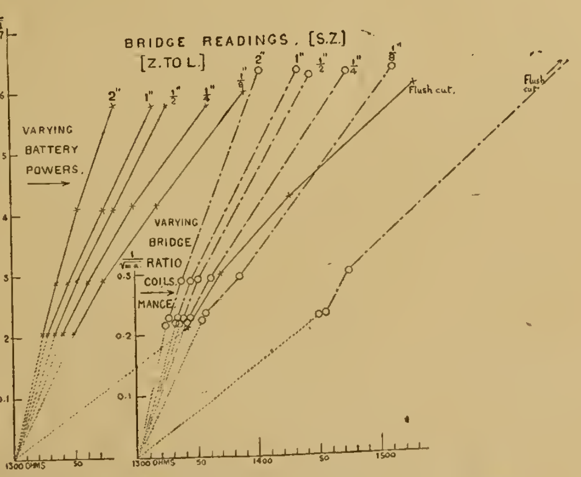


Fig. 40.—Core $\frac{70 \text{ lb. Cu.}}{75 \text{ lb. G.P.}}$ Artificial Exposures.

The main object of fig. 39 is to afford examples of C.B. practical working on five different occasions in the hands of three different observers.

Figs. 40 and 41 afford striking instances of the interest attaching to graphs of artificial exposure tests with especial reference to the educational influence these graphs bring to bear on cable-break localisation and problems as to what are the most suitable testing currents to be used on any particular occasion.

Very shortly after the first appearance (in *The Electrician*, of January 21st, 1901) of Mr. E. Jona's "Graphic Method for Calculating the Distance of a Break in a Submarine Cable," the writer derived keen pleasure and many useful lessons from drawing Jona graphs of his various localisation tests of the past, including tests by Sir Henry C. Mance's method.

Some minds assimilate in an instant the inward significance of ornate tabulations of figures and percentages with an ease envied by the writer who, of more ordinary calibre, greatly prefers *graphs* which afford at a glance an easy and illuminative interpretation of the conditions involved by, perhaps, quite a crowd of resistance and current values.

Figs. 40 and 41, referring respectively to cores 70 Cu./75 G P. and 400 Cu./360 G.P., each give two sets of curves, one involving varying battery powers as a means for varying the testing currents, the other varying bridge ratios on the Mance principle.

In each series graphs are given for the following copper strand exposures:—2 in., 1 in., $\frac{1}{2}$ in., $\frac{1}{4}$ in., $\frac{1}{8}$ in. and a flush cut, viz., the conductor showing its sectional area flush with the gutta-percha dielectric.

Inspection of these artificial exposure graphs suggests the following reflections;—

1. In the Mance test, under ordinary conditions, bridge readings with bridge ratio 10, 10 serve no purpose, and may easily lead to quite erroneous results.

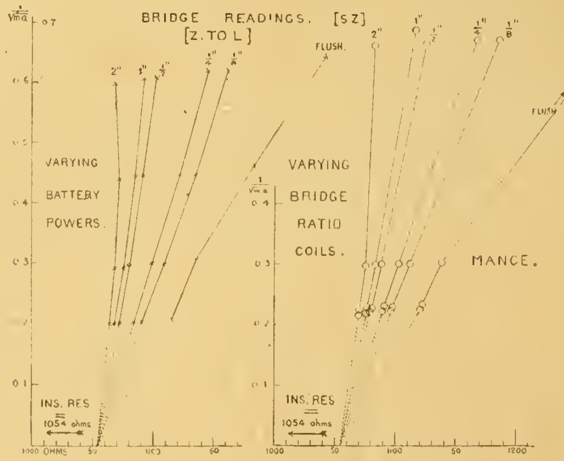


Fig. 41.—Core $\frac{\text{400 lb Cu.}}{\text{360 lb. G.P.}}$ Artificial Exposures

2. A set of Jona graphs of Mance readings affords useful corroboration of the general trend of the corresponding set obtained with varying battery powers. Take, for instance, fig. 40, which shows tests on 70/75 core. In this diagram the lay of the corresponding curves in the two sets is almost absolutely identical. Take, *e.g.*, the manner in which the 1 in. and $\frac{1}{2}$ in. curves in both sets are in particularly close proximity to each other, or the manner in which the tests on the *flush-cut* exposure evince exactly parallel characteristics of—in this particular case—uselessness as indices of the true resistance up to the break. The reason for this uselessness becomes evident from what now follows.

3. The *flush-cut* curves illustrate graphically a fact which in the early days cable electricians found out by personal experience, namely, that when a lively bridge-balance and great differences in observed resistances due to corresponding changes in current pointed to a *small exposure* at the break, *the only reliable results were to be obtained with quite weak currents.* Fig. 40 shows the *lay* of the *flush-cut* exposure curves to be hopelessly erroneous owing to the heavy polarisation of the small exposure by the use of too strong currents, accompanied by dense agglomeration of high-resistance hydrogen gas bubbles thrown off from the small copper exposure, but tending to cling and greatly increase apparent resistance between the flush-cut copper and water at the circle of contact between the small copper conductor and the surrounding flush surface of gutta-percha.

On the other hand, the portions of the two *flush-cut* curves corresponding to results from the *lower* testing currents (say, from 2 to 6 milli-amperes) if taken by themselves are found to point straight towards 1,300 ohms, viz., the true resistance up to break.

4. A comparison of the small-core curves in fig. 40 with those obtained from the heavy core, as shown in fig. 41, will interest the student.

(*To be continued.*)

PROCEEDINGS OF INSTITUTIONS.

Production of Iron and Steel by the Electric Smelting Process.

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1909, *by* E. J. Ljungberg, Falun, Sweden.)

There is at present not much to add to what has already been published concerning the melting of steel by the use of electric current. Furnaces up to a capacity of 15 tons have been built for making special steel with good commercial results, but for making steel of ordinary quality the electric method still seems to be too expensive, even where cheap water-power is available.

At Gysinge, one of the works belonging to the Stora Kopparbergs Bergslag, there is one Kjellin induction furnace with a capacity of 2 tons, but as this is working as a Talbot furnace, not more than about 1 ton at a time is tapped.

The continuous current used in this furnace represents about 200 KW, and the output in 300 days amounts to about 1,200 tons of ingots, using 50 per cent. pig and 50 per cent. scrap. The product is a superior carbon tool steel.

In the electric furnace, as well as in the crucible plant, there are also produced, among different kinds of special steel, high-speed self-hardening steel, tungsten steel, chromium steel, and nickel steel. Such steels can easily be made in electric furnaces when the necessary care is taken. When speaking of high-quality steel, all steel-makers know that the utmost care in heating, hammering, rolling, and tempering is necessary if a good result is to be obtained.

For a country like Sweden, possessing practically no coal mines but numerous waterfalls, the manufacture of iron and steel direct from ore by the agency of the electric current is of much more interest than the melting of pig and scrap to make steel. At the works at Domnarfvet extensive and costly trials have therefore been made in the direct reduction of ore during this and the past few years.

In these experiments two modifications of a furnace constructed by Mr. Wallin in Berlin, and several modifications of a furnace constructed by Messrs. Grönwall & Lindhlad (the Electro-Metal Co.), Ludvika, have been tried. Of these it is needless to describe any except the latest form.

The accompanying drawing shows a furnace similar to a common blast-furnace, but with three electrodes fed by three-phase alternating current at about 40 volts, 60 cycles, and 9,500 amperes, averaging 674 H.P, instead of tuyeres. In this furnace, which has been running for 1,903 hours, there has been produced 28 tons of iron, containing from 0·95 to 3 09 per cent. of carbon.

In the manufacture of this quantity there was used:—

Ore	442 tons.
Lime	24 "
Coke	41 "
Charcoal	58 "
Electrodes, total	6·5 "
Electric current	891,623 KW.-hours.

or per metric ton of pig-iron produced:—

Coke and charcoal	353 3 kg.
Power, H.P-year	0·492
Electrodes effective, 8 8 kg.; wasted ends, 13 9 kg.	22·7 kg.
Pig-iron from ore and lime	60 02 kg.
Pig-iron from ore alone	63 50 kg.
Pig-iron per H.P.-year	2·03 tons.

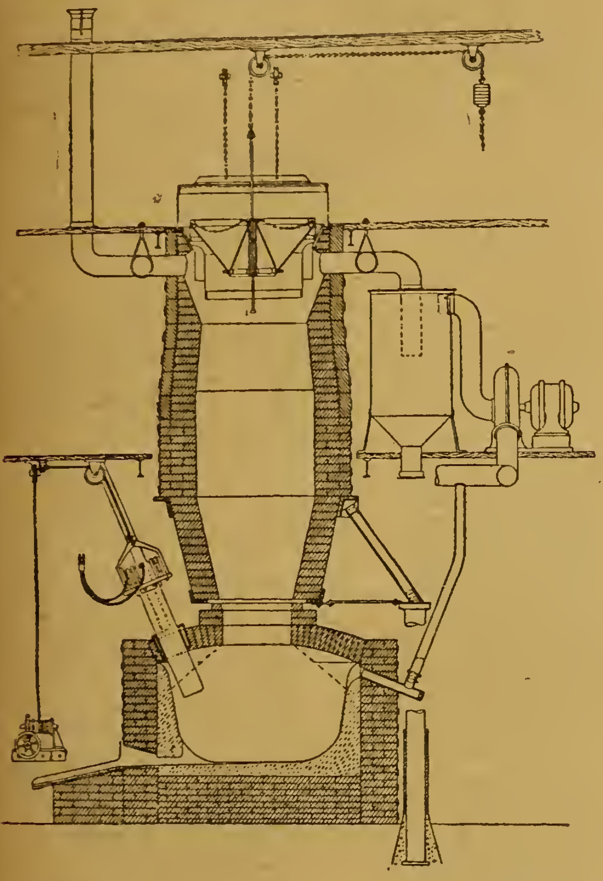
The temperature of the gases escaping from the furnace is generally very low, and they contain on an average about 22 per cent. of carbon dioxide (from 8 to 41 per cent.). The amount of carbon monoxide varies from 39·4 per cent. to 61 per cent. The gases contain practically no nitrogen, but steam from the water in the ore, lime, coke or charcoal is present.

The efficiency of the electric current ought to be higher than hitherto if the considerable loss of heat by cooling water and radiation can be reduced. These losses seem to be about 30 per cent.

No air whatever is used in the process, and the gases are produced from the carbon in the charcoal and coke and the oxygen in the ores (FeO + C = Fe + CO). Either charcoal or coke may be used, but the consumption of fuel will be practically the same in either case.

According to the description of the inventor, the figure shows a vertical section through the furnace, which consists of a lower portion, or smelting chamber, corresponding to the hearth of a blast furnace, and a top section or shaft. The latter is supported on columns, which prevent any weight from bearing on the arch of the smelting chamber. The latter is so proportioned as to provide a considerable amount of free space between the charge and the arched roof through which the carbon electrodes project into the charge. The brickwork is thus protected against any very high temperature, and remains a non-conductor of electricity. This is an important feature of this furnace, since experiment has shown that if the electrodes enter the chamber at the point where the charge touches the walls, a very high temperature is generated at this point; the brickwork is destroyed and becomes a conductor of electricity, giving rise to a more or less complete short-circuit. The brickwork may be further cooled by means of a blast of cool gas taken from the top of the furnace and blown in round the electrodes with a fan, no heat being lost by this proceeding.

The ore and fuel are crushed to a suitable size, and are fed into the top of the furnace through the bell hopper in the usual way, the ore being partially reduced by the carbon monoxide rising through the charge. The latter spreads out in the smelting chamber as shown, and the reduction is there completed. Since the electrodes project well into the charge, the highest temperature occurs in the centre of the latter, and the brickwork is thus kept cool compared with the walls of an ordinary blast-furnace.



Electric Smelting Furnace, Domnarfvet, Sweden.

It will be seen from the figures given in the paper that a step has been taken in the direction of replacing a considerable part of the fuel used in making iron and steel by the electric current, and that the problem is technically solved. As regards its commercial value, it is too early to make any definite statement yet, but this will be readily understood by all iron and steel makers when they reflect how many years it has taken to bring the Bessemer, the open-hearth, and the basic processes to their present state of perfection.

The Determination of the Economy of Reversing Rolling Mills.

By C. A. Ablett, B.Sc., A.M.Inst.C.E. (London).

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1909.)

Since the last autumn meeting of the Iron and Steel Institute, five steel works have decided to adopt electrically-driven reversing rolling mills, making in all over 20 firms who have come to this decision, and twelve such plants are at work in different parts of the world, one at least being installed to replace an engine less than 10 years old, which was in good condition.

The reasons influencing this decision may be briefly summarised as follows:—

1. Greater economy in fuel consumption.
2. Larger output from plant.
3. Reduced running costs—*i.e.*, reduction in cost of repairs, attendance, oil, &c., the reduction in the cost of oil being very striking.
4. Greater convenience and reduction of management expenses due to centralisation of power supply.
5. The great economy of the electrical plant is maintained throughout the life of the plant, and does not diminish as the parts wear.

The capital cost of an electrically-driven reversing-mill is greater than that of a steam-driven mill driven by a plain two-cylinder engine, but in the last two years the experience gained in setting a number of such plants to work has enabled the capital cost to be very materially reduced.

Further reductions in the capital cost are scarcely possible unless some entirely new method of reversing-mill driving is evolved in place of the Ilgner system, which has been employed exclusively up to the present, and the present state of electrical knowledge does not offer much prospect of this.

In a very large number of cases the economies which could be effected by the adoption of electric driving are found to amply justify the increased capital expenditure. At the present time, the question of saving in fuel consumption appeals to most steelmakers as the chief inducement offered by electrical driving, as the possibilities in the direction of greater output are not fully recognised, there being as yet no published figures relating to this. It is therefore of interest to consider the methods by which the economy in fuel, power or steam consumption can be ascertained.

Tests are frequently made to determine the economy of a reversing mill engine, either—

1. By indicating the engine and estimating the steam consumption per indicated horse-power from some of the larger diagrams, or
2. Where boilers can be isolated, by measuring either the feed water or the coal burnt for a considerable period, and keeping a record of the tonnage of steel rolled over that period, so that the result is expressed in pounds of coal or pounds of steam per ton rolled.

In the author's opinion the results of such tests have little value. The steam consumption corresponding to small diagrams is naturally considerably higher per indicated horse-power than that which corresponds to full load, so if the steam consumption was worked out for all the diagrams taken in rolling down an ingot, with a continuous indicator, the average steam consumption per indicated horse-power would be shown to be much higher than if only a few of the larger diagrams were chosen.

No clue is furnished to the losses taking place before the steam comes to the engine stop-valve, which are naturally higher in proportion to the total work done with a reversing-mill engine than with a continuous-running engine, and the losses due to condensation and leakage in the engine cannot be accurately ascertained.

The method of measuring the feed water or coal burnt per ton of steel rolled, which can only be carried out where it is possible to isolate boilers for the purpose, is open to the objection that two entirely different quantities are included in one measurement, *i.e.*, the economy of the engine, and the actual work done in rolling the steel. This prevents any comparison being made between different engines, unless the same sections are being rolled from the same sized ingots under similar conditions in both cases.

Where it is possible to isolate the boilers supplying a reversing mill engine, reliable figures for the steam or fuel consumption can be obtained by making a simultaneous test to determine the actual work required in foot-pounds to roll the ingots, supposing that the same sized ingots are being rolled down to the same section for a number of hours.

If a set of continuous indicator diagrams are taken during the total time that one ingot is being rolled, the combined area of the diagrams reduced to the proper scale, as determined by the steam pressure and the size of cylinders of the engine, gives the total work done on the ingot in foot-pounds. If this quantity be multiplied by the total number of ingots that were rolled while the test was taken and divided by 33,000 and by 60, the amount of work done by the engine during the test in indicated horse-power hours is obtained. If now the weight of coal burnt or feed water consumed be divided by the total horse-power hours as obtained above, the pounds of steam or of coal per indicated horse-power-hour is obtained, without incurring any of the sources of error mentioned above.

It is naturally desirable to take continuous diagrams for a number of ingots while the test is being made, and to take the mean of the results, in order to avoid any chance of an error in the cards for one ingot. The author has usually found that when the total work done is obtained for a number of ingots, rolled under similar conditions, the values obtained agree within 5 per cent.

The above-mentioned tests do not furnish any clue to the mechanical efficiency of the engine, and in the author's opinion the usual method of arriving at this—*i.e.*, taking indicator diagrams when the engine is driving the mill at full speed running light—shows the mechanical losses to be considerably less than they really are when ingots are being rolled, and that this is particularly the case when the engine is geared to the mill.

The energy consumption of an electrically-driven reversing rolling-mill, as expressed in kilowatt-hours per ton rolled, can be determined in the simplest possible manner by inserting an ordinary integrating wattmeter in the supply system.

Results expressed in kilowatt-hours per ton are generally found most useful, as the cost of the kilowatt-hour varies according to local conditions; knowing this cost, the total cost of power can be arrived at directly.

The following figures show some characteristic values for the kilowatt-hours per ton rolled, obtained from tests on reversing mills:—

	Kilowatt-hours per ton.
4½ in. × 4½ in. billets from 2·5-ton ingots. Output, 53 tons per hour	22·5
6 in. × 6 in. blooms from 2·5-ton ingots. Output, 63 tons per hour	17·5
8 in. × 8 in. blooms from 2·5-ton ingots. Output, 80 tons per hour	13·0
12 in. × 9½ in. blooms from 7-ton ingots, measuring 34½ in. × 25 in. Output, 65 tons per hour	11·2
32 in. × 9 in. slabs from 6-ton ingots measuring 36 in. × 19½ in. Output, 40 tons per hour ...	4·3
32 in. × 5 in slabs from 6-ton ingots measuring 36 in. × 19½ in. Output, 40 tons per hour	5·8
Flange rails, 100 lb. per yard, from 2 ton ingots. Output, 30 tons per hour	48·0
Beams, 120 lb. per yard, from 1·5-ton ingots ...	36·0
Channels, 92 lb. per yard, from 1·5-ton ingots ..	37·0

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Mining Switchboard.

The accompanying illustration, fig. 1, shows a cellular high-pressure switchboard of the Union Electric Co., of Park Street, Southwark, S.E., designed principally for underground mining work where available space is limited, and inaccessibility of live portions of the switchgear essential. The design consists of numbers of cells constructed either of steel framework and sheet-iron, or of artificial stone. The upper portion of these cells contains the busbars and receptacles for the isolating plugs. The circuit connections, which are provided with suitable plug receptacles, are arranged upon porcelain insulators at the back of the cells. For each cell a movable enclosure or switch unit, mounted on wheels, contains the oil-break switch, current and pressure transformers, time relays, signal lamps, and the measuring instruments required, together with the operating lever for the isolating plugs, which are fixed upon suitable insulators and project through the back of the enclosure. The plugs for the circuit connections are arranged in a like manner; these plugs engage with their respective receptacles when the switch unit is pushed into its cell. The action of putting in the isolating plugs automatically locks the movable switch unit in position. The oil-break switch lever is also interlocked with the lever of the isolating plugs, so that the former must be put to the off position before the isolating plugs can be withdrawn.

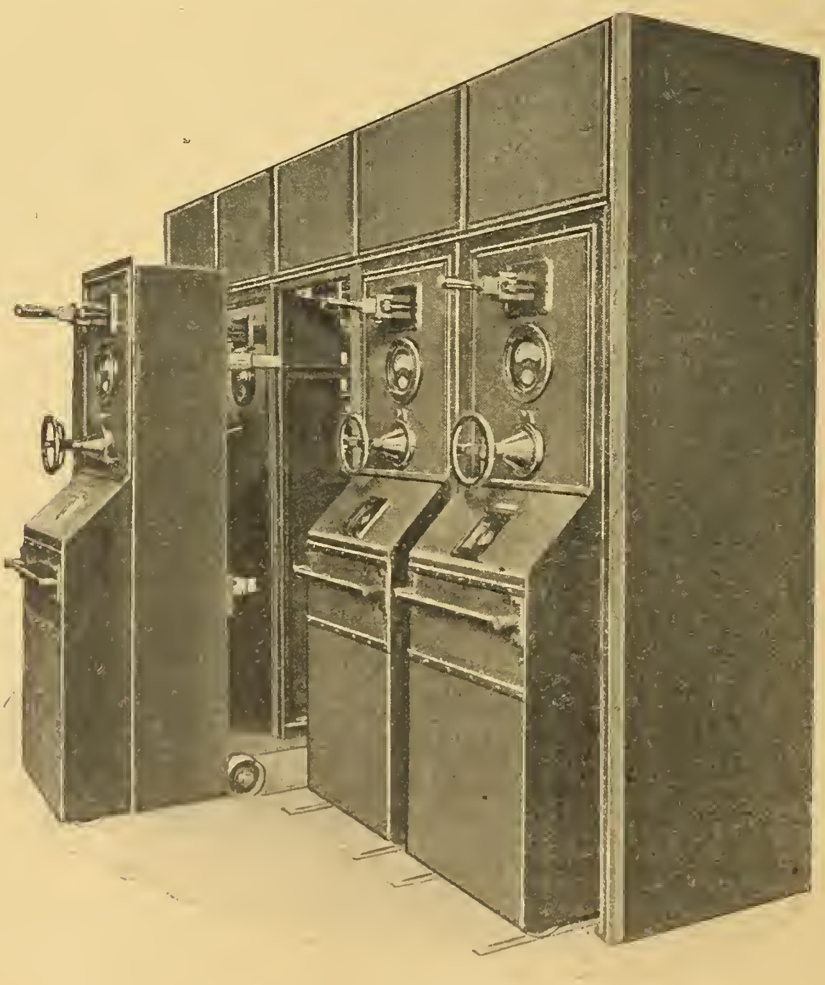


Fig. 1.—Union Electric Co.'s Cellular Mining Switchboard.

The illustration shows a board of this type constructed for two incoming and three outgoing 6,000-volt circuits.

S.M. Electromagnetic Clutch.

Messrs. C. E. Lugard & Co., of Middlesbrough, have put on the market this clutch, which has been in use on the Continent for some time past. It consists of a stationary magnetic body containing a coil, and provided with feet for fixing to a suitable support. The armature is divided into two parts; the driver is fitted with a renewable cone of phosphor bronze or hard fibre (according to the nature of the drive), and the driven part is fitted with an accurately ground cone of steel. Continuous current is supplied to the energising coil, which draws the two parts of the armature together, driving being effected partly by the friction of the cones and partly by magnetism. Between all other faces of the clutch an air gap is maintained, so that sticking from residual magnetism is impossible. The principal advantage of the clutch is that it has no slip rings or brushes, the cable being connected to terminals fixed on the side of the stationary magnetic body.

Some large clutches have been successfully applied to rolling mills using 1,200 H.P. at 350 R.P.M., and 800 H.P. at 215 R.P.M., and they have been running for some time on wire-rod mills, enabling the mill to be stopped instantly from any number of desired points, and providing an automatic safety device against overload.

Reversing clutches have been fitted to large planing machines, doing away with shifting belts, striking gear, &c.; they are said to be better than reversing motors, because the same speed of cut and return can be maintained for any length of stroke. For shafting, loose pulleys, &c., a very large number have been made.

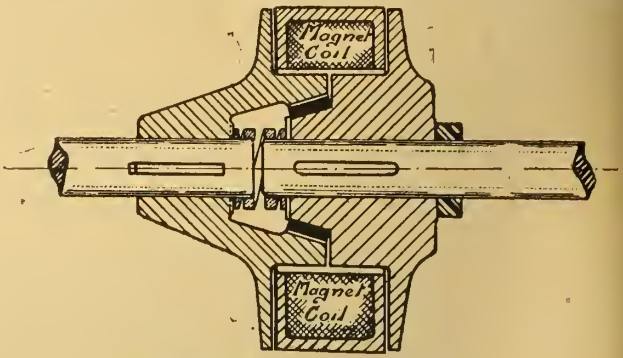


Fig. 2.—Section of S.M. Clutch.

The clutch is made in 17 standard sizes and 3 types.

Grinding Mill for Samples of Fuel.

The grinding mill illustrated below has been designed specially for crushing samples of coal and slack. The mill is constructed on the coffee mill principle, and consists of (1) a hopper; (2) two ribbed grinding cones, the outer of these being fixed while the inner one is rotated by the spur-wheel on the central shaft; and (3) a receptacle for the crushed sample of fuel.

The mill is strongly built, and the grinding cones are adjustable so that the space between their lower edges, and the fineness of the sample, can be varied at will. The bearings of the horizontal driving shaft are of gun-metal, and a heavy fly-wheel is attached. The smallest size of mill stands 20 in. high, and takes lumps of fuel up to 2½ in. × 1¼ in. in superficial dimensions. The hopper holds 8 lb. of fuel; this charge can be passed through and reduced to pass a 16/in. mesh sieve in five minutes, using hand power for driving the mill. With mechanical power, the output can of course be accelerated.

The mill is adapted for crushing down the larger samples of fuel weighing 14-28 lb. obtained in those central stations where fuel sampling is now regularly carried out. Mr. William Barnes, of the St. Oswald Works, Ashbourne, is the maker.

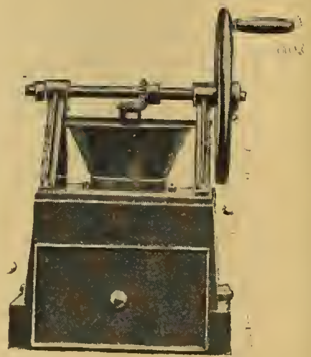


Fig. 3.—Grinding Mill for Samples of Fuel.

A New Mercury Air-Pump.

An apparatus which is mechanically driven, and which enables an extremely high vacuum to be attained, is described in a recent number of *E.T.Z.* It consists essentially of a bent tube *r*, half filled with mercury (figs. 4 and 5), ending in two S-shaped extensions *b*, and connected at its centre point by the straight tube *c* and a flexible tube *p*, to the vessel to be exhausted *d*. The S-shaped ends expand into the tubes *f*, which are connected by the T-tube *t*, *t* and flexible tube *l* to any ordinary air-pump *w*. In order to save time, the pressure in *d* is first reduced to about 10 or 20 mm. of mercury by means of the pump *w*, setting the tube in the position shown in fig. 4. The apparatus is then set rocking about the axis *a*, from the position of fig. 4 to that of fig. 5. The mercury retained in the S-shaped extension acts as a valve, preventing the return of air from the tubes *f* into the main tube *r*, whilst at the same time the air drawn from the vessel *d* through *c* is forced through the S-tubes into the tubes *f*, and is removed from these by the air-pump *w*. Fig. 6 shows how the apparatus is mounted. The pump is driven by means of a small turbine.

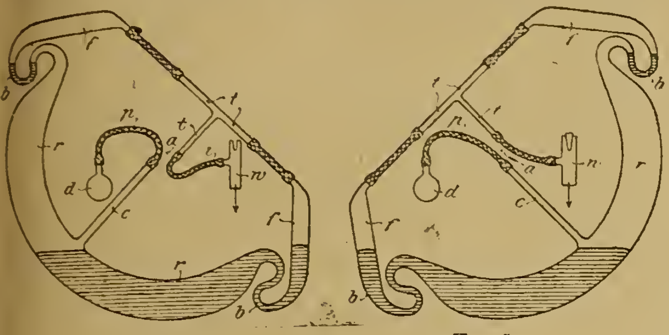


Fig. 4. Fig. 5.
Von Reden Mercury Air Pump.

It is stated that a vacuum of 0 00001 mm. of mercury can be obtained with this pump. The parts can be very easily taken apart and cleaned. The pressure is measured by means of a special kind of Macleod gauge, arranged in the form of a spiral tube, in which a portion of the exhausted space can be cut off by a mercury seal and the gases compressed to $\frac{1}{1000}$ of their original volume, with a corresponding increase in the pressure, which is thus rendered measurable. The pump, which is the invention of Dr. von Reden, is made by the Polyphos-Elektrizitats Ges., of München.

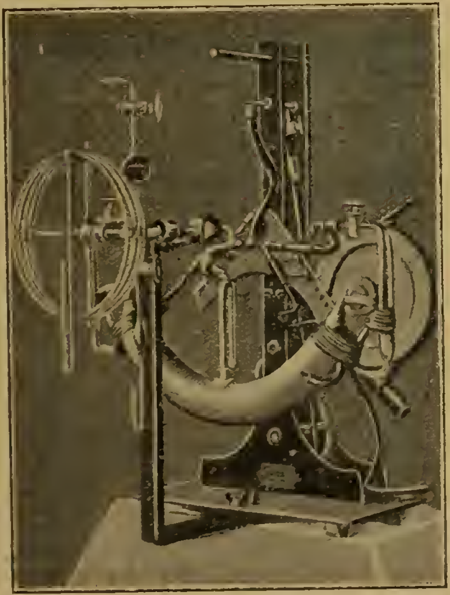
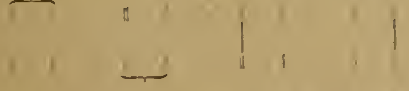


Fig. 6.—Von Roden Pump, Complete.

Lundberg "Intermediate" Switch.

Messrs. A. P. Lundberg & Sons, of Pioneer Electrical Works, Islington, have sent us a sample of their new "Intermediate" switch, replacing their present type of "Pivot Intermediate" switch, for controlling lamps from a number of different positions. The switch, which is illustrated in fig. 7, is of very ingenious construction, being provided with double clip contacts, through which the current may pass in any one of four possible ways, thus:



The connections of the intermediate switch are shown on the accompanying diagram, fig. 9, from which it will be seen that the terminals must be connected either crosswise or lengthwise; this is effected by a very cleverly built-up patent rocking contact arm, shown in fig. 8. The arm consists of six brass stampings, insulated with mica, and held firmly together with screws insulated with porcelain bushes, the construction being therefore proof against breakdown through overheating or moisture. According to the scheme of connections illustrated, only one pole of the circuit is brought into the switch, so that short-circuiting is impossible. The switch is made in two patterns, for surface and flush work respectively; it is interesting to note, too, that by the omission of one of the U-shaped contact arms it can be converted into a series-parallel switch with no "off" position, or if both U-shaped arms are removed, it becomes a double-pole switch. In its normal condition it makes a reversing switch without "off" position. If used for these purposes, the switch should have a porcelain cover, or the metal cover should be lined with an insulator.

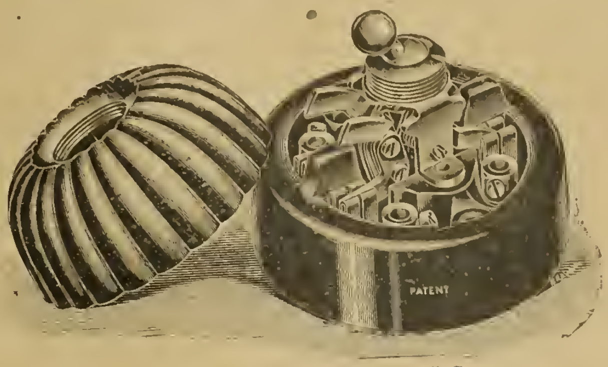


Fig. 7.—Lundberg "Intermediate" Switch.

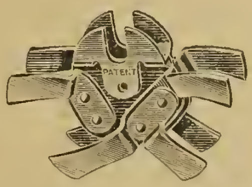


Fig. 8.—Rocking Contact Arm.

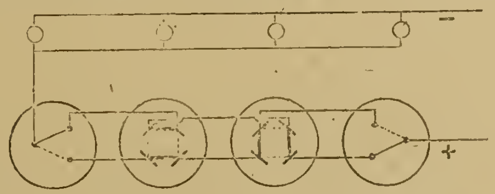


Fig. 9.—Diagram of Connections—Lamps Alight.

Rolling Heavy Copper Rod.

Our readers will be interested in the accompanying view which was recently received from Messrs. Thomas Bolton & Sons, Ltd. It shows one of the heavy wire rods which this company now roll at their Oakamcor works with the object of dispensing with all joints of any description in the manufacture of trolley and transmission wires. They are rolled from huge bars of solid copper, some 6 in. square in section, with a length of 9 ft. or more according to the weight required, the coil shown in the illustration being equivalent to about half-a-mile of No. 0000 s.w.g. wire.

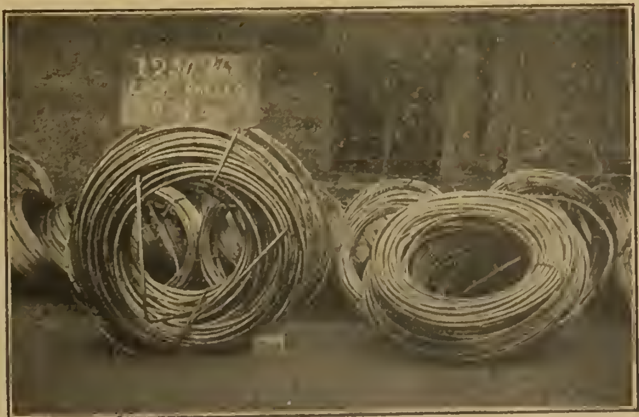


Fig. 10.—Jointless Trolley Wire.

We are informed that the method is unique in the copper industry, and is proving very satisfactory from the manufacturers' point of view, while the absence of joints is much appreciated by tramway engineers.

Messrs. Bolton have of late been devoting special attention to the tensile strength of heavy wires, one of Buckton's latest self-registering testing machines being constantly employed on samples of copper destined for trolley wires. An examination of the stress-strain diagrams showed specimens of wires as thick as Nos. 00000 and 000000 S.W.G. having an ultimate strength as high as 25 tons per square inch, with an elongation of 2¾ per cent. to 3 per cent. in 10 in.

New B.T.-H. Motors and Generators (Type D G).

The British Thomson-Houston Co., Ltd., of Rugby, are bringing out a new line of D.C. motors and generators embodying recent improvements. The armatures are of sheet-steel laminations with form-wound coils, and the commutators are forced on and keyed to prevent relative movement; the magnet frames are of cast-iron, with laminated wrought-iron poles, which can be removed with the field-coils without displacing the armature. The end shields can be turned through 90° or 180°, and the bearings are in length three times the diameter of the shaft, and of the self-oiling type. The temperature-rise after six hours' full-load run is specified not to exceed, in the case of protected-type generators, 40° C., and all the motors and generators will stand an overload of 25 per cent. for 30 minutes, or 50 per cent. momentarily. Five types of cover are supplied, ranging from perforated metal to flame-proof; the machines that are equipped with solid covers can be provided with a fan behind the armature, which draws in air at the inside of the commutator end shield and discharges it at the pulley end, so as to obtain the full advantage of an enclosed machine without the reduced rating and increased temperature-rise otherwise necessitated. The machines are rain-proof, and can be made dust-proof. Price-list No. 222 gives full particulars of the series, with dimensions and prices, and the accompanying figures show the appearance of the open and enclosed machines.

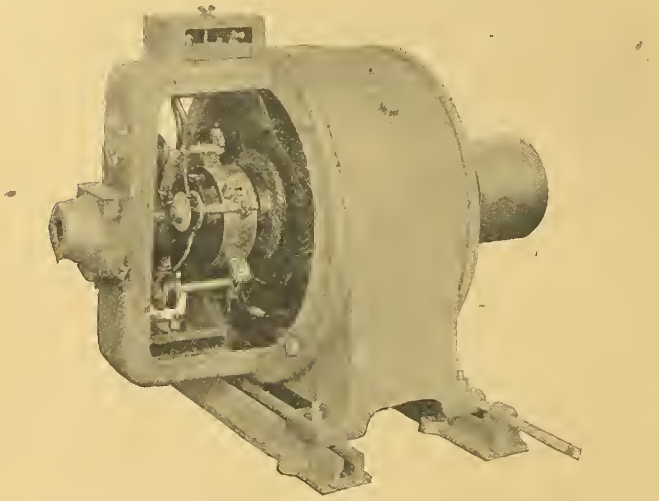


Fig. 11.—B.T.-H. Open Motor (Type D G 8).

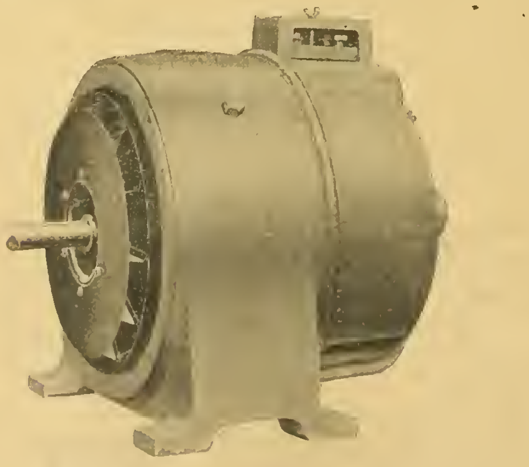


Fig. 12.—D G Totally-Enclosed Motor, with End Shield Removed, showing Fan.

Electric Smelting.—According to the *Standard*, the first great electric smelting plant for the treatment of ores to be established in Canada is to be erected at Sault Sainte Marie, Lake Superior. Similar furnaces are now in successful operation in Sweden. A second plant, involving an investment of some $7,000,000, is contemplated at a point on the Ottawa River, and it is confidently expected that this will be followed by many more plants of a similar nature.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Magnetising Current of an Induction Motor.

I have read with much interest "W. D's." most courteous reply, and his explanation of the various losses in an induction motor, and I beg to thank him for the same. I am afraid, however, he has not fully understood the query raised; it was as follows:—

It was found that a certain 10-H.P. slip-ring induction motor gave the following tests:—(1) 200 volts 15 amperes 85 cycles, rotor at a standstill and open-circuited; (2) 200 volts 29 amperes 85 cycles, 1,100 watts, no-load reading.

From the above reading (1) is magnetising current added vectorially to the energy current (which comprises eddies and hysteresis), equals 15 amperes.

Whereas, reading (2) is magnetising current added vectorially to the energy current (which comprises eddies, friction, windage and hysteresis), equals 29 amperes. From (2)—

$$\text{Energy c} = \frac{1.100}{200} = 5{\cdot}5 \text{ amperes};$$

$$\therefore \text{Mag. c} = \sqrt{29^2 - 5{\cdot}5^2}, = 28{\cdot}5 \text{ amperes}.$$

From (1) the magnetising current appears to be anything below 15 amperes.

These figures seem to point to the fact that the current taken for magnetising at no-load is different from that taken with rotor open-circuited and at a standstill. Is this the case?

Still Troubled.

Notes on Trade Abroad: Are we Indifferent?

I note in your issue of September 24th that special mention is made of the fact that the Winnipeg electric light plant contract had been obtained by British manufacturers, and the necessity for the British manufacturer to have his representative "right there."

Permit me, as a Canadian engineer, to say that you cannot bring this point home too strongly. With the preferential tariff and present low freight rates the British manufacturer is in a position "to have and to hold" one of the finest markets in the world.

The total indifference of the British manufacturers has been brought home to me from the fact that, in visiting Europe at this time, I tried to interest them in this market by obtaining their representation. To my surprise I have been compelled to go to the Continent, where I have been received with true business zeal, and I am glad to say it will be profitable.

The Canadians are human when it comes to business, and the lowest bidder gets the contract; but in a great many cases our neighbour to the south of us gets the business, because he is "right there" with his business connections, and is not afraid to hustle. Hoping this hint will be beneficial, I beg to remain

A Canadian Engineer.

September 29th, 1909.

A Peculiar Phenomenon.

I encountered rather a curious phenomenon a few days ago, which may interest your readers.

In the generating station here there is a single-phase alternator of the revolving-armature ironless type, made by Siemens Bros. & Co. The alternator is about 10 years old, and has 12 pairs of poles. The 24 field-magnet coils are all connected in series, and the exciting voltage is 100.

By putting one hand on the insulated portion of the winding of one of the field coils on one side of the armature and the other hand similarly on the corresponding coil on the opposite side of the armature, one received quite a severe shock; this was only noticeable on about five out of the 12 pairs of poles. The shock was at first thought to be due in some way to static electricity, but some tests made showed that this was not so.

Finally, it was found that, while a reading of 60 volts was obtained across the terminals of two of the coils in question, between the terminal of one coil and a damp rag placed on the insulated portion of the winding of the opposite coil, 30 volts was obtained, thus showing very considerable leakage through the insulation. The voltmeter used was an electro-magnetic one, but as the lowest reading on it was 30 volts, I could not get a proper reading from the insulation of one coil to the insulation of the other. Presumably it would have been about 15 volts.

The insulation on the coil windings is a double cotton covering heavily varnished on the outer layer (where it was touched by the hand), and it was through this cotton covering and varnish that the leakage took place. A fresh coat of varnish eliminated the trouble entirely. The machine was perfectly dry, and the insulation tests were very good both to earth and to the high-tension connections. Apparently through age the varnish and cotton covering had both become comparatively good conductors.

One wonders how long it will be before the turns on the coils become short-circuited in this manner.

Alfred S. L. Barnes.

Electricity Works, Gibraltar,
May 28th, 1909.

Prospects in Chile.

As an engineer who has spent some little time in Chile, I would not recommend "Desalentada" to go out to that country on "spec"; rather would I advise him to inquire of the London offices of some of the big importers and shippers and the nitrate companies for suitable vacancies, and proceed out under contract (under £250 per annum is no use).

Santiago, Valparaiso or Conception have little to offer for the technical man unless he has commercial training and experience to back him up. The best field for making money is in the North, on the "pampas" or nitrate grounds, as good *practical* men are scarce here and conditions of living are rather rough and monotonous. Good salaries, with living accommodation, are to be obtained up North; but, again, it is highly desirable to have arrangements made before leaving.

Above all, it is to be thoroughly understood that the language (apparently no obstacle so far as "Desalentada" is concerned, and a useful qualification in pushing his application), the customs of the country and the methods of doing business are all quite different to those of this country, and unless "Desalentada" is possessed of an adaptable temperament he is not likely to remain happy once the novelty of the situation has worn off; far better would he, I think, be advised to "chance his luck" in one of the Colonies, say Australia, where there are plenty of opportunities for an engineer to "make good."

Marshall Tate.

London, S.W., *October 4th*, 1909.

Not Wanted in Australia.

I am afraid "Milli-Volt" is rather too severe on Australia, as, from my own observations, there is plenty of scope and numberless opportunities for the right sort of men (engineers) in that colony, neglecting the factors of Socialistic and, admittedly, poor Government, together with trade union influence and tyranny.

Myself, I landed in Sydney from South America, and within three weeks secured a situation at £4 per week with only *one* testimonial to show (my other papers had been sent home to England direct), and after one month I landed a more suitable billet at £5 per week, with the same recommendations and applying through the daily paper. After having been with this last employer a short time, the whole of the applications came under my notice, and I am bound to say that not one of them possessed any exceptional degree of merit; further, my employer assured me that it was extremely difficult to obtain really good men.

I may have been lucky, but conscientiously believe that any good man holding satisfactory credentials will not long remain unemployed in Australia (pretty well any State), granted that he is energetic and "does not allow the grass to grow under his feet." Outside the larger cities, there are plenty of opportunities for practical engineers "up country," and in the mining districts; should everything else fail, a man need never starve if prepared to accept agricultural employment (unskilled) till a favourable opportunity presents itself of securing work in "his own line."

Lavender Bay.

Coefficient of Self-Induction.

In reply to your reviewer's comments, may we be allowed to express our preference for a technical rather than a dramatic treatment of the matter under discussion, and to press for a definite reply on the point at issue.

Referring to the case of a coil which has an iron core and carries an alternating current, and admitting the definition of the coefficient of self-induction as quoted by your reviewer, we would ask him to tell us in plain language:—

1. Whether, in his opinion, the definition of the coefficient of self-induction involves the relation between the current in the coil and the flux it produces.

2. Whether, in his opinion, the relation between the current in the coil and the flux it produces as represented in a vector equation, involves the use of a complex number or not.

We may point out that, so far as we are aware, there has been no difference of opinion in this correspondence as to the *numerical value* of the coefficient of self-induction; and therefore the question whether such a quantity is easy or difficult to calculate would seem to be entirely irrelevant.

We have never suggested that the numerical relation between current and flux was other than a rational number, and the last lines of your reviewer's observations seem to indicate that he, too, has arrived at this rather obvious conclusion.

C. F. Smith.
William Cramp.

Manchester, *October 4th*, 1909.

Electric Laundry Irons with Indicators.

Referring to your Adelaide correspondent's letter on the above matter, about 15 months ago I installed an iron in our tailor's shop, with a 5-C.P. lamp in parallel, in a position visible to all users, to serve as an indicator.

I certainly think it is essential that an indicator of some description should be provided; and as a lamp is the most visible, as well as most simple, to understand, I think it may be considered the most satisfactory type of indicator; the current consumed is small, and the saving great when one considers how easily an iron could be left on if no indicator was provided, especially when the iron may be used intermittently.

Of course, the lamp gives a certain amount of light, but I do not think a supplier of current would raise any objection when he understood the purpose for which it was used. If he did object, what would be his opinion regarding a glow lamp radiator? Anyhow, if objection was raised, a coloured lamp could be used.

From my own practical experience, I think an indicator is necessary for several reasons, and would strongly recommend the extended use of the same.

A. W. Wyatt.

Cornwall County Asylum, Bodmin.
October 4th, 1909.

Tramway Power Tariffs.

It is somewhat surprising to find from your comments on my last letter, that you are still unconvinced as to the wisdom of Manchester's adoption of a combined system for lighting and traction. The opinion of the Manchester Tramway Committee and their manager, arrived at after protracted discussion, evidently counts for nothing, although they are, of necessity, the best acquainted with the actual conditions obtaining in this city.

Coming to the fresh matter which you submit in support of your case, the original matter being now, I submit, discredited, is it not grossly unfair to compare separate with combined systems when the figures used are not on a common basis?

It is farcical to say that the figures are "not strictly comparable." To make a comparison worthy of the name, they require sweeping adjustments. For instance, in a former issue, you agreed to the correction of the Glasgow units from 27,443,493 to 24,707,760 in order to put Manchester and Glasgow on equality, yet you repeat the error in a magnified form by quoting, from Mr. Slattery's tables, Glasgow's total as 29,150,391. Again, Sheffield's cost, as I have shown in my previous letter, is merely the cost of gross output, and does not compare with cases where sales of energy are made to tramway committees direct on the traction routes. This objection applies to all the figures in Mr. Slattery's second table. The comparison in this respect is almost as absurd as that between the cost of coal at the pitmouth in Northumberland and the cost of the same coal delivered to the consumer in London.

I would point out also in the first table that until actual figures are given for the outlay borne by the electricity departments in providing the feeder cables and distribution system generally, together with the annual costs involved in their maintenance, it is quite useless to attempt to make any intelligent comparison.

One notes in passing that Belfast and Cardiff are given as examples of undertakings owning their own stations. According to Garcke, the Belfast tramway "generating station is an extension of the lighting station, and the plant is designed for lighting or traction supply," but I believe I am correct in stating that the whole of the capital incidental to the feeder cable system was found by the tramways department. At Cardiff the tramway power station gives a bulk supply to the lighting department. Further evidence of the inaccuracy of the tables can be found again in the case of Belfast, where establishment and capital charges are shown at the absurd figure of ·13d. per unit against Glasgow's figure of ·738d., Sheffield's ·274d., Birkenhead's ·297d., Leeds ·409d., and so on. From Belfast's own accounts the capital charges alone amount to ·28d. per unit of gross output. I consider that the most serious flaw in the tables is the varying treatment of depreciation, which is quite sufficient to render Mr. Slattery's tabulation valueless. Take Leeds policy, for instance. According to the *Electrical Times*, Leeds, in the year 1908, restricted the provision for renewals and depreciation to the actual sum expended on renewals. But this is not all. The funds that had previously been accumulated for these purposes were distributed and the whole sum passed over to the City rate. At that date Leeds then enjoyed the unenviable distinction of being without any reserve fund whatever. What is the use of comparing such a case with Glasgow and Manchester? The tables are, in fact, useless and downright misleading.

As to my comparison of Glasgow and Manchester costs, I need do no more than refer to the unexpected but welcome entry into this discussion by the *Electrical Times* in its article on the 24th ult. Whatever may be said as to my bias, nothing can be urged against your contemporary. Allow me to quote from the article :—

MANCHESTER.	GLASGOW.
The tramways department paid 1·14d. per unit for energy bought from the electricity department.	It cost the tramways department 1·17d. per unit to generate its own energy.

So far the position between us is that originally you made a scathing criticism of Manchester, then when pressed you made important qualifications, and finally you say you cannot agree with the writer of this letter. As this is to be my last contribution to the discussion, I submit that in fairness you ought either to have proved your case or withdrawn it, as the issue at stake is not personal, but is that of settling or unsettling the minds of those Tramways Committees who are purchasing their supplies.

S. L. Pearce.

Manchester, *October 4th*, 1909.

[We regret that Mr. Pearce should have construed our original leader into an attack upon Manchester; this was certainly not intended, and, we venture to think, the complete article could hardly be so interpreted. The Manchester-Glasgow comparison was, obviously, only a side issue, and in view of the importance of the question as a whole, and the attention which is being given to it by municipal tramway authorities and engineers, we cannot but feel that our reference to the matter was timely. As regards the merits of the question as a whole, our only desire is to arrive at the truth, whether it be in accordance with our expressed opinions or the contrary. Mr. Pearce, quite naturally, holds a brief for the combined station; and while we are not convinced by his arguments, we cannot but admire the ability and resource with which he supports his case.—Eds. E.R.]

Unemployment.

In reference to the letter by "Status" in this week's issue *re* Proposed Engineers' Association, I repeat, the matter has dropped as regards station engineers, for it appears that the society which took the matter up wants to assist chiefly consulting engineers and contractors in the preparation of specifications and contracts, with legal advice on such matters. The work of organising the assistant engineers in the electric supply business has been put in the background, whereas this was the chief aim of the correspondence. The letter by "Organiser" corroborates what I say, and I am still of opinion, as I was at first, that if we have a society at all, we must have a new one altogether, unless the present society can see its way to hurry up and place the work of organisation in the front absolutely; the other things can very well wait. We have been waiting nearly two years now, and during this time money might have been coming in.

Electricity Supply.

As a constant reader of your unique paper I would like, from both experience and observation, to point out three great causes of unemployment :—

1. The "family plate" money around which every trade centres.
2. A glutted market.
3. Want of combination.

One writer truthfully and frankly stated that mansion or estate plants offer the bottom prices for mental and manual work, viz., run a gas or oil engine and dynamo, repair all lights and engine, shoe the horses, milk the cows, give massage to master and visitors without tips, dig up the spuds, and fill in spare time with Mary and the lambs in the garden, and sacred duties on Sundays, for the insulting stipend of 25s. per week.

The cause of this is largely the fault of engineers generally; when the infant electricity arrived we shut the door against it, and others picked it up, and so it fell into amateur laps instead of being embraced as an impetus to our fading engineering trade and a branch of its tree.

This new and grand industry has drifted, and this leads me to the cause of the glutted market.

The Polytechnics opened for a mercenary purpose evening classes and workshops, and in these electrical workshops we find clerks, butchers, grocers, drapers, and some of all grades, who, by paying the fees, can pick up the electrical trade like the pigeon picks up peas, rather promiscuously. These classes are a delightful recreation after a full day of chopping up pork, tearing calico, and washing currants. After a few lessons quite a colony of these men leave their own trade and try to pose as electricians; but the workshops are the testing houses, as good mechanics and electricians are watching these robbers, and laughing as they drill a ⅝ hole in their brass with the back gear in, and file like the village blacksmith.

And the same spirit is prevalent amongst our local tradesmen, making it common for every ironmonger to complete his circulars with the title of electrician, bells fitted, cranks, and otherwise—*stress on the cranks.*

The last cause is the want of combination.

If men have served a lawful five years, let them anon learn the lesson "Unity is strength," and join their brothers in fighting for a living wage, and if out of work, certain bread and cheese; if sick, sick pay; and if on the rocks, a benevolent grant—by joining the Amalgamated Society of Engineers (Electrical Section).

To-day we must give credit to Trade Unionists for a living wage, and value the services and sacrifices of past heroes.

John Burns once visited an asylum, and during his usual inspection, he was warned to keep his eye lifted. He laughed heartily, and replied: "No need for that, as lunatics never combine."

The title of electrician belongs only to the man who has erved his time to the electrical trade, and not only knows he theory, but can do his own repairs, and not to the man vho has bits of many trades like the street instrumentalist vho plays two instruments with his foot, four with a nod f the head, and the tune that brings most coppers to the rum.

Let all those brothers who have served their apprenticehip and are out of work join the electrical section on the irst chance, and keep out the invader and intruder.

All free traders believe in this bit of protection, as it vould guard our savings from the robber.

I may differ from my other colleagues, as I am not ashamed f the name that my godfather and mother gave me.

Wm. Podmore,
Electrical fitter.

Sheerness-on-Sea, *October 4th*, 1909.

Correction.—In our reply to Mr. James Gordon's letter, on page 530 of our last issue, we were made by the printer to say that we had said something that we did not say. For the word "no" in line 13, of course, read "any." We don't know how the printer made such a mistake, nor does he, but he really admits that he did it.—Eds. E.R.

BUSINESS NOTES.

The European Aluminium Trade.—It has hitherto been impossible to form a syndicate of the French makers of aluminium such as has been projected for some time past, and which would probably pave the way towards the re-establishment of the international combination that was dissolved a year or two ago. The French makers in anticipation of the creation of the national syndicate concluded a kind of price convention for 1910 a little time ago, but as the syndicate has not been constituted some of the producers insist that the price convention should be determined. However, there is still hope that an understanding will be reached. In the meantime the Société Electro-Métallurgique de Froges has fixed the price of aluminium rolled plates at 2 fr. per kilogramme, and at 2 fr. 10 centimes for wire bars, sheets and wire being on a higher basis.

Consular Notes.—Venezuela. — The British Vice-Consul at Caracas, in a recent report, states that during the years 1907 and 1908 the Central Railway Co. electrified the first 6¼ miles of their line, and they are now extending the road as far as Santa Lucia, a village deriving the little importance it possesses from its situation at the head of the fertile valley of the Tuy River, which should make it a transport centre for the products of that district. The tramway system of Caracas has been electrified, and Caracas now enjoys the advantages of an excellent tramway service. The work was carried out by a London firm, and the system used is a trolley one. The telephone system of the Venezuela Telephone and Electrical Appliances Co., a British owned concern, has been converted to the common battery system, and thoroughly up-to-date plant has been installed, so that Caracas also possesses a telephone system worthy of many a larger town.

Brazil.—The British Consul at Pernambuco reports that over and over again he has laid stress on the desirability of the employment by British exporters of suitably and properly qualified representatives to push trade. Personality counts for very much with the Brazilians, and the representative who will take the trouble to learn the language thoroughly, to understand the Brazilian, and to be sympathetic with him, will constantly score in competition. Apart from the difference to his own personal comfort in his dealings, it will materially affect the interests of those whom he represents. Of course, this means time to gain experience, and to learn to avoid as many of the difficulties with Custom House authorities as is reasonably possible. It would seem that different rates on the same goods are levied in different ports along the Brazilian coast. Apparently different interpretations are made of the same regulations in different places.

Chile.—The British Consul at Valparaiso reports, for the information of those persons who may have to do business with Chile, that care should be taken to have all documents, such as contracts, powers of attorney, &c., legalised by a Chilian Consul before sending them to Chile. Much time and trouble will be saved by so doing. The Consul states that it is satisfactory to see that British merchants have at last realised the importance of sending out their catalogues and price lists in the language of the country. Some of the catalogues which have recently been delivered at the Consulate have been most carefully got up, and should repay the senders for the time and money they must have expended on their compilation.

Ecuador.—The British Consul at Guayaquil reports that rubber gave 12 per cent. less in 1908 than in 1907. Reports as to the plantations are very discouraging. Trees grow badly and reach only a very small size, with little vitality after 10 to 12 years. Those tapped for rubber give 8 to 16 oz. of gum, and most of them after this production are found to be exhausted and die out. The cause of this is yet to be discovered.

Siam.—The British Consul at Patani, in a recent report, calls the attention of persons interested in rubber to the possibilities of that district as a rubber-producing country. The only foreign-owned rubber plantation in Patani is near Bangara. It is owned by an Englishman, and was started about four years ago. Reports with regard to it are very favourable.

Long Life to Metfil.—The Edison and Swan United Electric Light Co., Ltd., of 36, Queen Street, E.C., inform us that they have just received a letter from a satisfied customer to say that one of their 32-c.p., 100-volt Metfil lamps has failed, after burning for 5,880 hours. The depreciation thus amounted to 1d. per 160 hours.

East London Electrical Exhibition.—At the invitation of Mr. C. Newton Russell, electrical engineer to the Borough of Shoreditch, a meeting of exhibitors was held at the Electricity Offices, Coronet Street, Hoxton, on September 30th, when the following committee was appointed:—Mr. F. Pooley, chairman; Mr. H. Harrison, vice-chairman; Messrs. E. P. Barfield, T. Lambie, S. Rentell, and H. Dixon; the last-named, whose address is 11, Victoria Street, Westminster, S.W., being secretary. It was announced at the meeting that nearly all the available space had been taken up. Any further applications for space should be sent at once to Mr. Russell. The secretary of the Exhibitors' Committee invites suggestions, &c., which exhibitors may wish to have brought before the Committee.

Book Notices.—We have received a copy of No. 2 of *Country and Town*, a new 6d. monthly illustrated journal devoted to the beauties of art in country and town. It is edited by Mr. Cecil Alexander Sharp, and bears evidence of the exercise of a wise discrimination in the selection of matter to interest everybody rather than to appeal only to a limited circle who are already catered for by other and technical publications. The contents are somewhat distant from our own province, but we have no doubt that a number of our own readers will be pleased to study this, the October number, with its finely executed coloured plate and statuary group, its charming views of "Our Villages and their Churches," with appropriate notes thereon, and its articles on "A Lake District Garden," "Old English Porcelain," "Leadwork at Haddon Hall," "The Priory Church of St. Bartholomew the Great, Smithfield," "Country Homes," and a variety of smaller items relating to country and town matters coming within the wide sphere of operations covered by the subjects which these titles indicate. *Country and Town*, which has our good wishes for a successful run, is published by the Abbey Press, of 13 and 14, Tothill Street, Westminster.

The *Agricultural Economist and Horticultural Review*, a copy of the October issue of which has been received, is edited by Mr. Greening, of "One and All" fame, and it contains a variety of interesting matters more or less entertaining to the gardener. More than that we need hardly say, nor have we space to spare to do so.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXV, Part 9. September, 1909. London and Newcastle-upon-Tyne: Andrew Reid & Co.

"Mechanics' and Machinists' Pocket-Book and Diary, 1910." By W. H. Fowler. Manchester: Scientific Publishing Co. Price 6d. net.

"Alternating-Current Motors." By A. S. McAllister. Third edition. New York: McGraw-Hill Book Co. 1909.

"Science Abstracts," Sections A and B. Vol. 12, Part 9; September, 1909. London: E. & F. N. Spon. Price 1s. 6d. each section.

"The Dynamo." By C. C. Hawkins and F. Wallis. In two volumes. London: Whittaker & Co. Price 21s. net.

"Electric Traction on Railways." By P. Dawson. London: *Electrician* Printing and Publishing Co. 1909. Price 25s. net.

"British Standard Specification for Ammeters and Voltmeters." London: Crosby Lockwood & Son. Price 2s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXV, No. 7. September, 1909. New York: The Society.

Catalogues and Lists.—Messrs. E.M.F., Ltd., 10, Ironmonger Lane, Cheapside, E.C.—A collection of illustrated leaflets relating to their various lines of manufactures, including E.M.F. auto-transformers, metal-filament lamps, luminous radiators, lighting fittings for shop, mill, colliery and other service, ceiling roses, lamp-holders, dry cells, shades and reflectors, bells and bell indicators, wood blocks, and Newall's anti-vibrator for use with metal-filament lamps. The firm has also issued an effective show-card, for distribution to lighting consumers, emphasising the economical and illuminating qualities of the E.M.F. metal-filament lamps.

The Endolithic Manufacturing Co., Ltd., 61½, Fore Street, E.C.—Illustrated sheet of ivory, ivorine, metal or bone name labels such as they make for electrical engineers for attaching to switchboard work and electrical apparatus, batteries, machinery, &c.

Messrs. J. Dugdill & Co., Failsworth, near Manchester.—Set of illustrated sheets showing their adjustable arm electric light fittings and other manufactures.

Messrs. Davidson & Co., Ltd, Sirocco Engineering Works, Belfast.—New 16-page pamphlet, containing a clearly-arranged partial list of installations of the "Sirocco" mine fans in use in Great Britain.

Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston.—New price folder dealing with tantalum lamps. We understand that many thousands of these lists have been supplied to electrical contractors and ironmongers with their own name and address. The firm will readily supply a quantity free to any electrical dealer who applies for them. From Messrs. Siemens we have also received a catching picture postcard, the effect of which is to stick right in the recipient's mind that if tantalums be used he can have "a brilliant passage." We do not like to commence to explain exactly what that means, but if any of our readers who have not received a copy will write for one they will catch Mr. Hassall's humour. Only a block of the card could adequately convey what was in his mind, and unfortunately we have not room for that. The design is executed in colour as a showcard for ironmongers and electricians to display in their establishments, to aid them in educating the public regarding the brilliant illuminating qualities of the lamps.

The Reason Manufacturing Co., Ltd., Brighton.—New pamphlet catalogue of 32 pages, wherein they give particulars, illustrations and tabulated sizes and prices, of their many fuse-boxes, and sealing troughs for same. The list is brought right up to date.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, London, E.C.—New price list of electric radiators. A number of new types are being introduced this season in Adams, Flemish, Georgian, Sheraton, Tudor and other designs. Convector radiators and a combined luminous and non-luminous type are also being supplied.

Messrs. Kynoch, Ltd., Birmingham.—Leaflets illustrating, briefly describing and pointing out the advantages, of their self-oiling bearings and their roller-bearing and non-adjustable swivel pedestal.

The Union Electric Co., Ltd., Park Street, Southwark, London.—List No. 8,015, describing their insulation-testing set for contractors and mine electricians.

Messrs. Mavor & Coulson, Ltd., Glasgow.—October date-card relating to Pick-Quick bar coal-cutters, giving notes on undercutting and overcutting.

Messrs. Walter's Electrical Manufacturing Co., Ltd., Kensal Road, London, W.—Twenty-four page booklet containing a number of photographic views of their works, exterior and interior, the latter showing the test room, main instrument shop, wood-working shops, and the casting shop and battery making room. Alternate pages show a selection of the firm's specialities in electrical and telegraph instruments. An accompanying list gives a full account of Moore & Powles' patent one wire three indication block instrument.

Messrs. Tredegar & Co., 56, Victoria Street, London, S.W.—Seventy-six page catalogue (on art paper throughout) showing some of their wooden electric light fittings. A very fine collection is brought together, including a variety of attractive designs of fittings such as brackets, electroliers, standards, pendants, &c., in oak, gilt, white gilt finish, Gesso work, inlaid and carved mahogany.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Another new pamphlet, No. 16 A (20 pages), has been issued. It relates to the Peebles polyphase induction motors, which are manufactured in all the usual types to conform to the Home Office and Fire Insurance Rules. A type of motor specially suitable for use in textile mills is being made. Sets of weights and dimensions are given for all sizes listed, also particulars of outputs, efficiencies, power factors, &c, for both 50 and 25-cycle circuits at all the usual speeds. A few excellent half-tones appear of the latest types of machines.

Messrs. J. Hodgkinson, Ltd., Queen Anne's Chambers, Westminster, London.—Four-page circular describing their patent coking stoker and self-cleaning fire-bars, and showing a view of five 8-ft. diameter Lancashire boilers fitted with these stokers, also one of 16 similarly fitted boilers of 9 ft. diameter at the Salford electric power station.

The Davis Electrical Co., Ltd, 17, Moor Street, W.C.—Folding card stating prices of metal-filament lamps.

The Ransome-Ver Mehr Machinery Co., Caxton House, Westminster, London.—90-page illustrated catalogue containing full description and data regarding the Ransome concrete mixer (manufactured by Ransome & Rapier, Ltd., at Ipswich). The information given includes particulars of mixers complete with electric motor, starters, and switches, or for belt or steam driving, or with paraffin or petrol engine, also shipping particulars, working capacities, and code-words. Mixers with hoisting apparatus and elevating hoppers are likewise included. Erection and working instructions are given, and particulars are set forth of other concrete mixing machinery. Many pages are occupied with testimonials from contractors who have used the Ransome plant, and photographs of the jobs on which it was employed. One of these pictures shows the mixer at work on the alterations and additions at Dale End generating station, Birmingham. Numerous line drawings with dimensions appear, of belt, engine and boiler, and motor drive general arrangements. The catalogue is a most useful production, and should be interesting to contracting firms having requirements for concrete-mixing in connection with their operations.

Messrs. Marion & Co., Ltd., 22-25, Soho Square, London, W.—Twenty-page pamphlet illustrating and giving prices of a number of their electrical manufactures, including Boardman's photo arc lamps, "N.C.C." carbons, resistances, light diffusers and reflectors, "Westminster" enclosed photo arc lamps, and "Cooper-Hewitt" mercury vapour outfits.

Messrs. Laidler, Ritchie & Co., Ltd, Nutsford Vale Works, Longsight, Manchester.—Priced leaflets of "Meteor" metallic-filament lamps and of Fludor solder.

The Empire Engineering Co., Caxton House, Westminster, S.W.—Small booklet containing information relating to the "Empire" petrol or gas engine for country house electrical installations and other purposes.

Messrs. Ozonair, Ltd., 94, Victoria Street, Westminster, S.W.—A new catalogue of the now well-known "Ozonair" apparatus has just been issued, in which the various types are well set out with illustrations always facing descriptive matter. In each case the description is accompanied with code-words and particulars of the capacity and the amount of energy consumed. All converters are now supplied with ball bearings, enabling them to run for many months without attention. Among the various new types introduced in this list is a complete installation on a small scale all ready for fixing by the ordinary wireman. A new combined self-contained apparatus for disinfection purposes, &c., is also described, and a code index occupies the last page.

Smoke Nuisance Charge Breaks Down.—The City of London Electric Lighting Co., Ltd., were summoned by the Southwark Borough Council for smoke nuisance at their Bankside premises. Owing to dissatisfaction with the manner of serving the notices, Mr. Baggallay dismissed the summonses and allowed the company five guineas costs.

American-German Patents Treaty.—The new treaty between the United States and Germany, which came into force on August 1st, provides that the working of a patent in the territory of one of the contracting parties shall be regarded as equivalent to its working in that of the other; previously an American patent not worked in Germany within three years was liable to revocation if an action was brought with that object in view.

Bankruptcy Proceedings.—In Tuesday's *London Gazette* the following entry appears under "Notice of day appointed for proceeding with public examination adjourned *sine die*":—Harness, Cornelius Bennett, Claregate, Little Heath, Potter's Bar, of no occupation, Court, St. Albans. Date fixed for proceeding with examination, October 26th, 10.30 a.m., at the Court House, St. Albans."

Liquidation.—Mexican Power-Development Syndicate, Ltd.—A meeting is to be held at Basildon House, Moorgate Street, E.C., on November 8th, to hear an account of the winding-up from Mr. A. W. Tait, liquidator.

Electro-Chemistry in Mexico.—A company has been granted a concession to establish a factory for producing carbide of calcium, cyanide of potassium, caustic potash, caustic soda and chloride of lime in Mexico; the company undertakes to invest about £20,000 in the enterprise. The concession is for a period of ten years. The company may import free of duty all machinery and apparatus, building materials, &c., necessary for the construction of the factory and for the manufacture of the chemicals.—*Board of Trade Journal.*

British Patents in Australia.—Following the lead of the British Patents Act of 1907, the Australian Commonwealth Senate has passed an amendment to the Patent Acts for the compulsory manufacture of all patents in the Commonwealth. It is generally considered that this compulsory clause must seriously affect British owners of Australian patents. The Patents, Trade Marks and Designs section of the London Chamber of Commerce has passed a resolution urging that the Chamber should approach the British and Commonwealth Governments by deputation, to urge the introduction of a clause in the Bill to grant reciprocally exemption from the compulsory working of British patents in Australia and Australian patents in the United Kingdom.—*Standard.*

New Zealand.—A decision has recently been given by the New Zealand Customs authorities to the effect that "electrical appliances, viz., medical transformer, consisting of transformer coil, rheostat, and switch," are dutiable at the rate of 30 per cent. *ad valorem* in the case of foreign goods, and 20 per cent. on British manufactures.

Electric Steel.—The *Electrical World* states that the Slatons Works, in the Ural district, are about to install an electric induction furnace for steel manufacture, supplied by Messrs. Siemens & Halske.

Hampstead Electrical Exhibition.—An exhibition of electrical domestic appliances was opened on Wednesday at the Public Baths, Finchley Road, the official ceremony being performed by the Mayoress of Hampstead. The exhibition is to remain open until to-morrow, (Saturday) night, so that any electrical men interested have to-day and to-morrow (between 11 a.m. and 10 p m.) to see the latest novelties in electrical appliances that are shown, some of them, it is stated, for the first time. From the list of exhibits and exhibitors appearing in the catalogue before us, we gather that electric heating and cooking apparatus will be very strongly displayed, while sunbaths, electric signs, flashers, fans, motors, electric vacuum cleaners, the Siemens "O.S." wiring system, and the Eddystone system of surface wiring are all represented. "XL" stoves, Phœnix apparatus, "Tricity" cookers, Dowsing, Adnil, Stellite, Boyd, Ediswan, Archer (G.E.C.), Bastian, Le Radiant, and Calux electric heating apparatus are a number of the special lines on view. We hope that the exhibition will be an unqualified success, bringing on an excellent increase of both heating and lighting custom.

Trade Announcement.—The address of the Holophane Glass Co. has been changed from 146A, Queen Victoria Street. London, E.C., to 12, Carteret Street, Westminster, London, S,W.

LIGHTING and POWER NOTES.

Bearpark (Co. Durham).—The P.C. has accepted the offer of Mr. Holliday to erect an overhead line for public lighting in Broom Lane at £40, and to provide a supply for 10 25-c.p. lamps.

Beckenham.—The U.D.C. has referred to a Committee for consideration, a scheme of free wiring and the supply of electricity for a fixed sum per lamp per annum, and also the question of tendering for the lighting of the parish of Shortlands.

Bridlington.—The T.C. has applied to the L.G.B. for a loan of £3,000 for electricity purposes, including the provision of a new engine and generator.

Brighton.—In order to meet a prospective increased demand for electric power at the Brighton locomotive and carriage works, the Electricity Committee proposes to expend £2,850 in laying an additional feeder cable.

Burslem.—The T.C. has received from the L.G.B. sanction to a loan of £7,535 for extensions to the electricity works.

Camborne.—The T.C. having rejected the tender of the Gas Co. for lighting the village of Knave-go-by, has asked the Electric Supply Co. to quote terms.

Canada.—The Attorney-General of Ontario has refused to grant a fiat authorising an application to the law courts for an injunction to restrain the Hydro-Electric Commission from carrying out its contract with the Ontario Power Co. This is regarded as ending the controversy as to the Ontario Government's policy in this matter.

Continental Notes.—Switzerland.—The Bernese Hydro-Electrical Co. has presented a petition to the Council of Berne asking for a concession of water power on the Aar, and its tributaries from Meiringen to Grinsel. The company has already purchased what it considered the key to the position in some property of Handegg for a half million francs. The river Aar has for some time attracted the attention of engineers, and with the enormous quantity of water available it is estimated that the present scheme will provide 120,000 to 150,000 h.p. at Innertkirchen, but four supplementary stations will also be established, one at Guttannen, where a fall of 90 metres is available; those of Engsten, of Gadnen and of Urbach are less important, and during the winter months will, it is estimated, be capable of generating 5,400 h p.

There is about 250,000 h.p. already utilised in Switzerland, and it is calculated that a further 750,000 h p. at least is available in connection with the various waterfalls. In many of the Cantons the local government is retaining the ownership of all the public rivers and lakes. The price of electrical energy generated varies according to the method of consumption; where meters are used the price is usually below 9 centimes per hectowatt-hour; where sold for power, an annual sum of 105 lire to 335 lire is paid for the use of each horse-power for 3,000 hours per annum. There is a tax per horse-power of one lire per annum for any fall up to 100 h.p., of two lire from 100 to 500, and of three lire for everything above 500 h p.

Servia.—The Austro-Hungarian Consul at Belgrade states that the communal authorities of Velke Hradiste have applied for powers to build a large electrical works for the needs of the district.

France.—La Société Centrale d'Industrie Electrique is the title of a new company which is being formed in Paris with a capital of £200,000 to establish electrical undertakings in various parts of the world. La Société pour l'Exploitation des Procédés Thomson-Houston is interested in the new undertaking.

Derby.—The T.C. proposes to apply to the B. of T. for a prov. order for electric light within the districts of Alvaston and Boulton U.D.C.; the parishes of Littleover, Breadsall, Chaddesden, Normanton and Sinfin Moor, in the area of the Shardlow R.D.C.; and Markeaton and Darley Abbey, in the district of Belper R.D.C.

Dover.—The T.C. is negotiating for the supply of electricity to Messrs. Pearson & Co.'s blockyard and to the wireless telegraph station on the Western Heights for the Admiralty.

Mr. Mark Parker, who is applying for prov. orders for the Boroughs of Deal and Sandwich, the Urban District of Walmer and the Rural District of Eastry, proposes, if the scheme is carried out, to apply to the T.C. for a bulk supply of energy, and the Council has decided to carry on negotiations with him, on the satisfactory promotion of a syndicate.

Dudley.—The annual report on the working of the Corporation's electric light undertaking, issued last week, shows that the units sold decreased by 44,571, compared with the previous year. The reduction in output had taken place chiefly on the tramway and motor supply. On the other hand, a healthy increase in the number of units supplied for private lighting had taken place. The year's working resulted in a gross profit of £5,872, a decrease of £105 compared with the previous year. In November last the two-rate system of charging was abandoned and a flat rate system substituted; the alteration is now working well.

East and West Ardsley.—The U.D.C. has informed the Yorkshire Electric Power Co. that it cannot see its way to allow the company to supply current in the district without the payment of an acknowledgment or royalty.

Falkirk.—Despite the much-criticised action of the Corporation in refusing to extend its own electricity undertaking and in allowing a private company to take over certain customers, the past year shows the business to be in a flourishing state. The income was £4,053, and expenditure, £1,965, leaving a balance of £2,088. After paying interest, &c., there was a clear profit on the undertaking of £953.

Finchley.—As a result of the L.G.B. withholding sanction to a loan of £2,200 for electric lighting in the Great North Road and Regent's Park Road, and the decision of the Council to adhere to its original scheme, a deadlock has arisen. Meanwhile the Council has decided to expend out of the current rate £240 for electrically lighting Regent's Park Road.

Fleetwood.—At midnight on Wednesday, last week, the Fleetwood U.D.C. took over the undertaking of the Fleetwood and District Electric Light and Power Syndicate. The closing formalities were conducted in London.

Grimsby.—In connection with the supply of energy by the Corporation to the Great Central Railway Co., the borough engineer reports that the company is proceeding with a power station at Immingham, and that it will supply its works at Grimsby from that station. Consequently it may be expected that in the course of a month or so the company will give the necessary 12 months' notice to terminate its agreement with the Council.

India.—The Kandy Hotels Co., Ltd., of Ceylon, has authorised its directors to borrow Rs. 5,000 for the extension of the electric lighting.—*Commercial Intelligence.*

Longton.—A L.G.B. inquiry was held on September 29th into the application of the T.C. for a loan of £1,740 for the extension of mains through Dresden, where there are 30 applications for a supply. There was no opposition.

Leicester.—At the quarterly meeting of the T.C. on Tuesday, Mr. Jennings stated that the net profit on the Corporation electric lighting undertaking for the past six months, after provision for interest and sinking fund, was £907.

London.—Shoreditch.—It was reported at a meeting of the B.C. recently that the electricity department had made a gross profit during the last year of £21,335. After meeting interest on loans, £10,793, and repaying capital to the extent of £5,951, &c., the net profit on the year's working was £4,117, which was used to wipe off the deficiency brought forward last year.

Bethnal Green.—The Council on September 30th debated for two hours in private, proposals with regard to the supply of electricity in the borough. It was finally decided that the question should stand adjourned until after November 9th, when the new Council will come into office. It is reported that the main business at the private meeting was the discussion of a scheme submitted by Shoreditch. In the result it was decided by 14 votes to 7 not to entertain the proposal.

Hackney.—A C.M.B. auto-converter designed for an input at 480 volts and for an output of 5 kw., 100 volts, is to be obtained at an estimated cost of £57 in connection with an electric standby at the baths.

Marylebone.—The accounts of the electricity undertaking for the June quarter were issued on October 6th, and show steady progress in many directions. The gross income from the sale of current to private consumers was £23,303, as compared with £22,002 for the corresponding period of 1908. Meter rents, public lighting charges, &c., bring the total income for the 1909 quarter up to £25,530—an increase of £1,528 over the corresponding period of last year. The increase was due to large consumers connected during the 12 months. The increase in the number of units sold was greater, the total for the quarter being 1,864,294 units, which is an improvement of 18·8 per cent. over the total for the 1908 quarter. The difference in the above two rates of increase is, of course, due to the lower average price obtained for current, viz.:—3·24d. per unit sold, as against 3·66d. in the corresponding quarter of 1908. This fall in price is balanced by the large additional business of improved load factor and the extended sale of current for power, &c., purposes. The actual total expenditure on revenue account for the quarter is less than in either of the two previous years, the total costs for the 1909 June quarter being 1·29d., as against 1·54d. and 1·78d. in the corresponding periods of the two preceding years. There was a marked lowering of the generating costs (from ·76d. in 1908 to ·63d. in 1909), due in a large measure to advantageous coal purchasing, but still more to the better load factor now obtaining. In conclusion, the report says that, although the results of the first quarter's working give reason to think that the results for the year may exceed the expectations at the time the estimates were framed, this will, however, practically depend upon whether the sales department can obtain a sufficient amount of new business to balance the inevitable further decrease in consumers' accounts due to the more extended use of metal-filament lamps. Up to September 25th, 1,760 of the 1,964 street lamps the Council resolved to light with electricity in place of gas, had been converted, and the results had been quite satisfactory. As a considerable saving in street light expenditure will be effected in the extension of the system, 165 more street gas lamps are to be converted on the same terms, and authority has been given for further lamps to be taken over as the lamps are extended.

Mansfield.—On September 29th a L.G.B. inquiry was held into the application of the T.C. for a loan of £3,500 for electricity purposes, £2,000 being for mains, £500 for meters, £200 for the enlargement of the economiser, and £300 for water-softening plant. There was no opposition.

Merthyr Tydfil.—The B. of G. on Saturday decided to adhere to its decision to light the Workhouse and the Infirmary by electricity, despite the opposition of the L.G.B. It was of opinion that the annual saving for actual lighting under the scheme proposed would amount to at least £100.

Mexico.—The *Electrical World* states that several important hydro-electric schemes are on foot in the mining districts of Mexico. A Canadian syndicate is preparing to erect a large installation on the Conchos River; the Mines of Mexico Co. is about to commence the construction of works on the Mayo River, near Alamos, to supply a rich mining territory within a radius of 175 miles; the Guanajuato Power and Electric Co., and the Michoacan Power Co., are extending their plant, which will have a total capacity of 21,000 H.P. when completed, and the manager reports that besides the mining companies, farming interests and factories are taking power freely, and thousands of irrigation wells are being pumped by electric power. Other new installations will be situated on the Altar River, on the Santiago River, near Guadalajara, on the Quetzalpa River, and on the Matamoros River.

The *Diario Oficial* of August 30th publishes the text of a contract between the Ministry of Fomento and Mr. William A. McLaren, whereby the latter is empowered to utilise the River Realito de Tubares, which runs through the States of Chihuahua and Sinaloa, for hydro-electrical purposes. The concessionaire is granted the right to import, free of duty, once only, all the machinery and apparatus necessary for carrying out the work.—*Board of Trade Journal.*

Runcorn.—The Salt Union, in connection with the development of the Weston Point (Cheshire) trade, has purchased several acres of land from the Manchester Ship Canal Co., and amongst other things proposed is the erection of an electrical installation to provide not only power for its own use, but to supply Runcorn, and, it is stated, Widnes as well. The company's draft order was considered at the meeting of the Highways Committee of the Runcorn U.D.C. on Thursday, last week.

South Africa.—A U.S. Consul reports that a hydro-electric plant on the Crocodile River is projected by the Pretoria Power Co. An output of 20,000 H.P. is contemplated, requiring an expenditure of £700,000; the energy developed will be used for the fixation of nitrogen, the plant for this purpose costing £250,000.

Spalding.—The B. of T. has intimated to the U.D.C. that unless an E.L. scheme is at once proceeded with, the prov. order obtained four years ago will be revoked. The Council has appointed a special Committee to deal with the matter.

Stourbridge.—The Midland Electric Corporation, Ltd., has commenced the supply of electricity to consumers in High Street, Coventry Street, Market Street and New Road.

Taunton.—The inhabitants are watching with interest a passage of arms between the T.C. and the Chamber of Commerce. The latter body questioned the financial soundness of the electricity undertaking, and requested that certain information be made public, in order "to dispel the existing feelings of uneasiness and lack of confidence." The Town Council at its last meeting suggested that the Chamber of Commerce should apply for a L.G.B. inquiry if it were not satisfied, and the Committee has decided to recommend the general body of members to accept the Council's offer.

United States.—Plans have been prepared for the construction of a hydro-electric plant of 30,000 H.P. on the Colorado River in Arizona, to supply an area within a radius of 170 miles of the power station. A large irrigation project is included in the scheme, and the total cost is estimated at more than £400,000.

Woolwich.—The B. of G. proposes to have the electric light installed at the receiving home and dispensary at Plumstead. The borough electrical engineer estimates the cost of the installation with fittings at £45.

Worthing.—The receipts from private consumers during the past half-year have been £464 less than was estimated by the Electricity Committee of the T.C. last March, and this has left the accounts, without any allowance for the depreciation fund, £812 to the bad, a figure which it is estimated will be increased to £830 at the end of next March.

York.—The T.C. has received from the L.G.B. sanction to loans of £550 and £2,510 for the extension of the switchboard and the laying of mains.

TRAMWAY and RAILWAY NOTES.

Bournemouth.—On Tuesday the Corporation discussed proposals for a limited service of Sunday cars. It was pointed out that some £4,000 or £5,000 was lost yearly to the tramways department owing to the cars not running, and that only one other municipal tramway had no Sunday services. However, the proposal was defeated by 31 votes to 10, and a further proposal to take a poll of the ratepayers met a similar fate.

Belfast.—A deputation has requested the Tramways Committee to reconsider the project for removing the central tramway poles in favour of poles on the side walks, on the ground that the "islands" in the centre of the roadways afforded safe places of refuge to pedestrians, and thus prevented many accidents. The Committee promised to give the matter consideration.

Bolton.—A deputation from the Tramways Committee waited upon the Electricity Committee on September 30th, on the subject of the price charged to the tramways department for electrical energy, and the matter was deferred.

Continental Notes.—SWEDEN.—A preliminary contract, says *Affärsvärlden*, has been closed with the Allmänna Svenska Electrical Co., of Västeras, and the Siemens-Schuckert Co., of Berlin, jointly, for the installation of electric power on the border railway, at a cost of 5,120,000 kr. The A.E.G. and Svenska Emissionsholaget tendered at 5,185,000 kr. The contract stipulates that the State can purchase the plant whenever it pleases, and at the end of 25 years the plant passes to the State without compensation. By the use of electricity it is hoped to render a double track unnecessary, to shorten the time in transit nearly 50 per cent., and to reduce the cost per ton of ore from 52 to 41 öre.

GERMANY.—It is reported that the Berlin electric tramway authorities, who have been using watt-hour meters on their cars for some years to check the consumption of energy, have found by experiment that the most economical mode of driving is also that in which current is used for the shortest aggregate time. They have, therefore, replaced all the watt-hour meters by simple time-meters, consisting of clocks which go only when current is on the motors.

ITALY.—A committee has been formed to work a line of electric tramways from Spezia to Fivizzano. The route will traverse a thickly-populated district, where there is a considerable commercial activity, and a capital of 2,300,000 lire is being raised for the purpose.

The Société Anonyme des Tramways de Bologne has obtained powers to construct and work a new electric tramway from the Alemanni terminus to the suburb of Crociali di Bologna. The new line will be by way of an extension of Via Mazzini tramway.

The Société Anonyme des Tramways de Livourne, of Leghorn, is to construct and work a new electric tramway from the Pizza Cavour-San Jacopo to Via Salviano.

The agreement entered into between the Ministry of Public Works and the Societá Ferrovia del Mottarone for the construction and working of an electric railway from Stresa to Mottarone has been approved; also the arrangement entered into between the provincial authorities of Venice and various other communal bodies in regard to the wayleaves requisite for the construction of an electic tramway from Mestre to Mirano.

TURKEY.—The cost of the electrical tramway system for Adrianople is estimated by the municipal engineer at £73,200. It is a condition attached to the work that an Ottoman company shall be formed to control it, but it is anticipated that the order for machinery will be placed abroad.

RUSSIA.—According to the *Financial News* the town of Nikolaieff is desirous of issuing a new loan of 4,000,000 roubles for drainage works, electric tramways, &c.

Darcy Lever.—The Bolton Tramways Committee has decided to extend the tramways to this outlying village.

East and West Ardsley.—The U.D.C. has decided to oppose the proposal of the Wakefield and District Light Railway Co. to abandon the tramway scheme from Wakefield to East Ardsley.

Glasgow.—The proposal for a direct east and west service *via* Parliamentary Road and Sauchiehall Street having been defeated in the T.C., a notice of motion has now been tabled asking that a system of transfer tickets be introduced over this section of the system.

The T.C. Sub-Committee is suggesting the pruning of services on badly-paying routes. The proposal is that the Finnieston Street service be withdrawn, and that the new service along Bilsland Drive be reduced by one-half.

Haslingden.—The T.C. has promoted a conference of representatives of Accrington, Rawtenstall and Haslingden with regard to a through tramway service, in order to obviate the inconvenience caused by the present enforced change at the Haslingden and Rawtenstall boundaries. Accrington and Haslingden agreed to through running between Accrington and Bacup, with an equal number of Accrington and Bacup cars. The Rawtenstall representatives not having power to treat, the conference was adjourned, so that they might consult their Council.

Japan.—The British Vice-Consul at Osaka reports that the City Assembly has voted a sum of £60,000 for restoration work in the area devastated by the fire which occurred in that city recently. *Inter alia*, it is intended to construct a broad road, three miles in length, and to lay down electric tramlines, which will be linked up with the existing municipal system.—*Board of Trade Journal.*

Kirkcaldy.—It is reported that the promoters of the proposed tramway from Kirkcaldy to the Rosyth Naval Base, *via* Aberdour and Inverkeithing, have temporarily abandoned the scheme.

London. — On Tuesday last the Acton to Willesden section of the Middlesex County Council tramway scheme was opened for traffic. The route links up the London United tramways with the Middlesex Light Railways, giving communication with Cricklewood, Edgware, &c., and is some two miles in length.

The Metropolitan Electric Tramways Co. is stated to be proposing to run a trackless car on the overhead trolley system between Golder's Green tube station and Hendon.

By 33 votes to 7 the Paddington B.C. on Tuesday decided to refuse consent to the construction by the L.C.C. of electric tramways from the Marble Arch *via* Edgware Road to Harrow Road, and from Harrow Road *via* Edgware Road, Maida Vale, High Road, Kilburn, and Shoot-up Hill to Cricklewood. In the latter case a contribution of one-third the cost of necessary street widenings was asked for. It was contended that the tramways were urgently needed by the inhabitants of the localities named, but most of the members of the B.C. apparently favoured a tube railway in preference to tramways, as affording a more desirable means of transit.

Newcastle-on-Tyne.—A meeting of the Tramways Committee of the Corporation was held on September 30th, when it had under consideration the falling off that had been reported in the number of passengers and the consequent diminution of receipts from fares. It was reported that in the course of the preceding week the number of people travelling in the cars was 20,000 less than the number carried in the corresponding week of last year and 40,000 less than were carried in the corresponding week of 1907. The Committee, recognising that this decrease in the number of passengers must have a considerable effect on the income, decided to instruct the tramway manager to take immediate steps for cutting down extra mileage, and for curtailing the expenses of running the service in any way that he thought best. At the conclusion of the business the chairman, Sir Joseph Baxter Ellis, intimated that he would not be prepared to allow himself to be re-nominated for the position of chairman next year.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Western Telegraph Co., says Reuter, will immediately begin the laying of the new cable uniting Argentina directly with Europe *via* Ascension. The cable will cost about £1,000,000, and that it is hoped that it will be in working order by October, 1910. The Chamber has passed the Bill already adopted by the Senate, approving the construction of the cable.

The Atlantic Cable of 1882.—The *Montreal Gazette* states that the cable steamer *Mexican* returned to New York after repairing two of the European cables which were laid by the cable steamer *Faraday* in 1881-2. The breaks were north-east of Sable Island, and the cables were found to be buried several feet in sand. They were in as perfect condition as when laid, although in the water for 27 years. After 12 miles were picked up the cables were again joined through, and the whole of the operations were completed in 36 hours.

Broken Insulators.—Last week four boys were charged at Sheffield with damaging telegraph insulators, and it was stated in evidence that during the last six months 487 insulators had been broken in the Chesterfield district, while 1,115 had been broken in the Sheffield district in 12 months.

Cable Interruptions and Repairs :—

	Interrupted.	Repaired.
Tourane-Amoy	June 17, 1909	
Assab-Perim	July 8, 1909	
Dakar-Conakry	Aug. 20, 1909	
Balikpapan-Kwandang	Sept. 2, 1909	
Cheiksaid-Perim	Sept. 15, 1909	
Hong Kong-Macao	Sept. 25, 1909	October 1, 1909.

Magnetic Storm.—A remarkable magnetic disturbance took place on Saturday, the 25th ult., affecting telegraph systems all over the world by earth currents to such an extent as to interrupt communication in many places for some hours. The disturbance began about mid-day, and lasted, in the case of the lines to Scotland and the north-east of England, for about three hours, but intermittent interruptions occurred up to 9.30 p.m., and in Scotland there was further trouble on Sunday. The phenomena were most noticeable on the longer lines, and affected the submarine cables to some extent. The underground telegraph lines to Birmingham, Manchester, Liverpool and Glasgow, which have metallic returns, were not affected. Auroral displays were observed in northern and southern regions, and there was an exceptionally marked spot on the sun, to which the storm was probably due. It was reported from Kew Observatory that the disturbance was of a highly oscillatory character, and the recording apparatus was unable to register the extreme range, owing to the curve having run across the full width of the paper. On Saturday evening the compass needle moved 70° to the west and then 85° to the east, and the horizontal force showed remarkably large variations. [This note was accidentally omitted from our last issue.]

Telephone Action.—Recently the National Telephone Co. sued Mrs. Philip, of Lexham Gardens, Kensington, for £8 4s. 10s., the balance of an amount due under a guarantee of £10 for call fees. It was shown that the company removed the telephone before the defendant had vacated the premises, though she was living elsewhere, and as she had not had the opportunity of using the telephone for the whole year covered by the agreement, owing to the premature removal of the instrument, judgment was given in her favour.

United States.—The United States Government has issued returns in regard to telegraph and telephone systems in the country, and from particulars published by the *Telegraph Age* it would appear that there are 65 miles of wire in the Republic of Panama, 484 miles in Puerto Rico, 1,403 miles in Alaska and 6,438 miles in the Philippines. These systems handled over 1,000,000 messages. The Weather Bureau controlled 537 miles of wire and 96 miles of submarine cable, and 2,280 places were supplied with forecasts, 734 with special warnings and 5,998 with emergency warnings, all this being done at the expense of the Government. Daily forecasts were sent to 2,141,151 addresses. Puerto Rico boasts of 128 offices and 1,774 miles of wire, and the traffic amounted to 216,489 messages.

Wireless Telegraphy.—On Friday last the Postmaster-General stated that arrangements had been completed with the Marconi Co. for the transfer to the Post Office of all their coast stations for communication with ships, including all plant, machinery, buildings, land, and leases, &c., and for the surrender of the rights which the company enjoyed under their agreement with the Post Office. In addition, the Post Office secures the right of using, free of royalty, the Marconi patents existing and future for a term of 14 years for communication between stations in the United Kingdom and ships, and between stations on the mainland of Great Britain and Ireland on the one hand and outlying islands on the other hand, or between any two outlying islands; and (except for the transmission of public telegrams) between any two stations on the mainland; and on board Post Office cable ships. The inclusive consideration to be paid to the company is £15,000. All the stations will, under the International Radio-Telegraphic Convention, be open for communication equally to all ships, whatever system of wireless telegraphy they may carry; and the Post Office will be free to use or to experiment with any system of wireless telegraphy at its discretion. All inland communication of messages by wireless telegraphy will be entirely under the control of the Post Office. The company will retain the licence for their long-distance stations at Poldhu and Clifden, which are primarily intended for shore-to-shore communication with America. Arrangements have also been made with Lloyd's for the transfer to the Post Office of their wireless stations for communication with ships, and for the surrender of all claims to licences for such communication. In return Lloyd's will receive the plant value of their stations, and will have transmitted to them (with due regard to the secrecy of private telegrams) information received at the Post Office stations in regard to the position and movements of ships, and other maritime intelligence. Lloyd's and the Marconi Co. have mutually arranged to cancel an agreement between themselves which was made in 1901, and which has proved a source of dispute. The Postmaster-General thinks it important that no private monopoly in wireless telegraphy should be allowed to grow up, and hopes that the new arrangements will result in the rapid extension of the use of the system. The negotiations have been conducted in consultation with the Admiralty, who consider it important that the coast wireless stations should be in the hands of the Post Office. The whole of the present employés of good character will be taken over by the Post Office.

The Indian Government, says Reuter, recently issued an order making the importation of wireless telegraph apparatus contraband. It is understood that the Government is considering a scheme to provide important centres with a wireless system worked entirely under European control.

A dispatch from St. Petersburg announces that the Russian Ministry of War is now beginning to establish a network of wireless stations for the purpose of connecting European Russia with the Far East. It is proposed for this purpose to erect a number of intermediate stations between the Baltic and the Pacific Ocean, and it is calculated that from three to four stations would be sufficient to permit of messages being transmitted from the Far East to St. Petersburg. The scheme is supported by the results obtained from the most recent trials which have been made in military telegraphy in Russia, it having been found possible to exchange telegrams between wireless stations on the Baltic and the Black Sea, a distance of 1,240 miles. It was noticed during the trials that the results were extremely favourable in damp weather, and particularly in the night time.

The Government of Uruguay is about to establish wireless stations at Flores Island, Punta del Este and at Cape Santa Maria.

Wireless Telephony.—The Japanese Navy is experimenting with Prof. Missuno's wireless telephone system.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Victoria.—Accumulators for the P.M.G. See "Official Notices" October 1st.

Telegraph and telephone material for the P.M.G., Melbourne. See "Official Notices" September 10th.

Common-battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

Bray.—October 19th. 50 B.H.P. Diesel oil engine, and high and low-tension disconnecting boxes, &c., for the U.D.C. See "Official Notices" to-day.

Brumby and Frodingham.—October 16th. Public lighting by electricity for the U.D.C., with 55 50-C.P. lamps, poles, wiring, switches, &c.; direct-current, 220 volts, available. Mr. J. Green, surveyor to the Council, Frodingham, Scunthorpe, Lincs. Returnable deposit, 10s. 6d.

Dartford.—October 13th. Wiring the Council Chamber and offices for the U.D.C. Electrical Engineer, Electricity Works, Dartford.

Durban.—In connection with the new Town Hall now in course of erection at Durban, it was recently decided to install 15 electric time clocks, so as to keep uniform time in the various offices. Tenders are about to be called for another turbine set for the electric power station, of a similar capacity to the one lately installed. Tenders are also to be called for a negative booster and cable in connection with the electric tramways.

Great Western Railway.—October 18th. Stores including electrical wires and telegraph apparatus, carbons, &c. See "Official Notices" to-day.

Handsworth.—October 13th. Low-tension feeder and distributor cables (lead-covered and paper-insulated), for the U.D.C. Generating station, Soho Road, Handsworth.

Keighley.—October 16th. Two boiler feed pumps, high-tension switchboard and transformers, 300-KW. motor-generator, and mains for the Electricity Department. See "Official Notices" October 1st.

Leyton.—October 26th. Installation of electric light and hot water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" to-day.

Manchester.—October 12th. Wiring and complete electric lighting installation at the Cheetham Baths and Public Hall for the Baths and Washhouses Committee of the Council; specifications from the City Architect, Town Hall (deposit one guinea).

October 19th.—Steel tie-bars for tramway rails, and bolts and nuts for fishplates for the Tramways Committee. Specifications from J. M. McElroy, Tramway Manager.

Mountain Ash.—October 25th. Electrical stores for the U.D C. electricity undertaking. See "Official Notices" to-day.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 KW. each, for disposal. See "Official Notices" September 24th.

South Africa.—According to the *British and South African Export Gazette*, three generators of 2,000-KW. capacity are about to be ordered for the new Farrar-Anglo-French power station; orders will shortly be placed for a number of electric motors for the Rand Water Board; valuable orders may be anticipated in the near future for telephone and telegraph material in connection with extensions of the Transvaal Government services; and the Monomotapa Concessions, Ltd., will be in the market in the near future for a large hydro-electrical plant.

Spain.—November 2nd. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working of a telephone system in the town of Oviedo during a period of 15 years.

October 15th.—60 years' electric tramway concession from the Calle Mayor del Gras to the end of the West Quay, Valencia. Deposit 2,425 pesetas (£88). Tenders to the Director-General de Obras Publicas Ministerio de Fomento, Madrid. A Spanish company also has preferential rights in this competition.

November 20th.—60 years' concession for constructing and working an electric tramway from Sans to Coll-Blanch (Barcelona). Deposit 1,295 pesetas (£47). Local representation necessary. Tenders to Dirección General de Obras Publicas, Madrid. The Compañia General Tranvias, which has submitted an application, has certain preferential rights.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Wallasey.—October 19th. Three miles of electric tramways (overhead line material, poles, wire, ears, &c.) for the U.D C.; also paper-insulated cables for same. See two "Official Notices" to-day.

Winchester.—October 11th. Electric light installation at the new County Offices, for the Hants C.C. Personal application necessary to Mr. W. J. Taylor, county surveyor, The Castle, Winchester, between 9 a.m. and 5 p.m., and on Saturday between 9 a m. and 1 p.m.; returnable deposit, £2 2s.

Worthing.—October 11th. Cables for the Corporation. See "Official Notices" October 1st.

CLOSED.

Belgium.—Nine concerns submitted tenders for the establishment of the overhead equipment and the laying of the return rail in connection with the Anderlues-Lobbes section of the Carnieres-Thuin electric railway which is being constructed by the Société Nationale des Chemins Fer Vicinaux, the lowest being that of Messrs. A. Massart & Co., of Houdeng-Goegnies.

Blackpool.—The contract for the E.L. installation at the Lancashire and Yorkshire Railway Co.'s Servants' Home at Blackpool has been placed with Mr. Geo. Morrison, Blackpool.

Bolton.—The Electricity Committee has just placed an order for 25,000 tons of coal, to be delivered during the next 12 months.

Brighton.—The B. of G. has accepted the tender of Messrs. C. G. Reed & Sons, Brighton, for electrical fittings for the Workhouse.

The Lighting Committee of the T.C. has recommended the acceptance of the tender of Siemens Bros. & Co., Ltd., for cable, needed to supply power to the Railway Co., at £2,380.

Bristol.—The T.C. has accepted the following tenders:—

General Electric Co., Ltd.—Carbons for a year, £367.
Electrical Co., Ltd.—Alternating current meters for a year, £762.
Siemens Bros. Dynamo Works, Ltd.—Arc lamp globes for a year, £31.

Derby.—The T.C. has accepted the tender of Messrs. Taylor, Whiting & Taylor, Derby, for the installation of the E.L. at the new schools in Kedleston Road, at £235.

Grimsby.—The T.C. has accepted the tender of Messrs. Cragg & Nephew, Doncaster, for 12 months' supply of steam coal from the Bentley Colliery for the electricity undertaking, at 5s. 11d. per ton delivered at the works. It has further accepted the tender of Johnson & Phillips, Ltd., for two years' supply of cables, at £757.

Halifax.—The B. of G. has accepted the tender of Messrs. J. Sunderland & Co., Halifax, for electrical fittings for six months.

Hull.—The T.C. has accepted the tender of Messrs. Thursfield & Co., of Birmingham, for E L. fittings for the Town Hall, at £891. The local tender amounted to £1,425.

Kingston-on-Thames.—The T.C. has accepted the tender of Henley's Telegraph Works Co., Ltd., for 880 yards of ·1 square inch low-tension cable, at £191; and that of Messrs. W. T. Glover and Co., Ltd., for 880 yards of 10-ampere cable, at £72.

London.—Messrs. Meldrum Bros., Ltd., of Timperley, have secured the order to equip the boilers of the South-Western Hospital of the Metropolitan Asylums Board with their Koker stokers. This is the ninth institute under the Board to adopt this system.

Fulham.—The B.C. has accepted the tender of the Electrical Co., Ltd., for 150 meters in various sizes for a total of £202. This was the lowest tender received.

The following tenders have been accepted for the supply of smokeless steam coal for the electricity works:—

Gilman & Co.—2,000 tons Mapperley Smithan nutty slack, 10s. 5d. per ton.
Kaye, Son & Co.—1,000 tons Cowdenbeath washed peas, 10s. 1d. per ton.
Philips & Co., Ltd. 500 tons (with an option to take a further 500 tons), Riddings slack, 11s. 8d. per ton.

Hackney.—For the purpose of an electric lighting standby at the Baths, the B.C. has ordered a C.M.B. auto-converter, designed for an input at 480 volts of an output of 5 KW., 100 volts, at £57.

Marylebone.—The B.C. has accepted the tender of C. A. Parsons and Co., at £162 10s. for, putting carbon brushes on three turbo-generators. Orders have been placed with Blackmore & Co., for 5,000 tons of coal, at 10s. 6½d. per ton, and with Cory & Co., for 15,000 tons, at 10s. 7½d. per ton. As a check to coal consumption two additional flue gas recorders are to be obtained from the Auto-Recorder Co., at £60, less 5 per cent.

St. Pancras.—The B.C. has received the following tenders for the re-winding of the 500-KW. armature at the Regent's Park station:—

White, Jacoby & Co., Ltd.	(accepted)	£130
Siemens Bros. Dynamo Works Ltd.		£214
Westminster Engineering Co., Ltd.		£214

Luton.—The B.G. has accepted the tender of Mr. P. T. King, Luton, for installing the E.L. at the Workhouse, at £57 10s. The only other tender was that of Messrs. Shoolbred & Co., at £63.

Mansfield.—The T.C. has accepted the tender of the Western Electric Co., for 500 yards of cable.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for the maintenance of the battery supplied by them (in accordance with their tender accepted in July last) for a period of 10 years, with the option of extension, at £530 per annum.

Truro.—The B.G. has accepted the tender of the National Telephone Co., for overhauling the telephone route to the Workhouse and supplying three new instruments, at £55.

Warrington.—The B.G. has accepted the tender of the Economic Electrical Co., of Liverpool, for electrical requisites, for six months.

Wolverhampton.—The District Electric Co., Ltd., of Wolverhampton and Birmingham, have received instructions to carry out the installation of electric lighting and bells at the new Municipal Baths, now in course of erection.

Woolwich.—The B.C. received the following tenders for 580 yards of 4-core ·05 cable :—

W. T. Henley's Telegraph Works Co., Ltd.	(accepted)	£153
Siemens Bros., Ltd.		154
Callender's Cable Co., Ltd.		158

For 310 yards of ·2 and 250 yards of ·05 cable the following tenders were received :—

Siemens Bros., Ltd.	£192	Alternative (accepted)	£47
W. T. Henley's Telegraph Works Co., Ltd.	194	"	47
Callender's Cable Co., Ltd.	196	"	48

With reference to the construction of the cooling pond at Plumstead works, the tender of Messrs. M. Stodart & Co., for the supply and laying of 1,248 yards super. of asphalt and 429 ft. of fillet, at 2d. per foot, was accepted.

York.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for the extension of the electricity mains along the tramways route, at £2,031. The T.C. has also accepted the tender of Messrs. Cox-Walkers, Ltd., Darlington, for a traction switchboard, at £383.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 9th.—At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Electricity in Coal Mines," by Mr. R. Nelson.

Institution of Mechanical Engineers (Graduates' Association).—Monday, October 11th. At 8 p.m. Paper on "Invention and Industrial Progress, with a Treatise on the British Patent System," by Mr. J. E. S. Lockwood.

Association of Engineers-in-Charge.—At St. Bride's Institute, E.C. Wednesday, October 13th. Presidential address by Prof. Henry Adams on "Standardisation."

Junior Institution of Engineers.—Friday, October 15th. At 7 p.m. Visit to the Model Engineer Exhibition, Horticultural Hall, Westminster.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution House, Storey's Gate. Paper on "Heat Transmission," by Prof. W. E. Dalby.

Electric Organ Blowing Equipments.—The Adnil Electric Co., Ltd. (Marples, Leach & Co., Ltd.), who specialise in electric blowing installations for church and public hall organs, are engaged upon a number of orders of this class. The following may be named :—

St. Anthony's Catholic Church, Forest Gate	A C.
Brunswick United Methodist Church, Burnley	D.C.
St. Chad's Church, Stafford	D.C.
Parish Church, Colne, Lancs.	D C.
St. Edmund's Church, Roundhay, Leeds	A.C.
St. George's Schools, Ascot	D C.
St. Mark's, Surbiton	D C.
The Chapel, Welbeck Abbey (for the Duke of Portland)	D C.
Earl of Cadogan's Church, Culford	D.C.
The residence of R. W. Hawkey, Esq., Chiswick	D.C.
Christ Church, Chester	D.C.
Tonbridge Schools, Tonbridge, Kent	D C.
Chamber organ at Messrs. Chappell's warehouse, New Bond Street	D C.
St. Matthew's Church, Southsea	A.C.

In the majority of these cases local contractors have done or are doing the wiring installations. The Marples patent system of regulation is employed in all the D.C. installations, and the "Adnil" single-phase, self-starting A.C. motor in the A.C. installations.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 16th 1909 :—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 11th.—"A" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Tuesday, October 12th.—"B" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Wednesday, October 13th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 14th.—"C" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

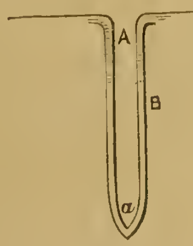
Friday, October 15th.—"D" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

(Signed) P. H. Campbell,
Capt R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

London District Engineering Dispute.—The *Daily Telegraph* says that the differences between the employers and workmen in the engineering trades in the London district have now been settled on a satisfactory basis. Recently the employers sought to secure a reduction of wages by 2s. per week. "A protest was at once made, and the employers withdrew their proposal, but substituted another, as the result of which it would be agreed that no change in the rate of wages should take place for five years to come. Strong opposition to the proposal was manifested by some of the older Trade Unionists, but those at present leading the movement saw the tendency of the day was towards a fixed rate of wages for a period of years. They consequently recommended the acceptance of the proposal. The engineers' ballot has now been completed, and though the figures have not been definitely announced, sufficient is known to make it clear that the great majority of the workmen are in favour of accepting the proposed arrangement."

Regenerating X-Ray Tubes.—In *Archives of the Röntgen Ray* for October, Dr. T. G. Beckett, of Melbourne, describes a method of regenerating X-ray tubes which he has used successfully for more than three years. It consists in providing a small glass tube A joined to the focus tube, and having a slightly porous tip at a; an outer tube B is filled with mercury to seal the tip of A, and is pressed on over a velvet sleeve at the base of A, which holds it tightly in position, though a rubber band or other additional safeguard to hold B securely is advisable. When the tube grows hard, B is lowered until the tip a is exposed to the air; after a sufficient time, depending upon the hardness of the tube and the porosity of the tip, B is replaced, and the X-ray tube can then be used in any position, without fear of spilling the mercury. Dr. Beckett has had a tube thus regulated in constant use for over two years, and would not exchange it for a new one. The tip of A is most easily made porous by heating it to redness, and directly the redness has disappeared, lightly touching a pool of clean mercury with the tip, when a multitude of fine fissures will instantly be formed. This is a delicate operation, as, if the glass is too hot, the fissures will be superficial only, and if it is too cold, none will be formed. If held too long in the mercury, the glass cracks too much. The best results are obtained when it takes 30 seconds to reduce the vacuum to the proper value; too rapid an action is fatal.



National Institution of Apprenticeship.—The Report for 1908 shows that 166 boys and 16 girls were apprenticed during the year, and the total since May, 1905, now amounts to 630. Many others have been placed to learn good trades, but without indentures. The analysis shows that some 16 were apprenticed to electrical trades during the year, making a total of 40 boys and three girls since 1905 under this heading. The premiums paid in 1908 amounted to £2,263, but the bulk of these are repayable by parents or guardians in instalments, and £981 was so repaid during the year. Some 3,000 applications for assistance are now received yearly, and a sum of £13,000 is required to deal with these; the Council therefore appeals urgently for funds to carry on the work, which should be sent to Messrs. Robarts, Lubbock & Co., 15, Lombard Street, E.C.

Electricity in Battleships' Turrets.—The trial of an electrical system of working the primary guns in the turrets of our battleships and cruisers of the *Dreadnought* type has not (says the *Naval and Military Record*, Plymouth) given entire satisfaction, but it is hoped that as experience is gained many of the difficulties will be overcome. In comparing the hydraulic system with electrical power there are advantages and disadvantages on either side, and, naval men being conservative to a degree, are in no hurry to part with an old for an untried system. Gunnery men, however, have come to recognise that to serve turret guns rapidly with ammunition is one of the principal needs of the Navy, since rapidity of fire is now so important, and cannot be obtained without a thoroughly reliable and efficient service of projectiles and gun charges from shellroom and magazines to the breech of the gun. The rapidity of movement in the electrical apparatus for the ammunition service has been found by the Americans to excel that of hydraulic power, and most of their heavy ships have consequently been fitted with electricity. The same conclusion is now being arrived at by the experts of our own Navy, but as yet the electrical service is not so reliable as hydraulic power in British ships. Considerable improvements, however, are taking place, and at least one large shipbuilding firm has given the turrets an installation of electrical apparatus that gunnery officers find to their liking. Rapidity of fire is so important from primary guns that it is considered expedient to persevere with electrical plant.

The European Electro-Metallurgical Industry.—The severe competition which started recently as a consequence of the failure of the negotiations for the establishment of a price convention in the carbide of calcium industry is stated by the *Frankfurter Zeitung* to be making itself still perceptible in an undiminished degree in the markets of Continental Europe. In the second week in September the price of unpacked products at Continental works was 6s. per cwt., as compared with the former quotation of from 7s. 6d. to 8s. 6d., but since then the price has receded to 5½ fr., or, say, 4s. 5d. per cwt. It is obvious, the newspaper remarks, that such underselling is ruinous to the whole industry, and the result has always manifested itself in the sense that various small producers of carbide of calcium have either collapsed or suspended production. It is considered that an improvement in the whole situation of the market can only be brought about by co-operation in the form of an international syndicate, especially as foreign competition is becoming keener.

The same observation, it is continued, also applies to ferro-silicon. This product of 50 per cent. ranges at present from 9s. to 9s. 6d. per cwt. packed at maker's works, with a scale of 6d. per cent. and double hundredweight. How large the reduction has been is illustrated by the circumstance that the price in 1907 was on the level of from 19s. to 20s. per cwt., and in February of the present year it stood at 11s. 9d. to 12s. 3d. The price of aluminium, even when a present rate of 1s. 5½d. per kilogramme is assumed to be the normal, is substantially less than the cost of production. The position of ferro-chromium is the same. The common cause of the unfavourable development which the electro-metallurgical industry has experienced is unchecked expansion, which has led to the premature progress of the producing works and to heavy over-production. It is therefore expected that a thorough recovery will only be possible when success attends efforts to bring the output and consumption into better proportion to each other.

Football Notes.—Electrical Football League.—Last Saturday the County of London Electric visited the St. James' Electric, when the latter proved victorious by 10 goals to 2. Next Saturday the Metropolitan Electric visit the County of London Electric at their new ground in Buckholt Road, Wandsworth, near Wandsworth Town station (L. and S.W. Railway).

The "South Metro." Electric.—The South Metropolitan Electric Light and Power Co., Ltd. (Greenwich), have formed a football club to be known as the "South Metro. Electric," and Mr. C. H. Ellis, the hon. secretary, writing from 37, Annandale Road, East Greenwich, S.E., informs us that the club is about 20 weak, and have so far been unsuccessful in obtaining a ground. They would, therefore, be glad to hear of anything in this way from our readers, and would be very pleased for the opportunity to play a "friendly" with clubs in the same line who have a ground.

Train Lighting.—Comparing three systems of lighting railway trains with electricity—with a steam-driven dynamo and batteries, with storage batteries charged at the termini, and with axle-driven dynamos and batteries—Mr. O. W. Ott recently stated at Chicago that the costs worked out as follows:—

	Steam dynamo.	Storage.	Axle dynamo.
Total cost per car, per year; operation	$533.18	$599.61	$631.33
First cost per car; equipment... ...	874.24	1,073 50	1,673.50
Weight of equipment per car; lb. ...	2,075	3,800	4,900

The actual cost of maintaining electric light on more than 150 cars on a prominent railroad in the United States during the year 1908 was found to average $524 per car, and the average cost of equipment was $1,344 each.

An Australian Claim.—According to the *British Australasian* the action in which Francis Edward Bradford, electrical engineer, claimed from the Victorian Government £3,500 for alleged breach of contract in connection with the proposed electrification of the suburban railways, has been concluded. The jury failed to agree.

Inquiries.—A correspondent wishes to obtain a "turn-down" lamp with two filaments, operated by tilting the lamp, when a globule of mercury, acting as a switch, connects the filament desired.

Makers of the "Flare" arc lamp are asked for.

Mr. C. Mittelhausen, electrical engineer and manager to the Bexley U.D C., will be glad if any reader who has supplied energy to blocks of cottages at a fixed price per lamp per quarter, will let him know the financial results of the system, as ascertained by a master meter covering the whole block.

Will.—It is announced that the late Mr. Hugh Erat Harrison, Principal of Faraday House, left estate of £17,012 gross, and £16,740 net personalty.

Concert.—The Anchor Cable Athletic Club held a tea and smoking concert last Friday week, at Leigh. During the evening, Mr. A. Crooke, chairman of the Leigh and District Cricket League, presented the Second Division Championship cup and medals to the members of the cricket team.

National Electrical Manufacturers' Association.—The next committee meeting of this Association will be held on Tuesday, October 12th, at Balfour House, Finsbury Pavement, E.C., at 2.30 p.m.

Electrical Production of Steel.—The Siemens and Halske Co., of Berlin, announces that the working up of minette iron ore in Lorraine-Luxemburg by means of the electrolytic process, has yielded an unusually favourable result. The electric steel plant erected at the Eicher Hutten Verein, of Le Gallais Metz & Co., at Dommeldingen, Luxemburg, according to the patents of the Gesellschaft fur Elektrostahlanlagen, has produced, since it was first set in operation, steel which is said to be in every respect equal to Swedish steel. It is considered that the manufacture of electric steel in this way on the Rochling-Rodenhausen system should give an unexpected importance to the whole of the Lorraine-Luxemburg iron ore industry, as the district contains very considerable quantities of ore, and the opportunity for transport leaves little to be desired.

Corrosion of Iron.—At the Iron and Steel Institute's autumn meeting, Mr. J. N. Friend read a short paper on this subject, in which he again upheld the theory that the presence of acid is essential to the corrosion of iron; almost any acid is effective, but the wide prevalence of carbonic acid has rendered this the most common agency, and thus has arisen the erroneous impression that carbonic acid is necessary to the formation of rust. The author points out the great difficulty of definitively deciding between the acid and the electrolytic theory, and criticises experiments which have been alleged to disprove the former, claiming that the balance of evidence is decidedly in its favour. He concludes that pure water is not sufficiently active to effect the corrosion of pure iron in the presence of oxygen alone at ordinary temperatures, while Dr. Walker (see Elec. Rev., August 20th, 1909) holds the contrary view.

Institution and Lecture Notes.—Prof. H. Stroud delivered a lecture at Armstrong College, Newcastle-on-Tyne, on the 2nd inst. on "Wireless Telegraphy," with the aid of numerous experiments and lantern slides. The antenna at Armstrong College is fan-shaped. Between the two high towers is stretched a double cable of stranded wire, insulated at each end by porcelain insulators of special construction; eight wires in two sets, so as to avoid the gable of the King's Hall, are connected with the double cable, and pass down to the experimental room in the physical department, all the wires being joined together at the lower end and insulated from the earth. In the experimental room the antenna can, by means of a switch, be put in connection with the spark sender, the Poulsen arc sender, the receiving circuits, or the earth. During the lecture the antenna was used in connection with a spark sender and a receiving circuit on the table in the Hall, and signals were sent to and received from Cullercoats wireless station. The electrolytic detector was used, but instead of the telephone ordinarily employed for receiving the signals, a galvanometer was used, so that all could see the movement of the spot of light which indicated that electric waves were being received from the Cullercoats station eight miles distant. The lecturer expressed his thanks to Mr. Morris-Airey, who had assisted in the design and equipment of the College wireless station, and to Mr. Sörensen, engineer and manager of the Cullercoats station.

Association of Engineers-in-Charge.—The programme of the new session gives evidence of successful activity on the part of the Council. Papers on steam turbines, the heating and ventilating of public buildings, arc lamps, recording instruments, and electric welding are included, besides several of the social functions which form so notable and useful a feature of this society's organisation. On Wednesday next week the new President, Mr. Henry Adams, M.Inst.C.E., will deliver his inaugural address on "Standardisation," with Mr. James Swinburne, F.R.S., the retiring president, occupying the chair. Communications should be addressed to the Hon. Sec., Mr. Hy. Capsey, 112, Melbourne Grove, S.E.

The roll of the Institution of Municipal Engineers now stands at 612 members and 82 students, making a total of 694—a remarkable number, considering the short period during which it has been in existence.

Institution of Mining Electrical Engineers. — At the meeting last week, the President stated that articles of association had been drawn up, the principal clauses of which he explained. A London branch was heing formed, with Mr. R. Krall, Balfour House, Finsbury Pavement, E C., as secretary. A committee had heen appointed to inquire into the causes of electrical accidents in mines, and to report in Decemher. Further reference will he made to this meeting next week, the report having come to hand as we go to press.

New Turbine Gearing. — It is reported in the daily Press that Rear-Admiral Melville, his partner Mr. Macalpine, and Mr. George Westinghouse have jointly evolved a system of spur gearing which enahles a high-speed turbine to drive a low-speed propeller without noise and with an efficiency of 98½ per cent. The pinion driven hy the turhine, it is stated, is mounted on an elastic steel floating frame, which enahles it to adjust itself instantly to changes of alignment. Immense advantages are claimed for the system in connection with marine propulsion. A detailed description of the device appeared in *Engineering* of Septemher 17th last.

Appointments Vacant. — The Municipality of Bloemfontein has heen advertising for a station engineer at its electric power station at a commencing salary of £27 10s. per month, rising to £30 per month.

The Municipality of Kroonstad has been advertising for an electrical engineer for its electric power station at a commencing salary of £30 per month, rising to £35 per month.

Sub-station electrician for the Mountain Ash U.D.C. (£2). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. Hesketh, resident engineer and manager of Cromer electricity works, has been appointed resident engineer and manager of the Alderley and Wilmslow Electric Supply, Ltd.

The City Council of Bristol last week appointed Mr. A. Wilson, who had heen in its service for four years, the last two E. distribution superintendent, as deputy city electrical engineer at £300 per annum, leaving over the question of future increments until a committee now sitting on the general increment question had reported.

The Electricity Committee of Brighouse Corporation have appointed Mr. Amos Aspinall, who has long heen in its service, manager of electricity department.

General.—Mr. A. Whalley, M.I.E.E., is retiring from the British Insulated & Helsby Cahles, Ltd., to commence a consulting practice, from Novemher 1st, at 27, Chancery Lane, London, E.C. (care of Knox, Hassal, Dodd & Co.) and at 19, Croxteth Grove, Liverpool. During 23 years with the Telegraph Manufacturing Co., Helshy, and with the British Insulated and Helshy Cables, Ltd., he has heen chief engineer at Helsby and manager and engineer at Liverpool respectively, and has been responsible for the design and manufacture of every description of insulated wire and cahle for lighting, power, traction, telephony, &c., also of all apparatus for complete trunk and local telephone exchanges, telephone instruments, &c., and, in addition, of telegraph equipments for railway and postal administrations. He has had charge of important cable contracts abroad, and carried out the equipment of the London and other large telephone trunk exchanges for the Post Office during the last six years, besides common hattery exchanges. For 20 years switchboards, &c., have heen supplied under his control to the National Telephone Co. His connection with telephony dates from 1881, in the days of the Lancashire Telephone Exchange.

After six years with the General Electric Co., Ltd, Mr. Oswald L. Record has left to take charge of the accessories department of the Lahmeyer Electrical Co., 109-111, New Oxford Street.

The *Canadian Gazette* states that Mr. W. W. Pope, K C., for 20 years connected with the solicitor's office of the Grand Trunk Railway, has heen appointed secretary to the Hydro-Electric Power Commission. The chairman is the Hon. Adam Beck.

It is stated that Mr. Wm. Griffith, chief inspector of the electrical and signal department of the L. & N.W. Railway in the Manchester Division, stationed at Tyldesley, is about to retire. Mr. Griffith has spent 40 years in the company's service.

Mr. F. H. Banbury, engineer of the Acheson Oildag Co., of Niagara Falls, sailed for Europe towards the end of September. Mr. Banbury is an Englishman who went to America about five years ago, and was connected with the Commonwealth Edison Co., of Chicago. A little over a year ago he hecame connected with the Oildag Co., and he has now come to Europe in the extended patent interests of that company.

Tramway Officials.—The York Tramways Committee has recommended the appointment of Mr. J. W. Hame, city electrical engineer, as general manager of the tramways, the remuneration, therefore, to be fixed at a later date.

Obituary.—We regret to learn that on Wednesday morning last Mr. Charles J. Robertson, M.I.E.E., engineer and technical director of the Rohertson Electric Lamps, Ltd., Brook Green, died after a prolonged illness.

NEW COMPANIES REGISTERED.

Halesowen Lighting and Traction Co., Ltd. (105,136).—This company was registered on September 29th, with a capital of £10,000 in £1 shares, to acquire the rights, powers and privileges granted to G. Balfour by the Provisional Order granted hy the Board of Trade under the Electric Lighting Acts, 1882 and 1888, in respect of the Rural District of Halesowen, Worcs., as amended and confirmed hy the Electric Lighting Orders Confirmation (No. 1) Act, 1908, and to carry on the business of electricians, suppliers of electricity for light, heat and power, &c. The subscrihers (with one share each) are:—G. Balfour, M.I.E.E., A.M.I.M.E., The Elms, Bromley, Kent; H. L. Williams, Briarwood, Worcester Park, engineer; P. M. Moon, 123, Mount View Road, Stroud Green, N., engineer; W. Shearer, Swinton, King's Avenue, Bromley, Kent, secretary; W. J. Selley, 163, St. Alhans Road, Seven Kings, clerk; H. W. Gill, 29, Shrewsbury Road, Forest Gate, clerk; A. H. Beatty, 80, Kensington Mansions, Earl's Court, S.W., contractor. Minimum cash subscription 10 per cent. of the shares offered to the public. The number of directors is not to he less than three or more than five; the first are G. Balfour, W. Shearer and A. H. Beatty; qualification, one share; remuneration as fixed hy the company. Registered hy Pemberton, Cope, Gray & Co., 5, New Court, Lincoln's Inn, W.C.

Electrolytic Apparatus Syndicate, Ltd. (105,153).—This company was registered on September 28th, with a capital of £5,000 in £1 shares, to adopt an agreement with J. T. Nihlett for the acquisition of inventions for electrolytic apparatus, and to carry on the husiness of manufacturers of and dealers in all kinds of mechanical, chemical, electrical and electrolytic apparatus (except for electro-plating). The subscrihers (with one share each) are:—J. T. Nihlett, Cleve Hall, Denmark Hill, S.E., electrical engineer; P. J. Manger, 29, Girton Road, Sydenham, S.E., accountant; G. H. Humphrey, Cloyne, Hutton, Essex. Private company. The numher of directors is not to be less than two or more than seven; the subscrihers are to appoint the first; qualification, £20; remuneration, £25 each per annum (chairman, £50). Registered office, 11, Victoria Street, S.W.

Therol Foreign Patents Syndicate, Ltd. (105,185).—This company was registered on September 29th, with a capital of £2,500 in £1 shares, to acquire and turn to account a certain patent, to adopt an agreement with G. G. Bell and J. St. V. Platts, and to carry on the husiness of electricians, mechanical engineers, manufacturers and workers of, and dealers in, electricity, &c. The subscribers are:—J. E. Spagnoletti, Bowden Green, Pangbourne, Berks., engineer, 250 shares; H. M. Bailey, 20, Addison Road, Chiswick, W., electrical engineer, 100 shares. Private company. The number of directors is not to be more than six; the first are Sir James Clark, J. E. Spagnoletti and H. M. Bayley; qualification, £100; remuneration as fixed by the company. Registered office, Goldhawk Works, Goldhawk Road, W.

Westminster Tool and Electric Co., Ltd. (105,206).—This company registered on Septemher 30th, with a capital of £1,000 in 500 "A" shares of £1 each and 10,000 "B" shares of 1s. each, to carry on the business of electrical engineers, electricians, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in electrical apparatus, &c. The subscrihers (with one share each) are:—S. T. Keagh, 128, Landcroft Road, East Dulwich, S.E., clerk; W. M. Bailey, Kingswyn, Forest Hill, S.E., accountant; H. Parker, Clonkeen, Longlands, Park Road, Sidcup, clerk. Private company. The numher of directors is not to he less than two or more than five: the first are F. D. Johnson, F. W. White and A. Stewart; qualification, £50; remuneration as fixed by the company. Registered office, Palace Chamhers, Bridge Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Penrith Electric Supply Co., Ltd. (99,764).—Mortgage on certain land and premises in King Street and Friar Street, Penrith, dated Septemher 1st, 1909, to secure all moneys due or to become due to the Bradford District Bank, Ltd., Bradford.

Electric Supply Co. of Victoria, Ltd. (66,059).—This company's annual return was filed on September 14th, when 147,375 preference and 125,000 ordinary shares had been taken out of a nominal capital of £300,000 in £1 shares (150,000 preference). £1 per share has been called up on 22,882 and £22,882 has been received. £249,993 is considered as paid. Mortgages and charges £167,955.

Davis Electrical Co., Ltd. (99,740).—Issue on Septemher 22nd of £500 debentures, part of series created November 12th, 1908, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £500.

Bray, Markham & Reiss, Ltd. (74,871). — This company's annual return was filed on August 27th, when 8,000 shares had been taken up out of a nominal capital of £20,000 in £1 shares; £8,000 has been paid. Mortgages and charges: Nil.

CITY NOTES.

Willans & Robinson, Ltd.

Mr. J. C. Peache, managing director, presided on Tuesday at the Cannon Street Hotel, over the thirty-first half-yearly meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, October 1st, page 546), said that the result shown for the half-year's working was, the directors regretted to say, unsatisfactory. After allowing for the loss on the half-year's working, the balance standing to the credit of the profit and loss account was insufficient to provide for the payment of the full preference dividend, and there was no surplus to go to the payment of interest on, or to the redemption of, the funding certificates. The directors realised it was a result that the shareholders must view with concern and anxiety. In the course of his remarks he hoped to be able to lay some facts before them, which would allay in some degree that anxiety, and to satisfy them that when this period of failing trade was past, they would again attain the condition of progress that had lately marked the course of the company's affairs. The disappointing result of this half-year's working was entirely due to the continued depression in trade. They might take what comfort they could from the fact that they were not alone in this unfortunate position. Other concerns all over the country were suffering in the same way, and their published accounts were in varying degrees telling the same tale. The principal business of this company was the production of machinery for the generation of electricity. This was a line of business that had been adversely affected to a greater extent than, perhaps, any other in this country. This branch of engineering was suffering, in common with other industries, from the present widespread want of confidence and reluctance to risk the employment of further capital; but beyond this there were causes, confined to this industry alone, which had been accentuating in its case the effects of the general depression in trade. The introduction of the metallic-filament lamp and the great economy in current realised by its use was having a very serious effect on the revenue of electric lighting stations. In all parts of the country the output of current was falling off, and electricity concerns, instead of having to order new plant, were finding that their existing plant was in excess of their present requirements. In the end, no doubt, this cheapening of electric light would lead to a great extension of its use and a renewed demand for plant. For the present, however, new construction was at a standstill, and the business of building electric generating plant for this country, at all events, was in a state of stagnation. The number of orders to be obtained in this country for electric generating plant were few, and owing to excessive competition, prices had been driven down to a level that left only a narrow margin for profit. The orders obtained in recent half-years had been insufficient to keep the works fully employed. In the second half of 1908 the value of orders obtained was disappointing, but that half-year profited by a large balance of unexecuted orders brought forward. In the first half of the year 1909 (the half-year they were now considering) the value of orders obtained was considerably larger than in the previous half-year. That was an encouraging feature, but the bulk of their old orders had then been worked off, and for two months in that half-year it was necessary to put the works on short time. Since June, he regretted to say that the improvement experienced in the early part of the year had not been maintained, and there was no doubt that for the present and for the immediate future they had to face a continued scarcity of work. He would briefly give an account of the steps they were taking for obtaining business to keep their shops profitably employed. They had devoted great efforts to obtaining orders for steam turbines abroad, and in this direction they had met with considerable success, and had obtained good orders for Canada, Australia, South Africa and Japan. Indeed, in the absence of work coming forward for this country, the bulk of their orders for electrical generating plant had been from abroad. They had endeavoured with some success to extend their connection with industrial concerns in this country, and had supplied a number of turbine plants for driving the machinery of cotton mills, collieries, harbour works, and so forth, but in these directions work had been restricted by the general depressed state of trade. Cotton mills, for instance, were now running on short time, and no new mills were being built. Under their agreement with the English Diesel Co. they were entitled to a considerable volume of orders for Diesel oil engines. Unfortunately, due to the depressed state of trade, the Diesel Co. had not so far been able to keep them supplied with orders at the rate they were entitled to expect under their agreement with that company. They were still building a certain number of Willans engines, and had several in course of manufacture at the present time. Repair parts for Willans engines still furnished them with a substantial volume of work. Condensing plant, a comparatively new manufacture with them, brought in a certain number of orders. Parts for motor vehicles also gave them profitable employment, but in all these branches they were adversely affected by the present slackness of trade. There were several new branches of manufacture in process of development. Hydraulic turbines and high-lift turbo-pumps formed two of these, and there were a number of both these turbines and pumps on order in their shops. The first of the turbo-pumps had passed its trials with most satisfactory results. In this new departure they had the co-operation of Mr. Orten-Böving, an engineer of wide experience in the manufacture and working of hydraulic turbines and pumps. He had already obtained a number of orders for them, and it was hoped that an increasing business in this class of machinery might be relied on in the future. They were also engaged on the development of some other branches of manufacture. These had not yet reached the final stage, but they trusted in the near future some of them would be of material help to them in earning a profit for the shareholders. Notwithstanding the poor result of the past half-year's working, the position of the company's affairs to-day was a sound one. In cash and marketable securities they had a substantial provision against the needs of the immediate future. The cash balance at June 30th was £49,339; marketable investments held at the disposal of the company, £11,653. The item of debtors stood at £168,703. Of this total £74,000 had since been received, and the balance was a good asset. The result of the agreement made with their debenture stock holders in March now showed in the balance-sheet. By that agreement the fire fund was made available for the redemption of debenture stock. By June 30th last they had actually redeemed £8,767 of stock, making a profit of £1,761 on the transaction, and this profit had been added to the reserve. Up to that day a further sum of £9,666 had been redeemed, making in all £18,433. At December 31st last the reserve fund stood at £36,331. At June 30th it stood at £62,629, this increase was due to the release of the fire fund securities which were ear-marked for the redemption of debenture stock. Since June 30th they had settled a claim arising out of a contract made for the supply of large gas engines. This contract was entered into by the company in the year 1903. For some years past it had been known that the company had incurred a heavy liability on this account: a lawsuit has been pending, and in July last, acting under the advice of counsel, a settlement of all claims was arrived at with the plaintiffs, by the payment to them of £15,000. This loss had to be set against their reserve fund. As stated in the report, with the exception of any loss that might be made on the final disposal of the Queen's Ferry works, the settlement of this lawsuit closed the last of the serious difficulties arising out of the situation dealt with by the Advisory Committee in the spring of the year 1904. For the Queen's Ferry works, there had been one or two encouraging inquiries, and there was some hope that a sale would result from negotiations now in progress. In the meantime the works had been kept in good order and repair. The charge on account of Queen's Ferry for the half-year was £1,170. A considerable part, however, of this sum was due to costs that would not recur—such as salaries to officials whose terms of engagement did not terminate until a recent date. In future the cost of maintaining Queen's Ferry would probably not exceed £600 per half-year. It was necessary to be patient about the disposal of this property. It was hardly likely that a price would be obtained that would fully cover the figure at which the works stood in the balance-sheet. On the other hand, it would be unwise to attempt to force a sale by accepting an inadequate offer. The present depressed condition of trade was much against the prospect of their being able to find a purchaser, but the works formed a very fine industrial property, and they must be content to hold it for the present. The sale of surplus plant at Queen's Ferry realised some £9,313, and with the proceeds they had been purchasing new and efficient tools for the equipment of the Rugby works; £338 10s. had already been spent in this way, and they had a balance of £8,974 available for the purchase of further tools. This £8,974 was included in the item of debtors, £168,703 15s. 7d., and although ear-marked for the purchase of plant, with this qualification, formed an addition to the cash resources of the company beyond that shown on the balance-sheet. A bad time like the present afforded a favourable opportunity for cutting down expenses, and, as they were aware, the directors had devoted their special attention at this point since 1904, though this process could not be carried on indefinitely. Nevertheless, during the past half-year it had been possible to effect further material reductions, and there were still other reductions that were being carried out at the present time. This matter of expenses was one that had had, and would continue to have, their close attention. There was, however, one direction in which they dared not cut their expenses—that was in their machinery for procuring orders. With orders hard to get, their efforts for effecting sales had to be redoubled. The expenditure on travelling, for instance, might appear large, but in bad times like these, expenditure of this sort was even more necessary than in good times, when orders were coming in freely. The cost of patents and development work again showed an increase—£7,974 at June 30th, as against £7,281 at December 31st. Depreciation at the rate of 10 per cent. per annum had, as usual, been written off this half-year from the January total—viz., £358, but the additions during the half-year had more than balanced this. These additions had been principally occasioned by development work on water turbines and high lift pumps. In the opening up of new branches of manufacture, expenditure of this description was inevitable, but it was, they trusted, expenditure which would yield a good return in the future, and as already explained it was of vital importance to the company to widen the field of its operations. The board were not in a position to make any proposals with regard to the vacant post of chairman or as to additional directors. It would be a good thing for the company were it possible to secure as chairman, a man of first-class ability, in touch with the financial and business interests on which they were dependent, and one who would be able to effectively further and extend the business of the company. The board were giving this important matter their careful attention, but until they were in a position to place before the shareholders recommendations which would fully meet the needs of the case, they would ask them to leave the management of the company's affairs in the hands of the three directors who now formed the board. The work of the two ordinary directors had not been confined to the businesss of the monthly board meetings. They had carefully looked into the affairs of the company, and had been active in forwarding the interests of the company in other ways. He had not hesitated to call for their help in matters of importance as these had arisen, and their meetings had by no means been confined to the regular monthly fixtures. In Mr. Robertson they had a very active and helpful colleague. Both Mr. Anderson and he felt that his accession at a time when the company was passing through a difficult time, though of advantage to them, was rather hard on him. The company has a most capable staff of servants, and the works were in a high state of efficiency. They trusted that the present setback was but temporary, and that as, and when the state of trade returned to a normal condition, the works were well prepared to take full advantage of it.

Mr. Shirley Price, in seconding the motion, said the chairman had made no attempt to gild the pill. He did not think the pill after all was so difficult to swallow. It was not so serious as many he had had to swallow that year in regard to other concerns. He thought there was a hopeful future before them.

Col. Plunkett asked how much of the item of £5,162 for the salaries of staff was due to Queen's Ferry, and how much to the Rugby works.

A Shareholder asked if anything was likely to be done with the freehold premises at Thames Ditton.

Mr. Bulford said that they heard now that a lawsuit had been settled for £15,000, but they had never heard of that before. However, he wished they would treat the Queen's Ferry works in the same way, for the board had been telling them year after year what they were going to do with Queen's Ferry, and they were about sick of it altogether. He would like to know whether the assets were valued by an outside valuer or by their own. How did they arrive at £300,000 for the Rugby works—it was a sum which would buy about half Rugby. He did not believe in the report a tiny bit, but considered the assets were faked, and judged the board for what they had done. The board had brought them to beggary. He considered that a body of business men should investigate the affairs before the report was adopted.

Mr. W. Steward wished to know whether the reduction of expenses was anything in proportion to the reduction of the volume of business. A year ago Sir Gilbert East made some observations to the effect that Mr. Peache could not do everything, and said his subordinates could force him to pay high salaries. The expenses had apparently increased, but he did not know how that was attributable to Queen's Ferry. Whilst everyone felt confidence in the management of the works by Mr. Peache, yet the shareholders did not feel a corresponding confidence in the department which might be called the business management, and he supported what had been said as to the need of a good man as chairman.

Mr. Lines suggested that if they could not get a good class man as chairman they might amalgamate with a good class concern.

Replying to these and other questions, the Chairman said the freehold premises at Thames Ditton stood at the figure to which they were written down, and they were doing all they could to get rid of them. The lawsuit had been mentioned several times, but naturally it was a thing they did not talk much about for fear of prejudicing the result. The claim made against them was for over £100,000, and the proceedings had been going on for three years. Under the advice of counsel, they settled the whole matter for £15,000. It was a big sum, but not, he thought, an unreasonable settlement. That sum did not include their own costs. He could assure them that they had good reason for hopes as to the disposal of Queen's Ferry, although it was quite true that they had expressed good hopes in the past. The assets had not been valued by an outside valuer, but if there was a strong feeling on the subject it could always be undertaken. The board were perfectly certain that a valuation would more than justify the figures in the balance-sheet. Everyone knew that it was impossible to reduce working expenses in exact ratio to a reduction of business, although they tried to economise all they could. It was a reasonable suggestion to include the directors' fees with the salaries of the staff, for they were paid for actual work in the business. Taking the two together, the figure for the second half of 1908 was £7,652, whereas in the past half-year it was £7,150, which showed a reduction. Neither the finding of the right man as chairman, nor getting offers for an amalgamation with a firm which would be an advantage to the company, were easy things, but the last point had been under their consideration, and a year or so ago there was an actual proposition before them. If, in the future, it were to appear desirable to again consider such a matter, he could assure them that they were very ready to give it their serious consideration.

The report was then carried with one dissentient, and a vote of thanks to the board concluded the proceedings.

Bank Rate.—The Bank Rate was yesterday raised to 3 per cent.

Sao Paulo Tramway, Light and Power Co.—A quarterly dividend at the rate of 10 per cent. per annum is announced.

Eastern Extension, Australasia and China Telegraph Co.—An interim dividend of 2s. 6d. per share, tax free, for the quarter ended June 30th, is announced.

Para Electric Railways and Lighting Co., Ltd.—The directors announce a dividend on the preference shares for the half-year ended May 31st, 1909, at the rate of 6 per cent. per annum, less tax, payable on November 1st.

Glenboig Union Fire-Clay Co., Ltd.—A dividend of 8 per cent. has been declared on the ordinary shares for the past year.

Lisbon Electric Tramways, Ltd.—An interim dividend of 2½ per cent. has been declared.

Puebla Tramway, Light and Power Co.

The directors state that the issue of their report for 1908 was delayed, pending the completion of the arrangements for the acquisition of the local competing lighting company (Compania Hidro-Electrica de San Agustin, S.A.). During the period covered by the accounts the earnings of the tramways have been affected (as foreshadowed in the report to December, 1907) by the paving improvement work which is being carried out by the Municipality of Puebla, and in connection with which considerable betterment work and expenditure has had to be undertaken by the company which, when completed, will, it is anticipated, result in benefit to the tramway business. The lighting business (says the *Financial Times*) has suffered very severely during the last two years in consequence of the fight with the San Agustin Co. The board, however, are glad to state they have succeeded in putting an end to this competition by securing for the company the control of the San Agustin Co. as from July 1st, 1909, on satisfactory terms, and they expect a material increase of revenue. The gross and net earnings of the power business continue to show a steady increase, and the results therefrom are satisfactory. The supply of power to the San Rafael Paper Mills (1,500 h.p.), mentioned in the report for 1907, commenced in October, 1908. The results for the six months to June 30th, 1909, show a marked improvement over those of the previous period. The net profits for that period amount to approximately £21,500 (nearly equal to the profits earned in the year 1908), and thus the bond interest for the same period—£21,891—is practically covered. The board consider that the outlook for the future is very promising. With the removal of the ruinous competition in the lighting business, a great improvement will be shown in the net profits of that department. The material increase in the profits of the power business during the first six months of this year should also be further augmented during the current half-year by the revenue from the power already sold or being contracted for. Being satisfied that it is now a practical certainty that the balance of the power available from the two Portezuelo Falls and the falls of the San Agustin Co. will be sold within the next two years, the directors have decided to proceed immediately with the partial development of the Tuxpango Falls (30,000 h.p., but say 25,000 h.p. to allow for abnormal dry seasons, such as the last season has been), so that the company will be in a position to meet the growing demands of the City of Puebla and the district served by the company.

Anglo-American Telegraph Co., Ltd.—The board has resolved, after placing £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending September 30th, 1909, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, as last year, payable on November 1st.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock of this company for the half-year ended September 30th, 1909 (payable October 1st) have been posted.

Germany.—The Rheinisch-Westfalisches Electricitätswerk Gesellschaft, of Essen, is declaring a dividend of 8 per cent. for the last financial year, the same as for the preceding 12 months.

Brisbane Electric Tramways Investment Co., Ltd.—The directors will pay a dividend of 3s. 6d. each on the ordinary shares, in respect of profits for the half-year to June 30th, 1909.

Melbourne Tramway and Omnibus Co. (Australia).—A dividend of 4½d. per share for the quarter ending September 30th, is announced.

Messrs. Pirelli & Co., Milan.—The capital of this company is now 10,500,000 lire. The general meeting of the company, presided over recently by Signor Riva, was attended by 53 shareholders. The shares are 500 lire. It was decided to distribute 40 lire per share, and to carry forward 2,954 lire. The directors reported satisfactory work at the establishment in Milan, as well as that at Villanueva, near Barcelona; the latter is now almost in a position to undertake the construction of submarine cables. Negotiations are proceeding for the establishment of new works at Bicocca.

Prospectuses.—*New York Telephone Co.*—Messrs. Baring Bros. & Co., Ltd., have been before the British investor offering £2,000,000 of 4½ per cent. first and general mortgage 30-year bonds at 95. A further £500,000 is reserved for Amsterdam, and £2,500,000 for the U.S. The list was to close on 7th inst.

Carey United Rubber Estates, Ltd.—This company last week offered 100,000 shares of £1 each for subscription. The company is acquiring an estate at Kajang, F.M.S., which is "now yielding large returns," and will also acquire 5,000 acres of virgin forest from the Jugra Land and Rubber Estates, Ltd., and plant rubber thereon.

East African Rubber Plantation Co., Ltd.—An issue of 75,000 shares of £1 each was offered last week. The company acquires a number of plantations in the north-east of German East Africa.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Sept. 29	2,853	+ 37	17	26,686	— 521	..	..
Ayr	Oct. 2	561	— 17	20	8,106	— 73	8	..
Bath	,, 2	1,708	+ 42	39	30,770	+ 1,445	..	..
Belfast	,, 1	7,695	+ 284	25	101,792	+ 4,396	37	..
Birkenhead.. ..	,, 3	2,238	+ 7	26	28,926	— 398	18·68	..
Birmingham Corp.	Sept. 25	13,185	+ 186	26	167,627	+ 3,972	56·5	..
Blackburn	,, 25	2,254	— 10	27	30,647	— 852	13·97	..
Blackpool-Fleetw'd	Oct. 2	1,674	+ 117	13	18,877	+ 1,220	..	..
Bolton	,, 3	4,732	— 22	27	63,895	— 838	26	..
Bournemouth ..	Sept. 29	3,593	— 43	26	46,379	+ 283	21·96	..
Bradford	,, 25	9,932	+ 833	25	127,408	+ 3,583	54·81	..
Brighton	Oct. 3	2,111	+ 28	27	28,715	+ 1,326	9·5	..
Bristol	,, 1	9,975	+1,424	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Sept. 24	446	— 8	38	8,316	— 83	8·65	..
Barnsley	,, 24	335	— 19	,,	6,429	— 329	..	..
Barrow	,, 24	522	— 11	,,	8,949	— 614	5·37	..
Cavehill	,, 24	212	— 41	,,	3,453	— 79	..	..
Devonport ..	,, 24	749	— 231	,,	14,114	— 3,529	8·85	..
Gateshead ..	,, 24	1,984	— 108	,,	87,853	— 443	11·25	..
Gravesend ..	,, 24	474	+ 16	,,	8,038	— 100	6·5	..
Greenock.. ..	,, 24	1,807	+ 256	,,	21,319	+ 1,013	7·25	..
Hartlepool ..	,, 24	510	+ 22	,,	9,060	— 187	6·72	..
Kidderminster ..	,, 24	237	+ 24	,,	4,253	— 172	..	..
Leamington ..	,, 24	420	+ 18	,,	6,810	+ 248	..	..
Merthyr	,, 24	428	— 14	,,	8,184	+ 82	2·9	..
Metropolitan ..	,, 24	13,815	+1,069	,,	237,565	+18,822	22	..
Middleton ..	,, 24	702	+ 41	,,	13,030	— 883	8·5	..
Mid. Joint Com'tee	,, 24	11,698	+ 78	,,	217,023	— 2,119	..	..
Oldham—Ashton	,, 24	1,140	+ 10	,,	21,455	— 1,237	9·18	..
Peterborough ..	,, 24	242	— 32	,,	40,536	— 376	5·31	..
Potteries	,, 24	8 809	+ 110	,,	67,593	— 1,097	29	..
Rothesay	,, 24	548	+ 179	,,	9,239	+ 177	2·75	..
Southport.. ..	,, 24	629	+ 9	,,	11,401	— 275	8·17	..
S. Metropolitan..	,, 24	1,789	+ 26	,,	80,806	— 297	..	..
Swansea	,, 24	2,054	+ 114	,,	36,989	+ 841	12·5	..
Tynemouth ..	,, 24	521	+ 56	,,	9,943	+ 787	3·75	..
Weston-s-Mare ..	,, 24	415	+ 42	,,	6,578	+ 406	8	..
‡Worcester ..	,, 24	613	— 26	,,	10,808	— 128	5·75	..
Wrexham ..	,, 24	242	+ 11	,,	3,802	— 136	..	..
Yorks. Wool. Dist.	,, 24	2,023	+ 130	,,	34,858	— 71	17	..
Miscellaneous ..	,, 24	445	+ 18	,,	8,083	+ 138	..	..
Burnley	Oct. 2	2,656	+ 247	..	..	..	..	..
Burton-on-Trent ..	,, 3	530	— 29	27	7,269	— 207	6·63	..
†Bury	Sept. 26	1.227	+ 64	25 4/7	31,014	— 423	22·5	..
†Cardiff	,, 18	2,306	+ 101	25	56,285	+ 547	..	..
Carlisle	Oct. 2	854	— 56	39	6,562	— 821	..	..
Chatham and Dist.	Sept. 30	1,779	— 112	39	31,305	+ 1,628	14·98	..
Cork	,, 30	1,078	+ 68	..	17,570	— 604	9·89	..
†Croydon	,, 17	8,320	+ 502	..	38,417	+ 2,183	11·25	4·75
†Darlington.. ..	,, 25	180	— 21	26	4,854	— 863	..	..
Darwen	Oct. 1	486	+ 5	26	6,679	— 201	4·36	..
Dover..	Sept. 25	455	— 25	26	5,966	— 398	4·75	..
Dublin	Oct. 1	11,232	+ 420	..	78,544	+ 1,473	54·25	..
Dundee	Sept. 29	2,404	— 25	19 4/7	23,709	— 541	15	..
East Ham	Oct. 2	1,992	+ 116	26½	27,125	+ 3,571	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 2	35,193	—2,386	..	301,208	— 4,077	94½	5
Hastings	Sept. 30	2,406	— 66	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeson	Sept. 30	277	— 15	26	8,618	— 227	..	..
Ipswich	Oct. 2	862	— 29	27	11,582	+ 133	10·5	..
†Kilmarnock ..	Sept. 25	292	— 11	19	2,915	— 102	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	,, 29	2,757	— 12	39	52,182	— 446	39	..
Leeds	,, 25	13,783	+ 718	26	177,087	+ 4,033	54	6
Leicester	Oct. 2	4,537	+ 51	..	..	..	..	..
Leith	Sept. 25	1,201	+ 208	19 1/7	12,347	+ 1,643	9	8
Liverpool	,, 25	21,741	+ 312	38	410,895	— 1,837	58 5	..
‡L.C.C.	,, 18	75,258	+1,847	..	896,195	+ 3,694	124·7	2·375
London United ..	Oct. 2	12,561	—2,870	..	242,261	—25,233	..	..
†Lowestoft	Sept. 18	280	— 5	51	9,593	+ 1,046	8·5	..
Manchester ..	Oct. 2	31,207	— 201	27	404,806	— 8,027	105	..
†Newcastle	Sept. 25	8,899	— 108	..	99,504	— 1,498	..	..
†Newport	,, 25	667	+ 25	26	17,867	— 311	14·5	..
†Oldham	Oct. 3	8.678	— 336	27	51,785	— 3,788	28·75	..
†Pontypridd.. ..	,, 2	838	— 25	26½	11,206	+ 1,030	5·5	1·75
†Portsmouth ..	,, 2	2,149	+ 12	27	60,832	+ 1,916	15·25	·75
†Preston	Sept. 29	1,497	+ 5	..	..	..	..	..
Rotherham	,, 30	1,166	— 70	25	15,020	— 703	10	·66
Salford	,, 27	9,469	— 1	25 5/7	119,772	— 8,826	..	..
Sheffield	Oct. 8	11,885	— 57	27 3/7	154,334	— 1,005	39·62	2·6
Southampton ..	Sept. 29	2,187	— 81	26	29,136	— 891	..	..
Southend-on-Sea ..	,, 29	1,117	+ 99	26	16,055	+ 2,317	..	..
†South Shields ..	Oct. 2	1,112	— 50	26 3/7	15,454	— 60	..	..
†Swindon	Sept. 22	169	+ 18	..	..	..	..	..
Tyneside	,, 29	881	— 17	18	5,947	+ 267	..	..
Wallasey	Oct. 2	1,895	+ 76	26½	25,840	+ 690	..	·22
†Walthamstow ..	Sept. 25	679	+ 25	26	17,981	+ 854	9	..
†West Ham.. ..	,, 28	6,749	+ 887	25 1/7	60,246	+ 8,881	15·48	·43
Wolverhampton ..	,, 29	1,889	+ 162	26	21,618	— 697	14·25	1·75
Baker St.-Waterloo	Oct. 2	6 215	— 280	18	88,025	— 70	4·25	..
Cen. London Rly...	,, 2	10,597	—6,299	13	64,808	—81,433	6·82	·55
Char. +, Eus. Hamp.	,, 2	7,410	+ 500	18	47,830	+ 4,970	7.75	..
City & S. Lon. Rly.	,, 8	6,258	+ 66	18	89,797	+ 1,286	7·8	..
Dublin-Lucan Rly.	,, 1	824	+ 88	18	2,177	+ 72	7	..
G.N. and City Rly.	,, 2	2 685	+ 7	13	16,424	— 81	8·5	..
G.N., P'y. & Brmtn.	,, 2	10,785	— 40	18	64,460	+ 450	9·25	..
L'pool Overh'd Rly.	,, 8	2,652	— 117	18	20,232	+ 55	6·8	4·8
†Llandudno-Col. Bay	,, 1	604	+ 29	44	18,054	+ 2,152	..	..
Mersey Railway ..	,, 2	4,046	+ 198	18	25,049	+ 963	4·5	..
Metropolitan Rly...	,, 8	88,581	—2,861	..	205,682	— 8,882	24·5	..
Met. District Rly...	,, 2	19,672	+ 107	18	122,675	+ 5,451	24	..
Anglo-Argentine ..	Sept. 30	79,296	+ 8,805	..	1,521.564	+92,780	..	..
§Auckland	,, 10	18,098	+ 195	36	122,707	+11,020	22·8	1·38
Bombay (B.E.T.) ..	,, 2	5,135	+ 899	35	87,785	+ 5,877	..	..
§Brisbane	..	..	..	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 2	6,623	— 277	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	..	..	..	..	..	..	..	..
Madras	Sept. 30	1,259	+ 115	39	22,929	+ 621	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	Oct. 1	2,750	+ 182	39	54,649	+ 527	28	2·32

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

In many markets of the Stock Exchange there is quite a lot of business doing. Rubber shares and land shares monopolise the greater part of attention amongst miscellaneous issues. A valiant attempt to infuse vitality and strength into some of the Home Railway stocks met with slender success, and the most that can be said is that prices have rallied above the worst.

It is more a matter of melancholy curiosity than anything else, to record that East London Ordinary stock changed hands this week at a lowly 50s. per cent., while the "D" Debenture stock was dealt in on the same day at 60s. The "C" Debenture stands nominally at 6, and the "B" can be picked up at about 19. The delay in the opening of the newly-electrified section of the London, Brighton and South Coast Railway has, no doubt, induced some luckless East London stockholders to realise, since it is to the Brighton Company's system of traction that the little East London is looking to take an example for its own long-talked of electrification.

Metropolitans and Districts are down ¼, and City and South London fell ½, these being the only quotable changes in the electric railway list.

The feature amongst electrical supply shares is a sharp rise in River Plate Ordinary. For some time past, all the shares which came to market were steadily absorbed, and now that the supply has become limited, the effect of the company's increasing prosperity is fairly reflected in the quotation. Another advance worthy of notice is that of 1/16 in Victoria Falls Power Preference, a movement intimately bound up with a dramatic rise in the price of the generally-popular Chartered shares. The home group is very quiet, and except for a few *ex* dividend markings, the changes hardly deserve attention.

Mexican Light and Power bonds have benefited substantially from the various evidences produced as to the precise amount of damage done at Necaxa, and there is also a rise of 1 in the 5 per cent. Gold bonds of the Mexican Electric Light Company. Mexico Tramways Common stock has recovered more than its decline of last week, and here again the bonds are strong. Other issues in this section are mostly a trifle firmer, small gains being obtained by Sao Paulo Trams at 150½, *ex* 2½ dividend, and Rio Trams at 94. Canadian General Common at 122½ is *ex* 1¾ per cent., and the Preference at 119, *ex* 3½ per cent., shows a point rise.

British Columbia Preferred Ordinary stock continues to ascend steadily, a further rise of 2 bringing the price to 122½. Anglo-Argentines are steady; Calcutta Tramways Debenture again rose a point. British Electric Traction Second Debenture has eased off, and Underground Electric Railway Income bonds slid back a little further.

Telegraph securities have moved somewhat irregularly. The Anglo-American gamble has quieted down considerably, speculation drifting into other channels. The price of the Deferred has gone a little easier. The Commercial Cable Company is reported to be having trouble with the Newfoundland Government in reference to the laying of certain pipes for conducting cables, and the matter in dispute is said to have been referred to the United States Government. Whatever the upshot, it is not likely to affect the company's 4 per cent. Debenture stock, quoted here at 90, *ex* dividend, last week. American Telephone and Telegraph stock is better on balance, allowing for the dividend payment, and the Mackay Companies' stocks have moved in directions opposite to each other. An issue of New York Telephone bonds was taken like the proverbial hot cakes, the subscription lists being open for less than two hours.

Marconi shares fell to 15s. upon the announcement that the company had received £15,000 from the Government for that part of the undertaking recently taken over. In the market the price is regarded as very disappointing, and the inspired statements in the newspapers, making the best of the matter, failed to brace up the quotation. Probably the proprietors are able to estimate for themselves the value of the payment, which, by the way, was on account of one of the sources of steady profit to the concern.

National Telephones are better. Orientals have gained 1/16, and the new United River Plate shares rose to 1⅝ premium.

The Manufacturing list is steady on the whole. Willans and Robinson issues are flat, reflecting the unsatisfactory condition revealed by the report. General Electric Preference rose ¼, and Castner-Kellner Debenture improved a point. Rubber shares have been fluctuating with some degree of violence, but prices manage to maintain the greater part of their strength, and so long as the product itself can be held up at an artificially-inflated price, the danger of a severe market-slump will not be very great.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Sept. 28th.	Closing Quotations Oct. 5th.	Business done week ended Oct. 5th, 1909.		Rise + or Fall –	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest.	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞–3⅜	2⅞–3⅜	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93–96	93–96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	147–149	146–148	147	..	..	5 7 5
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 38,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97–99	97–99	98	97½	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3¼%	3⅞%	3½%	£3 4s.	61½–63½	61¼–63½	62	..	..	5 2 8
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104–105	104–105	104¾	104	..	5 14 3
8,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21⅞–22⅛	21¾–22¼	22 1/16	21¾	–⅛	1 16 4
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101–103	101–103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8–8⅜	8–8⅜	..	..	..	4 14 1
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90–92	89–91	90	89⅛	–1	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½–9¼	8½–9¼	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17¼–18¼	17¼–18¼	18⅛	..	..	5 9 7
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3–3½	3–3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅛–8⅝	8–8½	8 7/16	..	–⅛	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½–102½	100½–102½	..	..	..	2 8 11
60,710*l*	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13½–13¾	13¼–13¾	13 5/16	13 15/32	..	7 4 8
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100–102	100–102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129–132	129–131	131	129¼	..	5 6 10
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85–87	85–87	86	85½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104–106	104–106	..	..	..	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾–12¼	11¾–12¼	12⅛	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102–104	102–104	..	..	..	3 16 11
300,000*l*	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100–102	100–102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼–10¾	10⅛–10⅝	..	..	–⅛	5 8 3
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾–14¼	13⅝–14⅛	..	..	–⅛	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26–27	26–27	26 5/16	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100–102	100–102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51½–53½	51½–53½	53¼	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	95–98	94–97	96½	..	–1	4 2 6
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	79–81	80–82	..	..	+1	4 17 7
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	¾–⅞	11/16–13/16	15/-	13/9	–1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝–⅞	⅝–⅞	..	..	..	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝–⅞	⅝–⅞	..	..	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106–107½	106½–108	107	..	+½	5 11 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121–123	121–123	122½	121¼	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛–10⅞	10¼–11	10⅞	..	+⅛	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛–10⅞	10⅛–10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16–5 11/16	5 7/16–5 11/16	..	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98–100	98–100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100–102	100–102	..	..	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 13/32–1 17/32	1 13/32–1 17/32	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 5/32–1 9/32	1 3/16–1 5/16	24/9	..	+1/32	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86–88	86–88	87½	..	..	4 11 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100–102	100–102	..	..	..	3 18 5
11,839*l*	Reuter's	8	5 %	5 %	5 %	5 %	7¾–8¼	7¾–8¼	..	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½–102½	100½–102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	131–134	131–134	..	..	..	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 11/16–6 15/16	6¾–7	6 15/16	6 13/16	+1/16	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼–5⅝	5¼–5⅝	5½	..	..	4 8 10
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜–1⅝	1 7/16–1 11/16	32/6	31/10½	+1/16	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100–102	100–102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13⅜–13⅞	13⅜–13⅞	13¾	13 23/32	..	5 0 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103–105	103–105	..	..	..	3 16 2
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16–13/16	11/16–13/16	15/7½	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾–9¼	8¾–9¼	9⅛	8 15/16	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½–9½	8½–9½	..	..	..	15 15 10
80,000*l*	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½–103½	101½–103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝–4⅞	4⅝–4⅞	95/7½	92/6	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4½–4¾	4½–4¾	92/6	91/-	..	5 17 8
978,250	Do. 4 % Deb. Stock	..	..	..	..	4 %	92¼–93¼	92¼–93¼	93	92⅜	..	4 5 10
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102–105	102–105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4½–4⅝	4⅜–4½	92/6	89/4½	–⅛	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜–1½	1⅜–1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½–1	½–1	..	..	..	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾–2¼	1¾–2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜–3⅞	3⅜–3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½–3½	2½–3½	50/-	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96–99	96–99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144–149	144–149	146	..	..	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	118–123	120–125	123½	123	+2	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106–110	106–110	109½	..	..	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102–104	102–104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102–105	102–105	..	..	..	4 5 9
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	½–⅞	½–⅞	11/3	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	1⅞–2⅜	1⅞–2⅜	40/-	37/6	..	6 9 9
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84–87	81½–84½ xd	82½	..	..	5 18 4
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63–67	62–66	..	..	–1	6 16 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼–7⅝	7¼–7⅝	7½	7 5/16	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛–6½	6⅛–6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103–106	103–106	..	..	..	4 4 11
304,940*l*	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89–94	89–94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16–7/16	3/16–7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38–42	38–42	..	..	..	9 10 6
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16–11/16	9/16–11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0–⅛	0–⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0–⅛	0–⅛	..	..	..	Nil
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41–46	41–46	42½	41½	..	9 15 8
125,000*l*	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27–31	27–31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅞–5⅜	4⅞–5⅜	..	..	..	4 3 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾–5	4¾–5	96/3	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98–101	99–102	102	..	+1	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅝–11⅛	10⅝–11⅛	..	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜–5¾	5⅜–5¾	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105–107	105–107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16–7/16	3/16–7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2–2⅛	2–2⅛	42/-	41/-	..	5 17 8
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105–108	106–109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	8 %	3¼%	61–63	61–63	61¾	61½	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85–87	85–87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43–45	43–45	45	..	..	5 11 1
1,130,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	31–32	30½–31½	30½	..	–½	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	⅝–1⅛	⅝–1⅛	..	..	..	13 6 8
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90–93	90–93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

† A period of nine months.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sept. 28th.	Closing Quotations Oct. 5th.	Business done week ended Oct. 5th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1¼	1 — 1⅛	..	..	— 1/16	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1 1/16 — 1 3/16 xd	..	..	..	4 14 1
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/16 — 5/16	3/16 — 5/16	..	5/-	4/3	24 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	20/-	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	82 — 85 xd	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7¾— 8¼	8 — 8½	8¼	..	+ ¼	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	83 — 87 xd	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
30,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103¼	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13¼	12½— 13¼	12½	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14¾— 15½	14¾— 15½	..	..	..	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½— 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼ — 2¾	2¼ — 2¾	50/-	..	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38¼ — 38¾	38 — 38½	38⅝	38¼	— ¼	1 6 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	65 —67	65	..	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	15¾— 16½	16¼	15¾	— ¼	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	19/32 — 21/32	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 96½	94½ — 96½	..	..	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —128	127 —130	128⅞	128	+2	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	90 — 92	92 — 94	93⅛	92½	+2	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35¾	34½	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	103½	103	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88	87¼	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	34 — 36	..	..	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅝— ⅞	⅜ — ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅝— 3⅛	2¼ — 2¾	..	..	— ⅜	2 3 9
245,495	Do. % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	78 — 82	76 — 80 xd	78	77	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Sept. 28th.	Closing Quotations Oct. 5th.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4⅛ — 4⅝	..	..	— ⅛	5 12 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7¼ — 7¾	7¼ — 7¾	7¼	..	..	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½— 8	7½ — 8	..	..	..	4 7 6
386,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½— 5	4½— 5	90/-	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅜	3⅞— 4⅜	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	..	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½— 11	10½ - 11	10 13/16	10⅝	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102¾	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3½	2⅞— 3⅜	..	..	— ⅛	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝ — 8⅛	7 13/16	7⅝	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝ — 11⅛	11	10 13/16	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	104 —107	107	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101¾	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	57 — 60	57	..	—1	7 10 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½— 5	4⅜— 4⅞	..	..	— 1/16	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	4⅞ - 5⅜	..	..	— ⅛	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	7⅛— 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	99 —101	100⅛	100	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	7	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞— 2¼	1⅞— 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5¼	5 — 5¼	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	4 — 4½	88/9	87/6	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	81 — 83	82¼	81½	+1	6 0 6
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	70 — 74	70 — 74	72¼	71	..	4 14 7
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	104	103¾	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	83½— 85½	86 — 88	87	85½	+2½	5 16 8
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	97 —100	..	..	+1	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	100— 102	..	..	+1	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 13¼	12½ — 13½	..	..	..	5 6 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 5/16— 1 7/16	1 15/32— 1 19/32	31/-	30/-	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	8/9	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	22/6	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102—105	100 —103 xd	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	½— 1	⅜ - ⅞ xd	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅜ - 1⅞	1¼— 1¾ xd	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	74½ — 78½ xd	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	27/32— 29/32	29/32— 31/32	19/4½	18/6	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½ - 9	8½— 9	8¾	8 17/32	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 1/32	..	..	4 8 0

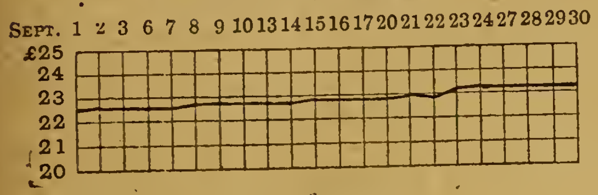
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per nt., April 1st, 1909

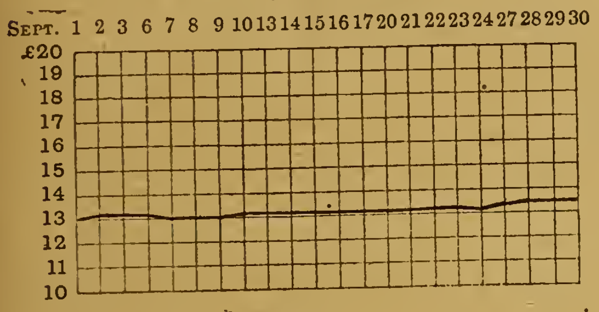
METAL MARKET.

Fluctuations in September.

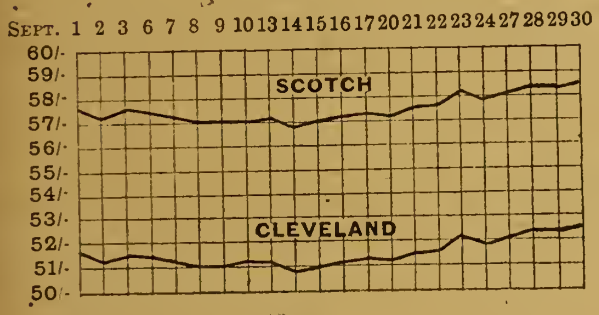
SPELTER (G.O.B's.).



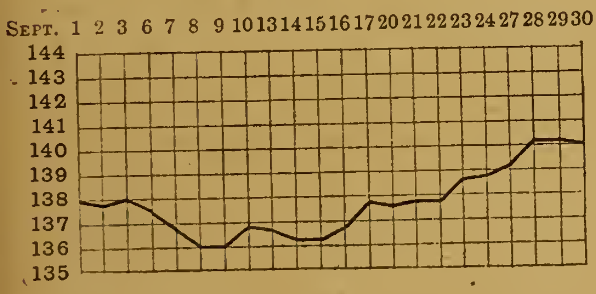
LEAD (ENGLISH).



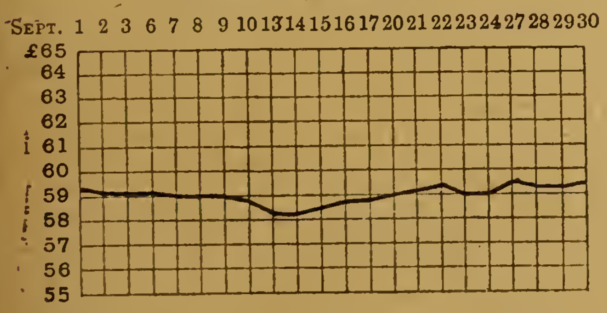
IRON.



TIN.



COPPER (G.M.B's.).



The Electrical Treatment of the Insane.—A correspondent writes that the use of electricity for the treatment of the insane was successfully demonstrated at Cardiff last week, when Dr. Goodall, the superintendent of the Cardiff City Mental Hospital, informed his committee that he had given electric treatment to a patient who had been removed from another institution to the Cardiff Asylum. She had been unable to move from bed for some time, but was able to get up in three days after being electrically treated, and in three weeks afterwards had recovered sufficiently to be liberated.

NOTES ON ELECTRIC PRACTICE IN MINES.

By W. O. PEPPER.

Electricity is now generally admitted to be a practical and efficient power agent in mines, and its adoption is increasing daily.

Accidents from shock and, in a few cases, from fire, have cast a certain amount of stigma upon it—to some extent retarding its more general adoption in the past; but competition, together with the operation of the Eight Hours Act, will have an important influence in favour of its general use in the near future. There are now so many excellent examples of properly equipped electrical plants working in collieries, that the fears originally created by careless and indifferent design are bound to die a natural death.

To-day a well-designed scheme, run and maintained in an efficient manner, is, for all practical purposes, as safe as the safety lamp. A motor or a lamp, handled carelessly in a fiery mine, is equally dangerous. With care, both are efficient agents in winning coal.

The modern colliery plant is almost exclusively three-phase alternating, which, for many reasons, is by far the best. These notes will deal chiefly with the three-phase type, with occasional mention of direct-current apparatus.

The pressures, where alternating currents are generated, have considerably increased in the last year or two—going up as far as 3,000 volts for underground work. Alternating currents are particularly flexible, being easily transformed by stationary machinery to the pressure decided upon as the most suitable for a given mine.

Frequency is not a deciding factor in mine work, and may be dismissed by remarking that 40 or 50 is the frequency generally adopted.

Power House.—From the electrical standpoint there is no difficulty in laying out the generating plant to withstand the heaviest work called for at a colliery. The capacity of the engine and generator should err on the generous side, as an induction-motor load makes heavy demands on generator and mains. One feature calling for special attention in a colliery power station is the provision of a good automatic regulator. With an induction-motor load it is extremely important to supply the motors at their proper voltage, as the torque falls off rapidly with the pressure.

Apart from these points, the power station calls for no special mention, following the lines of the best central station practice.

Cables.—The transmission circuits in a mine are, perhaps, the weakest links in the electrical chain. The cables are generally carried along the sides of the roadways and near to the roof, suspended by leather or canvas strips from the pit-props. They are thus exposed to falls of roof. In the shaft water is the chief source of trouble, but there is also considerable danger from falling objects, a not infrequent occurrence.

The cables most favoured are the vulcanised bitumen make—double-armoured for the shafts and single-armoured for the roadways.

Closely running these in favour is the paper-insulated lead-covered and armoured type. The advantages claimed for this latter class are that the lead affords a water-tight sheathing, an extra mechanical protection and a means of effecting a better earth connection. The lead is, however, easily damaged, and when damaged it is difficult and sometimes impossible to repair it. The paper insulation is very soon rendered useless when moisture enters it. On the other hand, the vulcanised bitumen cable has splendid moisture-resisting properties, and the armouring affords a good earth. Where an additional earth is required, the following method gives good results, and at the same time is inexpensive. Old haulage and winding ropes are requisitioned and connected to the earth at the pit top by means of any water or other mains in the shaft, and also by the water in the lodge rooms. They are then carried into the roadways and slung high up on the sides, and run to all the main transformer and motor houses. From these ropes the electric cable is slung with light wrought-iron hangers in the form of a rough catenary suspension. By close spacing, all strain is taken off the cable, and it lies more or less horizontally. This method also saves a considerable amount in the length, as ordinarily a free sag is allowed to prevent rupture in the event of the roof falling in. But the chief object of this suspension is to ensure a good earth for motors and apparatus in-bye, and at the face. This method has been adopted in a small way with good results.

The Home Office Regulations at present do not permit the use of metallic hangers. As, however, this method ensures an effective earth, permission would very likely be readily granted. If generally adopted, a light but sufficiently strong plough steel "messenger" wire should be used with as few joints as possible to ensure continuity.

For portable motors a special wire is run from the nearest switch pillar or motor house.

Great care must be taken in coupling the earth wire to the earth plates. The wire ropes are easily spliced by men skilled in the work in pits.

Switchboards.—There are now many excellent types of switchboards for underground work, self-contained and strongly enclosed. Interlocking devices prevent any access to live parts.

The framework of a panel or switch should never be built into the walls, as squeezing and rising of floors is always going on to some extent. Each panel, or group of panels, should have a certain amount of freedom to follow these movements; otherwise straining will ensue, and prevent the blades of a switch from making proper contact.

All switches, circuit-breakers and controllers should be immersed in oil, even with direct current.

Direct-current switchgear is receiving more attention from designers, and its immersion in oil is meeting with great success.

A direct-current arc is more difficult to break and confine than that of an alternating current. The alternating arc breaks at zero value, and its intensity diminishes as the frequency increases; thus an arc at 60 periods is easier to confine than one at 25 periods. A direct-current arc is more prolonged and vicious. An effective magnetic blow-out together with immersion in oil will add greatly to the safe use of direct-current switchgear.

A convenient form of circuit-breaker to adopt for use in mines is the compact tramway type. This is very suitable for coal-cutters, and fuses for this work are rightly being abandoned. Controllers for coal-cutters should be fitted with a strong ratchet device to ensure uniform starting. Reliable automatic overload cut-outs are plentiful, and should replace all fuses. Fuses for induction motors are anything but reliable as a means of protection against ordinary overloads. They have to be large enough to carry four or five times full-load current at starting; they are, therefore, useless for ordinary troubles.

The same difficulty applies to an A.C. overload circuit-breaker. This difficulty is not insuperable. Some mechanical device can be arranged to throw the relay catch out of gear whilst switching in. When the motor has attained full speed, the relay can be released and set to operate at a suitable overload.

The lines of all switchgear should be as simple as possible, dust and dirt-proof, and contact with a live part impossible.

Where a switch and controller immersed in oil are combined in one case, and there is much starting and stopping, efficient ventilation is important. The fumes rising from the carbonised oil should be allowed a free exit, due care being taken that no flame can escape. If the oil is at its correct level there will be no escape of flame.

An ammeter should be provided with every motor-panel above 10 H.P., and a voltmeter or lamp to indicate whether pressure is on as soon as the isolating switch is closed.

In a fiery mine, remote control of any motor, that is, starting up a motor which is out of sight of the man in charge, should never be allowed.

Transformers. — For underground work oil-immersed transformers are in general use, and should be the only type employed. Oil sights should be fitted and frequently inspected; unless this is attended to, trouble follows, either through creeping and sometimes overflowing, or through overheating if the level is too low.

Earthing the neutral of transformers when star connected is sometimes done, but more often not. It is perhaps better not to earth it, as there is often trouble with instruments and other small auxiliaries if earthed.

Transformers in mines should not be connected in delta, as with this connection it is possible for motors to continue running with a defective phase. In a mine no apparatus should be allowed or able to continue to run under such conditions.

The employment of good static earth detectors, in conjunction with a frequent insulation test by a good Megger or Ohmer, will generally indicate the state of the cable system and detect any gradual deterioration.

If all casings are well earthed there will not be much danger of shock to person.

Lighting.—It is generally better to employ special transformers for lighting—stepping down to 50 or 25 volts.

All motor houses should be liberally lighted, the wiring being slung on insulators and in sight.

Motors.—With alternating current the squirrel-cage induction-motor is the ideal one. It is, however, handicapped by its low starting torque, and heavy current consumption at starting.

Where heavy loads must be started, and speed variation is necessary, as in hauling, the slip-ring, wound-rotor type is adopted.

By means of the slip rings and external resistance, any slip or speed can be obtained. This type has also the advantage of a high starting torque, and will not fall out of step, as the maximum effort is not reached till the motor is nearly at rest. As a variable speed motor it is not efficient, and should be run up to speed as soon as possible.

The squirrel-cage motor is more adapted to centrifugal pumping conditions and to endless rope haulage where full-load effort is not suddenly thrown on it. This type should be adopted wherever possible, on account of its simple and robust construction.

Synchronous motors do not find much scope in mining work. For small powers they are, perhaps, out of the question, but the larger sizes can be well adapted. The chief drawbacks are that more skill is required to start them, and surging or pumping occurs when heavy loads disturb the line.

But even with these defects, they are always justified in the case of a fan drive, which is in continuous service and forms a perfectly steady load.

The great saving, by the increased power factor, in the generator capacity and line losses will easily compensate for their apparent delicacy. This saving amounts to about 15 per cent., and in some instances, where the other motors on the system are well loaded, to 20 per cent. in the generator.

Coal Cutters.—Squirrel-cage motors are proving best in this branch. With liberal power on the generator, motors up to 15 H.P. can be thrown on the line without undue disturbance. Above this, auto-starters should be employed.

Winding.—The advantages of electricity for underground purposes are at once apparent to even the most conservative of mine proprietors and managers.

Cost, more often than not, was the least of the problems in excavating the old large steam pumping rooms, where the large unsupported roof area was a continual source of apprehension. The new compact high-speed 60,000-gallon capacity pump room of 16 ft. × 12 ft. × 10 ft. means a saving not only in first cost, but also in worry.

The saving and advantage are not so apparent when applied to winding. Lately the exhaust and mixed-pressure turbines have covered up the multitudinous defects of the steam winder, thus retarding the steady advance of the electrical method.

It cannot be disputed that where a bulk supply, or a large power plant supplying a group of collieries, is at command, the electrical wind proves itself a really practicable system, and in conjunction with the general adoption of electrical plant at the pits is the means of effecting very great economies.

Electrical machinery is to-day as reliable and durable as other classes of machinery. It is more flexible and more easily controlled, and in view of present-day conditions affords the best means of meeting competition safely and profitably. The plant must be of the best quality, and under skilled supervision.

SIMPLICITY IN DESIGN.

By ALINGTON JOHNSTON.

It is not my intention here to apply the above heading to any individual piece of plant or apparatus, electrical or mechanical, although simplicity should be the aim and object in machinery of every description, if it is to have any commercial value.

The heading of this article is more in view of the general arrangement and lay-out of individual pieces of machinery and their adjuncts, in order to form the simplest and most efficient grouping possible from an operative point of view.

My intention is to show how necessary it is to adopt the most simple methods as regards both the steam and the electrical side of a large generating station, so as to facilitate quick and easy operation and low maintenance. Only too often we see this object totally disregarded, and the plant a source of annoyance and trouble to those who have charge of the undertaking.

Simplicity is often absent due to governing factors, and difficulties arise which cannot be surmounted, try as you will.

One of the greatest factors is the site of an undertaking. For various reasons, we are not always able to pick and choose, and in a crowded district a site may be settled upon which has distinct disadvantages, but is the only one available; sooner than delay the scheme the ground is bought, or leased, and erection started. As the site is not all it might be, it is likely that the delivery and handling of coal will be complicated, and a good water supply difficult to obtain without elaborate arrangements with regard to pipe-work and pumps. These items and others all tend to complicate the running of a station, and add heavy maintenance charges.

Putting aside the above case, we will consider a site which has advantages instead of disadvantages—facilities for coaling, adequate water supply, and unlimited space. Here is an opportunity. The general lay-out of the buildings and plant should be such that access is easy to all parts, and no complications should arise. Bear this in mind, and a sound and creditable engineering feat will result.

The engineer's specification undoubtedly plays the most important part, and is the oracle to which both parties turn, contractor and engineer, in times of uncertainty.

Specifications should be made as short as possible, and to the point, stating exactly what is required in clear, concise terms, and not written like a technical book.

A specification is not intended to teach a contractor his work, but to show him the essential points which his machine or machines *must* fulfil, and without which they will not be accepted. Leave him to supply a good sound piece of work, which he will do for the sake of his own credit and future business.

Be careful in arranging the contract for the plant, and avoid having a number of different firms to do the work. A multitude of sub-contractors is conducive to chaos of the worst kind. With numerous sub-contractors the work is very often prolonged beyond the specified date of completion, and from start to finish is a cause of annoyance to everyone concerned. No one knows where his work begins or leaves off.

Suppose we assume the generating station to be modern and up to date in every respect, and to consist of steam turbines driving generators to supply current at high pressure over a large area. There are then three divisions of work to be considered: the boiler house, the turbines and generators, and the switchgear.

Let these three divisions represent three separate contracts, and the firms who get the work in each case will be the only people known from start to finish.

This *is* possible, as a firm tendering for the boilers would be in a position to supply most of the boiler-house plant. There are well-known firms who do this. The above also holds good with regard to the engine room. The third and last division—namely, high and low-tension switchgear, instruments and cable work pertaining to this contract—could also be done by one firm. I do not claim that the plan can be carried out in its entirety, but it could to a very great extent, and would simplify matters immensely.

Here is an example in my own experience of the equipment of a boiler house *alone*. The sub-contractors numbered *eight*. The result was, that with few exceptions, none of the work came into line. It was altered and rearranged time after time, and the confusion of mind and matter was parallel to the building of the Tower of Babel.

Another essential item is accessibility. It is often totally disregarded, and the plant, especially basement plant, is so terribly congested that it is with the greatest difficulty that repairs and running operations are carrried out.

We must not lose sight of the fact that there is generally an expensive overhead traveller in an engine room, which is not put there for the sole purpose of dealing with the erection of the plant, but is intended to handle, as far as possible, all machinery, big and small, in the station; and if machinery is congested and tucked away under concrete floors and in odd corners, or in among a mass of pipework, the traveller is not of much use. Heavy lifting tackle, and all sorts of unnecessary "fakes" are employed instead, entailing inconvenience and delay.

The grouping of plant is a most important question, and should be so arranged, as far as circumstances will permit, as to allow of a direct lift for the engine-room crane. Unnecessarily heavy floors of steel joists and concrete and badly designed foundations are generally responsible for difficulty of access.

The tendency in present-day practice is to keep this important point more in view, and instead of the basement being a dungeon, with no head room and "boxed" in, there are large open spaces left protected on the engine-room floor level by hand-rails. The covering, where a floor is needed, is composed of neat gratings, which can be easily removed to get at any machinery situated beneath.

Nearly all running plant in connection with the condensers and water supply can be installed in accessible places if forethought and common sense are exercised. The items which are most abused, and which come as afterthoughts in many undertakings, are pipework and provision for running cables and small wiring. The last is treated as quite an insignificant detail, but what looks more unsightly than badly-arranged cable runs? If the auxiliaries are all motor driven, as they would be in a modern station, a large amount of wiring is required, and if provision for direct runs has not been made in the building and foundations, a great deal of trouble and ugly work is the result.

It is my opinion that in the design and lay-out of central stations, more than in any other branch of engineering, we neglect past experience, and allow mistakes to occur which have already been proved bad practice, and have hampered schemes of a like nature in the past. There can be no turning back, for this would bring disaster to everyone concerned. So the undertaking drags on with a veritable millstone hanging from it, in the shape of heavy maintenance and repairs and low economy in the plant.

TURBO-ELECTRIC PROPULSION.

By A. P. CHALKLEY, B.Sc.

The following reference to electro-mechanical propulsion appeared in the *Financial News* of August 25th. It is these hasty and inaccurate statements which are most harmful to new projects, since people believe them to be based on real grounds, and it will be as well to point out some of the many fallacies which occur—indeed, it would be hard to conceive more false conclusions in so short a passage :—

> TURBO-ELECTRICAL PROPULSION.
>
> In reference to the suggested turbo-electrical propulsion for steamships, a correspondent writes pointing out some of the difficulties which would have to be overcome before such a system could be rendered practicable. The most serious objection, he says, is the liability of electrical insulation to break down from dampness, and a ship's main driving power may become utterly useless from a small cause. If large quantities of water obtain access to the engine room, serious results must follow, and while any form of mechanical propelling agency may be repaired at sea, there is little hope of coping with an electrical breakdown. Further, the design of the main motors seems a formidable task. The main

result is efficiency at sea speed, for which purpose constant running has to be provided for and overheating liberally guarded against; but reversibility by controllers of large size is necessary, and the motors must be capable of large initial torque and of being run dead slow and at varying speeds for long periods, as in channels, or during fogs, whilst the windings and resistances must not get too hot. Altogether, the designers' task is especially onerous, and the fluctuations of voltage due to starting the main motors from a generator with no reserve power, and the varying amperage, due to drop of voltage at starting, would be most severe upon the equipment. In marine turbines the incoming steam neutralises the "thrust" on the propeller shafting; but motor-driven shafts would be subject to the large friction from this cause. Finally, sea-going electricians of a high degree of expertness would be necessary.

Taking the first and "most serious objection," the writer presumably means that not only the cables, but also the generators and motors are liable to breakdown, owing to the insulation being destroyed by dampness. All the electrical portions of the plant are very low in the ship, far removed from the outside atmosphere, and the air is quite the warmest and driest of any part of the vessel, and there is not the slightest reason for any deterioration in the insulation, which, as a matter of fact, would probably improve. The very large motors employed in mines for winding and other machinery, and rolling-mill motors for steel works and factories, operate under conditions far more severe than would the dynamos and motors placed in well protected positions in the depths of a ship. That there is not the least danger may be inferred from the fact that trouble is never experienced with the large dynamos now used on ships for lighting and power, and it is a fact for which the present writer can vouch, that in the case of the *Mauretania* the insulation resistance of the dynamos increased considerably after some months' service. The higher voltage which would be used for turbo-electric propulsion does not alter the question, since the insulation in the first instance would be relatively stronger, and since 220 volts is now the common working pressure on battleships, the increase to 500 or even 1,000 volts with electric propulsion is not a very big change. Indeed, we may regard as an indication that the danger to insulation at sea is being recognised as a fallacy, the fact that the Admiralty has been gradually raising the voltage of electrical supply on warships, and there are several firms who would be perfectly willing to guarantee to maintain a 3,000-volt turbo-electric system for an indefinite period without a single breakdown in insulation.

The next interesting point raised is the trouble which would ensue if water entered the engine room. The writer here shows a lamentable lack of knowledge regarding sea-going conditions. If he implies that the whole engine room and stokeholds become full of water, nobody will deny the statement that "serious results must follow," but it is difficult to see how there would be any difference in the two cases. In the event of this *very* improbable contingency, everything would be at a standstill, and neither electrical nor mechanical machinery would be capable of driving the ship if the plant were totally submerged. If, however, the engine room became partially filled with water, the electrically-propelled ship would be better off than the direct driven, since the castings are smaller and lighter, and the turbines and generators would be placed considerably higher in the former case. But the point has evidently been forgotten that all modern ships are divided into watertight compartments, and the effect of one compartment being filled is not very disastrous, since it can be at once isolated by closing the doors and the water pumped out. The great advantage of electric propulsion, if this should happen, is easily demonstrated. Consider a ship with two engine rooms, one of which becomes full of water. With the electrical system the remaining generator would continue to run and supply *both* the motors driving the propeller shafts, so that the boat need not stop, but if the ship was direct driven, it would certainly be inadvisable to run with only one propeller, as would be necessary.

It is next stated that there is little hope of coping with an electrical breakdown—a remark which is somewhat difficult to follow. Unless the plant had been totally submerged, the repairs necessitated by the influx of water would be quite insignificant, and with regard to general reliability, electric propulsion has much in its favour. All the ordinary accidents to which electrical machinery is liable are much more easily overcome than those of steam engines and turbines. If a turbine strips at sea, if a piston engine cylinder cover is forced out, if a connecting rod breaks, its repair is seldom attempted; but if an armature coil burns out, or even if a short occurs, the fault is soon located, and a few comparatively unskilled men can put matters right in a very short time. Besides, it must be remembered that serious accidents rarely happen to electrical machinery, as it can be so much more efficiently protected than steam plant with fuses, circuit-breakers, and other safety devices. It may be said that there is still the danger of breakdown of the steam turbine with turbo-electric drive, but this, curiously enough, is not so great as with the direct drive. Blade stripping at high speed is much less likely, owing to the very much smaller cylinder castings (due to the higher speed and the smaller power required), which consequently minimises the risk of distortion. Moreover, there are no astern turbines, where the greatest possibility of stripping often occurs, as exemplified by the *Mauretania.*

With regard to the design of the main motors, the writer is wrong on practically every point he raises. Certainly it is interesting to be told that overheating is to be guarded against. Is this a new or insuperable difficulty in the design of motors and generators? Probably he is under the impression that direct current will be used for electric propulsion, but this, of course, is not likely. The controllers for reversing will be very small instead of very large, since it is only necessary to have a simple switch to reverse the phases either in the motor or generator, as explained in a previous article. (See Electrical Review, July 23rd and 30th, 1909.) The motors need not have a very large starting torque—a ship is not like a tube train requiring to reach full speed in 30 seconds—but by means of the simple switchgear they can be stopped and reversed in a few seconds. They must admittedly be capable of running dead slow and at variable speeds for long periods, and this is just where electric propulsion has an enormous advantage over the direct drive. As was shown in a previous article, in the electrical system the motors run at quarter, half, three-quarter or full speed at practically the same efficiency, whereas in the case of the *Lusitania*, the steam consumption at 15 knots was 40 per cent. greater than at 25 knots.

The extent to which the writer understands the problem is suggested by his statement that the windings and resistances must not get too hot. It is, perhaps, sufficient to say that there are no main resistances, and hence the likelihood of their becoming too hot is rather small; all the regulation is, of course, carried out by a transformer arrangement.

We further read that the generators have no reserve power, which may be needed when the motors start—a wild remark which betrays complete ignorance of one of the most characteristic properties of turbines. Even if the motors required more than full power when they started up—which they do not—turbo-alternators, as is well known, can easily take 30 to 50 per cent. overload without appreciable drop of voltage. The machines at Lot's Road, designed for 6,000 KW., often run at 9,000 KW. for some time, while those at Carville (nominally 4,000 KW.) develop 7,000 KW. for an hour, and exactly the same type would be adopted at sea. The idea, therefore, of a highly improbable overload being severe on the machinery is somewhat amusing.

The question of the thrust on the propeller shaft is unworthy of discussion, since motor-driven shafts are in exactly the same position as those driven by reciprocating engines. Apparently the writer has never heard of the propeller thrust block.

The last sentence is pathetic, and perhaps explains this strenuous opposition. "Sea-going electricians of a high degree of expertness would be necessary." Why not? Are there not enough of them?

Tungsten Lamp Patents.—According to the *Electrical World*, the General Electric Co., U.S.A., which already owns the Just & Kuzel patents, has now purchased all the American patent rights covering the tungsten lamps of the Bergmann Electric Works, Berlin, for the next ten years.

MUNICIPAL TRAMWAYS ASSOCIATION.

The Central Repair Depôt of the L.C.C. Tramways.

Abstract of paper by W. E. Ireland, *Rolling Stock Superintendent.*

This depôt is situated on a site close to the River Thames at East Greenwich, some 6·9 acres in extent, and adjoining the Angerstein Wharf branch of the S.E. and C. Railway, from which it is proposed to construct a siding leading into the depôt.

Fig. 1 shows the general plan arrangement of the buildings which will comprise the completed depôt, whilst fig. 2 shows a cross-section. The portion within the hatched lines covering 3·25 acres, is practically finished and has been in use some months, this consists of smiths', machine, wheel, truck overhauling, inspection, body and paint shops, and tool, finished part and general stores on the ground floor, with electrical repair, plough, tool, light machine and pattern shops on the galleries.

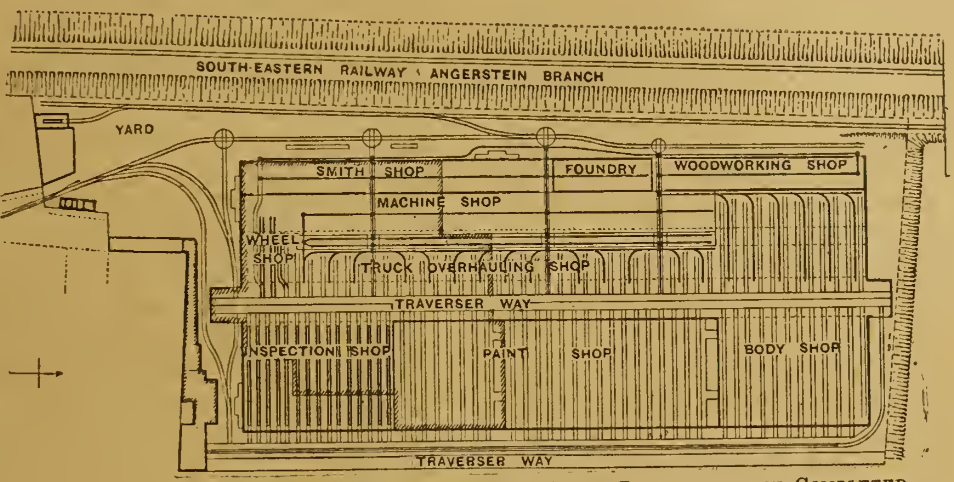


Fig. 1.—Plan of the L.C.C. Central Repair Depôt, as Proposed when Completed.

The buildings were designed and erected under the supervision of Mr. W. E. Riley, the Council's superintending architect, and have a capacity for dealing with the overhaul of 600 cars per annum; they are arranged on a definite scheme for dealing expeditiously with the cars during the two weeks each has to be in the shops for its annual overhaul and renovation.

The Metropolitan Police Regulations require the body work and painting of each car to be thoroughly renovated once in every 12 months. Advantage is therefore taken of this regulation to systematically overhaul and put into first-class condition the whole of the mechanical and electrical equipments of the cars. The layout of the depôt is arranged so that regular and synchronous progression of the work in the several shops is ensured.

The works superintendent issues forms, which are forwarded to the rolling stock superintendent, requesting the cars becoming due for renovation in any one week to be transferred from the several car-sheds from which they operate in service, to the repair depôt on the Sunday night; each car after entering, sheds its plough by means of a special run-out arrangement. A small steam locomotive then draws the car into the depôt through the porch-like entrance and on to a specially constructed shallow traverser, by means of which it is taken into the inspection shop. Here on the following morning an inspector carefully examines the car, noting the repairs required, and compiles a detailed list of the necessary work for the information of the superintendent. While the car is in the inspection shop the brake rigging and other parts of the trucks and equipments are disconnected, and bearing caps and bottom halves of the gear cases taken down ready for dismantling. The car is again drawn on to the traverser, a pneumatic jack placed under each side of both headstocks and the body lifted clear of the trucks. The traverser is then moved along the pit, carrying the trucks from beneath the body to a point immediately under one of the lighting wells provided in the floor of the gallery above. Here the motors are lifted by an electric travelling crane running on a gantry above the gallery to the motor overhauling shop, and the trucks sent into the truck shop on the western side of the traverser pit. The body is then placed upon a temporary truck and taken into the body shop for the attention of body makers and wiremen. The work required on the trucks, motors and bodies usually takes about four days to complete, at the end of which time the whole car is reassembled ready for the paint shop.

The paint shop is cleared of its finished cars every Sunday and the overhauled and reassembled cars placed in readiness for the painters to start their part of the work the first thing on the following morning. The painting and varnishing occupies a week, it being a rule that each week's output of renovated cars is ready for inspection by noon on the second Saturday following the day upon which they were received at the depôt.

The foregoing gives a general idea of the routine as formulated, but owing to the fact that the depôt is not yet in a finished state, it will be evident that some minor departures from the strict observance of this routine are inevitable.

The smiths' shop contains 14 down-draught hearths, two 5-cwt. motor-driven pneumatic power hammers, one Ryder forging machine, one drop hammer with ½ ton tup, one forging and annealing furnace, one double-head emery grinder, one punching and shearing machine, a 60 in. exhauster and 17½-in. blast fan.

Stoneware ducts 30 in. dia. are laid in the ground and provided with suitable branches brought to the floor level for connecting with the draught pipe of the hearths. These ducts terminate in a square brick chamber at the southern end of the shop into which a 60-in. exhauster is built. This arrangement not only provides for the efficient extraction of the smoke, dust and fumes, but also ensures very satisfactory ventilation throughout the shop.

The blast pipe is also composed of stoneware ducts laid alongside the exhaust mains under the floor, with branches brought to the floor level. That this method of dealing with a smiths' shop has proved satisfactory will be readily appreciated from an inspection of the shop, for although work has been in progress at practically all the fires continuously since June, 1908, the walls are almost as free from dust and dirt as when the shop was first opened.

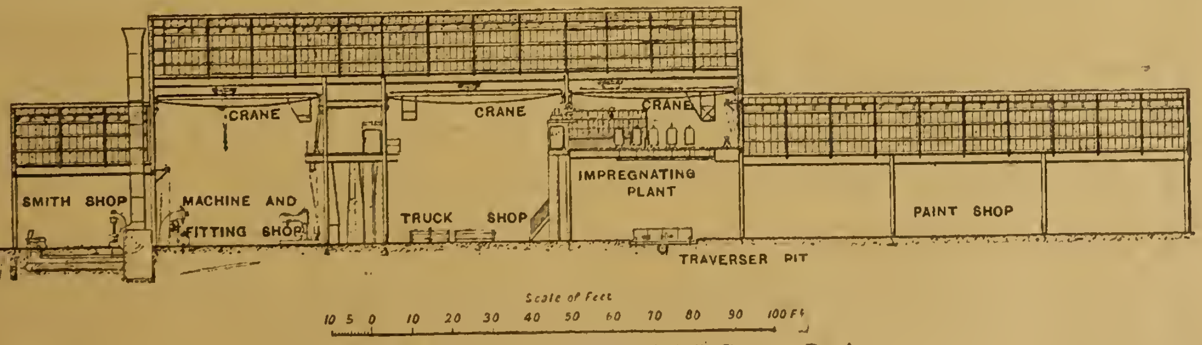


Fig. 2.—Cross-section Through the L.C.C. Repair Depôt.

The hearths and anvils are set at an angle in relation to the longitudinal centre line of the shop, thus enabling the maximum length of bar to be handled at each without incommoding the work in progress at the next fire.

The wheel shop is equipped with three high-speed tire turning lathes, three tire boring mills, one 150-ton power wheel press, one wheel boring machine, one 4-hole gas tire heating hearth with jib crane and pneumatic hoist, and half-a-dozen jig saws for cutting off tires. The tire-turning lathes are motor-driven and capable of taking the heaviest cut on high carbon-steel tires that modern high-speed steel will withstand.

The cutting power of these machines was calculated upon turning at the rate of 50 ft. per minute; up to the present time it has not been found possible to get above 30 ft. per minute cutting speed on tires of from ·60 to ·68 carbon, skin hardened by months of constant rolling on the track.

One of the most important points to consider when specifying for or designing a machine for turning high tensile tires is the rigidity of the machine. Both tramway engineers and machine-tool makers appear to have treated this point too lightly in the earlier types of lathes, with the result that the work took far too long to do, and owing to the vibration set up in the machine, only light cuts could be taken even with high-speed steel tools. Tests have been made in the Council's shops on both types of machines, and it has been noted that the tools failed much sooner with a light cut on a machine which "chattered" than with a heavy cut on a rigid machine, and whereas, in the earlier type of lathe, from eight to ten hours were required to re-turn a pair of tires, or an average of six pairs per week of 54 hours, with the machines now in use the average output of each machine is six pairs per day or 34 pairs per week of 54 hours.

The life of steel tires made to the Council's specifications averages 56,000 miles for pony wheels and 50,000 for driving wheels. This gives an average rate of wear per ½ in. radial reduction of thickness of 5,090 miles and 4,545 miles respectively.

The tire-boring mills were specially built to the Council's specification; pneumatic hoists are carried on jib cranes above the mills for lifting the tires on to and off the machines. At the present time some 430 new tires and 575 pairs of wheels complete are handled in this shop per month, or an average of 5,160 and 6,900 respectively per year.

The machine shop is equipped with a 3-ton three-motor electric crane running the full length of the shop; a number of lathes, by well-known makers, also milling, drilling, screwing and tapping machines.

The space at the northern end is occupied temporarily by an oil and waste-saving plant consisting of two turbo-centrifugal machines, one rotary washer and two oil filters by the Oil and Waste Saving Co. This useful plant is capable of dealing with all the wool waste from axle boxes and bearings, in addition to the ordinary cotton waste and wipers used at the car-sheds and works.

The plant is designed to handle about 20,000 lb. of wool waste and reclaim some 12,000 gallons of oil per year, and it is estimated that the saving due to this alone will be in the neighbourhood of £600 to £700 per annum, exclusive of the cost of labour involved in handling the material, which, together with the cost of soap powders, steam, power, &c., will probably not exceed £150 per annum.

The centre of the shop between the machines is occupied by fitters' benches, equipped with the usual parallel quick action vices and also a marking off table. The line shafting is driven by five 36-H.P. polyphase motors, each attached to the upright stanchions. The shafting is divided into five sections, coupled by means of claw couplings, so that any section may, if necessary, be run independently of the others. Several of the machine tools in this shop have been built to the Council's specifications, and are adapted for work of a special character.

The power hack saws, special vertical milling machine and four-spindle drilling and tapping machine form the main part of a special plant for machining magnetic brake shoes, of which a very large number are used. The material for making these shoes is obtained in the bar direct from the rolling mills, and is cut into lengths by the power hack saws; after cutting to correct length the bars are placed in a jig on the milling machine table, which will accommodate 48 shoes. The cutter is of special form to the author's design, and carries 14 high-speed steel tools for roughing and two tools for finishing. The diameter of the cutter determines the width of the register cut in the shoe, and the depth of the cut averages $\frac{3}{16}$ in. The rate of feed of the table varies from 2 in. to 4 in. per minute according to the size of the cutter used, and the cutting speed of the tools is 70 ft. per minute. This machine when working on shoes for the largest magnet will machine a gap 18¾ in. in length by $\frac{3}{16}$ in. deep at the rate of 60 shoes per hour. The power required for cutting at this rate is about 25 H.P.

In each shoe two ¾-in. holes require to be drilled and tapped, and the four-spindle machine was designed to deal with this work; the shoe, carried in a jig which slides along the table, is first set under the drill spindles and the two holes drilled simultaneously; it is then moved to the tapping spindles and the two holes tapped simultaneously.

The tool, finished part, shop, and general stores are located immediately beneath the small gallery and between the machine and truck overhauling shops. All tools are served out to the workmen over a counter, and to keep track of each the recipient is required to sign a ticket, which is placed in the bin from which the tool is taken. The shop store is used for parts in course of progress through the shops.

The general store, which contains a 20-ton weighbridge and some 7,000 steel bins, is used for the storage and distribution of such parts as are usually obtained from outside manufacturers, and stands in relation to the shops generally as does an outside supplier to a manufacturing works, this part of the organisation being under the supervision of the superintendent of the tramways stores.

The truck shop is equipped with two 5-ton three-motor electric cranes, and the usual fitters' benches, vices, pneumatic drills, hammers, chippers, &c. There are 14 working tracks, each capable of accommodating four bogie trucks or three single four-wheeled trucks. A narrow gauge industrial railway track runs along the full length of the shop on the side adjacent to the stores, with branch lines between alternate pairs of truck tracks. Two small battery-power motor-driven service wagons are in course of construction for the purpose of transferring material from or to the stores and other parts of the depôt and the men employed on truck overhauling. Pneumatic lifting jacks made to the author's design are installed in this shop for lifting the bodies off their trucks.

In this shop the trucks are first taken in hand for cleaning, after which all bolts, pins, links, brake rods, &c., are taken off, examined, and those which have worn are either scrapped or repaired, and replaced by new or replaced after repairing. The end and centre sills are taken off and the trucks squared up by trammelling diagonally across from centre to centre of the horn blocks. It has frequently been found necessary with the early types of trucks to either lengthen or shorten one of the side frames to bring the truck square.

All brake gear parts are thoroughly annealed, screwed parts are cut off and new ends welded on and screwed, the holes in the jaws of adjusting rods, links, &c., are closed in the smiths' shop and opened out to correct size by redrilling for the pins. The brake shoe holders, brake beams and shoes are removed and worn parts made good. The chains are removed and each link carefully examined, all faulty ones removed and replaced by new, and the whole chain carefully annealed before being put back on the truck. Axle boxes are thoroughly cleaned, the wool waste and oil removed and treated in the plant referred to elsewhere. Axle box bearings are removed and replaced with new ones where necessary, whilst those bearings which have a longer life are replaced after the sides have been eased in the machine shop. All springs are removed, corrected for size and retempered when necessary. Wheels and axles are removed, and the tires either returned or renewed as is found to be necessary; gear wheels are examined and renewed as required.

The Council's method of dealing with the gear wheel and pinion problem gives excellent results in practice.

Case-hardened steel pinions have been in use since 1906, and are now standardised. They were first tried on the single-deck steel cars when the Kingsway subway was opened for service in 1906. The pinions then fitted are still in service, and the average mileage of the 32 pinions on these cars is to date slightly over 110,000 miles each, whereas the average life of unhardened pinions working under exactly similar conditions is from 19,000 to 20,000 miles each.

The life of ordinary cast-steel gear wheels meshing with the case-hardened pinions is also improved. This is probably accounted for by the fact that the hardened teeth retain their correct shape for a much longer period than unhardened teeth, with the result that they transmit a uniform rolling motion instead of the combined rolling and sliding motion transmitted by partly worn teeth, which naturally causes greater wear of both pinion and gear teeth in a given time.

The steel has the following analysis:—Carbon, ·15 per cent.; silicon, ·02 per cent.; sulphur, ·05 per cent.; phosphorus, ·05 per cent. The pinions are specified to be case-hardened to a depth of not less than $\frac{1}{16}$ in. from the surface of the teeth, the centre being left soft.

A lubrication mixture which gives excellent results is composed of black axle oil and sawdust mixed in the proportion of 42 gallons of oil to 216 lb. of sawdust, the cost of which works out at approximately 4s. 8½d. per cwt. The mixture is liberally applied and found to quieten noisy gears to a remarkable extent, in addition to providing an efficient lubricant for the teeth.

The traverser pit occupies a central position in, and extends the full length of, the building; the track rails are laid to 13 ft. 6 in. gauge with standard L.C.C. conduit work in the centre.

When the second or exterior traverser pit is constructed, it is proposed to lay a pair of rails on each side of the centre conduit at 4ft. 8½ in. gauge and make use of this as a track for testing the cars, each of which will be run and the brakes and equipment tested before being sent to the car-sheds for service.

The inspection shop, situated at the south-eastern end of the building, has 15 tracks with pits, and the gangways between the pits are 1 ft. 1¾ in below the rail level. This shop is equipped with hydraulic pit jacks, and a system of compressed air pipes with cocks at frequent intervals for connecting to pneumatic drills and other portable tools.

The painting shop has eight tracks each capable of accommodating three cars. Between each pair of tracks H section columns are fixed, provided with movable wrought-iron brackets for supporting planks on which the painters stand. These brackets have vertical adjustments at 24 in. intervals.

The shop is heated and maintained at a temperature of 60° F. when the outside temperature is at 30° F., by means of nine small steam heated units of the Stanlock system. Each unit is capable of condensing 100 lb. of steam per hour, and circulating from 2,000 to 2,200 cb. ft. of warm air per minute, the circulation being effected by a small motor or belt-driven fan attached to each unit. Eighteen similar units are disposed in the several shops where heating is required.

A small gallery is located immediately above the stores and between the machine and truck shops, a temporary pattern-makers' shop, tool shop, and a number of light machines are located on this floor. One 20-H.P. polyphase motor with auto-starter operates all the tools on this gallery.

The large gallery, located above the traverser pit, is served by a 3-ton three-motor electric travelling crane.

The southern end of the gallery is occupied by the test room; here all re-wound and repaired armatures are placed in testing frames and run on load in both directions, the artificial load being absorbed by a Froude water dynamometer. Brake magnet and field coils are tested for continuity, internal short circuits and ohmic and insulation resistance, before being replaced on the cars after overhaul, and all repaired and new ploughs pass under the inspection of the test room attendant before being despatched to the car-sheds for use on the cars.

The method of testing field and brake magnet coils for internal short circuits presents some points of interest, and in view of its simplicity is perhaps worthy of description. A frame of Swedish transformer iron which is shown by fig. 3 has a hinged yoke across the top which is counter-balanced as shown and made to lift clear of the front limb of the frame.

The back limb carries a permanent coil which is excited from one phase of the A.C. supply and forms the primary coil of the transformer. The coil to be tested is placed on the front limb and the hinged yoke dropped into position. Just above the transformer is a panel containing the ammeter which indicates the current flowing in the circuit. If the coil to be tested has no short circuit the current flowing in the primary circuit will be so small as to be scarcely readable on the ammeter; if, however, there is a short circuit in the coil, even if but one turn, an appreciable current will flow and be indicated by the ammeter.

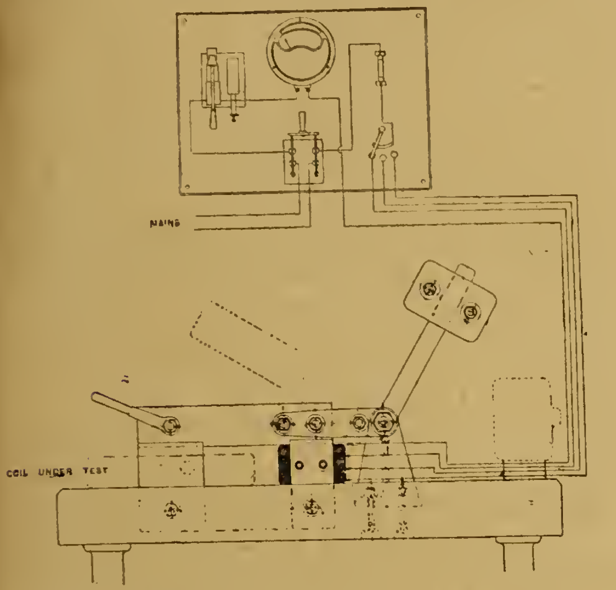


Fig. 3.—Testing Transformer for Magnet Coils.

With the exception of the space at the northern end of this gallery floor, occupied by the office block and the advertisement plate stove, the remainder of the gallery is used as an electrical repair shop. Here the following plant is installed: two commutator turning and grinding lathes, two armature banding lathes, and six coil-winding machines. Here all ploughs, motors, armatures, controllers, field and brake magnet coils are dealt with.

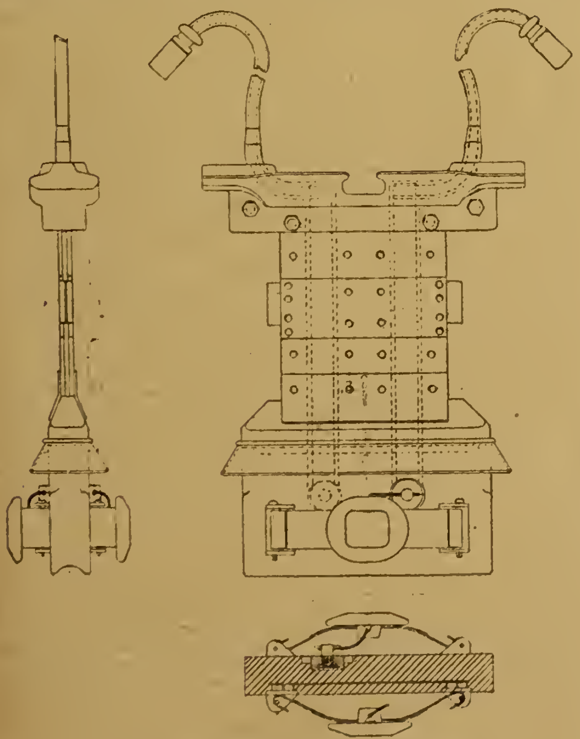


Fig. 4.—Standard L.C.C. Plough.

The commutator grinding and turning lathes have in practice shown distinct advantages over the usual method of simply turning the commutators and finishing off with glass paper.

A plant is installed for vacuum drying and impregnating armatures, field and brake magnet coils, &c.

All the ploughs required for operating the cars on the conduit system are made and repaired at the depôt. There are two types of plough in use, one of which is made with a solid hard rubber base and the other is made with a built-up wood base, in both cases the fittings are similar and interchangeable one with another. A full set of jigs and press tools have been made in the tool shop for the rapid and economical production of the detail parts.

The steel frames for the rubber base ploughs are made and bolted together on a jig and sent to the rubber works for the bases to be moulded on, and to ensure accuracy of position of the base of the frame, the rubber makers' moulds are fitted with locating blocks which match those on the frame erecting jig. The steel frames for the wooden base ploughs are precisely similar to those for the rubber ploughs. The wood base is, however, made up and bolted on in the depôt.

Fig. 4 shows the general arrangement of the latest type of rubber base plough in use. The collector shoes are of cast-iron, and fastened to a spring by a wedge. These shoes have an average life of 8,000 miles and cost about 3½d. per pair. The friction plates are of steel, have an average life of 3,000 miles and cost about 9s. per 100, which includes the cost of labour in producing them. This works out at 1s. 10d. per 100.

The total maintenance cost of ploughs, including all renewals during the last financial year, was ·05d. per car-mile. A new rubber base plough costs about 107s.

The depôt is lighted throughout, both inside and outside, with the exception of the paint and inspection shops, and the offices, by 60 Sunrae flame arc lamps by Davy, arranged in series of 10 on the 500-volt D.C. supply.

The power supply is by three-phase H.T. 6,600-volt current supplied direct from the generating station at Greenwich to the transformer room which is situated outside the depôt.

The H.T. current is controlled by means of a H.T. automatic oil switch with an overload time limit relay.

Four 150-KW. single-phase transformers of the Berry type, one of which is a spare, have been installed; these transform the pressure from 6,600 volts to 220 volts.

A switchboard by Spagnoletti has been installed for controlling the H.T. and L.T. alternating current, and the D.C. supply.

Each feeder panel carries two feeders, one of which has in each case been provided to meet the demand in the extensions, additional spaces having been left for further panels to be erected when required. The feeders from the panels are led in underground ducts to various sections of the depôt, where they are connected to fuse distribution boxes, from which each motor circuit is taken.

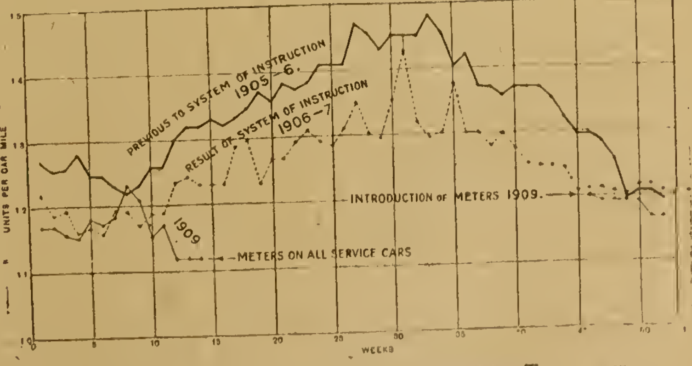
All feeders are of the three-core paper-insulated lead-covered type, the cables for the small ventilating fan motors are of the three-core V.I.R. type.

The installation of the electric lighting, power supply and telephones has been supervised by Mr. J. H. Rider, tramways electrical engineer.

Current Consumption.

A paper on this subject was submitted by Mr. R. S. Pilcher, of Aberdeen; the matter was fully dealt with by him in an earlier paper read before the Scottish Tramway Officials' Association, of which a lengthy report appeared in our issue of August 20th, page 292.

That good results may be obtained by careful instruction of the motormen and the installation of some type of meter, is evidenced by the current consumption curves relating to Aberdeen, which we reproduce herewith.



Current Consumption Curves, Aberdeen Tramways.

The author mentions that all the service cars on the Aberdeen system are fitted with ampere-hour meters, and (as shown by the curve) the current consumption is lower than it has been for the last five years, despite heavier cars. He believes that the actual type of meter employed matters little, as it is the comparison, day by day, with other cars on the same route, which is of value.

Some Comparisons of Continental and British Methods of Operating Tramways.

(*Abstract of paper by* A. R. Fearnley, *General Manager, Sheffield Corporation Tramways.*)

I think it will be agreed that the differences which at once impress one when inspecting Continental tramway systems are:—

The rigid adherence to the single-deck type of car.

The carrying of a large number of standing passengers, especially on the front and rear platforms.

The almost universal use of trailer cars.

The large and increasing number of vestibule cars (both motor and trailer cars).

The bow collector which is used in place of the trolley boom.

The provision of shelters or waiting rooms at important centres and junctions.

A further difference is now being introduced, viz.:—The provision of railess electric traction systems for developing ultra-suburban traffic, such as is catered for at present in this country only by the horse or petrol 'bus or by railways, until the population warrants laying down tramway track.

The most frequent objection that I heard or have seen to the use of double-deck cars on the Continent is that a great deal of time is lost in passengers entering and leaving the cars at the stopping stations, to which statement I anticipate few British managers will attach much importance. The most serious objection I heard advanced was one referring to the continued and lengthy absence of the attendant from the platform.

The best suggestions that I heard in favour of the single decker were that it can be readily coupled to a trailer and worked in this way without danger and inconvenience, and, what is equally important, the only additional attendant required may be a shedman or other employé of the department, not necessarily a regular traffic employé, the brakes being either magnetically or air controlled on both cars by the motorman, and these appear to be the most favourable arguments that may be advanced for its adoption in the first instance. In Sheffield the average current consumption per car-mile by the double-deck cars on our most hilly route is 1·64 units per car-mile, and on our most hilly single-deck car route 1·46 units per car-mile.

Another interesting comparison is in the mileage obtained from tires. The average taken from the double-deck cars under certain conditions is 4,505 miles per ⅛-in. wear, and for the single-deck cars under similar conditions 4,576 miles per ⅛-in. wear, or only 70 miles per ⅛-in. wear in favour of the single deck, with 46 per cent. less carrying capacity.

On comparing the life obtained from brake shoes, we find that:—

Double-deck	covered-top	cars	average	4,520	miles	per set of shoes.
,,	open-top	,,	,,	4,643	,,	,,
Single deck		,,	,,	4,530	,,	,,

Note.—Single-deck cars are worked on three routes, two of which have severe gradients; the third route is practically level.

The traffic wages are the same, except in cleaning, where there is certainly a little in favour of the single deck.

Other important arguments in favour of the double-deck car, without repeating many well-known points, are:—

Small quantity of rolling stock required.

Considerably less car-shed accommodation necessary. (Vienna, with a population of barely 2,000,000, has over 2,000 cars.)

Comfortable and very popular accommodation for smokers in all sorts of weather.

Judging by the way in which they are generally used, a trailer appears to mean additional accommodation for about 28 more passengers with each motor car. There are the increased wages and maintenance charges and the greater street area covered, together with the necessity for providing double track where the trailers are in use, also the extra current consumption (the Continental trailer appears to vary in weight from three to six tons), and the difficulty in placing depôts in suitable positions to avoid a large amount of lost mileage in taking the trailer on and off.

It is interesting to note that the use of the vestibule type of car is very general, and is rapidly on the increase on Continental tramway systems. In some cities it was probably provided in the first instance for the protection of the passengers riding on the platforms, and it now appears to be the exception for large Continental tramways not to have a considerable proportion of their cars provided with vestibules.

In 1907 I had the opportunity of experimenting with a bow collector which was manufactured by Messrs. Brecknell, Munro and Rogers, Ltd., for a Russian tramway, and whilst, of course, our overhead line had not been constructed for a collector of this type, we found that there would have been little difficulty in obtaining very satisfactory results with this arrangement if the overhead line had been suitable. I am of the opinion that the trolley boom, with its attendant overhead fittings, is the most unmechanical feature of the whole of our tramway equipment, and despite all that can be done in the way of perfecting our overhead work by keeping the line over the track, planting extra poles and fixing extra pull-offs to ease the curves and by regular and systematic examination of trolley standards, trolley heads and overhead fittings, there is still a big weakness in this attachment.

The cost of trolley upkeep in Sheffield for our last financial year amounted to £1,031 14s., or ·0336d. per car-mile. The cost on a line where the bow collector is in use was given to me as being ·041d. per car-mile, and, in my opinion, the bow collector would be a considerable advantage if it could be worked with such a small difference in cost.

In meeting the requirements of suburban districts lying beyond the point to which it is considered financially safe to construct tramway tracks, reports show that there are very considerable possibilities in the rail-less electric trolley car, and in my opinion, if it is given a fair trial without unnecessary restrictions and red flag regulations, it will, within the next few years, form an important addition to our tramway business.

In comparing this method of dealing with suburban traffic, I would say that I think it is superior to any system of horse, steam, electric, or petrol 'bus, which, so far as my knowledge extends, is at work in this country at the present time.

Some considerable time has now elapsed since the reports of the deputations regarding the feasibility of adopting the railless electric cars were made, and as yet no corporation has obtained the necessary powers to work such a system, but it is anticipated that at least two of our large cities (Leeds and Sheffield) will obtain these powers within the next 12 months.

Technical data concerning Electric Hub-Motors as in use on the Vienna Municipal Trackless Trolley System.—The electro-motor of the trackless trolley vehicle gives about 20 h.p. The field magnet is mounted on the axle, and resembles an internal pole star. The armature is placed outside, and forms a part of the wheel itself in such way that it revolves as a wheel around the pole star. The field magnet has ten poles. Each spool is wound in a patented way, and consists of a flat copper band of uniform section, but of variable width and depth. The armature consists of a great number of spools built into the frame of the wheel.

The collector is arranged in a vertical plane so that the vibration of the car cannot lift the brushes, which are fitted with special carbons.

The motors are placed in the back wheels for the trackless trolley system, but on lines of heavy gradient four motor wheels are employed—two at the back and two at the front—in which case the front wheels are fitted with a special device securing perfect steering even in the case of a sudden breakdown of one of the front wheel motors.

ELECTRICAL STEEL.

There is no doubt that the spread of electro-metallurgical processes has received an enormous impulse in recent years from the wide extension of cheap electric power supply. When we have in our own country such large power systems as that of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and other lands are favoured by such enormous water-power sources as the falls of Niagara and Shawinigan, to say nothing of the Scandinavian possibilities, there is no wonder that electric power is being applied to processes which were formerly considered to be the most remote from electrical engineering.

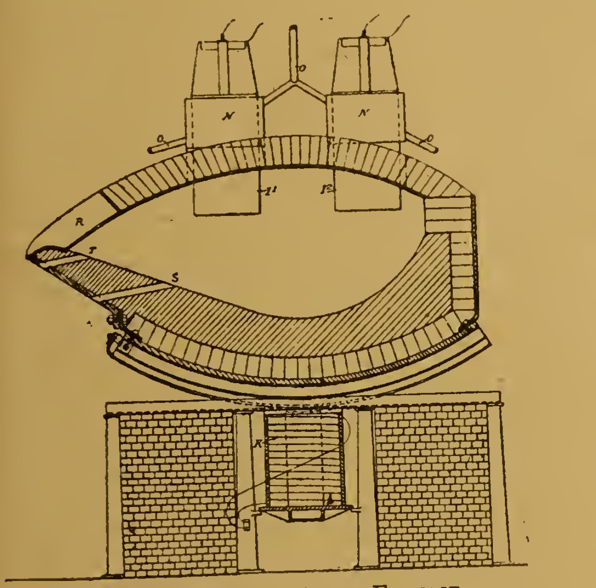
A notable case in point is the production of electric steel. At the present time some 67,000 h.p. is employed in America and Europe for the production by electricity of steel and its alloys, and the refining of low-grade steel and pig-iron. The use of electricity in metallurgical processes has in many cases resulted in the creation of industries in districts previously considered unsuitable. Wherever it is possible to obtain electricity cheaply, either from water power, steam-driven stations, or producer gas plants, it is feasible to put down an electric furnace.

If we assume that electricity can be produced at the rate of 40s. per electrical horse-power per year of 8,760 hours, it is found that by the latest processes of electric steel production one ton of steel-making pig-iron can be obtained at a cost of £1 15s. 6d., exclusive of the price of raw material. This figure is based on the cost of labour, repairs and maintenance, together with an average price of £1 5s. per ton of product for lime, electrodes, coke and electrical energy, and is the result of a 90-ton working test on a process which we are about to describe.

The high temperature at which the electric furnace works ensures almost complete freedom from phosphorus and sulphur in the iron, and assists considerably in the complete amalgamation, purification and deoxidation of the steel produced. Hence this is equal to the best crucible steel, and can be manufactured with traces only of silicon and manganese. Moreover, the precision with which carbon and metallic alloys may be added to the electric furnace renders it possible to produce steel of any desired grade and composition, ranging from tool steel to mild constructional steel. Added to this is the fact that occlusion of gases in the metal does not occur, and a product is therefore obtained which is free from blow-holes, uniform in composition as ascertained from analyses of drillings from different parts of ingots, and capable of being forged with great ease. By electrical processes practically pure iron has been produced, analysis showing 99·95 per cent. of true iron. Mr. Harbord, late Metallurgist to His Majesty's Indian Government, has concluded a report on the production of electric steel by saying:—"As a result of my investigations into the metallurgy of the electrical production of steel and the electrical smelting of pig-iron, I have come to the following conclusion:—Steel, equal in all respects to the best high-class Sheffield crucible steel, can be produced in an electric furnace at a cost considerably less than the cost of producing a high-class crucible steel."

Probably the most important application of the electric furnace, so far as existing steel works are concerned, is the electrical purification of low-grade steel and pig-iron, as by this means steel can be produced to any specification. When dealing with pig-iron, the metal in its molten condition is charged direct into an electrical furnace. It is here covered with an oxidising slag, which is removed after about 30 minutes. A layer of carbon is then placed on the liquid metal, and over this a slag free from oxygen. The neutral slag so far cools the mass that the greater part of the ferrous-oxide is reduced by the carbon. Certain quantities of manganese ore are added to the neutral slag, and this destroys any remaining ferrous-oxide. When the mass is perfectly white a carbon test is made. A carefully calculated mixture of iron and carbon is then introduced into the furnace, and when this is dissolved the necessary alloys are added to obtain the grade of steel required and the whole of the contents are drawn off. Where it is required to refine a low quality steel, this is first melted in a Martin or other furnace and then transferred while still molten to the refining furnace, built on a lower level than the first. A charge can be completely finished in 75 minutes. In some instances 60 minutes suffice, whilst for special steels the charge may remain in the furnace for as long as 1¾ hours. Allowing that a 5-ton furnace would require, say, 800 H.P., equal to an average energy consumption per ton of special steel of 280 H.P.-hours, the cost of energy for the process cannot be considered excessive.

The furnace which Mr. T. Scott Anderson, of Sheffield, has designed and patented for the above and similar processes is shown in section below. It consists of a chamber somewhat of the shape of the porcelain boiling dishes known to chemists, with a domed cover, an aperture being left at the spout for pouring purposes. It is constructed of highly refractory materials, and is mounted either on trunnions or rockers, as shown in the illustration, for the purpose of pouring. In addition to the main pouring lip for use when full, tapping holes are provided, so that when the metal is at the lowest point in the furnace hearth it can be run off. Tapping is preferable to pouring at this stage, as it is not uncommon to find that pouring from so low a point causes a distinct change in the quality of the steel, even though both metal and slag may be quiescent prior to pouring. Through the covers of the furnace are admitted substantial electrodes capable of vertical adjustment, arranged in parallel or series according to the work for which the furnace is designed. Both the furnace and the electrodes are fitted with a continuous water-jacketing system, and directly beneath the base of the furnace, in line with each electrode, are fixed electromagnets which counteract any interference with the formation of the arc and control its action while at work. Moreover, the furnace is so constructed that the concentration of the incandescent gases around the electrode is utilised to the best advantage, and the arrangement tends to efficiency in a very marked degree.



Anderson Electric Steel Furnace.

Another sphere in which this furnace is found to be of considerable advantage is in the production of steel from scrap steel and iron. In railways, dockyards and engineering works the problem of effectually and profitably dealing with the large amount of old and waste material is a weighty one, and any process which can show a return in tool steel, ingots for castings, and the like, has a certain hold on the market. A similar furnace to the one above described is used, the charge being placed in it cold, and a little ore and lime is added. When the furnace has been charged, current is switched on and the material reduced to a molten state by a combined process of arc and resistance heating. A slag formed by the lime and silicates of the ore floats on the surface of the molten metal; the electrodes dip just beneath this slag, but not into the metal. An air blast is then introduced, and the impurities in the charge becoming oxidised, enter the slag, which is then withdrawn. One or two new slags are introduced, and the process proceeds in this way, with the result that a very pure product is obtained. When this point is reached the requisite alloys are added and the charge is tapped. The current is kept on the furnace for about six hours, and the average energy consumption is about 1,000 H.P.-hours per ton of steel produced. Assuming the cost of scrap at about £3 per ton, the cost of labour of four men at £1 4s., and the cost of electrical energy at 8s. 6d. per ton of metal produced, and making allowances for electrodes, repairs and renewals, interest and depreciation, alloys, ore, lime, &c., the cost of steel making from scrap works out at about £6 8s. 6d. per ton—a figure taken from actual working. In this case the electrical energy required was generated from coal costing 25s. per ton, using gas engines and gas-producer plant. An installation capable of producing 900 tons of steel per annum from scrap, working six days of 24 hours each per week, was figured at a capital cost of £3,750.

A problem to which electro-metallurgical engineers have for a long time devoted themselves has been the direct smelting of iron ore by electrical means. Where cheap power is available, a great industry may be created; the iron ores of South Africa, India, Australia, Canada and Norway all await treatment by this means, and in New Zealand we have vast beds of magnetite or iron-sand yielding fully 80 per cent. of weight of pure metal, but hitherto so unamenable to ordinary smelting methods, that the New Zealand Government have in vain set aside a bounty of, we believe, £200,000, to be paid to the firm or firms who succeed in establishing a local iron industry based on the utilisation of these sands. The Anderson furnace, as adapted to reduction processes, demands that the material to be acted upon shall be first pulverised, so that in the case of iron-sands, these need not be briquetted. The ore is first mixed with the necessary flux and then supplied to the furnace by means of a hopper, the feeding being regulated by shutters in the connecting shutes. An adjustable electrode auxiliary to the two described in the refining furnace is situated immediately over the well of the furnace, and this serves to keep the metal in the receiver in a molten condition. This receiver may, with modifications, be used as a mixing vessel for the conversion of the iron into steel in one operation, or the pig-iron received from the electric reduction furnace may be carried in a molten state to a second or refining furnace. Both hematite and magnetite can be readily smelted, and an inferior charcoal is quite satisfactory as a reducing agent without briquetting. For the production of 60 tons of pig-iron per day of 24 hours, it may be taken that, assuming 5,000 H.P. to be available at a constructional cost for the power house of £10 per E.H.P., the total cost of plant would be about £55,100, excluding accessories such as crushers, elevators, storage, charcoal plant, &c., but including furnaces, regulators and their connections, instruments and cables, electrode plant and repair shop. Supposing that an ore containing 50 per cent. of pure iron is obtainable at 7s. per ton, and that electrical energy can be produced at 40s. per E.H.P.-year, the cost per ton of pig-iron produced, including charcoal, labour, limestone, electrodes and general expenses, interest and depreciation, repairs and renewals, and management expenses, should work out at about £2 15s. This figure for electricity is somewhat low, and hence it is essential for electric smelting that power can be obtained at a very cheap rate. The average energy consumption in this process is about 0·210 E.H.P.-year, or about 1,840 H.P.-hours, per ton of pig-iron produced.

It will, therefore, be seen that the electric furnace can compare very favourably with the blast furnace for the reduction of iron ore, where the above-mentioned condition of cheap power is obtainable, and there is the further point that a good ore runs no chance of becoming spoiled owing to the action of sulphurous gases, as sometimes occurs in the blast furnace, this leading to the fact that a far higher degree of purity can be obtained in the pig-iron. It will, therefore, be understood that the electrical production of iron and steel possesses points of interest to the manufacturer and engineer that are not merely academic, and it may not be very long before the work of such men as Mr. Scott Anderson, who is a gold medallist for metallurgical research, will be crowned with the success of a far-reaching industrial development.

It may fairly be said that the prejudice against electric furnaces, which was at one time very apparent in England, is very rapidly giving way to a realisation of their necessity, and an appreciation of the superiority of their product. To illustrate this it may be mentioned that Mr. Scott Anderson is now engaged on projects for electrical steel manufacture for several very important steel and engineering firms in Sheffield, Glasgow, and elsewhere. Furnaces are now being erected in Sheffield for the electric production of steel from ordinary scrap steel and iron, the product being in the form of high-grade castings, absolutely free from blow-holes, and tool steel. The steel in the billet costs a little under £6 per ton, and this is produced with scrap at £2 10s. per ton, and power generated from coal costing £1 5s. per ton, used in a gas producer plant. Following on this, it is expected that other furnaces on this system will be installed in Manchester, and at least one other centre, in the near future.

Another important project which is under consideration, is the production of high-grade steel billets direct from the ore, utilising extensive water rights for power purposes, and the fact that this question is now receiving almost universal consideration and approval is without doubt very strong evidence of the excellence of electric steel production. The electromagnets used with the Anderson furnace have proved the means of considerably reducing the current consumption, and thereby increasing the efficiency of the furnace, and this has contributed in no small degree to the satisfactory solution of this difficult problem.

German Enterprise in Austria.—The Bergmann Electricity Works Co., of Berlin, which is rapidly advancing to a position in the front rank of the principal manufacturing firms in Germany, has just established a subsidiary undertaking at Bodenbach, Bohemia, which has been registered as the Austrian Bergmann Electricity Works Co. The object of the new enterprise, which has an ordinary share capital of 500,000 crowns, is specially to erect and work an electricity works.

D.P. Batteries.—Amongst the orders which we are informed the D.P. Battery Co., Ltd., received last week, they have been commissioned by H.I.H. Empress Eugenie to install a storage battery of their LS 13 type at Farnborough Hill, and by the Crown agents for the Colonies to supply a battery of 118 L 15 type cells for the Bahamas. They have also received orders for 16 of their specially designed 25-volt batteries for private residences.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GERMAN EAST AFRICA, CAMEROONS AND TOGOLAND.—The following articles are free of duty:—

All articles imported by the Government, the Imperial Admiralty and the Imperial Postal Service; machines and instruments, materials and working plant, directly intended for building, repairing and operating railways and other means of conveyance; machinery for industrial and mining operations; means of transport of every description; physical, astronomical, chemical, mathematical, optical and like scientific instruments.

Electrical and similar materials not capable of being classed amongst the above-named goods would be dutiable at the rate of 10 per cent. *ad valorem.*

GERMAN NEW GUINEA.—The following are free of duty:—

All goods imported by the Government; physical, astronomical, chemical, mathematical, optical and similar instruments to be used for scientific purposes; transport materials of all kinds; machines for the immediate purpose of carrying on construction for communication, waterworks, &c.; railway lines and sleepers, telegraph wires, &c.; articles imported by the Postal and Naval authorities.

Other electrical and similar goods not capable of being included under any of the above headings would be dutiable at the rate of 10 per cent. *ad valorem.*

GERMANY—SAMOA.—A duty of 10 per cent. *ad valorem* is levied on electrical and similar goods.

GERMAN SOUTH-WEST AFRICA.—Electrical and similar goods are duty free.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,400. "Device for testing the pull or strength of magnets." E. C. F. Otto. September 20th.

21,416. "Improvements in ignition apparatus for internal-combustion engines." W. Mills. September 20th.

21,424. "Improvements in ejectors electrically operated." E. M. T. Boddam. September 20th.

21 434. "Improvements in magneto-electric ignition apparatus for internal-combustion engines." F. H. Hall. September 20th.

21,441. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. September 20th.

21,480. "Improvements in or relating to electrolytic condensers." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 20th.

21,481. "Improvements in and relating to electric energy meters." British Thomson-Houston Co., Ltd., and C. R. d'Arcy. September 20th.

21,517. "Improvements in and relating to electric batteries or accumulators." A. W. Somers and R. J. Crowley. (Application for Patent of Addition to No. 5,064, 1909.) September 1st.

21,526. "Improved insulator for supporting the current rails of electric railways and tramways." A. Watkins. September 21st.

21,529. "Improvements in static induction generators or influence machines." C. Harrison. (B. E. Baker, United States.) September 21st. (Complete.)

21,540. "Improvements in polyphase commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., United States.) September 21st. (Complete.)

21,541. "Improvements in apparatus for regulating the transfer of electrical energy between two electrical systems having different electric frequencies." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 21st. (Complete.)

21,542. "Improvements in and relating to polyphase commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b H., Germany.) September 21st. (Complete.)

21,564. "Improvements in electric heaters." J. C. Royce. September 21st. (Complete.)

21,577. "Improvements in and relating to machines for use in the manufacture of incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 21st.

21,595. "Improvements in liquid controllers and starters for electric motors." J. A. Liddle. September 22nd.

21,596. "Improved inspection and extension fitting for electric wiring." A. J. Burbitt. September 22nd.

21,606. "Improvements in dynamos and motors." J. A. Liddle. September 22nd.

21,622. "Improvements in motor-generators, boosters, balancers, auto-transformers, and generators for direct and alternating-current circuits." A. M. Taylor. September 22nd.

21,637. "Improvements in electric telegraphs particularly applicable to transmitting signals on board ship." W. F. Grafton. September 22nd.

21,659 "Impedance switches and regulators." H. J. Herberts. September 22nd.

21,669. "Improvements in installations of electrically-propelled vehicles for the purpose of obtaining current for braking." G. Rizzo. (Date applied for under Rule 13, March 22nd, 1909. An invention comprised in application No. 6,849, dated March 22ed, 1909.) September 22nd.

21,682. "Improvements in voltage-regulators for dynamo-electric machines." T. Ferguson. September 23rd.

21,701. "Improvement in the ignition of combustion engines." H. Portway. September 23rd.

21,752. "Improvements relating to the senders of tele-selectors." E. Blos. September 23rd. (Complete.)

21,809. "Improved means for automatically controlling the reversal of electrically-driven machine tools." W. Beardmore & Co., Ltd., and J. A. Sykes. September 24th.

21,807. "Improvements in electric lifts." E. M. T. Boddam. September 24th.

21,845. "Improved method of obtaining constant potential in an electric circuit supplied from a generator running at variable speed particularly applicable to the electric lighting of railway trains and the like." W. F. Grafton. September 24th.

21.854. "Improvements in and relating to electric lamp fittings." J. Gray. (F. J. Seabolt, United States.) September 24th. (Complete.)

21,858. "Improvements in and connected with the ignition contrivances of internal-combustion engines." A. Gray. September 24th. (Complete.)

21.904. "Improvements in or connected with microphones, receivers of telephones and the like." T. W. Newman. September 25th.

21.940. "Improvements in electric clock winding mechanism." J. Gray F. J. Seabolt, United States.) September 25th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of and Apparatus for Electrical Separation. W. Fairweather. (Huff Electrostatic Separator Co.) 16 583. August 6th.

Electric Signalling on Railways. G. H. Brown. 18,996. September 10th.

Electric Light and Similar Electrical Fittings. A. T. Woodhall and A. Emery. 19,150. September 11th.

Method and Means of Transforming Electrical Energy into Heat Energy. C. O. Bastian. 19,333. September 15th.

Overhead Conductors for Electric Railways and Tramways. J. Ormston and W. E. Charlton. 20,647. October 1st. (Cognate application 6,534/00.)

Clamping Devices for Electrical Fittings. Siemens Bros. & Co. and J. Huddleston. 21,912. October 16th.

Magneto-Ignition Apparatus. Firm Robert Bosch. 25,547. November 26th. (Date applied for under International Convention, November 6th, 1908.)

Magnetic Blow-Outs for Electric Switches. T. von Zweigbergk. 25,954. December 1st.

Electric Furnaces. C. Bingham. 26,356. December 5th.

Automatic Electric Timing Switch. F. W. W. Baker and G. Pearce. 27,323. December 16th.

Contact Device on a Travelling Bridge-Crane to Convey Current from an Electric Overhead Conductor to an Electric Locomotive passing under the same without Interfering with the Working of the Crane. C. K. Mills. (Maschinen und Dampfkesselfabrik "Guilleaume Werke" Ges., Germany.) 28,076. December 24th.

Holders or Sockets for Incandescent Electric Lamps. H. W. Marsh. 28,177. December 24th.

1909.

Service Registers in Telephone Installations. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 10,203. April 29th.

Electric Safety Lamps. G. O. Wolters. 10,312. April 30th. (Date applied for under International Convention, May 2nd, 1908.)

Telephone Transmitters. C. E. Egner and J. G. Holmstrom. 12,918. June 1st.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges., Germany.) 17,104. July 24th.

Electric Smelting Process.—A new electro-thermic smelting process has been introduced at the works of the Canadian Zinc Co., at Nelson, British Columbia. The electric furnace, which was devised by Mr. F. T. Snyder, technical adviser to the company, is, in its general construction, very like an ordinary, rectangular, water-jacketed, lead blast furnace, with inside dimensions of 34 × 54 in. At either end a carbon electrode is conducted through the end jackets, while a third electrode is connected and built into the furnace bottom. From a framework above, three cylindrical carbon electrodes, 9 in. in diameter, are lowered into the furnace, their height above the bottom being regulated by suitable gearing hung from the roof. In operation, the electric current, entering by these three suspended electrodes, passes to either the end or bottom electrodes, the electric arc so formed generating the requisite heat for smelting the ore, which is fed into the furnace from the charging floor level, around the electrodes. The products of the fusion are: Slag and matte run off through a suitable iron spout; lead, collected in the bottom of the furnace, and ladled out of a lead well; and metallic zinc, which is condensed on the cool sides of the jackets and, running down, flows out of openings in the side of the furnace, through carbon blocks, perforated by small holes. The capacity of the furnace is as yet a matter of expectation only, but it is anticipated that it will be capable of treating about 15 tons of ore per day, the consumption of power being estimated at 50 E.H.P. per ton of ore (? per day). The necessary current is obtained from the Bonnington Falls plant, and is delivered by that concern at the south-east side of Nelson, across which town the Canadian Zinc Co. has had to carry it; for this purpose, a pole line, about 3 miles in length, has had to be erected, a high standard of construction having been demanded by the town authorities as a condition to its permission to pass through the public streets. The high-voltage current enters the works directly to a transformer house, which is equipped with transformers capable of dealing with about 750 E.H.P. The experiment is being watched with interest in ore-smelting circles in Canada.

THE
ELECTRICAL REVIEW.

VOL. LXV. OCTOBER 15, 1909. No. 1,664.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

FINANCE AND INDUSTRY.

It must be admitted that the methods by which trade is carried on in Great Britain are sometimes casual or unorganised. To take a concrete example, let the case be supposed of an inventor who holds a patent for something really valuable. Everyone knows to begin with that the inventor is often apt to be an erratic genius totally devoid of the special ability which, even with money at his command, would enable him to make a commercial success of his invention. Usually he has very little money, and there is no royal road by which he can set about getting it. Generally speaking, he hunts around in a casual sort of way, and meets some man who thinks he sees value in the invention, and through a greater or less number of intermediaries he finally gets into touch with a promoter who exploits the invention and the inventor, floats a very much over-capitalised company, and sets the company going with enough working capital to keep it afloat for a year. Gradually the shares drop in value from the premium at which the promoter unloaded them on a public tickled by a huge advertising expenditure. Shareholders sell out chiefly at a small loss, the total loss is distributed over a wide area, and the number who lose heavily is few, too few to make an effective protest. A good invention is thus lost or discredited. Properly and honestly applied, a tenth of the money would have ensured a success.

In Germany things are done differently. The industrial banks afford a means of bringing men into touch with capital. The banks have the command of the best technical advice, on which they can draw when investigating any proposition or invention that may be submitted to them. The inventor is kept within bounds and receives a fair reward for his work, and undertakings are set going with the minimum of expense.

It is quite true that some of the German monetary groups have sometimes gone too far in supporting undertakings of doubtful value, but this is not a necessary fault of the system. It has often happened from too great an anxiety to secure work for affiliated manufacturing establishments, and the anxiety to secure work for these establishments no doubt largely prompted the banks to advance capital for such undertakings as, say, the Victoria Falls Co.

These German banks, as we have often shown, make it their business to help the manufacturer. We say again that it ought to be possible to devise some means on the lines of the more cautious of the German industrial banks by which genuine industry should be furnished with capital. There is plenty of business to be carried on for which small sums of £3,000 or £5,000 would be ample. It seems to be practically impossible to get such small sums. The promoter class turns up his nose at such small demands because they do not afford him his pickings. Hundreds of thousands are more to his liking. Men with money to invest can seldom be found. They yield only to the glamour of the promoter and his over-watered schemes, and will risk with him thousands of pounds, rather than put hundreds into a genuine business as principals. The German Industrial Bank collects the people's savings and applies them to industry. Some of the undertakings succeed well; some, no doubt, fail. The depositors in the bank, one and all, receive the average result of all the business done by the bank.

In our English system Smith happens to put his money into the good thing, and Robinson loses all his in a failure. Smith makes 300 per cent. and Robinson loses 100 per cent. In Germany each man would have made 100 per cent. profit and get back his capital also. The worst of our English system is that the man who finds the money for the success could have made an equal success had he found one-fifth the amount without the mediation of the promoter. And the man who pays his thousand to prove a thing to be a failure could have proved it equally so by expending two hundred, and might even have made a success by expending three hundred. But the promoter has had seven-tenths of his thousand pounds, and thus to make this one man rich a good business is spoiled by lack of working capital, and a thousand investors are left to curse "industrials." It is the promoter who should be cursed. He is indispensable as matters stand, but we want a Censor who will limit the voraciousness of his appetite. The big promoter to-day cares little for the success of his companies. A company, with its offshoots and subsidiary companies, its re-absorptions, may be made merely a machine to be worked to extract shareholders' money under the protection of the law. Any group of men can work the game, which has many variants. A small proprietary financing syndicate of the inner ring, a large indnstrial company and a large number of subsidiary companies to be put out and absorbed, amalgamated and divided, are the stock-in-trade, and the payment of commissions on all this chopping and changing is a perfectly legal matter to which the little syndicate is entitled.

When a company is promoted to work a patent, the promoter's huge profits are made in the enormous enhancement of the value of the patent between the time when the initial syndicate purchase it from the inventor, and the time it parts from it to the company. When a promoter exploits an established concern, he extracts his great profit, perhaps, out of goodwill, and the value of a goodwill may be made very large if a business is capitalised on a 5 per cent. basis on the opinion of the amount of profit that the business will make. All the foregoing may be merely an elementary expression of an oft-repeated grievance, but it is as well that the subject should continue to receive attention. As we have before said in these pages, there appears to be a real need and opening for British industrial banking somewhat in the lines of the German Banks.

The Marconi Patents.

A correspondent of the *Financial Times*, who appears to have some knowledge of the inner workings of the telegraph world, recently drew attention to the purchase by the Post Office of the six coastal stations of the Marconi Co., with the right to use all the Marconi Patents, existing and for a period of 14 years, for the small sum of £15,000, and inquired what assets the company possessed, seeing that the "master patent" would expire on June 2nd, 1910. The company replied, admitting that the patent in question was abont to expire, but stating that it had long ceased to be regarded as of much value, and had, in fact, been valued in the accounts merely at the amount of patent fees, &c. No depreciation, therefore, had been necessary. On the other hand, the company possessed some 500 patents protecting details, besides the trans-Atlantic transmission stations and the numerous installations on board ship. The correspondent, however, who signs himself "Marconi Shareholder," retnrns to the charge in the *Financial Times* of October 9th, averring that £75,000 was paid by the company in cash or shares to Mr. Marconi for the "master patent," and asks what has become of the balance of the pnrchase price, after deducting the cost of the letters patent. By the company's own statement, it has not been written off.

This shareholder acquired his holding in 1901, when the market price was considerably above the present figure, and when the attempts to signal across the Atlantic were just about to afford some indications of success. But trans-Atlantic transmission even now can hardly be regarded as a commercial success, and to crown all, the Canadian station has been burnt. What assets, he asks, have the shareholders to set against the £500,000 capital issued by the Marconi Co.—not counting loans—a capital big enough to lay an Atlantic cable?

Our sympathies must be with the unfortunate shareholders who, as this one says, "have had no luck." But our conscience is free from blame, for we have consistently urged caution upon prospective investors in the undertaking, and have pointed out the limitations of the system. Within those limits, it has been so successful as to become indispensable; but the company's policy was too long directed towards sensational enterprises of little utility—except to cause violent oscillations in the price of the shares. Since the reorganisation of the directorate wiser and more prosaic counsels have prevailed, and if the company perseveres in the straight, if unexciting, path of patient industry and sound development, we do not donbt that in the long run even "Marconi Shareholder" will be consoled for his earlier misfortunes. It is curious to observe that not only in this country, but also in the United States, the progress of the science has been delayed and hampered by errors of management and over-capitalisation, and in the States it is in a deplorable condition. Only our German cousins appear to have acted on a methodical plan, combining instead of dividing their forces, and it is from them that competition will come, for which our British companies had better be prepared.

A Manchester Charge.—At the Manchester City Police Court on Tuesday (12th inst.), Edwin A. Wilson, of Halliwell Lane, Hulme, was charged with having stolen electrical goods, including tantalum lamps, wire, &c., to the value of £500, the property of Baxendale & Co., Miller Street, Manchester, his employers. Several other men were charged with receiving the goods. Mr. Rylands prosecuted. Wilson pleaded guilty to the charge, and said he was ready to give evidence against the men charged with having received the goods, knowing them to have been stolen. Mr. Lustgarten, who appeared for the prisoner, said Wilson had practically grown up in the firm, having been there for 20 years, and his father had been manager of the firm for 40 years. The stipendiary postponed sentence until the other cases should be tried. Edwin Kay, an electric wireman, of 18, Parson's Lane, Bury, was charged with receiving part of the goods. Evidence was given that on October 4th he went into the shop; Wilson was behind the counter, and a man named Bradshaw was watching. There had been complaints of tantalum lamps having been sold below what was called a "maintained" price. Kay was served by Wilson, and received a big parcel from him. Kay had paid 11d. He was fetched back, and denied knowing there was more in the parcel than he had paid for, but it was alleged that he afterwards pleaded guilty. Wilson, the first prisoner, gave evidence that Kay had received several of the stolen articles, and had not paid for them. Fredk. Mason, an electrician, of Lever Street, Manchester, was charged with having received about £100 worth of goods which had been stolen. About 1,000 of the lamps which had been sold by him had been traced by Detective Winter. Prisoner pleaded guilty. All four prisoners were remanded for a week, bail being granted only to Harry Wilson, of Stockport.

ELECTRIC TIME SERVICE IN EASTERN OBSERVATORIES.

By R. M. H.

Some little time ago an article appeared in the Electrical Review, in which were described at length the arrangements made by Mr. E. D. Pearmain to secure the advantages of an electric time service in connection with the astronomical installation at the Observatory in Mauritius, and in the course of the article Mr. Pearmain referred to a desire to possess specially constructed master clocks to take the place of those which were constructed on the spot. It may be of interest to readers who are concerned with this particular application of electrically controlled and operated mechanisms to know that this desire has recently been accomplished, and how the services have been arranged.

Two new master clocks have been made in this country, and the writer has had an opportunity of becoming acquainted with the details of their construction; as he is not aware that any description of such mechanisms has before appeared in the Review—or, indeed, in any journal—he hopes that the following information may be of interest.

One of the clocks is provided with a mean-time, and the other with a siderial, pendulum. The general arrangement of the gear in each case is similar, as shown in fig. 1, an enlarged view of the mechanism being shown in fig. 2. The pendulum rods are made of Invar steel, and they are provided with adjustable devices of copper, by means of which the amount of relative compensation may be varied should such be found necessary. The usual provision for regulation by means of raising or lowering the pendulum bob is entirely absent, this being arranged for by the attachment to each rod of a small tray, which may carry more or fewer small weights as required, and in addition a heavy nut is provided which may be raised or lowered by screwing up or down on the rod. The nut is graduated, to enable a close adjustment to be arrived at without the necessity for lengthy experiment. The pendulum bob is supported by means of a steel pin which passes through both bob and rod somewhat below the centre of the former, as will be seen in fig. 1. The position of the pin is so fixed in order that the bob may be approximately self-compensating as regards its own mass.

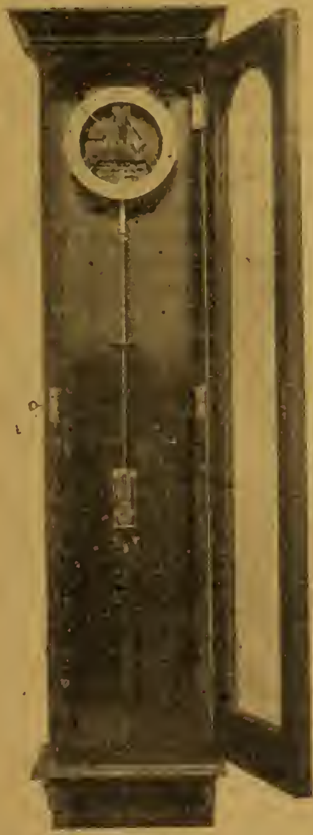

Fig. 1.—Master Clock, Mauritius Observatory.

The pendulum receives an impulse every alternate second by means of the gravity lever which will be observed in fig. 2 crossing the pendulum at right angles. This lever is pivoted at its left-hand end, and when released, by the disengaging of a trip lever on the swing of the pendulum to the right, falls, communicating an impulse to the pendulum through the medium of a roller which it carries acting on an inclined plane, which, as will be seen, projects from the right-hand side of the pendulum. Having fallen and given up its kinetic energy to the pendulum, a bell crank prolongation of the lever which projects downwards makes contact with a screw point carried upon an extension of the armature of an electromagnet. This completes a battery circuit through the magnet, and the armature being attracted, the gravity lever is restored smartly to its potential position ready for the next impulse. The momentum of the gravity lever carries it slightly beyond the travel of the screw fixed to the armature, so that at the instant when the trip lever engages with the gravity lever the circuit is broken and the armature falls back. This cycle takes place entirely during one swing of the pendulum, so that the second swing is entirely free. It will be noticed that the lever gives its impulse directly to the pendulum, intermediary wheel work being eliminated. The presence of an element introducing the risk of a variable friction factor, as would be inherent with a train, is therefore entirely obviated. The suspension of the pendulum has received a good deal of attention from the makers. The thickness of the spring is selected with regard to the weight of the pendulum, and it is placed between brass cheeks finished to surfaces as plane as it is possible to get them. All the pivots are carried in jewels.

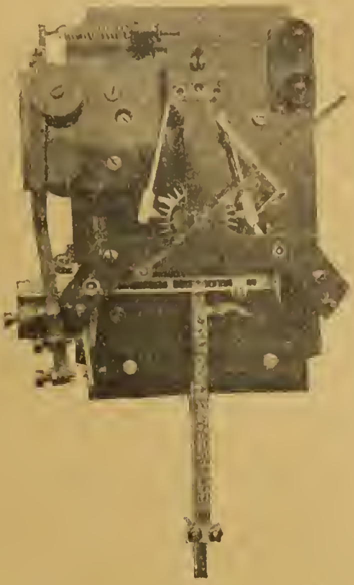

Fig. 2.—Master-Clock Movement, Mauritius Observatory.

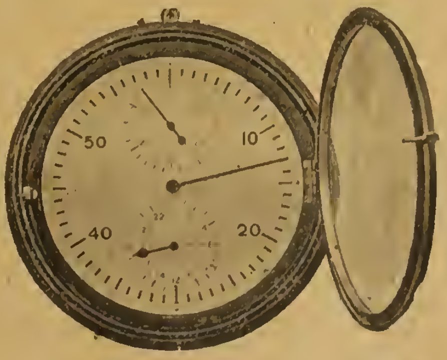

Fig 3.—Secondary Dial, Mauritius.

The pendulum of the mean-time clock is fitted with a device by means of which its beat may be retarded or accelerated through a fraction of a beat. This consists of a tungsten steel permanent magnet, fitted to the rod so as to oscillate in juxtaposition to the poles of a pair of solenoids carried on brackets fixed to the case. A reversing switch enables either positive or negative currents to be circulated through the solenoids, so that if the magnet be attracted, the pendulum will be accelerated, whilst if the the magnet be repelled the pendulum will be retarded. As such correction is necessarily slow in operation, it may be used for minute correction to the beat of the pendulum; it does not, moreover, interfere with the fixed adjustment governing the normal rate of the pendulum.

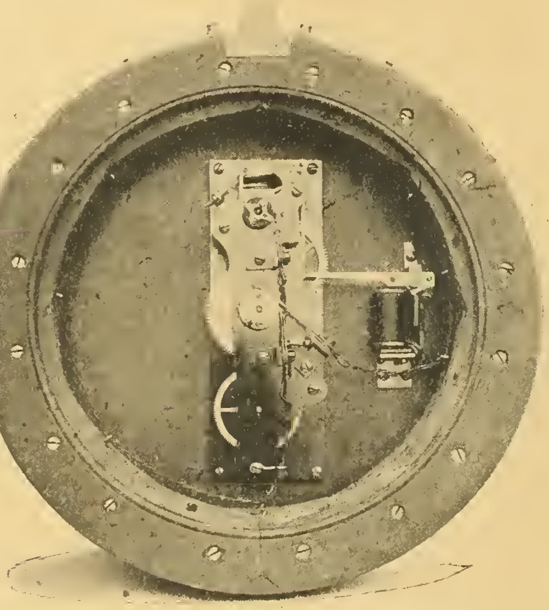

Fig. 4.—Mean Time Dial, Mauritius, with Hourly Contacts, &c.

The contacts which are made by the pendulum to provide energy for the continuance of its motion are very brief, varying from 0·025 to 0·05 second, and this duration is self-controlling, inasmuch as it depends upon the rate with which the magnet restores the gravity lever, which in turn depends upon the self-induction in the whole circuit. It is found that, although the contacts occur very frequently (every alternate second, as explained above), the duration is so minute that the installation may be worked from ordinary Leclanché cells without putting an undue drain upon their capacity. Owing to this fact, this installation will prove more economical in battery maintenance than the original installation, in which mercury contacts were used, whose duration may have closed the circuit for a period of the order of one second at a time.

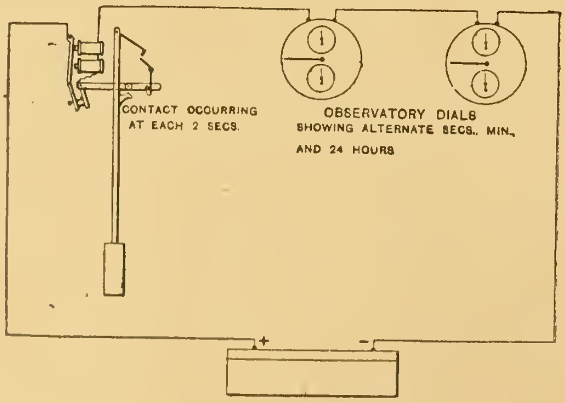
CONTACT OCCURRING AT EACH 2 SECS.
OBSERVATORY DIALS SHOWING ALTERNATE SECS., MIN., AND 24 HOURS
+
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Fig. 5.—Diagram of Connections, Mauritius.

Each of the master clocks drives two or three secondary dials (figs. 3 and 4). One of these—the mean-time dial—is fitted with supplementary contacts to enable the time ball to be dropped. In this clock the circuit is completed at each 60th second by means of a contact fitted upon the seconds arbor. This circuit, however, includes, in series with the foregoing contact, an auxiliary contact fixed to the minute arbor. The latter arbor revolves once in an hour, and only at the 59·5th minute this contact is closed to enable the circuit to be completed by the contact upon the seconds arbor. Therefore, at the 60th second of the 60th minute of each and every hour the circuit is completed for the release of the time ball. The springs for these contacts may be seen in fig. 4. One of the secondary clocks driven by the siderial-time pendulum is arranged so as to break the circuit each minute.

The writer would here like to compliment Mr. Pearmain upon the design and construction of the time-ball mechanism, as well as upon the manner in which, having regard to the local difficulties he had to contend with, he achieved an efficient time service for the island.

Fig. 5 shows in diagram form the electrical arrangements for one of the pendulums and dials, showing that the latter are connected in series. It may be mentioned that there is practically no limit to the number of secondary clocks which may be so connected, provided the voltage applied to the circuit is suitably increased for every additional dial included, the circuit being operated on a constant-current value principle.

Whilst the writer was engaged in the absorption of the details of the Mauritius system, as explained above, he came across details of a similar system, but differing in one or two rather important details, so as probably to make it interesting to readers of the foregoing matter. This apparatus was designed and manufactured by the same makers to the order of Mr. A. B. Chatwood, F.R.S.A., Astronomer to the Nizam of Hyderabad, for the new Nizamiah Observatory.

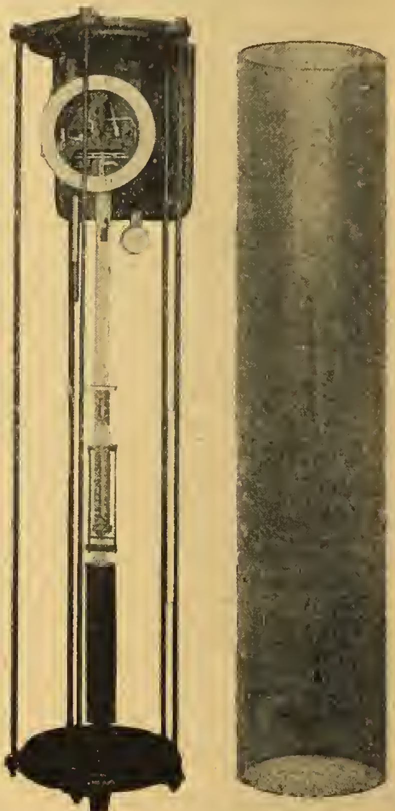

Fig. 6.—Transmitter, Nizamiah Observatory, with Glass Cylinder Removed.

The construction of the master clock pendulum is essentially the same as that of those described above, but it is arranged that, instead of every alternate second, the impulse is given to the pendulum once in every six seconds. Two additional contacts are fitted to the rod, close to the suspension—where their disturbing effect is reduced to a minimum—and by these the secondary clocks are enabled to indicate every second. This offers certain advantages where transit observations are concerned, and only a slight disadvantage; the greater frequency of the contacts slightly increasing the cost of battery maintenance over that of the Mauritius system.

The master clock (fig. 6) is enclosed within a novel type of case of somewhat more than passing interest. The whole of the mechanism is enclosed within a hermetically sealed glass cylinder. (In the figure the glass is shown removed.) The iron casting at the top carries the mechanism, and in the bottom is a hand-hole closed by a removable iron cover, through which access to the pendulum may be had for regulating purposes without removing the glass cylinder. The bottom casting carries also a small non-return valve and connection to which an air-pump may be attached, so that the interior of the case may be maintained at a constant air pressure; and, in order that no leakage of air may take place, india-rubber packing is placed between the castings and the glass cylinder, the terminals passing through air-tight glands in the casting. In order that both pressure and temperature may be observed, an aneroid barometer and a thermometer are fixed within the cylinder.

The secondary clocks, of Mr. Chatwood's own design, were provided with white figures on a platinum black ground. It is claimed that this enables the dials to be read with greater facility.

The circuit arrangements (fig. 7) differ materially from the Mauritius arrangements, inasmuch as the dials—which also may be any number, the voltage being suitably arranged—are operated by two independent circuits, controlling the action of two electromagnets in each dial, each of the contacts on the pendulum operating one magnet, so that the even seconds are indicated through one circuit and the odd seconds through the other. It will be observed that a condenser is joined across the master-clock contacts so as to absorb the spark.

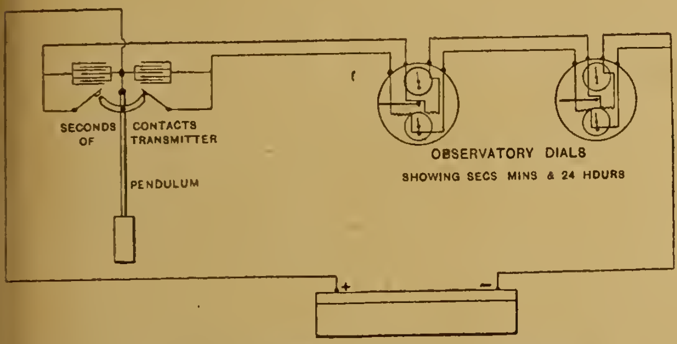

Fig. 7.—Circuit Arrangements, Nizamiah Observatory.

The writer should add, in conclusion, that he is indebted to the courtesy of the makers, Messrs. Gent. & Co., Faraday Works, Leicester, who make a speciality of this and other classes of electrical time work, for the illustrations and much of the information which has enabled him to place descriptions of these interesting installations before the readers of the Electrical Review.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 570.)

Fig. 42 affords graphic comparison between z to l and c to l sets of bridge readings to scale zero on an artificial copper exposure of $\frac{1}{2}$ in. (core 400 Cu/360 g.p.) connected to an inserted resistance of 1,050 ohms.

Fig. 43 shows how the trend of a series of readings and of the corresponding curves may be affected by the *condition* of the iron sheathing wires of the broken cable. The two sets of curves here shown are from a real recovered broken end of 500 Cu/360 g.p. core with 9-in. exposure in salt water (wires unstranded) and contiguous sheathing in one instance (*a*) of new galvanised iron wires, and in the second instance (*b*) an approximately equal superficial area of old rusty iron sheathing picked up with the broken end. Naturally the water-column apparent resistance between the copper exposure and the iron sheathing was increased by the rust, thus causing the corresponding curve to deflect from the vertical much more than does the curve from the same core exposure with the new and galvanised sheathing.

Fig. 44 gives two graphs of actual localisation tests made by the writer on a repair of one of the French Atlantic cables (core 350 Cu/300 g.p.).

The ordinary Jona set of plottings (a) shows plotted on a calculator-board, ship's test to break from ship's cut-in. Ship picked up to break 0·78 n.m. of recovered cable, the measured c r of which was about 2 ohms. The inserted resistance between bridge and cable had been 992 ohms.

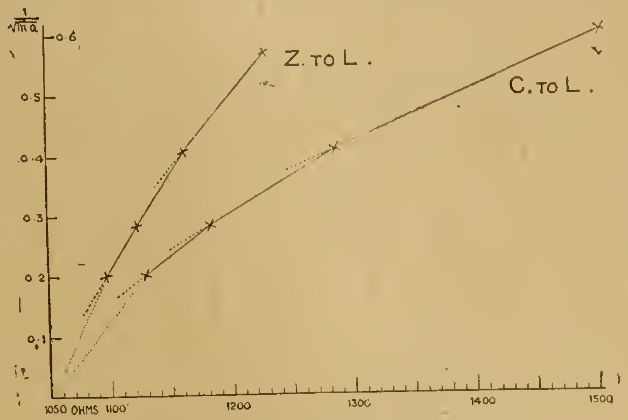

Fig. 42.—Core 400/360 lb., $\frac{1}{2}$" Exposure.

In fig. 44 the set of plottings (b), likewise from a calculator-board, affords an interesting instance of the writer's application of Jona's graphic system to the localisation of *partial earth* faults. The plottings marked with a *cross* show results of bridge tests with various battery powers. The *circles* show Mance readings with a constant voltage and varying bridge ratios.

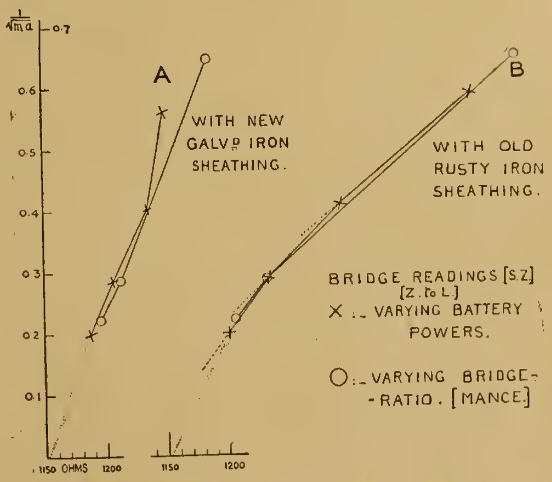

Fig. 43.—Core 500/360 lb., 9" Exposure (Wires Unstranded).

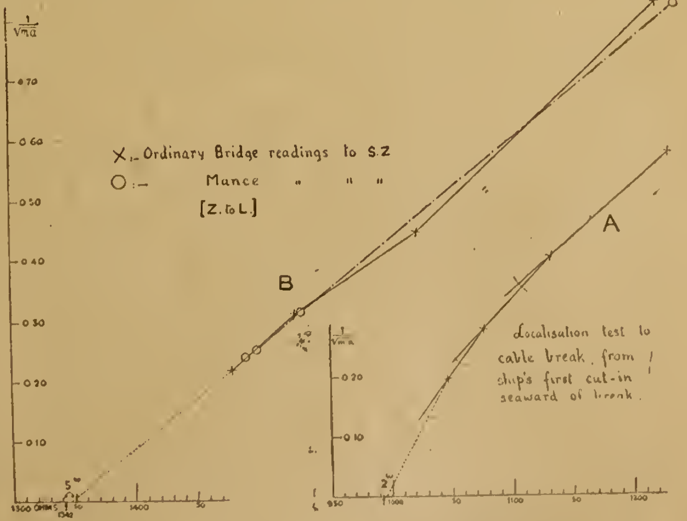

Fig. 44.—Actual Cable Tests—Core $\frac{350 \text{ lb. Cu}}{300 \text{ lb. G.P.}}$.

Test to localise partial earth-fault between ship's second cut-in and shore. Cable end "free" at cable house.

The trend of the curve showed the fault to be a few ohms from ship. In fig. 44 (b) the dotted line is drawn to the true ohmic position of the fault on the line of resistance as proved by length of cable picked up to the fault, and is seen to be absolutely in line with the Mance readings.

Distance of fault from ship was 1,347-1,342 = 5 ohms. An earth overlap made (under unfavourable conditions) to corroborate the above result gave 6 ohms, which proved to be 1 ohm in excess.

As the foregoing two graphs are good representative examples of tests respectively to a break and to a *partial earth* fault, full figures are here given.

Series A.	Leclanché cells (Z to L)	Milliamperes (M.A.)	$\frac{1}{\sqrt{\text{M.A.}}}$	Bridge readings to scale zero (992$^{\omega}$ deducted).
				ω
1	40	25·5	0·198	54
	20	12·8	0·279	84
	10	6·3	0·398	139
	5	3·1	0 568	231
2	40	26	0·196	53
	20	12·8	0·279	84
	10	6·3	0·398	139
	5	3·1	0·568	238

Series B.	Leclanché cells (Z to L)	Milliamperes (M.A.)	$\frac{1}{\sqrt{\text{M.A.}}}$	Bridge readings to scale zero (1,342$^{\omega}$ deducted).
				ω
1	40	21·9	0·214	133
	20	10·7	0·306	191
	10	5·2	0·439	288
	5	2·5	0·816	488
2	40	21·5	0·216	137
	20	10·7	0·306	189
	10	5·2	0·439	288
	5	2·5	0·816	488
3	40	21·5	0 216	138
	20	10 7	0·306	189
	10	5·2	0·439	288
	5	2·5	0 816	488

20 Leclanché cells, Z to L.

Series B.	Bridge ratios.	M.A.	$\frac{1}{\sqrt{\text{M.A.}}}$	Bridge readings to scale zero (1,342$^{\omega}$ deducted).
				ω
4	$\frac{10}{10}$	18	0·236	149
	$\frac{100}{100}$	16 8	0·244	158
	$\frac{1000}{1000}$	10·7	0 306	193
	$\frac{10000}{10000}$	2·5	0·816	504
5	$\frac{10}{10}$	18	0·236	149
	$\frac{100}{100}$	16·8	0·244	158
	$\frac{1000}{1000}$	10·7	0 306	193
	$\frac{10000}{10000}$	2·5	0·816	504

Fig. 45 (A) shows a graph localisation made by the writer from cable ship *Dacia* on one of the Atlantic cables, from ship's first cut-in on the Newfoundland banks, to ascertain the distance of a break which had interrupted the working of the cable, and which the *Dacia* had crossed the Atlantic to repair.

Tests from terminal stations had pointed to the break as having occurred, more or less, on a slope near the edge of a submarine bank, and much depended on *exact* knowledge as to the locality of the break and depth of water in which the broken ends of the cable lay.

On the strength of the information afforded by graph fig. 45 (A) the break was reported to be between seven and eight nautical miles from ship. Subsequently ship picked up 2·7 N.M. of core 500/320 + 4·9 N.M. of core 400/360 = total 7·6 miles of cable to break. Copper exposure was found worn to conical shape. Length of exposed wires of copper strand from 0·6 in. to 0·25 in.

The dotted line in fig. 45 (A) indicates that point on the line of resistance proved by subsequent tests on the recovered cable (corrected for temperature) to have been the true ohmic resistance between ship's first cut-in and break, viz., 1,232 − 1,213 ohms (inserted resistance) = 19 ohms to break.

Ship then hooked and cut in a short distance to the other side of break, spliced on ship's cable, straightway filled up the gap and completed the repair within the confines of the bank, and without having to deal with any great depth of water.

Fig. 45 (B) is of mere academic interest, showing, as it does, a graph of tests made after the completion of the aforementioned repair, on the short end between ship's second cut-in and the break.

It was known that this short piece could not amount to a mile of cable, so naturally by the time the buoyed short end had been picked up, passed round the drum and into the tank, up into the test box, opened out and joined through to the testing room, the broken end of the short piece being picked up was well "on the move," which fact fully accounts for the erratic lay of the curves plotted with *crosses* at those portions determined by the *lower current* readings. This second exposed end (Cu/400 lb. per N.M.) consisted of wires varying in length between 0·6 in. and 1 in.

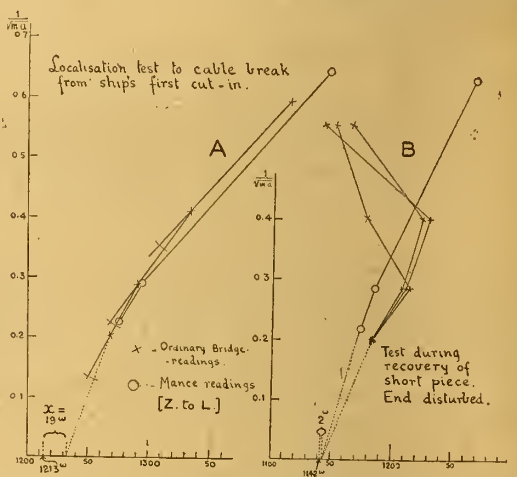

Fig. 45.—Actual Cable Tests—Core $\frac{\text{400 lb. Cu}}{\text{360 lb. G.P.}}$.

Without dogmatising as to the exact interpretation of these clearly supererogatory tests made on a short end whilst it was being picked up, the writer suggests that some explanation may be derived from a consideration of the following facts; this by way of a useful exercise on the influence of testing currents on copper exposures.

(*a*) Jona curves plotted under the conditions governing the curves hitherto shown in this work—viz., Z to L, against the negative polarisation current from the exposed end—normally lie from the lowest current plotting up on the right of the curve sheet, down towards the highest current plotting on the left.

(*b*) As will be shown and explained later on in the present work, a series of Z to L bridge readings on a broken cable from which, at the testing end, an appreciable *positive* current is flowing, would, if plotted, form a curve with a trend in a direction opposite to that of the curve mentioned in (*a*), and useless as an index of true resistance up to the break, for under these conditions the higher of two currents will be found to produce on the bridge the higher—not the lower—resistance reading.

(*c*) The erratic *cross*-plotted curves in fig. 45 (B) were obtained whilst the exposed end was being subjected to considerable mechanical disturbance by being dragged along the bottom of the sea through the water, now and again, perhaps, digging into the mud or sand. Thus, the gas due to the polarising effect of ship's *zinc* testing current would, doubtless, be repeatedly washed or knocked off as soon as it formed, thus tending to leave the *positive* current from the iron-copper couple at the broken end free to pass along the cable towards the testing end, in place of the negative polarisation current met with under normal testing conditions. This—from the appearance of the curves in fig. 45 (B)—would appear to have been the case with the lower current values, these naturally having been more easily affected by the passing of the end through the water than were the higher current values. These last mentioned appear to have been strong enough to polarise the broken end sufficiently to induce and *maintain* at the broken end a *negative* potential sufficient to bring the lower portion of the curves in fig. 45 (B) into the category of normal conditions. This rationale would account for the distinct set over to the left of the lower current portion of the *cross*-plotted curves as compared with the correct trend of the higher current portions.

In the practical example under consideration, the broken end was picked up and brought in board before the writer had time to repeat the tests Mance fashion, *i.e.*, with a constant battery and varied bridge ratios. This second broken end, namely, that of the short piece picked up was, therefore, after its recovery, immersed in salt water in a sheathing-earthed iron bucket. On this being done the Mance balances shown by the *circle*-plottings in fig. 45 (B) were observed, and all readings—now that the broken end was still—were found to be absolutely steady.

Polarity of Test Currents.

Although, for well-known reasons, break or fault tests involving an exposure of the cable conductors are, as a rule, made with the *negative* or zinc current to line (as this current does not, under ordinary conditions, cause the exposed copper to polarise) cases sometimes occur when workable results can be obtained only with the *positive* or carbon current applied through the Wheatstone bridge to line.

On these occasions the exposure is found to polarise under the zinc current, and to break down or decrease in resistance under the carbon—a characteristic quite contrary to the generally received customary procedure.

Then, again, under these same conditions, any increase in power Z to L naturally results in increased bridge readings, and the customary law as to increase in current producing a decrease in the bridge readings balancing the broken or faulty cable is found to apply only when the tests are made C to L.

All the actual instances of this reversal of the usual order which have come under the writer's notice have been connected with tests on heavy-core cables with a copper exposure at the break of considerable superficial area. In some cases there has been evidence, when the ship has picked up to the break, that the exposed copper has been buried, when both the setting free of the hydrogen evolved by the zinc current, and the formation of the cupric chloride salt under the carbon current, must have been greatly discouraged.

Where, then, a large exposure is buried in wet mud or sand, the main source of current from the exposed conductor will be the battery element set up between the copper conductor and the iron cable sheathing through the intervening electrolyte of wet mud or sand. The larger the exposure, the less will be the tendency for it to polarise, and the less affected will be the naturally *positive* polarity of the copper of this fault battery by the action of a testing current applied at the ship's end of a cable.

With a *positive* fault-battery current flowing from the cable at the testing end, an increase in voltage Z to L applied to the cable would—in the absence of polarisation, with its consequent reversal of the current reaching the testing end of the cable from the break—be accompanied by an increased bridge reading, whereas, under these conditions, with C to L, an increase of current would produce a decreased bridge reading. That this is so will be proved graphically further on.

The following is a table of actual results obtained in tests for the localisation of cable breaks, in which the use of Z to L testing current proved impracticable. Useful results were obtained by ship only with C to L.

These figures, for which the writer is indebted to Mr. F. C. Crawford, were obtained in 1904 on the c.s. *Dacia* during a repair of one of the Atlantic cables. (Core = $\frac{400 \text{ lb. Cu}}{360 \text{ lb. G.P.}}$ per N.M.) The exposed conductor at the break eventually proved to extend to 2 in. of opened-out copper strand.

Fig. 46 shows Jona's graphic method applied, by means of the writer's calculator board, to the figures given in the foregoing table.

Test *d* in series 1, although in the right direction in regard to the action of increased testing current (in this case C to L) proved useless with a calculated result of *minus* 13 ohms, solely owing to insufficiently strong testing currents having been brought to bear on a copper exposure of considerable superficial area.

Series.	Tests.	Cells, Leclanché.	Z or C to L.	Milli-amps. to break.	Resce. added to cable.	Bridge. rdgs. (To S. Z.)	—
1	*a*	20	Z	10·0	1,900	1,959	Useless.
"	"	10	"	5·1	"	1,929	
"	"	5	"	2·6	"	1,853	
"	*b*	20	"	10·1	"	1,947	"
"	"	10	"	5·1	"	1,917	
"	"	5	"	2·6	"	1,850	
"	*c*	20	"	10·1	"	1,933	"
"	"	10	"	5·1	"	1,905	
"	"	5	"	2 6	"	1,886	
"	*d*	20	C	9 8	"	1,998	Negative result. Currents of insufficient strength.
"	"	10	"	4·8	"	2,057	
"	"	5	"	2·3	"	2,168	
2	*e*	40	Z	21·8	1,600	1,683	Useless.
"	"	20	"	11·1	"	1,669	
"	"	10	"	5 6	"	1,640	
"	*f*	40	C	21·9	"	1,671	Fair result—viz., 27ω.
"	"	20	"	10·9	"	1,697	
"	"	10	"	5·4	"	1,741	

Note.—In attempts to make a Kennelly two-current test to false zero similar impracticable results were obtained, the higher current being accompanied by the higher bridge reading. The customary trend of current and bridge readings was obtained only with a carbon testing current.

Taking the first successful test in the foregoing series, viz., test *f* in series 2, we have—

$$1{,}671 + 1{,}697 - 1{,}741 = 1{,}627 \text{ ohms.}$$

$$1{,}627 - 1{,}600 \text{ (added resistance)} = 27 \text{ ohms.}$$

Correct resistance up to the break eventually proved to be 24 ohms. The conductor (400 lb. Cu. per N.M.) was found to be exposed for 2 in. Mud on centre wire indicated that the broken end had been buried.

Fig. 46 shows graphically, by Jona's method of plotting (Z to L), tests *a*, *b*, *c*, and (C to L) *d* in series 1, also (Z to L) *e* and (C to L) *f* in series 2 as given in the table.

From series 1 and 2 we see that in these examples :—

1. Curves plotted from Z to L readings lie in a wrong direction and are useless for indicating the point on the resistance line representing x or resistance up to the break.
2. Curves plotted from C to L readings lie in the right direction.
3. The curve for test *d* (C to L) in series 1 has a trend indicating something less than the added resistance of 1,900 ohms, in other words, a *negative* result due to insufficiently strong testing currents as already shown in the foregoing table.
4. The curve for test *f* (C to L) shows how, with increased positive currents, a satisfactory result was obtained.

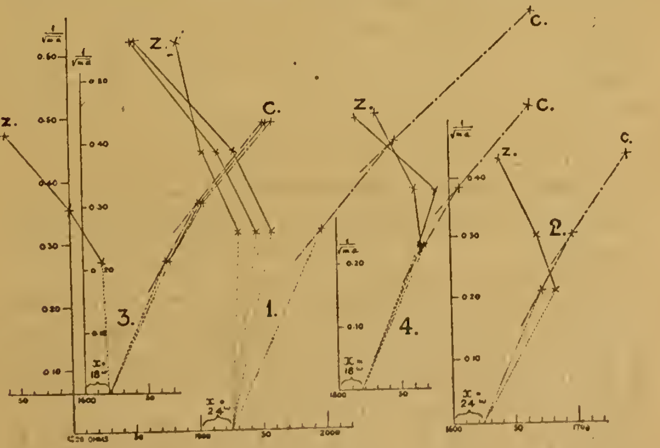

Fig. 46.

Actual cable tests affording an instance of the impracticability—under certain conditions—of usual localising routine with negative currents, with consequent employment of positive currents.

Core $\frac{400 \text{ lb. Cu}}{360 \text{ lb. G.P.}}$.

Fig. 46 likewise includes other series, viz , 3 and 4, showing actual tests subsequently made in connection with the same work as that already alluded to. Here it is seen how, on the occasion in question, the only satisfactory results obtained were with the *positive* or carbon current to line.*

In all these graphic examples obtained from plottings on a calculator board, dotted lines have been drawn connecting the curves severally with the correct points for x on the resistance line as proved when the ship had picked up to the break.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coefficient of Self-Induction.

In reply to the letter from Messrs. Smith and Cramp in your last issue, your reviewer finds it difficult to believe that they "have never suggested that the numerical relation between current and flux was other than a rational number." In your issue for October 1st, the following extract appears above both their names :—

"This definition does not appear to us to be inconsistent with the use of a complex number to express the coefficient. For, in the case of an alternating-current circuit in which iron losses affect the value and phase of the current, the ratio between that current and the magnetic flux undoubtedly involves a complex number."

Your reviewer leaves it your readers to reconcile these statements.

When there is iron in the core of a coil, the ratio of the flux to the current is not constant. This ratio is not only not constant, but it is a double valued function of the current. It, undoubtedly, has in general a different value when the current is increasing from what it has when the current is diminishing.

Your reviewer has never come across any sensible definition of self-inductance when the coil is immersed in a medium of variable permeability. He is therefore unable to answer the authors' misleading, or rather "leading," questions which postulate the existence of such a definition. With all due deference to the authors, Maxwell's energy definition, which is now adopted by all physicists, is quite correct and intelligible when applied to coils immersed in media of constant permeability. When applied to other cases it is intelligible, but the coefficient varying with the current and the time *cannot be used in a vector equation at all.*

Your Reviewer.

Cost of Living in the Federated Malay States.

Referring to your article on this subject in your issue of August 20th, it is obvious that the article was written by "one who *has* lived there," and as it is so very difficult for people at home to get correct ideas of the cost of living in different parts of the world, I would suggest that you publish no articles of this kind unless contributed by a person actually on the spot at the time of writing, and who has lived in that particular district for at least three years.

Anyone residing in the Straits Settlements would be exceedingly surprised to see that the value of the dollar is given as "about 2s. sterling, but its value fluctuates with the silver market," as the value of the Straits dollar has been *fixed* at 2s. 4d. since about four years ago—personally, I came out to Singapore about 3½ years ago, and at that time I learnt, amongst other things, that the value of the dollar had been fixed at 2s. 4d. a few months previously. Hence, a European on a sterling salary now gets 8·57 actual Straits dollars as the equivalent of £1 sterling, instead of about $10 as before, so that anyone coming out on £20 per month would receive—not $200 more or less, but exactly $171·40; a very considerable difference, and particularly so when one bears in mind the fact that the purchasing power of the dollar is just the same now as when its value was fluctuating.

I received my copy of the ELECTRICAL REVIEW only today, and I read this article with pained surprise; it is indeed disappointing to think that this kind of information cannot be relied upon, even when obtained through the pages of such a well-known paper as the ELECTRICAL REVIEW.

For the use of anyone who happens to read this, and who may intend going abroad at any time, I might mention that a source of information not, I believe, taken advantage of so much as might be expected, is the Emigrants' Information Office, 31, Broadway, Westminster, S.W., which office, to quote from one of their handbooks, "was established by Her late Majesty's Government in 1886 for the purpose of supplying intending emigrants with useful and trustworthy information respecting emigration chiefly to the British Colonies and is under the direction of the Colonial Office."

Letters may be sent unstamped to the above office, and the handbooks cost generally, I believe, about sixpence each.

Precision.

Singapore, *September* 10*th*, 1909.

[We welcome "Precision's" criticism, as we are anxious to give exact information on the cost of living abroad; but does not he labour the point somewhat? The only item in the article to which he takes exception is the statement that the value of the dollar is "about 2s.," whereas it is now fixed at 2s. 4d. This cuts both ways; a man engaged at $200 a month will now receive the exact equivalent of £23 6s. 8d. instead of £20 more or less. Our contributor lived in the Straits Settlements for many years.—EDS. E.R.]

Electric Laundry Irons with Indicators.

In our letter dated August 17th we drew your attention to a rule requiring indicating devices to be installed where electric laundry irons were in use in Australia.

We now beg to state that this rule has been suspended as far as South Australia is concerned.

For **Newton, McLaren, Ltd.,**
D. EARDLEY MCLAREN,
Managing Director.

Adelaide, S.A., *September* 8*th*, 1909.

Electricity in Mines.

I am very much in agreement with you on the subject of the panic among the miners' leaders with regard to electricity in mines.

I think there ought to be experiments undertaken at the experimental gallery at Altofts, to see if the arc from a severed cable or a short-circuit will ignite coal dust when there is no fire-damp present. Of course, in the case of fire-damp, the present rules (which require revision) amply provide safeguards; but is the *coal-dust* danger real? I am sometimes inclined to think not, as all the experiments carried out, both here and on the Continent, have always been initiated by a small gas explosion or by a small cannon to represent a blown-out shot. Now in the vicinity of such initial explosion, the coal-dust laden atmosphere will be raised in pressure, as has been proved by the recording pressure instruments at an experimental gallery in Germany, which recorded a pressure up to 20 lb., by an explosion of fire-damp without coal dust. Has this rise in pressure not something to do with coal-dust explosions? It would not be present at the damaging of a cable by tubs or a fall of roof, which can easily be proved by experiment.

As to the danger from shock, this can be avoided by installing good plant and proper maintenance, and all unskilled and unauthorised persons when in doubt should switch off, or leave alone, and send for the electrician. Too much attention cannot be given to earth connections, when, if the earth detector is in good order, trouble should soon be located and put right. In conclusion, I think revising the present rules and raising the status of mining electrical engineers by the formation of the Institute of Mining Electrical Engineers, will soon bring matters into a more satisfactory condition.

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* Since the above was written the new and revised (2nd) Edition of Mr. H. D. Wilkinson's "Submarine Cable Laying and Repairing" has appeared, and, regarding the subject of the carbon being at times the only practicable current to employ for tests to a break, the student will do well to read the paragraph beginning half-way down page 397.

Geo. Park, M.I.M.E.E.

Pelton Fell, *October 8th*, 1909.

Inadequate Salaries for Technical Teachers.

I see by your last week's paper that a demonstrator is required by the electrical engineering department of the Dundee Technical College. The main qualifications are a technical degree and practical experience, while the successful candidate is expected to assist in the equipment of the laboratory. The salary is £80. This salary seems to the writer a totally inadequate one, and he is surprised that a department presided over by an M.I.E.E. should offer so meagre a salary when such qualifications are necessary. The salaries paid to technical teachers are, as the advertiser must know well, low enough, and it should be the endeavour of one who has risen to make things better for those who come after. What the equipment of a laboratory, while the ordinary class and lecture work is going on means, only those who have passed through such an ordeal know. The writer remembers reading a day or two ago that Barnet (Herts.) advertised for a handyman for a workhouse at 30s. per week, which works out at a little less than the £80 offered in the present case.

A. T. T. I.

Unemployment.

Having read with much interest the correspondence on unemployment and combination, I beg to ask the various writers if it is not possible to do something in the direction of organising at once and see if the electrical trade want a society or not. I suggest that all who are interested in this matter send in their names and views to the Editor of the ELECTRICAL REVIEW, the envelopes to be marked in the left-hand corner (Society), and I beg to ask if the Editor would kindly send all the correspondence to my address, which I enclose, and I will undertake to read over the matter and report through your columns the result, and from that we should be able to ascertain the views of the trade. I am firmly convinced that it will be better to do this than keep on talking.

There is no doubt the trade does want organising, and the sooner the better, the only difficulty seems to be that our trade has so many branches and too much of the looking down upon one another; the station assistant thinks himself above others, and so on, but if we are to get a standard rate of wages for the various branches and positions, would it not be better if all this was left on one side and try to form a body? Then it would, perhaps, be possible to agree to certain scales of wages for each section.

There are so many branches in the trade that most people think it impossible to organise, but you have only to look at the Amalgamated Society of Engineers, and you will see many branches in their trade, but each branch has its own rate of pay, and you don't find much falling out in their ranks.

In reply to Wm. Podmore, who suggests joining the A.S.E., I think it would be far better to have a separate society; there is plenty of room for one, and plenty of men in the trade to form one.

As for the proposed Engineers' Association, that is not what is wanted, it being on the same lines as the Institution of Electrical Engineers, which is of no use to the man who has to work for his living.

No doubt most people are aware that there is already an Electrical Trades Union, but the bulk of their members are wiremen; they do not make any provision for other branches, and even if they do, all candidates accepted are classed as wiremen, that being their main object.

What we want to do is to organise electricians, men who have served a specified time at the trade and can do wiring, and are capable of taking charge of plant and doing running repairs.

I appeal to all shift engineers and electricians in charge of plant to send in their names, views, and suggestions, as soon as possible, and then someone in each county can get into touch with all who are interested. I am willing to do my share in the North, and perhaps others will do theirs elsewhere.

Unity is Strength.

My sympathies are with the unemployed, having been out of employment myself; but I feel that I cannot let Mr. Podmore's lament go unanswered: especially that part dealing with polytechnics and those taking advantage of the facilities offered by them.

I am a believer in the principle of the living wage, &c., but Mr. Podmore does not abuse the men on this point. In fact, Mr. Podmore gives himself away somewhat when he says, "as good mechanics and electricians are watching these robbers, and laughing as they drill a $\frac{5}{8}$-in. hole in their brass." Now the point is this—these men are paid to work, not to watch and laugh at the efforts of others; that is their employer's business. If, instead of doing this, they took an intelligent interest in their own work, and watched the efforts of those who are cleverer and better men than themselves, they might then improve their own position; if not, in the monetary sense, they would in the esteem of their employers; and even that counts.

After all, the employers and their charge hands are the best judges of a man's capabilities and whether it pays to keep a certain man or not. If a man can do his work, it is immaterial to his employer where he gained his knowledge.

These polytechnic, &c., men are, as a rule, men who use their spare time and money for their future welfare, are not spoon-fed, and many have been compelled to rely on their own individual efforts; the consequence is, they make the most use of any opportunity which may occur, and succeed in life without taking any mean advantage of others.

Some little time back I had to examine the answers to an advertisement. The money and position were small; one man offered his services (had served his time), there was nothing in electrical work he could not do; he gave statistics showing day and year of birth; he worked out his own age, unfortunately for him he was a year out in his calculations. Another (he also had served his time) stated that he had passed "The Cities and Gilds" exams., I presume he meant "City and Guilds." There were over 100 applications; the majority of them displayed that curious combination of over-confidence and indifference.

A man should be judged by what he can do, not by what he ought to do and the amount of money his relations were able to spend on him as a youth.

All honour to those men whose parents were able to give them a fair start in life, but why abuse and refuse the right to work and live, provided the game has been played, to those who, like myself, as youths had to struggle against

Adversity.

Reversal of S.P. Motor.

I shall be glad if any of your readers can give me any explanation of the following singular occurrence. I have a 2-H.P. Fuller motor, 210 volts, 60 periods, single-phase (running off town supply), which I use to drive a couple of lathes and other small machines. This motor has been running for about eighteen months, and has given me every satisfaction, but on starting up on Saturday last I was surprised to find the direction of rotation was reversed.

The motor or connections had not been touch in any way. I will be obliged if you can find room in your valuable paper for this letter, as I have asked several electrical engineers, and none of them are able to give a satisfactory explanation.

Puzzled.

Australia.—A decision has recently been given by the Australian Customs authorities to the effect that "relay instruments, time elements, used in connection with electrical circuit-breakers, but are separate and distinct from them," are dutiable at the rate of $17\frac{1}{2}$ per cent. in the case of foreign productions, those of British manufacture being admitted at 10 per cent. *ad valorem.*

PROCEEDINGS OF INSTITUTIONS.

Steam Turbines.

By Gerald Stoney, B.E., M.Inst.C.E., M.I.E E.

(*Abstract of* Cantor Lectures *delivered before the* Society of Arts, *March and April*, 1909.)

It has been found that in the reciprocating engine there is little use, considering the temperature at which the feed water is returned to the boiler, in going to a better vacuum than 25 in. With the steam turbine, vacua of 28½ in. or 29 in., or absolute pressures of from ¾ to ½ lb. per sq. in., can be easily utilised, as the difficulty of dealing with large volumes of steam does not occur in the case of the steam turbine as in the case of the reciprocating engine, and it has been found that with the steam turbine the gain due to vacuum goes steadily on up to the highest attainable vacua. Between 25 in. and 26 in., or 26 in. and 27 in., there is a gain of about 4 per cent.; a further gain of 5 per cent. is made with the vacuum increased to 28 in., and a still further gain of 6 to 7 per cent. when it is increased to 29 in.

This is more easily understood if we consider that the theoretical power to be derived from the steam is almost proportional to the logarithm of the expansions, and thus practically the same power can be obtained working from 400 lb. to 1 lb. absolute, or 28-in. vacuum, as from 200 lb. to ½ lb., or 29-in. vacuum. In each case there are 400 expansions by pressure, and in each case the theoretical consumption of steam by Clausius' cycle would be about 9·3 lb. per KW.-hour. With 150° F. superheat this would come down to 8·7 lb., and under the conditions of 200 lb. pressure and 29-in. vacuum with 150° F. superheat, 13·2 lb. per KW.-hour has actually been obtained with an overall efficiency, including the alternator, of about 66 per cent., or 71½ per cent. on the turbine shaft, allowing for the electrical losses. Prof. Ewing, in his book on "The Steam Engine," gives a list of principal results obtained from condensing reciprocating engines, and in no case does the ratio of the consumption of steam by Clausius' cycle, compared with that used per indicated horse-power, exceed 64 per cent. As the ratio of brake horse-power to indicated horse-power is never more than 90 per cent., this means an efficiency at the engine shaft of not more than 58 per cent. When it is remembered that the figure obtained in the case of the turbine was 71 per cent., and further that the reciprocating engine is unable to take advantage of high vacua, it is easily seen where the advantage of the turbine, especially in large sizes, comes in.

In all machinery with reciprocating parts, heavy foundations are required, and in many cases the trouble due to vibration is considerable, especially in the case of quick-running engines. Besides that, especially in large turbines, the cost of repairs and attendance is much less, while the space occupied is only about one-third or one-quarter of that required for reciprocating engines. In very large sizes it has been found practically impossible to make reciprocating engines satisfactory, and it may not, perhaps, be generally known that one of the reasons which led the Cunard Committee to adopt turbines for the great express steamers *Lusitania* and *Mauretania* was the fact that the engineering difficulties of the enormous reciprocating engines required, made the problem almost impossible of solution without the use of turbines.

The arrangement universally adopted for all large turbines is one in which the expansion of the steam is carried out in stages. If the expansion is divided up into a number of steps the velocity of the steam is greatly reduced, and thus not only can the surface velocity of the turbine wheels be reduced but also the speed of revolution, and cutting action of the steam is prevented, for high velocity steam jets are able to cut away the hardest steel. Even yet in some classes of turbines with few stages there is still cutting action on the blades.

The compound turbine naturally divides itself into two sub-classes, those in which the expansion of the steam takes place both in the fixed and moving blades, and those in which it takes place in the fixed blades only. Included in the former class is the Parsons, while the latter contains the Rateau, Zoelly, Curtis, and various others. In the Rateau and Zoelly, which strongly resemble one another, the velocity of the steam at each stage is taken up by a single row of blades mounted on a wheel, and in the Curtis by a wheel having two or more rows of moving blades with guide blades between. There are also various combinations of these, especially those with a Curtis high pressure part and a Parsons low pressure, but as yet they have not come largely into use.

Within the last 12 years the output of the Parsons steam turbine has gone up by leaps and bounds, until there are now on land about 2,500,000 H.P. of the Parsons steam turbine at work and on order. Practically the whole of the great power distribution scheme in the North-east of England, at Newcastle, is supplied with these steam turbines. This not only supplies electricity for lighting to the district around Newcastle, but also the whole of the power to many works, shipyards and factories, besides the electrification of the Tynomouth lines of the North-Eastern Railway. In the power stations supplying that district, there are erected—besides smaller ones—eight turbines of 5,000 KW. each, the latter only taking 13·2 lb. of steam per KW.-hour at full load.

In the Rateau and Zoelly type of turbine (which have been developed chiefly on the Continent) unlike the Parsons, in which expansion takes place both in the fixed and moving blades, the whole of the expansion is in the fixed blades, the moving ones being cup-shaped so as to turn the steam and make it give up its energy without altering its velocity while passing through them. The fixed blades are in a series of diaphragms in a cylinder, with a shaft passing through holes at their centre, which shaft carries a series of disks having cup-shaped blades on their circumference. Where the shaft passes through the diaphragms there are suitable glands so as to minimise the leakage of steam as much as possible; and, in order to get a good height of blade, the fixed or guide blades, especially at the high pressure end, only extend to a portion of the circumference. As a rule, all the disks are approximately of the same diameter, expansion of the steam being allowed for by both increasing the height of blade and also increasing the widths of the sectors of blades admitting to the revolving disks.

The Curtis turbine, which was originated in America, is of a similar construction of diaphragms, carrying sectors of fixed blades with revolving disks between, but these disks carry, instead of one row of blades, two, three, and sometimes four rows with fixed blades between, each row taking up a portion of the velocity of the steam and delivering it to the next row of guide blades at reduced velocity; and when its energy has become exhausted, it is delivered to the next diaphragm, where the drop of pressure enables it again to act on another set of moving and guide blades, and so on until the exhaust is reached.

And now as to the theoretical aspects of the question. Some 60 to 70 years ago the thermo-dynamic theory of steam was worked out by Carnot, Regnault, Clausius, Rankine, Kelvin, and others, and it was shown that under given conditions of superheat, steam pressure, and vacuum, it was not possible to get more than the amount of power out of the steam as expressed by the cycle which was worked out almost simultaneously by Rankine and Clausius. It is, then, the object of the turbine designer to obtain a result as close as possible to the result which should be obtained according to the above cycle. In this connection it is necessary to have the velocity of the steam passing through the blades the best in relation to the velocity of the blades, and experience has shown that in the Parsons type of turbine this is best when the velocity of the steam is somewhere about double the velocity of the blades, and in the Rateau a little over one-third.

Now the velocity of the steam depends on the drop in pressure between one row of blades and the next, and it can be shown that $v^2 = 2 g H \frac{dp}{p}$ where $g =$ gravity, H is the homogeneous head of steam, which is about 63,000 ft. for high-pressure steam and about 45,000 ft. for steam at atmospheric pressure, p is the absolute pressure at any row of blades, and dp is the drop of pressure between one row of blades and the next, and therefore $\frac{dp}{p}$ is the amount of expansion that takes place in any row of blades.

Take, as an example, a Parsons turbine, as shown in fig. 1, which is the blading diagram for a 500-KW. turbine for 3,000 R.P.M., and 150 lb. pressure, with a vacuum of 28 in. If we assume that the turbine is of the same diameter throughout, it is easily seen that since the speed of the blades is constant, in order to make the velocity ratio between the steam and the blades constant, the velocity of the steam through the blades must be constant, and as the steam at each row expands by the amount $\frac{dp}{p}$, it is evident that each row must have larger openings than the one before by the amount $\frac{dp}{p}$, and also that this ratio $\frac{dp}{p}$ is a constant throughout the turbine on the assumption that H is constant, which is approximately the case, and for a preliminary consideration may be assumed.

From the equation $v^2 = 2 g H \frac{dp}{p}$ the velocity of the steam can be calculated at any point along the turbine, and from this and the area through the blades the quantity of steam used per hour can be calculated. In taking the area of the blades it is necessary, not only to take the actual area through the blades, but also that of the clearance space above them, and further to the quantity thus calculated there has to be added the leakage through the dummies, and also, if steam packed glands are used, the quantity of steam required to pack these glands.

Both these items, especially the latter, are small ones, but when all these allowances are made it is found that within errors of observation the quantity of steam used by a turbine is the calculated one. It is thus easy to calculate the quantity of steam used by a turbine, but the horse-power it will produce is another question, and in many cases, especially in new types or sizes of turbine where the steam consumption per kilowatt-hour was uncertain and a considerable margin was left, it was found that the steam pressures required to give the rated output were considerably lower than was anticipated.

The fact that the steam consumption of a turbine so nearly agrees with theory proves that the velocity of steam through the blades must very closely approach the theoretical, and in fact, unless this was the case, it would be impossible to get from turbines the high efficiencies that are obtained. We, therefore, have a turbine consisting of a drum with blades gradually increasing in height according to what is known as a logarithmic law, that is, each row of blades is $\frac{dp}{p}$ higher than the preceding one.

Now since, in an ordinary turbine working from, say, 150 lb. steam pressure down to a pressure of 1 lb. absolute, or a vacuum of 28 in., there are about 150 expansions by pressure—or, say, 100 expansions by volume—we require the blades at the low pressure end 100 times as long as the high pressure end, so that it will easily be seen that the blades at the low pressure end would be so long as to be impossible to put on the spindle. The device, therefore, is adopted of increasing the diameter towards the low pressure end (see fig. 1), and, since an increase of diameter also increases not only the circumference but also the velocity of the blades, it is easily seen that the height of blade will vary inversely as the square of the diameter; that is, if you double the diameter, you double the velocity of the blades, therefore you double the velocity of the steam, so that you require only half the area through the blades, but since the circumference is doubled you only require blades of one quarter the height. The usual custom in land turbines is to have three drums each $\sqrt{2}$ or 1·4 times the diameter of the next one, and thus the blades on the second drum are half the height they would be if on the diameter of the first drum, and

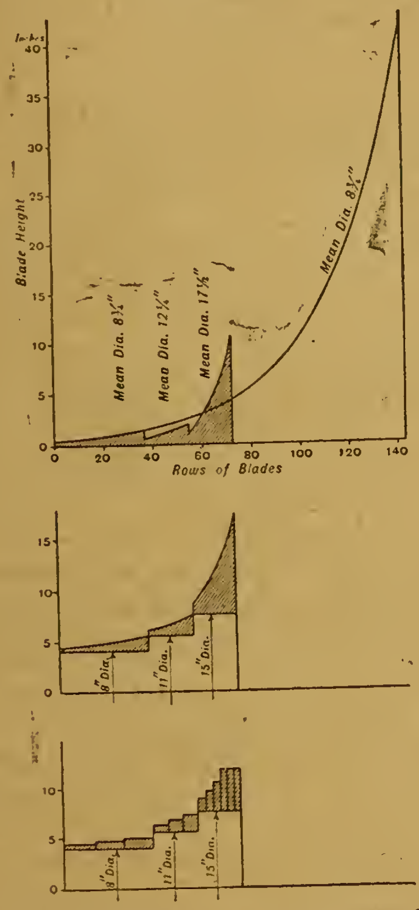


FIG. 1.—BLADING DIAGRAM OF 500-KW. TURBINE, 3,000 R.P.M.

the blades on the last drum, one-quarter the height they would have been if on the diameter of the first drum. This, in the case mentioned above, where there are 100 expansions by volume, reduces the ratio of blade heights from 100 to 25, and by making the blades at the exhaust end of larger opening, so that they have double the capacity for steam of the ordinary blades, the ratio of blade heights is further reduced down to 12½, and this is a very common ratio between the blades at the high pressure and the blades at the low pressure end in ordinary land turbines.

The three drums of the turbine are so proportioned that about a quarter of the power is in the first, a quarter is in the second, and half in the third, but this is purely an arbitrary division, and can be varied within wide limits to any extent desired, but in practice it comes out as a very fair compromise between the various conflicting conditions that have to be considered. Small diameters are an advantage, because you get longer blades, but, on the other hand, as we have shown before, the height of the blade varies inversely as the square of the diameter, and it must be further remembered that the number of rows required for a definite expansion also varies inversely as the square of the diameter, and therefore with small diameters you get great length of drum and long blades, and with larger diameters you get short drums and short blades. The first gives you a turbine shaft of great length which is liable to bend and whip, and, therefore, the clearance over the tops of the blades has to be increased: the latter gives you very short blades, and on account of their shortness the percentage loss by leakage over the top of the blades is large, and the best result is obtained by a happy compromise between the various conflicting conditions. In this relation it is easily seen that for any given number of expansions and revolutions, to obtain a given velocity ratio a certain volume of spindle is necessary, or generally a more convenient way of expressing it is that the product of the number of rows multiplied by the square of the blade velocity gives a constant which, for any given number of expansions gives a certain velocity ratio between the blades and the steam, which may be from 0·4 to 0·6.

The above theory is on the assumption that H is constant, that is, that steam is a perfect gas, which, of course, is not quite true, and therefore, in order to attain accuracy, corrections have to be made for the difference between steam and perfect gas, but these being of a secondary order, they are, as a rule, most easily made by considering H to be constant for various portions of a turbine separately.

In the above turbine, as I have shown, the theoretical curve for the blades is a logarithmic one, but it is almost impossible in practice to make a spindle and cylinder of logarithmic curves, and therefore the device is adopted of stepping the turbine, and, as shown in fig. 1, the blades are stepped so as to approximate closely to a logarithmic curve, each step being made so small that there is no appreciable loss of efficiency due to the varying velocity ratios along the step. Another method of calculating turbines is by the entropy diagram or $\theta\ \phi$ method, and this leads to exactly the same results as the method using H, or the homogeneous head of steam, which is given above. Some designers prefer one method, and some the other, but, personally, I have always preferred what may be called the H method.

Other types of turbines such as the Zoelly, Rateau and Curtis, can be calculated in the same way, but the velocity ratios to give the best results are different for them, and each type of turbine has to be considered separately on its own merits. In turbines, it is easily seen that, for a given size, the lower limit of speed is one in which the blades become so short as to cause excessive leakage, and thus loss of efficiency. On the other hand, the upper limit of speed is one in which it is impossible to get sufficient area through the low pressure blades to give good results, since it is not allowable to stress the drum or disk to which the blades are fastened beyond a certain point, and therefore the surface speed is fixed, and it is also necessary not to stress the blades beyond a certain point, and therefore the maximum height of the blade on the drum or disk is also fixed.

Another thing is that it is not advisable to have the height of blades more than one-fifth to one-quarter of the diameter of the drum to which they are fixed, as otherwise they spread so much at the tips as to become a bad shape.

With these limitations, it can be shown that turbines can be constructed of similar dimensions to run at speeds the inverse of those dimensions. Thus, if we take a 1,000-KW. turbine, running at 3,000 R.P.M., and double the size of it all over, the surface speeds will be the same at 1,000 R.P.M., and the stresses on the material of the blades, drum, &c., will be the same. On the other hand, we have double the diameter and double the height of blade, and therefore four times the area for the steam to pass through, with the blades moving at the same velocity, and, as a result, four times the power will be obtained, or our turbine at 1,500 revolutions will give an output of 4,000 KW. This gives the limiting speed for any given turbine, but except in exhaust turbines, which work with steam at atmospheric pressure, and therefore have to deal with great volumes, and also turbine-driven blowers which run at an average of about one and a-half times the speed of turbines driving alternators and dynamos for similar outputs, this limit is rarely attained.

Now it can be shown that alternators also obey the same rule of varying inversely as the square of the speed, and thus it will be seen that alternators coupled to turbines go up in size together, and that apart from the trouble there is due to being compelled to have an even number of poles, alternators of the maximum size for that speed have similar turbines attached to them. For instance, as above, a 1,000-KW. turbine attached to a 1,000-KW. alternator at 3,000 R.P.M. will have similar properties and characteristics to that of a 4,000-KW. turbine attached to a 4,000-KW, alternator at 1,500 R.P.M., and thus there is no limit to the size of turbo-alternator. In the case, however, of continuous current dynamos, the output of a dynamo (as it is chiefly limited by commutation conditions which depend principally on the ampere-turns on the armature per inch diameter) is practically only proportional to the speed, and it is easily seen that a limit is soon reached where the speed of the turbine is too low for economical conditions.

This statement that the output of a dynamo varies inversely as the speed is not exactly true, the real ratio in practice being as the 1¼ power of the speed, but still a limit is soon reached for continuous current work, and although we can make a 1,000-KW. alternator running at 3,000 R.P.M. we can only make a 500-KW. continuous current dynamo to run at the same speed, or a 1,200-KW. to run at 1,500 R.P.M. The 500-KW. at 3,000 R.P.M. is a very good machine, and so is the latter, but this is about the lowest speed at which a turbine can economically run at that size, and thus no one has put more than about 1,200 or 1,500 KW. into one dynamo. However, by using tandem dynamos it will be seen that the output is doubled, and this enables tandem turbo-dynamos up to about 4,000 KW. to be economically built.

In the design of marine turbines the same lines are followed exactly as in the design of land turbines, but in marine turbines the limitations of the screw propeller are to be dealt with instead of the limitations of dynamos, alternators, &c., in land work, and the importance of carefully balancing the efficiency of the propeller against the efficiency of the turbine has to be most fully considered. Screw propellers, as a rule, are more efficient the slower they go, turbines are less efficient the slower they go, and therefore the balance between the two has to be most carefully looked into. As a result it has been found that with simple installations of screw propellers and turbines it is not advisable to go below a speed of 15 to 18 knots.

Electrical Matters at Newport (Mon.).—The Electricity and Tramways Committee has recommended the T.C. to appoint Mr. C. P. Sparks (not Parkes as mentioned in error on p. 543), at a fee of 250 guineas, plus travelling and out of pocket expenses, to report upon the question of tariff so that the modifications can take effect as soon as possible, and as to whether the undertaking is being worked to the best advantage.

£6,318.

In view of the great interest that was taken in the Manchester Electrical Exhibition which, at this period last year, was giving so excellent an education to the thousands of that district, and was keeping us all engaged at such high pressure, we believe that the balance-sheet, given below, will be studied with no little interest. It will be observed that there was a net profit of £6,318. Twenty per cent. of this sum was returned to the exhibitors, and 10 per cent. to the donors, leaving £740, which was distributed among various charities as shown, about one-half going to the Electrical Trades Benevolent Institution. The Committee and others who were responsible for the success of the Exhibition—not excluding the electrical Press which played no little part in ensuring the above result—are to be congratulated on the financial outcome of the biggest exhibition effort that the British electrical trade has ever made.

Receipts.

To Space account—exhibitors	£10,061
„ Donations—Corporations	1,133
„ Gate money and tickets	4,751
„ Advertisements, catalogues, programmes and postcards	823
„ Sundry profits:—	
Lavatories, cloakrooms and side-shows	252
„ Electric current and meters	930
„ Gas and water	82
„ Commission on refreshments	1,033
„ Commission on stand fittings	282
„ Bank interest	46
	£19,393

Expenditure.

By cost of buildings		£4,031
„ Manchester Corporation:—For re-turfing, roadway, drainage, sewerage, and Poor Rate		908
„ Advertising:—Posters and bill posting ...	£409	
Electrical Press and Daily Press ...	729	
Post Office and other exhibits	78	
		1,216
„ Entertainments:—Bands	£666	
Luncheons, Press and opening ceremony	272	
		938
Decorations		262
„ Lighting:—Fittings, wiring and lamps ...	£424	
Electric current and meter hire ...	693	
		1,117
„ Gas, water and mains		189
„ Police and Fire Brigade		265
„ Insurances		122
„ Licences and legal charges...		115
„ Architect's and accountant's fees, &c. ...		126
„ Allowance gratuitous services		311
„ Stationery and printing catalogues ...		595
„ Management, travelling and preliminary expenses		1,546
„ Office expenses, wages, postage, &c. ...		1,268
„ Special rebate to members N.E.M.A. ...		66
„ Balance profit distributed thus:—Rebate to exhibitors, 20 per cent. on space money	£1,989	
Rebate to donators, 10 per cent. on donations	113	
International Trade Exhibitions, Ltd., 45 per cent. on profits as per agreement	2,843	
C. S. Northcote and W. Davenport, 10 per cent. on profits as per agreement	632	
„ Benevolence:—East Lancashire Systematic and Benevolent Institution ...	10	
Electrical Trades Benevolent Institution	365	
Manchester Royal Infirmary	146	
Ancoats Infirmary	109	
Salford Royal Hospital	109	
		6,318
		£19,393

Audited and found correct,

Edwin Guthrie & Co., *Chartered Accountants.*

10, Tokenhouse Yard, London, E.C,
September 21st, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Hand-Shield Wall Plug.

The use of the ordinary type of wall plug is attended with some danger, due to the flexible passing through the hand of the user, and its liability to fray and short-circuit on the edge of the hole from which it hangs. To remove these drawbacks, the British Central Electrical Co., of 17, Hatton Garden, E.C., have brought out a "Handshield" wall plug, as illustrated herewith; this, it will be seen, provides complete protection to the user, and as the flexible hangs out of a vertical hole, it is not subject to the deleterious bending met with in the ordinary type. The plug is made with either two or three pins, in two sizes for 5 and 15 amperes respectively, and is very neat and handy to use. It complies with the recommendations of the Home Office.

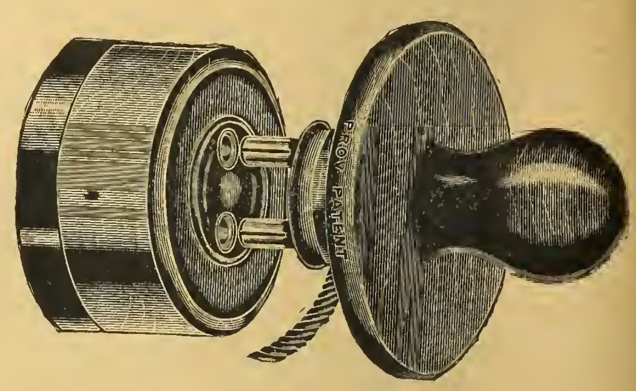


Fig. 1.—Hand-Shield Wall Plug.

Two-Speed "Cascade" Motors.

The Sandycroft Foundry Co., Ltd., of Chester, have brought out a two-speed "Cascade" motor, generally similar in construction to the one-speed machine, except that slip-rings are provided. The stator windings carry only primary currents when the machine is running at the higher speed. When running at the lower speed they carry in addition the secondary currents induced by the action of the second rotor field. The rotor winding is of the plain barrel type, exactly similar to those of ordinary slip-ring machines, the only difference being in the method of connection. The windings form a closed circuit, as in the one-speed machines, but a certain number of coils are tapped into the closed circuit and provided at their free ends with slip-rings. The arrangement of the windings is such that when the slip-rings are short-circuited the current induced in the rotor gives only one number of poles, and the machine under these circumstances behaves exactly like an ordinary slip-ring motor. When the slip-rings are open-circuited a small number of the rotor conductors become inoperative, and the currents in the rotor then produce two numbers of poles, the second of which acts upon the stator and causes the motor to run at "Cascade" speed. As an example, a machine wound to run at 8-pole and 12-pole speed carries 8-pole windings. To start such a machine a starting switch, connected to the slip-rings in the ordinary manner, is gradually short-circuited; the machine then behaves in every way as an ordinary slip-ring motor. When it is necessary to reduce the speed, the slip-rings are open-circuited and the short-circuiting switch mounted on the side of the motor and connected to the stator windings is closed. The rotor now re-acts upon the stator, and the machine runs at "Cascade" or 12-pole speed. The operation is reversed when it is required to raise the speed from the lower to the higher one. Whilst the machine is slowing down at "Cascade" speed it is acting as a generator and, returning energy to the line.

It will be noticed that with these machines it is never necessary to break the main circuit, so that the whole of the operations can be brought about without any sparking. This method of control is suitable for motors required to run for long periods at two definite speeds, and we are informed that it has been very successfully applied to the driving of air compressors, ventilating fans, mortar mills, pumps, &c. There is a large field for two-speed motors for driving such classes of machinery as winding engines and rolling mills; in these cases, instead of mounting a short-circuiting switch on the side of the machine, a controller is connected with the tappings. When starting, the stator controller is first brought into operation, and the machine is speeded up to "Cascade" speed under these conditions; the slip-ring controller is now brought into operation, and the machine then runs up to the higher speed. The method of operation is exceedingly simple, and the acceleration losses are very considerably reduced. There is a further advantage in the application of these machines for such work, as when starting in "Cascade" they are capable of exerting a larger starting torque than when operating on the slip-rings. For a given input the motor at "Cascade" speed develops 40 to 50 per cent. more torque than when running on the slip-rings. The most economical method of operating the winding engine is, therefore, to start with the maximum amount of power required during the winding, and to run up to speed with high acceleration up to the two-thirds speed. Above this speed the slip-ring controller comes into operation, and for the same power input the acceleration is reduced. With this system of control the efficiency of electric winders is high, and important advantages without complications are claimed for it.

The cost of a two-speed winding motor is but little in excess of that of an ordinary one-speed slip-ring machine, and the further additional cost is only that of the stator controlling gear. As the amount of energy to be dissipated in resistance is only about half as much as with single-speed machines, the sizes of the controlling resistances are much reduced. In the whole operation of winding and changing speeds the main circuit of the machine is never open-circuited.

Tell-Tale for Collieries.

The accompanying illustration shows a "tell-tale" invented and made by Messrs. Imeson, Finch & Co., Ltd., of Bridge Works, Stockton-on-Tees, to indicate the number and identity of men in a pit. It consists of a series of numbered swing brass checks, each held in the "out" position by a swivel pin, bearing the corresponding number. Each man, as he receives his lamp, withdraws the pin bearing his number, and attaches it to his lamp, the check at the same time dropping to the "in" position. No person is allowed to enter the mine without the swivel clip attached to his lamp. On leaving the pit, he detaches the clip and pins his check in the "out" position again. The lamps need not be numbered. The device is simple, cheap and effective.

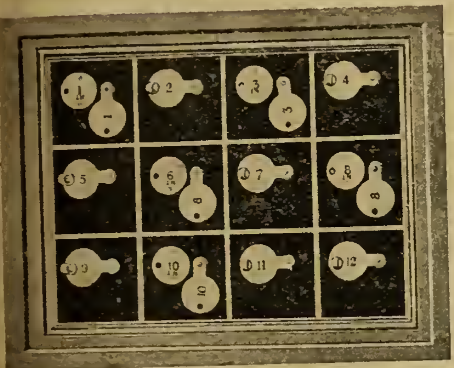


Fig. 2.—Imeson's "Tell-Tale" for Collieries.

Willans-Victoria Turbo-Pump.

Messrs. Willans & Robinson, Ltd., of Rugby, are placing on the market a new turbo-pump for both high and low lifts, designed on lines which enable it to be manufactured cheaply and accurately to gauge in standard sizes. The high-lift pumps will deal with heads up to 2,000 ft., and the low-lift ones up to 50 or 60 ft. Fig. 3 shows one of these pumps coupled direct to an electric motor, and fig. 4 is a sectional view of the pump. A noteworthy feature is the absence of a stuffing box at the delivery end, as only low pressure exists in the end chamber. Thus much wear and friction has been obviated, to say nothing of the saving of trouble and annoyance. At the suction end the stuffing-box is water-sealed, and the gland need not be screwed hard up, as the box has to hold against only $\frac{1}{10}$ atmosphere. There is no thrust bearing at all, as end thrust has been abolished by means of a patent device which automatically adjusts itself for changes of output and head while the pump is running, and for wear in the impellers. The bearings are separated from the packing by a gap of an inch or two, so that mud or grit cannot enter them. They are cast in one piece with the end covers, ensuring permanent alignment, and are provided with ring lubrication. In the case of sinking pumps, forced lubrication is fitted.

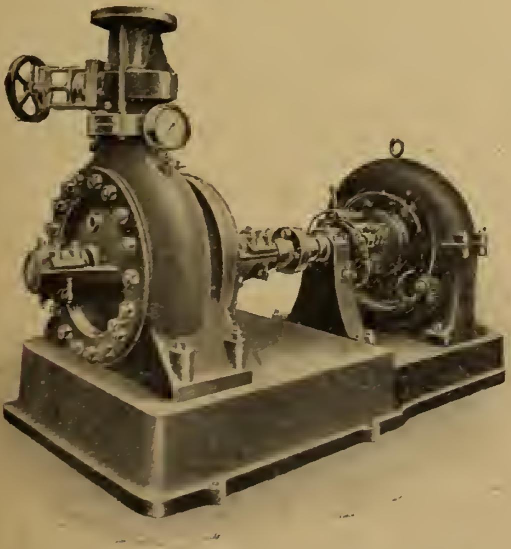


Fig 3.—Willans-Victoria Turbo-Pump coupled to Electric Motor.

From the drawing, fig. 4, it will be seen that the pump is not built up of sections, one for each stage; the central casing is of cylindrical bore, and the guide wheels and diaphragms fit accurately into it, so that dismantling and reassembling is extremely easy, and true alignment is ensured. The impellers and guide wheels are all made of special bronze, and the inner surfaces of the impeller and guide wheel channels are finished throughout, so that the water never comes in contact with a rough surface; this, as experience has shown, materially increases the life of the parts. The central casing is lined with special bronze. We are informed that high efficiencies are being obtained with these pumps, which are built to the designs of Mr. J. Orten-Böving.

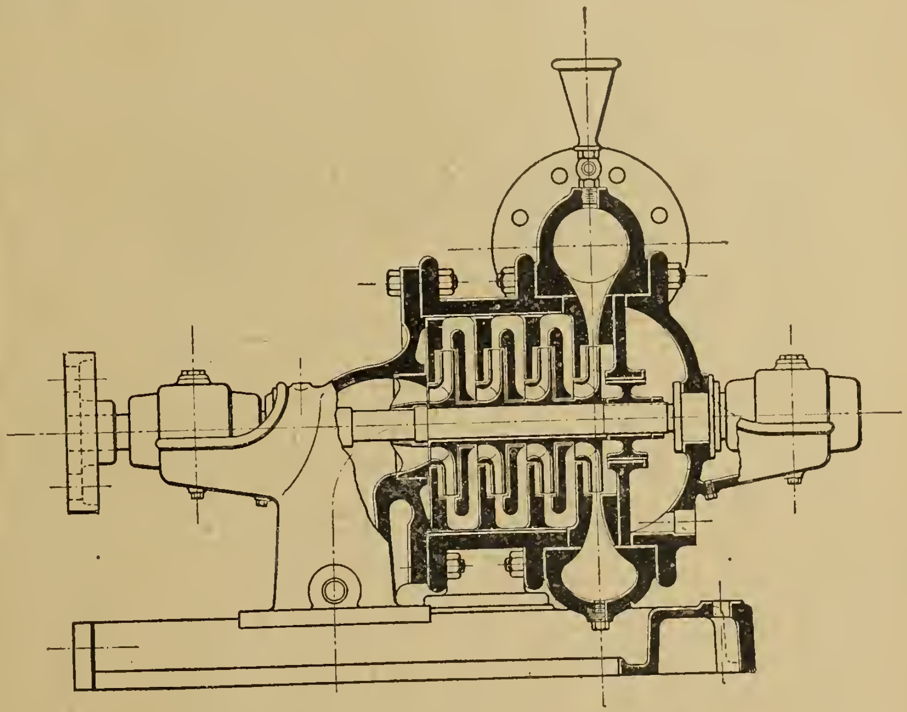


Fig. 4.—Section of Willans-Victoria Turbo-Pump.

New Gauges.

An extremely neat system of gauges has been brought out under "Windley's Patent" by the Crown Works, Chelmsford. It consists of a set of hardened steel blocks of standard dimensions, which are employed in conjunction with an outside caliper and an inside gauge, the whole outfit being mounted in a neat pocket case as shown in fig. 6. The blocks, which, like the holders, are beautiful specimens of British workmanship of the highest class, are seven

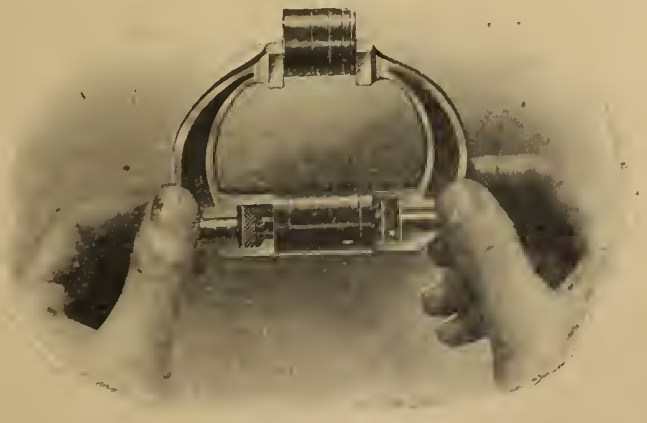


Fig. 5.—Testing the Accuracy of the Gauges.

in number, varying from $\frac{1}{16}$ to 1 in., and give, with the outside holder, a range from $\frac{1}{16}$ to $2\frac{1}{2}$ in. by steps of $\frac{1}{16}$ in., or 40 sizes; with the inside holder the range is from $2\frac{1}{2}$ to 4 in., 22 sizes, and in addition the blocks themselves give 40 end-measuring sizes singly and in combination.

When "wrung" together, by sliding one over the other under firm pressure, the blocks adhere to one another with remarkable tenacity; they can equally well be "wrung" together with one arm of the external holder, when they form a convenient height gauge, for use in combination with a surface plate. An important feature of the system is the self-checking characteristic of the device; as shown in fig. 5, five of the blocks wrung together are being tested against the 1-in. block in the holder, and a crucial test consists in afterwards interchanging the two; unless the gauge is perfect, it will not pass this test. The internal holder can similarly be tested with the external calipers. A set of these gauges was reported on by the National Physical Laboratory recently; no error in length as great as 0·00001 in. was found, and the end faces were reported to be parallel within that amount.

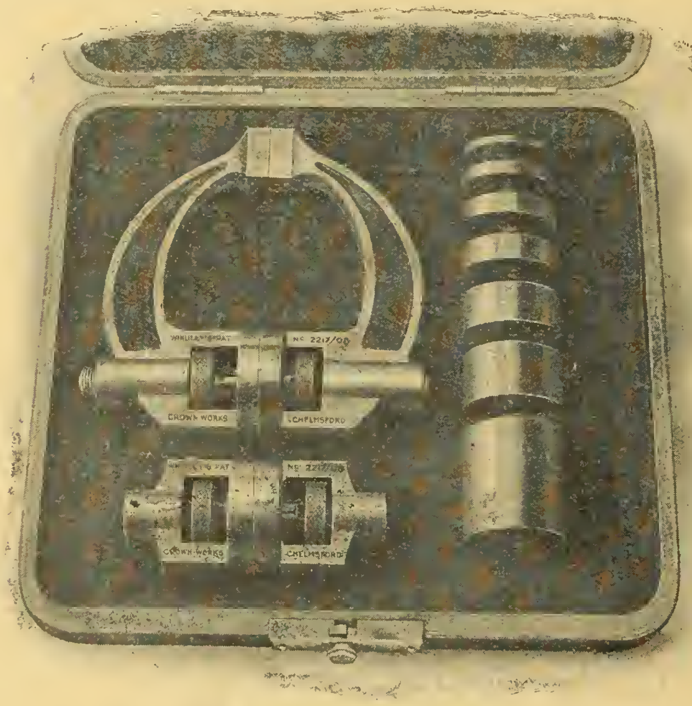


Fig 6.—Windley's Patent Gauges.

The blocks are readily inserted in the holders by a quick-grip lock-nut device, and the combination gives a handy set equivalent to over 100 separate standard gauges with, of course, a great economy in cost. We have examined a set, and greatly admire the excellence of their finish and the accuracy of their dimensions.

The Thorpe Electrolytic Watt-hour-Meter.

Undeterred by the apparently insurmountable difficulties in the way of constructing a shunted electrolytic meter of the gas voltameter type, the inventor of the Thorpe meter has for two years been experimenting with the view of devising such a meter. He now claims that he has succeeded, not only in constructing a shunted meter, but in making a watt-hour-meter on this principle. The materials appear so unpromising as to be absolutely forbidding, but the inventor states that his meter will register the smallest current passing, and that the drop at full load is not more than one volt; that it is a watt-hour-meter, with a dial like an ordinary motor meter, and does not require refilling or resetting; that no chemicals are used that are likely to give trouble; that there is no temperature error; that the meter has a practically straight-line law; and that it is cheap to manufacture. We have inspected the meter at work, and as it will be on view at the Shoreditch Exhibition, which opens on Monday next, anyone else can do likewise.

Fig. 8 shows the interior of the meter; the electrolytic cell is seen on the right, and consists of a glass bulb attached to a capillary U-tube, the former containing a weak solution of caustic soda and the latter mercury. Nickel electrodes convey the current to the liquid in the bulb, and as the gases evolved collect in the bulb, the mercury is slowly forced up the other leg until it makes a contact and actuates an electromagnet; the latter registers on a dial and recording train, and the extra current passing through the electrolyte fires the mixed gases as the liquid leaves the kathode point, thus releasing the electromagnet and at the same time refilling the bulb with electrolyte. The bulb at the other end of the U-tube is sealed, so that the temperature and pressure of the atmosphere have no effect on the records.

The trouble due to the back E.M.F. of the electrolytic cell is overcome by a novel device called an "absorption cell," which is a test tube containing two plates of nickel having a surface of 160 mm.^{2}, in a 20 per cent. solution of caustic soda. This cell, which is seen on the left hand of the figure, never requires refilling, as no gas is generated in it; it is connected, as shown in the accompanying diagram (fig. 9) at A, in parallel with a resistance B, which is the only resistance that requires adjusting—a very easy matter. "The function of this cell is to make the meter a watt-meter." In other words, the effect of the combination is that the rate of evolution of gas in the electrolytic cell E is proportional, not to the current passing in the main circuit, nor to the voltage of supply, but to the product of these two quantities. We have not

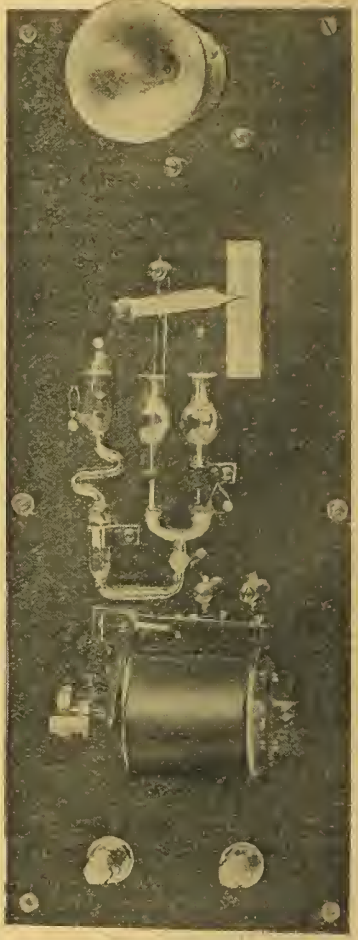


Fig. 7.—Thorpe Time-Limit.

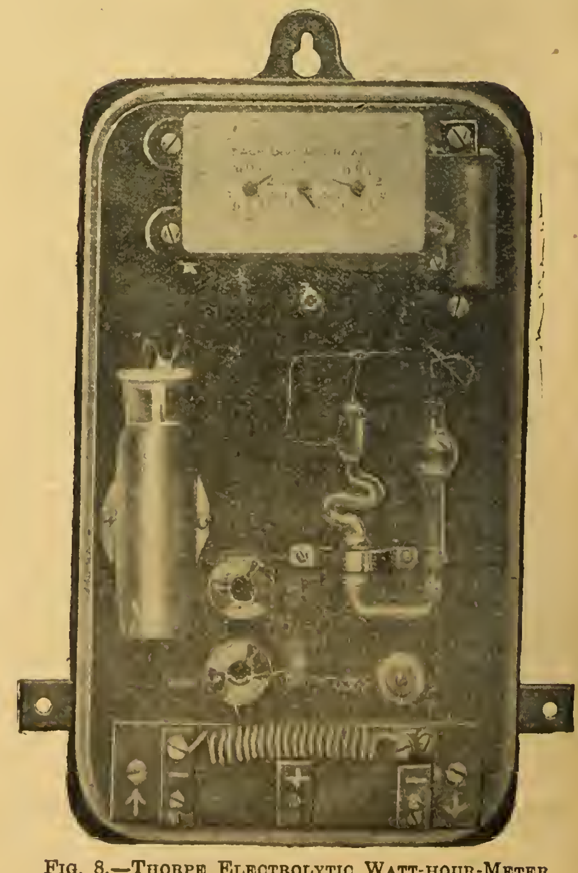


Fig. 8.—Thorpe Electrolytic Watt-hour-Meter.

yet understood precisely how or why this comes about, but we are assured that it is so in practice, within a range of voltage of 20 per cent. above or below normal. The main current passes through the shunt s, producing at full load a drop of ¼ volt in the case of the D type, and ½ to 1 volt in the case of the A type of meter. The current through the electrolytic cell is extremely small, the resistance r being of the order 4,000 ohms, and on open circuit, though a very small current necessarily flows, there is no "creeping," as the gases evolved recombine, without, therefore, actuating the recording mechanism.

A somewhat similar meter is made without a dial, a thermometer scale reading to ¼ unit being substituted; this is made for two ranges up to 250 and to 1,000 units respectively. This meter can be reset by means of a key, which fires the gases and restores the reading to zero, without opening the case.

The essential device of the Thorpe meter has been applied also to a time limit for a circuit-breaker, as shown in fig. 7. The coil at the bottom of the figure carries the main current, and on the occurrence of an overload attracts an armature, which closes a circuit through the electrolytic cell on the left-hand and the lamp at the top of the figure. It also closes a circuit leading through one leg of the double U-tube to a tripping coil on the circuit-breaker, but this is open at the contact in the U-tube. As the evolution of gases in the bulb goes on, the mercury is driven up the left-hand tubes, and on reaching the adjustable contact, which is set by the scale shown, closes the circuit to the tripping coil, opening the main switch. The electrolysis continues until the liquid in the bulb leaves the kathode, when a spark occurs and the gases are ignited, resetting the device. Should a temporary overload occur, the armature being released, prevents the trip coil from being energised, but the electrolysis continues until the apparatus resets itself as usual—a matter of only about 20 seconds. The time limit can be set to any value below 20 seconds—in the case of the instrument that we inspected. Lastly, the device has been applied to an automatic motor starter. All these new apparatus will be exhibited at Shoreditch by the **Thorpe Meter Syndicate, Ltd.**, for whom **Mr. Haydn Harrison**, of 11, Victoria Street, is the sole agent.

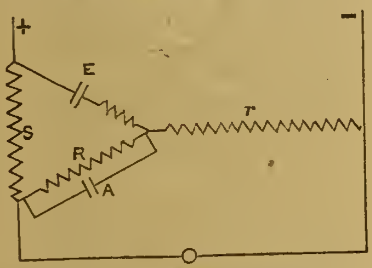


Fig. 9.—Diagram of Connections.

Suterlite Reflectors.

Messrs. Cunnington, Harris & Co., of 21, North Audley Street, W., who have taken over the business of Messrs. Frank Suter & Co. Ltd., have improved the "Suterlite" reflectors, which are now being made in aluminium and lined with opal glass. A special feature claimed for their design is the facility for wiring them with ordinary V.R. wire instead of flexible. The holders are mounted on a carrier A, as shown at B in fig. 11, which can be wired and slid into position in the channelling; the terminals G are slotted in such a way as to prevent any risk of shearing the wire, and it is only necessary to strip the insulation off about ¼ in. of the wire as at I before clamping it in place with a nut H. Instead of the 10-in. "Suterlite" carbon lamp, two of the firm's metallic-filament lamps, with contacts at both ends, can be used, as shown in fig. 10. The reflector can be made continuous by adding as many 12-in. sections as may be desired. Fig. 12 shows a section of the reflector with opal lining; it can also be had of polished aluminium. Fig. 10 shows a piece of the centre strip with the holders and one of the two lamps, which are silvered on the underside.

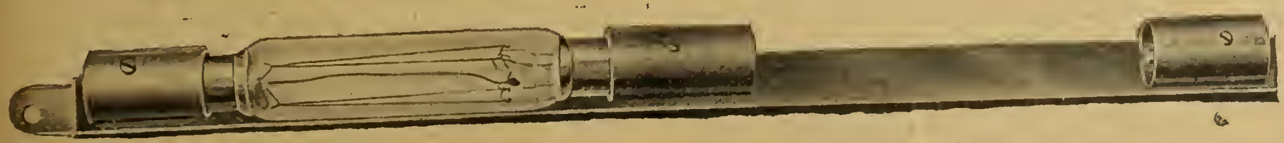


Fig. 10.—Centre Strip and "Suterlite" Metallic-Filament Lamp.

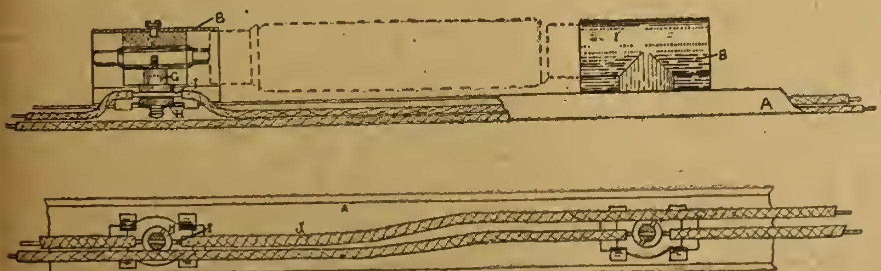


Fig. 11.—Details of "Suterlite" and Wiring.

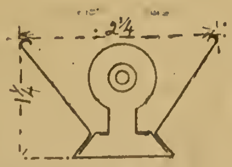


Fig. 12.—Section of Reflector, showing the Centre-Strip slid into place.

LEGAL.

A Pit Repairer's Claim.

A **Lochore** pit repairer has raised an action in the Sheriff Court, Kirkcaldy, against the Fife Coal Co., for £500 as compensation for injuries received in a pit explosion. Pursuer says he was sent to switch on the current for the ventilation of the seam. Not anticipating any danger, and being ignorant of the dangerous character of the gas with which the seam was impregnated, he did so, and immediately after the starting of the motor a terrific explosion of the inflammable gas took place. Three of the pursuer's fellow-workmen were precipitated down the shaft, and were either instantaneously killed or fatally injured, while the whole of the men in the seam, including the pursuer, were severely burned or otherwise injured. The accident, he contends, was caused through the failure of the defenders to provide a proper system of ventilation. Defenders admitted liability for the accident to the pursuer, and tendered £200 in settlement of the claim. The Sheriff is considering the case.

Alleged Electrical Defects in Fife Pits.

[*Prosecution by H.M. Inspector.*]

A case of great interest was heard on Thursday last week in the Dunfermline Sheriff Court.

Mr. C. A. Carlow, manager of the Fife Coal Co., was charged with having in Foulford Pit (1) caused or permitted to be used two switches and two fuses which were not sufficient in size and power for the work which they might be called upon to do; (2) caused or permitted to be used in the switch room, without being earthed, a metallic cover provided to prevent accidental contact with live parts; (3) caused or permitted to be used two gate-end or terminal boxes which were not in any way fixed, and of which one was not efficiently earthed, and the other was not earthed at all; (4) caused or permitted the unarmoured conductors or distribution cables in the main haulage road not to be efficiently covered and safeguarded at all parts, and not to be so installed, worked and maintained as to reduce the danger through accidental shock or fire to the minimum; (5) caused or permitted the unarmoured conductors or distribution cables in the main haulage road and in two haulage roads leading to the coal face from the main haulage road to be fixed within reach of injury from passing tubs or trams and not to be protected by a suitable covering, in consequence whereof the installation covering on the conductors was injured by abrasion at parts, and thus created danger through accidental shock or fire in contravention of the Coal Mines Regulation Act, 1887, and the electrical special rules.

Dr. John Ross, on behalf of the Fife Coal Co., said the Inspector having 41 mines to deal with calmly pounced on one pit in which he thought he had found defects, and without further notice this was followed by these proceedings. Accused was asked to do something that was almost impossible, namely, to remove the whole of the company's plant from this date. In regard to another pit at Lumphinnans, the Inspector was asked to state what he was driving at, but he would not come to close quarters and say what he wanted. He would rather lie by, and at a convenient opportunity seize the occasion of finding out some paltry defect. The Inspector knew perfectly well that the Fife Coal Co. were most anxious to use every precaution to preserve the lives and limbs of the men, and in the past they had spared neither trouble nor expense to safeguard the workers. They were anxious to meet the Inspector and see what he wanted, and in certain respects they had met the things he had asked for, but the matter of kindness or courtesy did not come into the case.

Mr. J. S. Soutar, the procurator fiscal, said he did not desire there should be any misunderstanding in regard to the purpose of the prosecution. The Fife Coal Co. controlled a large number of collieries, and employed about 12,000 men out of some 26,000 operating in the county, and it had been determined because of past experience that this opportunity should be taken of endevouring to stimulate, or perhaps he should say create, a sense of not merely the responsibility incumbent, but the relative duty consequent thereon, upon those who were superior to the certificated managers of the pits. Granted that Mr. Rowan might also be responsible, they might perhaps deal with him later on. They also alleged that Richardson, the certificated manager of the pit, had a statutory duty.

Sheriff Shennan: Apparently that is not disputed, assuming the complaint is relevant.

Mr. Soutar said there was a specific complaint made in April in regard to part of the plant, and the detailed objections were discovered in the end of July.

The Sheriff said he must write a judgment on the relevancy.

Dr. Ross: If you go into electricity we may have to send to the ends of the earth for experts.

Our correspondent reports that his Lordship's decision is anxiously awaited.

INTERLOCKED MOTOR STARTERS AND SHUNT REGULATORS.

By T. GOLDING and O. C. DINERMAN.

The subject of interlocking motor starters and shunt regulators has received but little attention from contributors to the electrical Press, and, since it is a subject of such vital importance, a short description of some of the methods adopted by leading manufacturers will doubtless prove interesting.

The necessity for effective interlocking is evident, when the dangers of starting up a motor with a weakened field are considered, both from the points of view of the motor and the starting rheostat. Unless some arrangement is provided to ensure a full field at starting, great damage is likely to occur. Not only should the motor be started up with a strong field, but precautions should also be taken to prevent resistance being suddenly inserted in series with the shunt field in large steps when the motor has run up to normal speed.

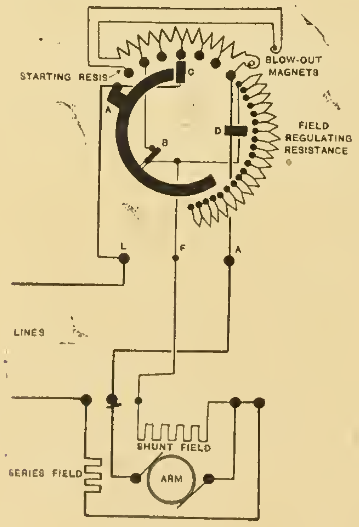


Fig. 1.

If devices are not provided to meet these ends, and the motor is started up with the field weakened by regulating resistance, the rushes of current in the armature are excessive, owing to the slow increase of back E.M.F. This, consequently, causes disastrous sparking at the commutator, with consequent wear and tear; further, if the motor is not sufficiently fully designed, there is a danger of burning out armature coils. Again, rheostats are designed to start up motors on the assumption that the current rushes will not exceed the normal full load current by more than a certain percentage. Obviously, therefore, if these rushes are much heavier than the specified amount, the resistance may be burnt out as well as bad sparking take place between the brush and the contacts.

Having started up satisfactorily, if a high resistance is suddenly inserted in the field circuit, not only is bad sparking obtained at the commutator, due to the greatly weakened field, but a high E.M.F. of self-induction is produced in the field windings, which may break down the insulation or in other ways cause damage. These effects are both costly and annoying, consequently any device which will reduce the danger is exceedingly valuable; and, as in actual practice the addition of suitable apparatus is generally so simple and cheap, it is advisable always to have some interlocking device when starters and shunt regulators are used.

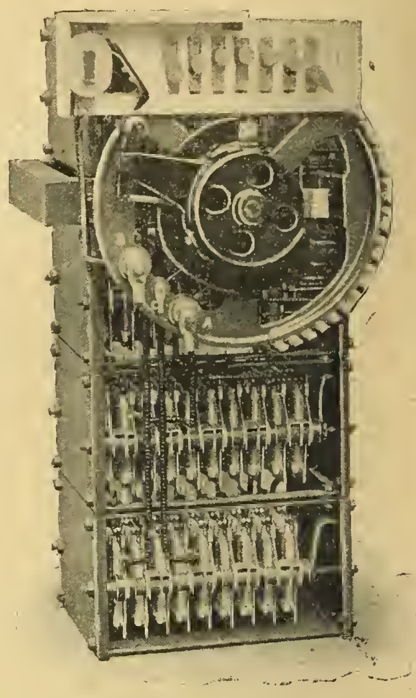


Fig. 2.

Generally speaking, the devices in practice designed to attain the above ends can be classified under two headings, viz., mechanical and electrical.

Of the mechanical interlocks, perhaps the most simple is the type illustrated in fig. 1. It consists essentially of a series of contacts, some of which are for starting, the remainder being for regulating.

In the example shown, the usual English method of moving brush arm is reversed, the sector being revolved and the brushes remaining stationary.

When the sector is in the position shown, the extension A brushes the first of the fixed contacts, and thus completes the field circuit through the brush B. Further movement will bring the sector on to the contact C completing the armature circuit through all the starting resistance. When this has been cut out, the sector short-circuits C and D, and, consequently, all starting resistance, at the same time breaking the field circuit at B, but making it again on the first regulating contact. As the lever is

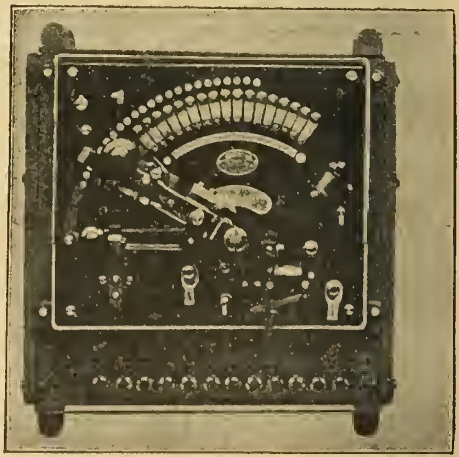


Fig. 3.

moved further round, regulating resistance is inserted, and the motor speed is increased.

It will be obvious that before the regulating resistance is inserted, the starting resistance must first be cut out.

This type of apparatus can be fitted with automatic features, to protect the motor against inequalities of load or supply. The actual apparatus—of which fig. 2 is an external view—is of German manufacture, and is designed for outputs from 1 to 150 B.H.P.

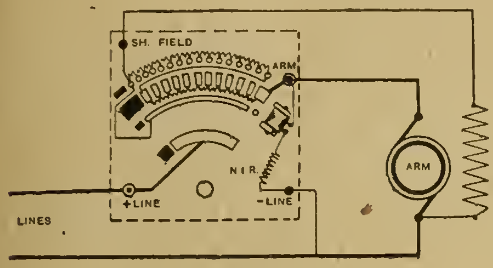


Fig. 4.

It will be noticed that in the "off" position the shunt field has a discharge path through the armature and starting resistance. This is clearly advantageous in cases where the regulating resistance has a high value.

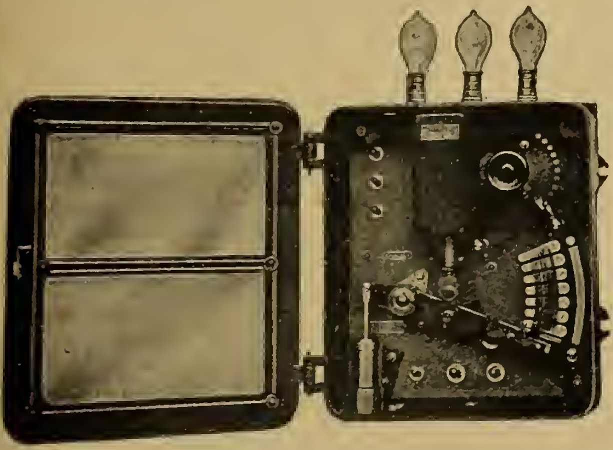


Fig. 5.

Whereas in the above case both operations are carried out by the movement of one lever, figs. 3 and 4 illustrate a type in which two separate levers are provided. One lever is for starting only, and on it reaching the "full-in" position and being engaged by the "hold-on" magnet, a projecting piece on the casting engages the trailing lever, moving it to the first of the shunt contacts.

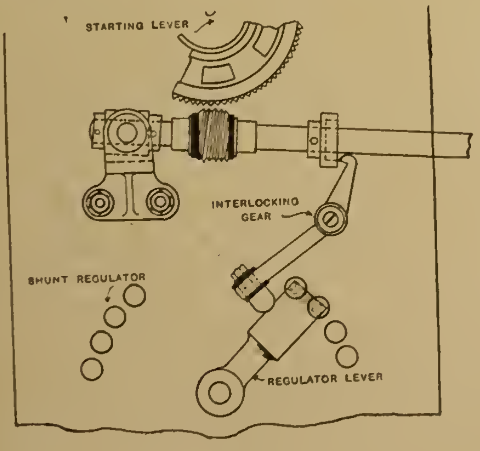


Fig. 6.

Whilst cutting out the armature resistance the shunt regulating resistance is short-circuited by means of a contact on the leading lever brushing a sector. In the normal running position of the leading lever this short-circuit is removed, and the trailing lever is free for regulating the speed.

Any abnormal condition in the line or load effects the release of the leading arm, which, being controlled by a powerful spring, returns to the "off" position, taking the regulating arm with it.

To illustrate the application of interlocking as applied to automatic motor-starters, fig. 5 is given. This is a most simple case, the regulating resistance being short-circuited (by a brush on the rheostat arm) in a similar manner to that described in reference to figs. 3 and 4, until all starting resistance has been cut out, when the regulating resistance can be inserted for speed variation. It will be clearly seen from the illustration that no provision is made to prevent the resistance being introduced in one step, consequently this would not be suitable for a large range of regulation.

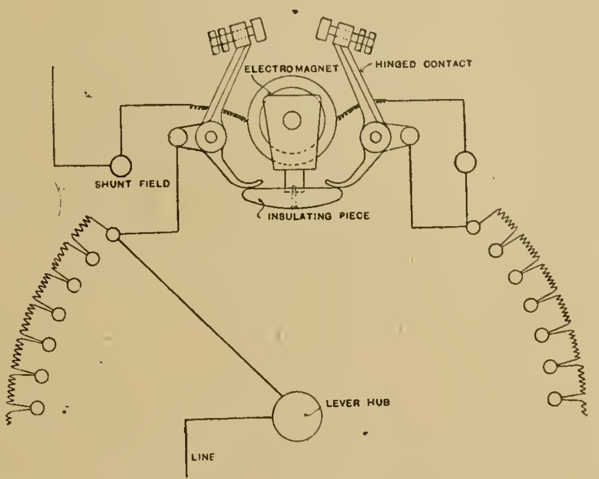


Fig. 7.

Of course, a device could be fitted to ensure the regulating lever being brought back to the "no resistance in" position before commencing to regulate, but in cases where the regulation to be obtained is sufficient to merit this addition, it is advisable to use a slightly different type of interlock —of the electro-magnetic type, to be described later.

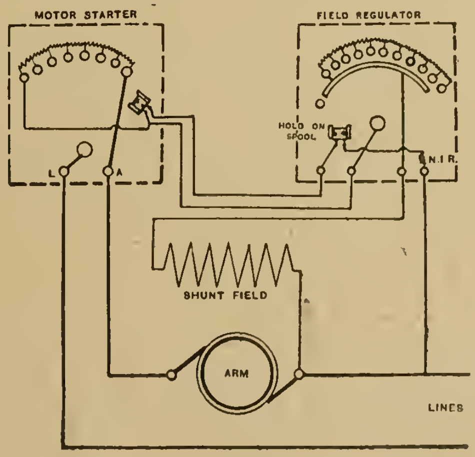


Fig. 8.

A device which necessitates the use of a link for interlocking purposes only is shown in fig. 6. In this figure the device is shown applied to a starter with worm slow-speed gear. It is, however, also applicable to any form of hand-operated motor-starter. This inter-connecting lever is provided with a hook at one end, which engages a collar on the worm spindle, and does not release it until the regulator lever is in the position when all regulating resistance is out of circuit, in which position the catch is released, leaving the worm free to engage the quadrant, and, consequently, to start up the motor.

In every case described above, it is essential that the regulator and starter are mounted on a common base. This, although in many cases an advantage, may in others be impossible or inconvenient, particularly when the regulation has to be effected at a distance from the motor. To fit the starter at an equal distance would necessitate the use of unnecessarily long heavy leads.

Interlocking in these cases is attained by the use of electromagnetic devices. Perhaps the neatest form is that shown in fig. 7. The arrangement consists of two hinged contacts tending to always come together, and an electromagnet with a hinged armature, which in the closed position opens the two contacts referred to. The magnet is not sufficiently strong to lift the armature, and the armature can only be lifted by bringing the shunt regulating switch to the first stop, where a small projecting piece on the rheostat lever slides against the armature and lifts it into the closed position. The two small contacts previously mentioned entirely short-circuit the shunt-regulating resistance, and, as the electromagnet is connected in the field circuit, whenever this is broken, the resistance is short-circuited quite independently of the position of the switch arm. The motor can be restarted with the shunt-regulator arm in any position, but no shunt resistance can be inserted until the switch arm is brought to the first position, and the small contacts consequently opened.

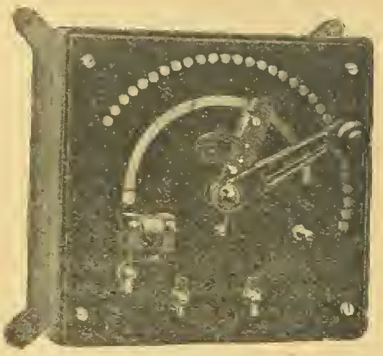


Fig. 9.

Another type of this class of interlock is shown in figs. 8 and 9. This is provided with two levers, one of which carries a soft iron armature and a brush which makes contact on the metal sector, unless held over by the "hold-on" magnet, when the contact is removed from the sector and made on a button. The other lever is free to move over the field contacts for regulation. When the former lever brushes the sector, all regulating resistance is short-circuited, the short-circuit not being removed until this has reached the position where it no longer makes contact on the sector. In order to bring it back to here, the other lever has to be brought back to the "all resistance out" position. If the motor has been started up, the magnet will retain the shorter lever—the longer one being free for regulating. Any abnormal conditions arising—such as failure of supply, overloading of motor, &c.—effects the deenergising of the hold-on magnet, allowing a spring in the hub to carry the lever into a position where all resistance is short-circuited.

An exceedingly simple and efficient method of interlock (covered by patents) adapted to a multiple lever type starter, is shown in fig. 10. On the lever of the shunt regulator is cast a fan with notches, which are engaged by a detent, actuated by an electromagnet in series with the shunt field. Unless this magnet is energised, the contact lever is kept at the "all resistance out" position by the aid of a powerful spring.

On the final lever of the starter is fitted a copper brush which bridges two contacts, these being so connected that when in this position the shunt regulator and hold-on coil are short-circuited. When, however, this last lever is closed, and consequently all the starting resistance is out of the motor circuit, the short-circuit is removed, allowing the hold-on coil to be excited, and leaving the regulating resistance available for insertion in the shunt field.

The magnet now being energised, the detent before referred to will hold the contact lever in any position, in which it is placed by hand, corresponding to the speed required. On failure of voltage or any interruption in the motor circuit, the hold-on coil will be de-energised, releasing the contact lever and allowing it to return to the first position, where all resistance is out.

In cases where the variation of shunt current necessary to give the required increase of speed is too great to allow the hold-on coils mentioned above to be connected in series with the shunt field, it is usual to connect them in series with a high resistance unit across the lines. This, however, does not materially affect the descriptions given.

The remarks with reference to fig. 1, regarding the discharge path of the shunt field when the rheostat is in the "off" position, can be made to apply to any of the above designs by the addition of a special contact and a slight modification of the connections.

The above descriptions can only be regarded as typical of the many interlocks on the market. This especially refers to the mechanical devices, the actual number of designs of which is enormous—modifications being made to suit special cases and starters.

It is difficult to compare the advantages and disadvantages of the types mentioned, because each has its particular value in the case for which it is designed. For instance, where space is an important factor, the combined starter and regulator is most suitable, whereas the separate pieces of apparatus are more suitable when controlled from a distance—as mentioned before.

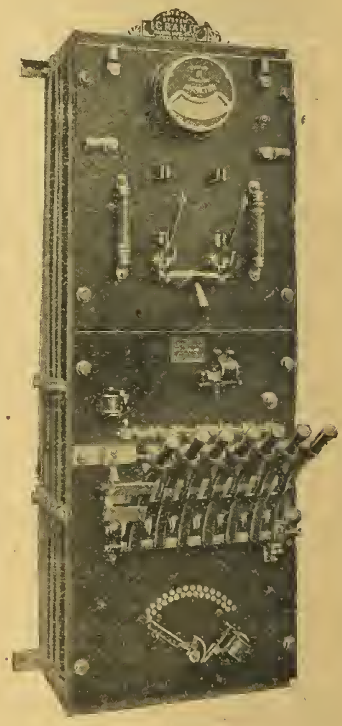


Fig. 10.

Several of the most prominent manufacturers have been most obliging in giving information, those to whom the authors are most indebted being Messrs. Brook-Hirst, Veritys, Adams Manufacturing Co. and Felten-Guilleaume Lahmeyerwerke.

Copper.—Messrs. Merton's statistical circular again shows an increase in visible supplies, which for the end of September, 1909, are 93,851 tons, an advance of 5,533 tons on the return for the end of August. The increase is divided between standard copper stocked in England and France, and that afloat from Australia. The supplies from North America are below the average, from Spain and Portugal slightly above, while the shipments from Chile and Australia are about one-third higher than usual. Total supplies are 5,633 tons above deliveries. Compared with last year, supplies are lower in all cases. The total for the year ending September 30th, 1908, was 473,914 tons, as against 433,000 tons for the current year.

BUSINESS NOTES.

Standardised Publications.—We are informed that the Engineers' Standardised Publications Association, of Craven House, Kingsway, which was formed a few months ago to promote reform in the sizes of price lists and catalogues, has received sufficient support to enable it to commence work with good prospects of success. Amongst those who have joined, we note the names of many well-known engineers and firms, including a score of borough electrical engineers, several consulting engineers, and a number of manufacturing companies. The main objects of the Association are to classify and standardise trade publications, so that they may be conveniently filed and indexed, and thus may form a useful reference library instead of finding their way to the W P.B.

Motor Exhibition at Olympia.—We are informed that the only International Exhibition of Motor-cars this year will be held at Olympia, London, from November 12th to November 20th inclusive, under the patronage of H.M. the King. There will be no exhibitions in Paris and the other Continental capitals this season, and therefore the London Show, which will be the eighth held by the Society of Motor Manufacturers and Traders with the co-operation of the Royal Automobile Club, is expected to bring over a large influx of visitors and buyers from other countries. London is stated to be becoming the motor mart of the world. Amongst the 300 firms who will be displaying their wares at Olympia will be the principal manufacturers of Great Britain, France, Germany, Belgium, Italy and America, and the very latest ideas in motor construction will be on show. The growing strength of the motor industry in this country, despite its having been handicapped in the early days by repressive legislation, will be proved beyond a doubt, and it is no slight evidence of its vitality that England alone of all the manufacturing countries has been able to withstand the recent "slump" in trade and hold an exhibition when every other country has, through pressure of hard times, had to abandon such a venture. During the past year important structural alterations have been made in the great building of Olympia, which, although the largest available for exhibition purposes in London, has not been in the past large enough for the purpose. With the view of adding to its convenience, the large annexe has been thrown into the main hall so as to form one large space open to the best display of motor-cars. The area of this vast hall is now so large that visitors will require to walk three miles if they wish to see every stand. It will be the greatest exhibition of its kind ever held in this country.

Catalogues and Lists.—The General Electric Co, Ltd., 71, Queen Victoria Street, London, E.C.—Still they come, these lamp posters!—but we hope that they are not going to continue to increase in size, or they will be too cumbersome even as draught excluders. "Osram" lamps are destined to appeal to every household—that is the intention of the G.E.C. and its publicity department, and the services of the inevitable and irrepressible Mr. Hassell have once more been requisitioned to drive home to the public mind in a striking and popular way the fact that they burn "20 hours for one penny," to the evident delight of the British workman and his left-handed wife. So simply expressed is this truth that even the bairns (whose faces, by the way, we should have preferred to see) are flabergasted at the cheapness, and their hunger is forgotten while they behold the "Osram" above their heads in preference for the somewhat substantial and comprehensive meal that lies awaiting them. The most catchy part of the poster is that feline attitude—the matron's manner gives us a cold shiver down our back, though the pie dagger is where it is. These posters are available in bulk for electrical contractors who apply for them.

The Unbreakable Pulley and Millgearing Co., Ltd., Hyde Road Engineering Works, West Gorton, Manchester.—Hanging card showing illustrations of some of their clutches, pulleys, &c., and giving several reference tables for engineers, showing horse-power of shafting and pitch of bearings, rim speeds of pulleys of various diameters at varying numbers of revolutions, and horse-powers of leather belting at various speeds.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Price leaflet showing full-size illustrations of "Eclipse" metallic-filament lamps for high and low voltages and the usual candle-powers; also battery lamps and lamps of high candle-power.

Messrs. A. P. Lundberg & Sons, 477-487, Liverpool Road, N.—Illustrated lists No. 8, 21 and 22, prepared in their usual style, and giving descriptions and prices of their "Tripin combination" switch and three-pin wall connection, and their "Presto" tumbler switch.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Another new pamphlet (No. 18A), describing, illustrating and giving dimensional and other tabular information relating to their Peebles continuous current dynamos and motors (open type) up to 1,500 H.P. and 1,100 KW.

Messrs. Simplex Conduits, Ltd., London and Birmingham.—New 1909-10 catalogue of conduits. It is a bulky publication of close upon a hundred pages of well-arranged matter, with a host of illustrations and particulars of prices, relating to the manufactures coming in sections T, U, D, and M of their catalogue. These are: conduits and fittings for electric light and power wiring; the Simplex flexible wiring system; distribution boards, switchgear, and enclosed fuses; also watertight fittings for mills, ships, &c.

Messrs. Classen & Co., Berlin W. 30/48, Germany.—Leaflet describing their "Fludor" soldering lamp, a neat and convenient little blow lamp burning methylated spirit, for use especially with the Fludor soldering materials.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—A finely-produced brochure of 48 pages entitled "Electricity for all Industrial Uses—illustrating the utility of the electric motor." Views of large polyphase generators and motors, with a view of the Union Works, lead off, and other beautifully executed pictures occupying alternate pages show Union motors applied to many different varieties of service, among them being the driving of conveyors of screen separators in coal mines, mine exhausting fans, three-throw ram and other pumps, plate bending and straightening rolls, lathes, boring mills, drills and other machine tools, textile factory and wood-working machinery, portable cranes for civil engineering works, tile-making machines, newspaper printing machinery, and a number of other departments of industry. Appropriate letter-press faces each page of illustrations. The book should be useful to those who are trying to interest the prospective power-user.

Westinghouse Companies' Publishing Department, Westinghouse Building, Norfolk Street, W.C.—30-page pamphlet containing a very full description with half-tone and sectional views of Halpin's patent thermal storage system for economy in steam raising (for which Mr. P. J. Mitchell, of Caxton House, S.W., is sole licensee for England and the Colonies), together with particulars of tests, opinions of users, &c.; also a 12-page pamphlet describing the McKenzie Holland, and Westinghouse all-electric power signalling at Yarnton, Great Western Railway.

The Reason Manufacturing Co., Ltd., Brighton.—24-page pamphlet, set out in the firm's standard style, containing a full description, with illustrations showing interiors, of their electrically wound time switches for continuous and alternating current. A list of prices of different types is given.

Messrs. Royce, Ltd., Trafford Park, Manchester.—New booklet consisting entirely of a large number of excellently executed half-tone prints on art paper, showing their specialities. These include a number of views of their electrically driven "Goliath" cranes, overhead travellers, cantilever cranes, walking cranes, jib cranes, transporters, standard winches and capstans, slow-speed crane motors, electrically operated worm-gears and controllers. This collection is a temporary substitute preparatory to the publication of the fifth edition of the firm's catalogue.

Messrs. Home & Rowland, Troughton Road, Charlton, Kent.—Two new price lists, one dealing with their auto-transformers for use with arc lamps, very fully detailing the prices in table form; the other similarly setting forth the prices of auto-transformers for use with metal-filament lamps. They also quote for other auto-transformers not included in the lists.

Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C.—Leaflets relating to the "Metalik" lamps, which are now supplied of 14 British C.P. for 60 to 130 volts, and 22 C.P. for 200 to 260 volts, these, it is claimed, being the lowest candle-powers on the market.

The Electrical Co., Ltd. (Metals Department), 121-125, Charing Cross Road, W.C.—Folders relating to their system of producing metal parts with hardened steel dies under heavy hydraulic pressure, with accuracy and certainty and without the defects incidental to the casting process.

Messrs. E. Goossens, Pope & Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.—A handy pocket pamphlet of 16 pages, containing full-sized illustrations of the firm's metal-filament lamps. The pages are not overloaded with matter, so the blocks stand out effectively, a boldly stated bulb reference letter, voltage and candle-power being all that is given. Prices of all shapes are clearly tabulated on a page at the end.

Installation Contracts.—Messrs. Edwards & Armstrong, of Bristol, have just completed the installation of the generating plant and underground system of mains for the town of Tewkesbury, and a 43-B.H.P. suction gas plant, 1,100-ampere-hour battery, underground mains, and wiring for 1,000 lights at the Brislington Asylum, near Bristol. They have in hand the following:—

Complete generating plant and underground system of mains for the town of Chippenham.

190-B.H.P. steam dynamo, motors, arc and other lighting for the Holywell Co., Ltd.

Complete plant, accumulators, &c., for Bucknill House, Shropshire.

Complete plant, accumulators, &c., for The Hill, near Banbury.

Complete plant, accumulators, &c., for Crown Hotel, Bridgnorth.

630-ampere-hour battery for Somerford Manor, Wilts.

50-B.H.P. three-phase motor and complete wiring for Co-operative Stores, Whitehall, Bristol.

Bennis still Going Strong.—From Messrs. E. Bennis & Co., Ltd., of Little Hulton, we have received their latest list of contracts secured for their well-known stokers. These are for such firms as Bessemer's, of Sheffield; Ruston Proctors, Clarke, Chapman & Co., for Chatham Dockyard and for South Africa, and for a number of mills in Preston, Keighley, Dewsbury, &c. We understand that 65 per cent. of the orders secured are for the firm's new gritless and smutless coking stoker.

Indian Electrical Installations.—The following are particulars of some electrical contracts that have recently been secured by Messrs. Walter Locke & Co., Ltd., of Calcutta:—

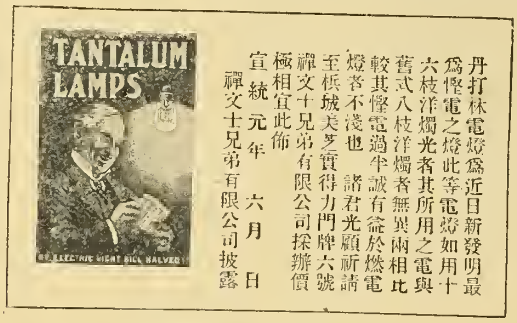
Hathaunda Palace, Daryabad, for the Rajah Prithwipal Singh.—Installation consisting of Crossley oil engine, Rhodes dynamo, J. P. Childs & Co.'s lift for four stories, 50 "Locke" fans, an Albany pump, motor-driven by a Rhodes motor, battery of 55 Hart cells, switchboard and wiring to 250 light and fan points.

Midnapur Palace, for Rajah Norendra Lall Khan Bahadhur, of Midnapur.—Installation consisting of Ruston-Proctor steam engine combined with Rhodes dynamo, 800 yards overhead main cable, battery of 60 Hart cells, switchboard, 25 "Locke" fans and wiring to 150 light and fan points; "Locke" metallic-filament lamps to be used throughout.

The New Premises in Calcutta of the Alliance Bank of Simla.—Installation consisting of wiring to 266 light and fan points for connection to the mains of the C.E.S. Co., fancy fittings, and 73 "Locke" fans.

The New Pump House at the Pulta Pressure Station for the Calcutta Corporation (per Messrs. Jas. Simpson & Sons).—Installation consisting of Reader steam engine combined with Rhodes dynamo, wiring, &c., to some 36 points.

Chinese Tantalums.—We recently illustrated the Russian adaptation of the Siemens Satisfied Consumer show-card. We are now pleased to learn that the makers of tantalum lamps are appealing to the people of China to allow them to throw the bright rays of these lamps to help them in their awakening. As we showed in our comments on the Chinese market recently, useful popularising work is possible over there with the aid of the fetching coloured poster, and the accompanying block shows how it looks in the Chinese lingo. Siemens Bros. Dynamo Works Co., Ltd., of Dalston, have now introduced these for popularising tantalums in English-speaking countries, in Russia, Spain, Portugal and China.


TANTALUM
LAMPS
MY ELECTRIC LIGHT BILL HALVED!

丹打林電燈爲近日新發明最爲慳電之燈此等電燈如用十六枝洋燭光者其所用之電與舊式八枝洋燭者無異兩相比較其慳電過半誠有益於燃電燈者不淺也　諸君光顧祈請至梹城美芝寶得力門牌六號禪文士兄弟有限公司採辦價極相宜此佈

宣統元年　六月　日

禪文士兄弟有限公司披露

It Speaks for Itself.

Bankruptcy Proceedings. — *Re* Herbert John Burdett, electrical engineer and contractor, Rugby.—This debtor came up for public examination on Monday at the Coventry Bankruptcy Court, before Mr. Registrar Kirby. The statement of affairs showed gross assets £1,214, and there was an estimated deficiency of £819. In reply to the Official Receiver (Mr. C. J. Band), debtor said he commenced business in the early part of 1902 at Castle Street, Rugby, subsequently removing to larger premises in Regent Street. He began with £150 capital, his own money. When he prepared a balance-sheet six months ago he took his stock at cost price, and this showed he was quite solvent. His stock then came out at rather more than £400. He now estimated it, at breaking-up price, at £120. He could not account for anything during the past six months to explain the £819 deficiency besides the difference in the value of the stock and severe competition. He did not file his petition earlier because he hoped to pull the business round, and he cut down expenses. The causes of his failure were: bad trade, competition and illness. In reply to Mr. A. Cripwell (Trustee), debtor stated that he had not been executing contracts at, or under, cost price, but with a very small margin. He had an arrangement with the bank for an overdraft of £100, and at the time of filing his petition it stood at £75. The overdraft was guaranteed by his brother-in-law. In answer to his solicitor (Mr. H. L. Reddish), debtor said he had been hopeful of arranging a composition. The examination was closed, conditional upon debtor supplying a cash account covering his last 12 months' trading.

Arnold Roberts, electrical engineer, Rawdon, Yorks.—October 26th is the last day for the receipt of proofs for intended dividend by the trustees, J. H. Haley and R. A. Venter, Bradford.

Ernest Fenwick Jones, electrical engineer, &c., 132, York Road West, Hartlepool.—This debtor attended the Court House, John Street, Sunderland, last week for his public examination, the deficiency being stated at £487. The case was ordered to stand adjourned.

J. G. S. Cunnington & H. P. Alison, electrical engineers and contractors, Great Newport Street, London.—The last day for receipt of proofs for intended dividend, by the trustee, Mr. A. Page, 28, King Street, E.C., is October 26th.

Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds.—October 28th is the last day for receipt of proofs for dividend by the Official Receiver, Mr. J. Bowling, 24, Bond Street, Leeds.

Dissolutions and Liquidations.—Halls Transmission Gear Syndicate, Ltd.—A meeting is to be held on November 15th at 9, Little Trinity Lane, E.C., to hear an account of the winding up from the liquidator, Mr. T. D. Cocke.

Morton, Butler & Co., electrical and mechanical engineers, Nettleton Road, Mirfield.—Messrs. J. D. M. Morton and J. D. Butler have dissolved partnership.

Trade Announcements.—Messrs. Geary, Adams and Co., Ltd., have been appointed sole agents for Birmingham and district for Messrs. Davey, Paxman & Co., Ltd., Colchester.

The Accessories Manufacturing Co., Ltd., have appointed Mr. J. W. Beswick, of Temple Chambers, 33, Brazennose Street, Manchester, as their representative in Manchester and district.

The Rotherham Electrical Engineering Co. have commenced business at 39, High Street, Rotherham.

The Davis Electrical Co., Ltd., 17, Moor Street, W., announce that they have acquired the works and stock of the Royal Standard Electric Lamp Manufacturing Co., and they have sent us an illustrated price-list of the lamps.

Messrs. R. H. Hayne & Co. have removed from Gloucester Mansions, W.C., to 72, Finsbury Pavement, E.C.

Book Notices.—The *Journal* of the Municipal School of Technology, Manchester. Vol. I, Part 3. Manchester: The School.

"The American Institute of Architects' Quarterly Bulletin." July, 1909. Vol. X, No. 2. Washington, U.S.A.: The Institute.

"Post Office Electrical Engineers' Journal." October. Vol. 2, Part 3. London: H. Alabaster, Gatehouse & Co. Price 1s.

"*Mechanical World* Pocket Diary and Year-Book, 1910." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Dynamo Electric Machinery: Alternating-Current Machines." By S. Sheldon, H. Mason, and E. Hausmann. Eighth Edition. London: Crosby Lockwood & Son. 1909.

"Wireless Telegraphy and Wireless Telephony." By A. E. Kennelly. London: T. Fisher Unwin. 1909. Price 4s. net.

"*Journal* of the Institution of Electrical Engineers." No. 197, Vol. 43. This number contains the following papers:—"The Electrical System of the L.C.C. Tramways," by J. H. Rider; "Theory and Application of Motor Converters," by H. S. Hallo; "Extending the Limits of Power Transmission," by A. M. Taylor; "Vagabond Currents," by J. G. and R. G. Cunliffe; "Electrification of Steam-driven Non-reversing Rolling Mills," by W. F. Mylan; and "Interpole Designs," by W. B. Hird. London: E. & F. N. Spon, Ltd. Price 5s.

"Statistics of Public Education in England and Wales." Part I. Educational Statistics, 1907-8. London: Wyman & Sons, Ltd. 1909. Price 2s. 3d.

"Rose's Universal Code Economiser." By Sydney A. M. Rose, A.M.I.E.E. London: Sidgwick & Jackson. Price 10s. 6d.

"Institution of Electrical Engineers. Articles of Association, and List of Officers and Members." 1909. From the Institution.

"Jack Carstairs of the Power House." By S. Sandys. London: Methuen & Co. 1909. Price 6s.

We have received a copy of the first issue of *Surveying and the Civil Engineer*, a new weekly journal for surveyors and civil and municipal engineers. Mr. B. Wyand, formerly on the editorial staff of the *Surveyor and Municipal and County Engineer*, is the editor of the paper, which is owned by the proprietors of the *Pall Mall Gazette*. *Surveying* is handsomely produced, and contains many interesting and practical articles, with well-printed illustrations. We wish it a prosperous and useful career.

LIGHTING and POWER NOTES.

Accrington.—The assessment of the Electricity Works having been very much increased, the T.C. has decided to lodge an appeal.

The electrical engineer reported last week that the recent exhibition had cost £154 in round figures, exclusive of permanent staff wages and electricity consumed. The receipts amounted to £140, and about 5,000 units had been used.

Bexhill.—The T.C. on Monday decided to apply to the L.G.B. for a loan of £2,560 for cable extensions to the Little Common district, and to provide the E.L. in each of the West Parade shelters.

Brandon.—The U.D.C. has decided to give the necessary six months' notice to the colliery companies supplying electricity to the Council, with the object of inviting fresh tenders.

Canada.—A meeting was held in Toronto on September 29th for the purpose of renewing the interest of the Municipalities in the hydro-electric power scheme. The Commission was represented by Hon. Adam Beck, chairman, while the visitors included representatives from the towns of St. Thomas, Hespeller, Waterloo, Toronto, Berlin, London, Guelph, St. Mary's and Stratford. Following an informal discussion, Mr. R. A. Ross, Montreal, consulting engineer of the Commission, was chosen chairman, and Mr. E. Clarence Settell, secretary of the Commission, secretary. Municipalities who have not at present civic lighting were represented, and much technical conference work was gone over in detail.

The Dominion Government has given a grant of 25,000 miners' inches of water on Lilloet River to the Burrard Power Co., of Vancouver, B.C. Under the terms of the grant the harnessing of the waters of the Lilloet will be commenced at no distant date, and as the power plant will be only 23 miles from Vancouver, it is declared that it will not be long before some sections of industrial Vancouver will be drawing power from this source.

Coatbridge.—Messrs. Stewart & Lloyds, at a recent meeting of the Dean of Guild Court, have received permission to proceed with the erection of an electric sub-station to drive motors at the British Tube Works, Dundyvan Road, Coatbridge.

Continental Notes.—France.—The Paris-Orleans railway has just ordered 900 Brown, Boveri equipments for the lighting of railway coaches, each consisting of a 2-KW dynamo and an automatic regulator.

Holland.—Work is about to be commenced on the establishment of a central electric lighting station in the town of Dordrecht.

Austria.—It is proposed to put down a plant to utilise the water-power of the River Gacka, near Otocal (Croatia) in the generation of electrical energy for lighting and power purposes.

Cookstown.—The Council last week considered the report of Mr. H. V. Pegg, on the scheme for the electrical lighting of the town. A motion to hold a meeting of the ratepayers of the municipal district was carried by the chairman's vote.

Co. Durham.—The County of Durham Electric Power Supply Co. has applied to the B. of T. for permission to use an extra high-tension overhead transmission line between Fell Bank, Birtley, and Harraton Colliery, and a similar line between the sub-station at Arkley Heads and Cater House Pit.

Dawlish.—On Wednesday, last week, at the meeting of U.D.C., mention was made of the receipt from Mr. Purves (on behalf of the provisional board of directors formed with the object of carrying out, if possible, an electric light undertaking for Dawlish) plans showing where it was proposed to lay the mains, and also a sketch of the poles proposed to be used for overhead mains, asking the Council's approval thereto. The surveyor reported that, although he recommended underground mains, he did not see much objection to the Council allowing overhead mains in the rural parts. The committee recommended the Council to approve underground mains from Queen Street to Luscombe Terrace and from Old Town Street and the Bartons, and that ornamental posts be required in some parts of the district for overhead mains. The question of arc lighting was deferred for a statement as to the cost in comparison with the existing system of lighting.

Dundee.—The question of the better lighting of the Lochee High Street has recently been under consideration, and the relative merits of gas and electricity were fully discussed. It has been agreed to recommend that the street be illuminated by electricity.

Ellesmere Port.—Mr. W. H. Wilson has informed the U.D.C. that he intends applying for a prov. order for E.L. The Council has decided to consent to the application provided it is empowered to acquire the undertaking at any future time on terms to be arranged, and on condition that the price for energy is agreed upon.

Gillingham (Kent).—The T.C. has agreed to supply electricity to the whole of the R.E. barracks, including the non-commissioned officers' mess quarters and the Government House and future extensions, for a period of five years, at 2¾d. per unit, The Government will pay the cost of necessary cables, &c.

Glasgow.—The Clyde Trustees have decided to proceed with the erection of a large granary at Meadowside with two travelling grain elevators on the quay; these latter and all the necessary appliances are to be operated by electricity.

Hessle.—The U.D.C. has informed Hull T.C. that it is unable to accept the offer of the Corporation for a supply of electricity. The negotiations are to be continued by committees from both bodies.

India.—Advices from India state that it is believed that the great Simla hydro-electric scheme will be completed in 1911.

Kingswinford.—At the monthly meeting of the R.D.C. on Monday, it was stated that Mr. W. R. Cheldon, of Lincoln's Inn, London, had been appointed by the B. of T. to determine matters in the dispute between the Midland Power Co. and the Council.

London. — Camberwell. — The South Metropolitan Electric Light and Power Co. submitted a plan to the B.C. for lighting Crystal Palace Parade with flame arc lamps. One scheme would cost £210 per annum, and £360 to install, and the other scheme would cost £126 per annum and £360 to install. The matter was considered by the Works Committee, who decided that though the candle-power supplied would be greatly superior to that given by the gas company, neither of the schemes proposed could be adopted in view of the large extra cost it would incur.

Westminster.—The City Council has received communications from the Shoreditch, Greenwich, Hammersmith and St. Pancras B.C.'s concurring in the Westminster protest against the policy of the L.C.C. in encroaching on the jurisdiction of Metropolitan B.C.s in the electric supply and other private Bills.

Macclesfield.—In reply to an inquiry from the B. of T. as to whether the T.C. intends to proceed with the prov. order, the town clerk has replied that the Electricity Committee will be prepared at the proper time to consider and recommend a scheme to the Council. At present there was no demand for electricity, as several large tradesmen and manufacturers had their own private installations. If there was sufficient demand which would justify the Corporation in erecting works without any financial burden to the rates, which at the present time are heavy, the Council would be prepared to favourably consider the matter.

Merthyr Tydfil.—The Public Works Committee of the T.C. has decided to accept the tender of the Electric Traction Co. for public lighting at Merthyr Vale and Aberfan at £535 per annum, with 119 two-light lamps. The present cost with gas and acetylene is £570.

Newcastle (Co. Down).—At the monthly meeting on the 4th inst., the Council had under consideration the question of lighting the town by electricity, and correspondence from a number of electrical engineers on the subject was submitted. A Lewisham firm, in reply to the Council's queries, wrote fully as to the proposed installations for lighting and power purposes in the town, and desired the Council's consent to its applications for a prov. order. The Lighting Committee's recommendations that the correspondence with the Lewisham firm be submitted to the Council's solicitor for his legal opinion, was adopted, and it was decided to write electrical engineers practising in Belfast and Dublin, asking their fees for the preparation of a report and estimate on the subject.

Oulton Broad.—The U.D.C. has received six or seven inquiries respecting the working of the Council's E.L. Order. A Committee of the Council is to confer with representatives of firms, &c., including those of the Oulton Broad Electricity Co., Ltd., and Lowestoft T.C.

Royton.—The Oldham T.C. having been asked to supply electricity in Royton, has applied for the consent of the U.D.C., and the matter has been referred to a Committee.

St. Helens.—The T.C. has received from the L.G.B. sanction to loans of £3,254 for motor-generators, transformers, switchgear and service lines, and two sums of £4,746 for high-tension feeder mains.

Sidmouth.—The B. of T. has revoked the 1903 E.L. order.

South Africa.—Power Commission evidence continues to accumulate, one of the recent witnesses being the Mayor of Pretoria who raised the arguments, familiar over here, as to the prior right of the municipality and as to the necessity of avoiding competition in the area. He considered that the T.C. should, subject to Government approval, be able to refuse the privilege of laying mains in the city. An interesting witness was Mr. I Haarhoff, who dealt with the farming interests. He said that the farmer could, on the co-operative principle, purchase an electrical ploughing outfit. Electric ploughing would save labour; if on the Fillet system it could go 20 in. deep as against 6 in. in the ordinary way. It was not impossible to have electric reapers for wheat, oat-hay and maize; mechanical irrigation would also be successful, and this would enable the Transvaal to compete with the coast.

South Shields.—At a meeting of the T.C., on the 6th inst., a report by the Finance Committee was submitted which recommended that the salaries of the following officials be reduced:—The town clerk from £1,000 to £800 per annum; borough accountant, £600 to £500; electrical engineer from £650 to £500; medical officer, £500 to £400, &c. Alderman Readhead said he was not in favour of the proposals, and it would not be wise for him to move its adoption. Alderman Scott moved, and Mr. Andrew Anderson seconded, formally, the report. There was considerable discussion, and the matter was adjourned till Monday last, when the proposal was rejected by 36 votes to 10.

Sowerby Bridge.—The transfer of the Council's E.L. order to the Electrical Distribution of Yorkshire, Ltd., has been completed. The company has paid the U.D.C. £318, the agreed purchase money.

Stevenage.—The proposal of a private person to take over the electrical prov. order has fallen through owing to terms not having been arrived at with Messrs. Crompton & Co. The U.D.C. has decided to ask the latter firm to assist it in the matter.

U.S.A.—One of the most interesting engineering exploits of the present time is being carried out in California, where the city of Los Angeles is constructing a water conduit some 230 miles long from the Sierra Nevada Mountains across the desert. The conduit will fulfil several objects, as it is to provide drinking water, irrigate land near the city, and provide hydro-electric power. The conduit work, exclusive of power development, is estimated to cost $24,500,000; it comprises canal, tunnel and siphon construction. The source of water is the Owens River, and several storage reservoirs are being formed at different points on the route of the conduit. The difference in level between the intake and Los Angeles is some 3,500 ft., and it is possible to develop 75,000 h.p. at some 40 miles from the city, where there is a fall of 1,500 ft., the power plant, transmission, &c., being estimated to cost $4,500,000. Electricity is being largely used in excavating, transporting and drilling, power being furnished from mountain streams in three hydro-electric plants of 3,300 h.p., and utilised after transmission at h.t. over the route some 150 miles.

Whitby.—The annual report of the Council's electric lighting department, just issued, shows a profit for the year of £700, which is far in advance of any other year. The revenue has increased by £483, while the expenditure has only been increased by £19.

Whitehaven.—The T.C. has lost the contract for lighting the harbour for five years by electricity, the terms submitted being considered by the Commissioners to be too high.

Yarmouth.—The L.G.B. has sanctioned the Counci borrowing the sum of £2,000 for house services in connection with the electric light undertaking.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Public Works Committee of the Deputies has reported favourably on the petition of the Central Argentine Railway Co. to construct a tube railway between Retiro, Casa Amarilla and Constitucion.

Messrs. Guerrico & Williams have applied to the Buenos Aires Legislature for a concession for electric tramways in Babia Blanca. The Pacific and Southern Railways are at present constructing electric tramways in that city.

During the first seven months of the year, the Buenos Aires tramways carried nearly 159 million passengers, 630 km. of electric and 1 km. of horse line being in use.

Bradford.—The tramway undertaking created a record during the half-year ended September 30th. The income approximated to £130,500, an increase of £4,100 over the corresponding period of last year, whilst the expenses decreased by £1,800. Last year the net profit was £13,900, whilst in the past half-year it was roughly £19,900. The number of passengers carried was 25,617,866, an increase of 688,645.

Canada.—The directors of the Ottawa and St. Lawrence Electric Railway Co. are reported to be selling their charter to English financiers. The scheme includes 254 miles of route, passing through 50 towns, and will cost $4,000,000. Work will be commenced on the scheme next year.

Cardiff.—At a recent meeting of the Electricity and Tramways Committee, the report of Mr. W. Howard Smith, of London, on the condition of the tramway tracks came up for consideration. Some dissatisfaction was expressed because the report generalised, and did not specify what remedies should be adopted. In the end, it was agreed that Mr. Harpur (city engineer) and Mr. Ellis (electricity and tramway manager) should report on the expert's report within a fortnight, if possible, and that the matter should be considered at a special meeting.

Continental Notes.—Germany.—The laying of a memorial stone in connection with the construction of an electric railway between the Berlin suburbs of Wilmersdorf and Dahlem took place at the Hohenzollern Platz, in Wilmersdorf, on October 5th. By a coincidence, an application to the Civil Court in connection with this scheme was heard and decided the previous day in the Landgericht I. The application, which was made by the town of Charlottenburg against the Elevated and Underground Railway Co., sought to obtain a provisional injunction to restrain the company from proceeding further with railway schemes, particularly in conjunction with the town of Wilmersdorf, which would render it impossible to connect the projected Charlottenburg underground electric railway with the station at Wittenberg Platz, and to operate trains in through traffic by running over the lines of the elevated railway. It appears that an agreement exists between Charlottenburg and the company, whereby a physical junction should be made between the two railways, but the former had refused the offer of a joint station and connection in the Uhlandstrasse. The Court dismissed the application, and the dispute is to form the subject of further proceedings unless the proposals to be made by the Prussian Minister for Railways meet with the approval of the interested local authorities.

The Continental Co. for Electrical Enterprises, which has for a long time past been seeking to obtain a concession for the construction of a suspended railway from Gesundbrunnen to Rixdorf, has submitted a fresh proposal to the Rixdorf Town Council. It appears that the latter's inclination rather lies in the establishment of an underground line from the north of Berlin to Rixdorf, and the negotiations with the company have consequently been at a standstill. Now, however, the company has resumed negotiations, and has offered in consideration of the grant of the right to use the streets in Rixdorf to introduce a uniform fare of 10 pfennigs (1¼d.) for the transport of passengers over the whole distance between Rixdorf and Gesundbrunnen, this rate comparing with the cheapest charge of twice this amount prevailing at the present time. Apart from this suburban question the company has now discontinued negotiations with the Berlin Municipal Highways Committee in respect of a concession for a suspended railway in Berlin. The company, in fact, after efforts extending over eight years, has withdrawn its offer, and has asked the State authorities to substitute their consent under the Secondary Railways Law for that of the city of Berlin in relation to the use of the streets. The action of the company is attributed to the circumstance that in consequence of the demands made by the Highways Committee, the fares would have been arranged on such a high level that it would have been impossible to establish a tariff which would permit of all classes of the population utilising the railway. It is considered to be an unconditional requirement that the passenger fares on the railway should not be materially higher than those charged on the tramways.

The Bavarian Ministry for Railways recently specified seven different sources of water-power as State property for use in connection with the projected electrical working of railways, including the Walchensee. It is assumed that the remaining water powers will be available for other purposes. Negotiations are proceeding with regard to the disposal of the water-power of the Alz, although these are specially influenced by the fact that the Austrian Government, on the principle of territorial sovereignty, claims the independent right of disposal with regard to the utilisation of Austrian water courses which enter Bavaria. The question is also engaging official attention in Prussia, where the Ministry for Railways is reported to desire to devote the sum of £2,500 to proceeding with preliminary works. Apart from this circumstance, the Konigliche Akademie des Bauwesens some time ago instituted a prize competition to advance the problem by attempting to secure comparative essays on water-power installations carried out, with a view to their serving as a model for future work in Germany. But as the contest took place at the same time as the Bavarian competition in connection with the Walchensee scheme, it only resulted in the presentation of five compositions, of which nothing further has been heard. On the other hand, the Walchensee contest resulted in the receipt of 30 proposals from the principals of the hydraulic profession throughout the world, and these are said to represent a wealth of technical knowledge. It is now suggested that the Prussian Minister should take steps with a view to the information thus rendered available in Bavaria becoming known among a wider circle throughout the empire.

Turkey.—The August number of the *Revue Commerciale du Levant* states that there is an opening for a tramway system at Ada Bazar. It is pointed out that the town is very scattered, and situated on level ground; that there is a large amount of traffic, and that the railway station is at the extremity of the town. Ada Bazar is situated on the Anatolian Railway, at a comparatively short distance from Scutari and Constantinople.

Spain.—The Compania General de Tranvias, of Barcelona, has applied for a concession for a projected electric tramway between Sans and Coll-Blanch (Barcelona).

Devonport.—The Tramways Committee of the T.C. reports the receipt of a letter from the Devonport and District Tramways Co., containing certain proposals for the sale of the company's undertaking to the Corporation, such letter being without prejudice, and to be treated as private unless the Committee was prepared to recommend the proposals to the Council for adoption. It was resolved that the Tramway Co. be informed that the proposal was not one which the Committee could recommend to the Council for adoption, but that it was prepared to consider the matter further if the company could submit a definite figure.

Dunfermline.—Col. von Donop, who will examine the tramway for the B. of T., has intimated that he will consider the question raised by the T.C. as to the terminus of the line in Dunfermline. The tramway company wrote the T.C. stating that the petition of 1,300 ratepayers asking the company to implement the terms of its order and take the line to Mileswark would not facilitate matters. The Council will delay further representations until the B. of T. visit takes place.

Gateshead.—The T.C. has approved of the application of the Gateshead and District Tramways Co. for a further extension of time until October 22nd, 1910, for the completion of the Wreckenton Light Railway.

Glasgow.—For some time past the Tramways Committee of the T.C. has been in negotiation with the Calico Printers' Association for the purchase of a corner property in Thornliebank, for the purpose of laying a double line of rails in accordance with the prov. order upon which the extension was authorised. The County Council of Renfrewshire has threatened proceedings in the Court of Session failing compliance with the terms of the order, but as the Calico Printers' Co. will not accept less than £1,000 for the property, matters have reached a deadlock.

The proposal to provide a long-service fund for motormen and conductors in the service of the T.C. department has again been under consideration.

Halesowen.—At a meeting of the U.D.C. last week it was reported that considerable progress was being made with the scheme for the construction of a light railway; and that the Worcestershire County Council had given notice that it intended immediately to carry out the widening of Long Lane, which will facilitate the light railway work.

Kingstown (Dublin).—The report of Col. von Donop (Board of Trade) as to increased speed on the Dalkey line has been submitted to the Council. It appears that a committee of the Council arranged with the inspector for the granting of increased speed at either end of the business district, the company withdrawing its application as regards the congested portion of the town. Several councillors disputed the authority of the committee to make concessions, but ultimately the report was agreed to.

London.—In connection with the Brighton Co.'s South London electrification, the company has, with the sanction of the B. of T., arranged for one of its three running lines between London Bridge and South Bermondsey to be used alternately for up and down traffic (morning and night) thus greatly increasing the capacity of the line. In order to achieve this result separate sets of signals have been provided for up and down work on this track, interlocked so that only one set can be used at once.

The death of a lineman, employed by Messrs. Blackwell, which occurred a few days ago at Peckham on the Brighton Co.'s electrical section, was investigated by the Camberwell Coroner on Monday. It appeared that Younger climbed one of the gantries from which the 6,500-volt overhead wires are suspended in order to obtain a clip, and in some way touched one of the live wires, being killed instantly. Medical evidence showed that the body was frightfully burned, and that many fractures resulted from the fall on to the track.

On Monday the Hampstead, Bakerloo and Piccadilly Tube railways instituted an accelerated service of trains. On the Hampstead line during the busiest hours, 42 trains an hour were maintained, or at 86-second intervals, and this is regarded as the limit by the railway authorities, it having necessitated a rearrangement of the signalling system. In all, 1,300 trains a day are run on this line. The "Bakerloo" was able to run 40 trains an hour, and on the Piccadilly tube 30 trains an hour were run. All three tubes run non-stop trains, or trains which miss certain stations alternately during rush hours. One daily paper, after remarking that this system gives a substantial saving of time, gravely records the fact that one traveller from Holloway spent 35 minutes in confused journeyings between King's Cross and Finsbury Park in the effort to arrive at his station.

On Wednesday, last week, the new L.C.C. tramway between Queen's Road, Battersea, and Clapham Junction, was inspected by the B. of T., and later in the week it was opened for traffic.

On Friday last a L.C.C. Merton car ran away down the hill between Balham and the terminus, colliding with a stationary car and injuring three people. It is reported that the brakes were defective.

A report submitted to the L.C.C. by the Highways Committee states that the tramways system at March 31st, 1909, extended over a total length of 127⅝ street miles, being 85⅝ miles of electric lines and 42 miles of horse lines. The capital expenditure on the undertaking amounted to £9,483,561, of which £1,068,971 represents expenditure during the year 1908-9. The debt outstanding was £8,043,139. The total receipts during the year from electric traction were £1,572,251, and the working expenses £896,286, leaving a surplus of £675,965; and the corresponding figures for horse traction were £275,199 and £305,402, leaving a deficiency of £30,202. After debt charges and other deductions had been made there remained a net balance of £107,570. There were 344,705,937 passengers carried on electric cars, and 68,207,004 on horse cars, a total of 412,913,841. The number of car-miles run was 31,962,784 miles by electric traction and 7,156,688 by horse traction, a total of 39,119,472 miles. The average fare per passenger was 1·05d.

Morecambe-Heysham.—Much curiosity, says the *Pall Mall Gazette*, has been expressed from time to time as to the performance in service of the single-phase electric system on the Midland Railway. Test runs over a level stretch 1,760 yards long between Lancaster and Heysham with a light train weighing 51½ tons, and having 420 H.P., showed that the distance could be covered in 119 seconds, starting from rest, the average speed being therefore 30¼ miles per hour. The acceleration was 25 miles per hour in 22 seconds, and the maximum was 1·91 ft. per second per second, or 1·3 miles per hour per second. This acceleration is rather low, and it is attributed to the low torque applied to the wheels, which can be altered by an alteration in the gear ratio and wheel diameter. The single-phase equipment is heavier by nearly 30 per cent. than a corresponding direct-current system, but the additional weight available for adhesion is frequently an advantage, and, while the figures given represent the actual state of matters so far as the electrical equipment is concerned, the difference to the total weight of the train is only 7½ per cent., so that the energy consumption per train-mile is not so unduly influenced as might at first sight appear to be the case.

Quarry Bank.—The U.D.C., as well as the U.D.C. of Brierley Hill, has had under private consideration a further communication from Mr. J. S. Lycett, managing director of the Dudley and Stourbridge Traction Co. relative to the proposed light railway between Brierley Hill, Quarry Bank, and Cradley Heath, but a definite decision on the matter has not yet been arrived at.

U.S.A.—There seems to be some prospect of wholesale railway electrification in Chicago, if the ordinance introduced by Alderman Snow, at the City Council, becomes effective. This ordinance, according to *Electric Traction Weekly*, will force every railroad in the city to substitute electricity for steam as motive power within an eight-mile radius of the City Hall by January 1st, 1912. The city relies on an old charter of 1863 and on its police powers in regard to smoke nuisance. The smoke nuisance is caused by the traffic of the terminal and suburban services of 25 or more steam roads entering the city, and by the elevated loop service, which is worked by steam and quite incapable of giving an adequate service under present conditions. The railway companies regard the cost of electrification as prohibitive, and state that electrical working is yet experimental. The cost of electrification of the Illinois Central terminals is estimated at from 40 to 50 million dollars and the cost of complete electrification of all roads at 200 million dollars.

A return of all the railways in the State using 1,200-volt direct-current installations shows that 11 companies are concerned, one operating as much as 90 miles, and all of them operating a total of 420 miles of route. The car equipments in use are all of the four-motor type, with motors of from 50 to 125 H.P. Our contemporary, in giving some details of the installations, draws attention to the small number of sub-stations necessary as compared with 600-volt working; all the equipments are arranged for operating on both 1,200 and 600-volt routes, and the adoption of the system was in each case decided on after considering the rival claims of 600-volt D.C. and single-phase A.C. traction.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions:—

Tourane-Amoy	June 17, 1909
Assab-Perim	July 8, 1909
Dakar-Conakry	Aug. 20, 1909
Balikpapan-Kwandang	Sept. 2, 1909
Cheiksaid-Perim	Sept. 15, 1909

Wireless Telegraphy.—It is reported that the German experiments in telegraphing from Nauen to a steamship *en route* for the Cameroons have proved successful, and that the possibility of establishing wireless communication between Germany and her colonies is regarded as proved.

CONTRACTS OPEN and CLOSED.

OPEN.

Alsace.—November 1st. The municipal authorities of Forbach are inviting tenders for the concession for the establishment and working of an electric tramway in the town.

Altrincham.—October 23rd. Electric light installation at the County High School for Girls. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester. (Returnable deposit £1 1s.)

Australia.—Victoria.—Accumulators for the P.M.G. See "Official Notices" October 1st.

Victoria.—Electric lamps for the P.M.G. See "Official Notices" to-day.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

Austria.—The Austrian State Railway authorities have just invited tenders for an electric lighting installation at the railway station at Tabor.

Bray.—October 19th. 50-B.H.P. Diesel oil engine, and high and low-tension disconnecting boxes, &c., for the U.D.C. See "Official Notices" October 8th.

Brumby and Frodingham.—October 16th. Public lighting by electricity for the U.D.C., with 55 50-C.P. lamps, poles, wiring, switches, &c.; direct-current, 220 volts, available. Mr. J. Green, surveyor to the Council, Frodingham, Scunthorpe, Lincs. Returnable deposit, 10s. 6d.

Cape Town.—October 19th. Tenders will be received by the Chairman of the Tender Board, Cape Town, for the supply of eight electric motors.

France.—October 19th. The municipal authorities of Saint-Mihiel (Meuse) are inviting tenders for the supply of five electric motors and a switchboard.

Great Western Railway.—October 18th. Stores, including electrical wires and telegraph apparatus, carbons, &c. See "Official Notices" October 8th.

Keighley.—October 16th. Two boiler feed pumps, high-tension switchboard and transformers, 300-KW. motor-generator, and mains for the Electricity Department. See "Official Notices" October 1st.

Llandudno.—October 30th. Hand tower-ladder for trimming arc lamps, for the U.D.C. See "Official Notices" to-day.

Leyton.—October 26th. Installation of electric light and water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" October 8th.

Lowestoft.—The Corporation requires a new tank for the hot well, also additional balancers and service cables. Tenders are being invited.

Manchester.—October 19th. Steel tie-bars for tramway rails, and bolts and nuts for fishplates, for the Tramways Committee. Specifications from Mr. J. M. McElroy, Tramway Manager.

Mountain Ash.—October 25th. Electrical stores for the U.D.C. electricity undertaking. See "Official Notices" October 8th.

Norway.—October 25th. The Commercial Intelligence Branch of the Board of Trade is informed by H.M. Consul at Christiania that the Norwegian State Railways have issued a call for tenders for the supply of transformers and electromotors for the Drammen railway works. Tenders, marked "Transformatores, &c.," will be received at Styrelsens Expeditionskontor, Christiania, up to 10 am. on October 25th. Copies of the conditions, specifications and plans, forwarded by H.M. Consul, may be seen by British firms interested on application at the office of the above Branch, 73, Basinghall Street, London, E.C.

Radcliffe.—October 27th. Cable for the U.D.C. Electricity Department. See "Official Notices" to-day.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 kw. each, for disposal. See "Official Notices" September 24th.

Spain.—November 2nd. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working of a telephone system in the town of Oviedo during a period of 15 years.

November 20th.—60 years' concession for constructing and working an electric tramway from Sans to Coll-Blanch (Barcelona). Deposit 1,295 pesetas (£47). Local representation necessary. Tenders to Dirección General de Obras Publicas, Madrid. The Compañia General Tranvias, which has submitted an application, has certain preferential rights.

The municipal authorities of Galaroza (province of Huelva) have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Wallasey.—October 19th. Three miles of electric tramways (overhead line material, poles, wire, ears, &c.) for the U.D.C.; also paper-insulated cables for same. See two "Official Notices" October 8th.

CLOSED.

Belfast.—The tender of Messrs. Imeson, Finch & Co., Ltd., for two miles of trolley wire, has been accepted by the Belfast Corporation Tramways Department. This is a repeat order.

Belgium.—La Société des Clouteries et Trefileries des Flandres, of Gendbrugge, has placed a contract with the Société Union Electrique A.E.G., of Brussels, for the equipment of a large electricity generating station in connection with its works. The plant will comprise two 2,000-h.p. sets of steam turbines and alternators.

Blackburn.—The T.C. has affixed the seal to a contract with the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of electric motors; and one with the Wigan Coal and Iron Co., Ltd., for steam and house coal for the electricity department.

Bradford.—The T.C. has accepted the tender of Messrs. Clay & Atkinson for eight automatic point-controllers for the tramways, at £440; and that of Messrs. Steel, Peech & Tozer for 200 steel tires for car wheels, at £327.

The City Council is to be recommended to accept the tender of Messrs. Steinthall & Boydell for the provision of a slate switchboard with fittings, at £310; that of the British Thomson-Houston Co., Ltd., for a turbo-generator, at £632 net; and that of Messrs. Collinson Bros. for an electric light installation at the Bradford Moor Branch Library.

Burnley.—The E.L. Committee has accepted the following tenders:—

Messrs. I. Frankenburg & Sons, Ltd., for cable required to connect No. 8 and No. 9 generating sets with the switchboard at the electricity works.

Messrs. Simpson Bros., Hapton, for two switches of 2,000 amps. each.

Messrs. Proctor, Ltd., Burnley, for two mechanical stokers for the electricity works.

The Guardians have accepted the tender of Messrs. Carter & Co. for their electrical requirements for the ensuing 12 months.

Bury.—The Electricity Committee has given the contract for the switchboard work at the new generating station to Messrs. Ferranti.

Devon.—The Committee of Visitors to the County Asylum have accepted the Metallic Seamless Tube Co.'s offer for a 12 months' supply of metallic conduits and fittings and white china wall-plugs.

Dudley.—The D.P. Battery Co., Ltd., has secured from the Corporation an order to supply, erect, and maintain for a period of 10 years, a storage battery of 256 cells, of their L S 37 type. This battery is capable of supplying over 1,000 amperes for an hour.

Glasgow.—A T.C. committee has recommended acceptance of the following:—

Additional piping and valves, Pinkston power station.—Babcock & Wilcox, Ltd.

T.C. wire.—British Insulated and Helsby Cables, Ltd.

The Electricity Sub-committee on Works recommends that the offers of the British Thomson-Houston Co. (£211) and Messrs. Ferranti, Ltd. (£270), for high-tension switchgear be accepted. Messrs. Appleby's offer (£154) for the provision and erection of a crane at Port Dundas works was also recommended for acceptance.

London.—L.C.C.—The Highways Committee reports that during the summer recess it received and accepted the following tenders:—

(*a*) Manufacture, delivery and laying of high-tension cables:—

Western Electric Co.	(accepted)	£4,757
W. T. Henley's Telegraph Works Co., Ltd.		4,818
British Insulated and Helsby Cables, Ltd.		4,873
Siemens Bros. & Co., Ltd.		4,888
Johnson & Phillips, Ltd.		4,937
Callender's Cable and Construction Co., Ltd.		4,958
W. T. Glover & Co., Ltd.		4,976
Robert W. Blackwell & Co., Ltd.		5,073
The Yorkshire Cable Co., Ltd.		5,438
Edward Le Bas & Co. (incomplete tender)		7,031

Estimate of chief officer of tramways, comparable, £5,000.

(*b*) Manufacture, delivery and laying of low-tension cables:—

Union Cable Co., Ltd. (foreign manufacture)		£31,997
British Insulated and Helsby Cables, Ltd.	(accepted)	32,000
W. T. Henley's Telegraph Works Co., Ltd.		32,403
Western Electric Co.		32,418
Callender's Cable and Construction Co., Ltd.		32,769
Johnson & Phillips, Ltd.		32,990
W. T. Glover & Co., Ltd.		33,457
Siemens Bros. & Co.		34,327
Robert W. Blackwell & Co., Ltd.		34,569
The Yorkshire Cable Co., Ltd.		37,711

Estimate of chief officer of tramways, comparable, £38,000.

(*c*) Supply and delivery of tramway feeder pillars:—

British Insulated and Helsby Cables, Ltd.	(accepted)	£1,117
W. Boydell & Sons, Ltd.		1,198
J. H. Tucker & Co.		1,230
Johnson & Phillips, Ltd.		1,239
Edison & Swan United Electric Light Co., Ltd.		1,274
Ferranti, Ltd.		1,275
Robert W. Blackwell & Co., Ltd.		1,289
British Westinghouse Electric and Mfg. Co., Ltd.		1,295
Universal Electrical Manufacturing Co., Ltd.		1,313
Whipp & Bourne		1,322
W. Lucy & Co., Ltd.		1,345
Spagnoletti, Ltd.		1,357
Western Electric Co.		1,385
Siemens Bros. & Co., Ltd.		1,395
Estler Bros.		1,414
Tetley & Co.		1,416
W. T. Glover & Co., Ltd.		1,447
Electric Construction Co., Ltd.		1,471
Tramway Supplies, Leeds		1,603
Société Anonyme (Jones & Co.), Brussels		1,675
Callender's Cable and Construction Co., Ltd.		1,698
Alfred Wiseman, Ltd.		1,743
Veritys Ltd.		1,952
General Electric Co., Ltd.		2,047

Estimate of chief officer of tramways, comparable, £1,530.

(*d*) Reconstruction of the tramways from Beresford Square to Nile Street—Supply of special work:—

Hadfield's Steel Foundry Co., Ltd.	(accepted)	£502
Edgar Allen & Co., Ltd.		543

Estimate of chief engineer, comparable, £520.

(*e*) Reconstruction of Highgate Hill tramways—Supply of special slot-rails:—

North-Eastern Steel Co.		£1,995
Frodingham Iron and Steel Co., Ltd.	(accepted)	2,036
Walter Scott, Ltd., Leeds		2,106

In connection with the reconstruction of Highgate Hill tramways, the tenders for roadwork and platelaying were as follows:—

	Tramway work.	Paving works for street widenings.	Total.
A. N. Coles, Paddington, W. (accepted)	£16,655	£2,447	£19,101
W. Manders, Leyton	16,400	3,295	19,695
R. C. Brebner & Co., Edinburgh	16,748	3,173	19,920
G. Percy Trentham	17,089	2,854	19,943
Dick, Kerr & Co., Ltd.	18,074	3,237	21,312
John Mowlem & Co., Ltd.	19,302	3,442	22,744
Bower Bros., Shepherd's Bush, W.	23,529	3,184	26,713
Chief engineer's estimate, comparable	16,813	3,239	20,052

The lowest tender for the tramway work was that submitted by Mr. W. Manders, but the tender of Mr. A. N. Coles was the lowest in the total amount for the tramway work and street-widening paving works, and, acting in conjunction with the Improvements Committee, this latter tender, amounting to £19,101, was accepted.

Tenders for steam, &c., piping, valves, water tanks, &c., for the final portion of Greenwich generating station:—

Staveley Coal and Iron Co., Ltd.	(accepted)	£7,845
Edward Le Bas & Co.		7,642
John Spencer, Ltd.		7,746
Foster Bros., Ltd.		7,760
Babcock & Wilcox, Ltd.		7,768
Railway and General Engineering Co., Ltd.		8,000
Stewarts & Lloyds, Ltd.		8,011
James Oakes & Co.		8,151
E. Bennett & Son, Ltd.		8,174
John Wilson & Co.		8,440
Shelby Manufacturing Co.		9,268
Westwood & Wrights, Brierley Hill (incomplete tender)		6,873

Estimate of chief officer of tramways, comparable, £9,000

The tender of Mr. H. L. Holloway, for erecting foundations for the installation of two 1,500-kw. rotary converters at the Elephant and Castle sub-station was accepted, at £743.

For the provision of choke coils, to be fitted to 25 of the existing motor-generators at the Council's tramways sub-stations, the tenders were:—

Electric Construction Co., Ltd.	(accepted)	£1,098
Johnson & Phillips, Ltd.		1,437
Spagnoletti, Ltd.		1,605
Ferranti, Ltd.		1,761
" " (alternative)		1,768
Dick, Kerr & Co.		1,923
" " (alternative)		1,298
British Westinghouse Electric and Mfg. Co.		2,706
" " " "	(1st alternative)	2,511
" " " "	(2nd alternative)	1,831
" " " "	(3rd alternative)	1,726

Estimate of chief officer of tramways, comparable, £1,500

For 1,000 destination boards, fitted with end protection plates, the tenders were:—

J. Challis, Ltd.	(accepted)	£217
Equipment and Engineering Co.		275
Hurst, Nelson & Co., Ltd.		300
United Electric Car Co., Ltd.		392
" " " "	(alternative tender)	500

The following appears in an entry regarding the contract placed in 1908 with Messrs. Mountain & Gibson, Ltd., for the supply of six stores transport vehicles required in connection with the Council's tramways:—

We reported on July 27th-28th, that a receiver of the company had been appointed on behalf of the debenture-holders, and the Council on that date decided that arrangements should be made for each delivery made by the receiver to be regarded as the subject of a separate contract; and that payment for each such delivery should be made to the receiver without the exercise of any right of set-off on the part of the Council for any claims the Council may have in respect of any of the said deliveries of contracts, but otherwise without prejudice to any claims the Council may have against the company under the contracts generally. One of the terms of the Council's contract is that Mountain & Gibson shall indemnify the Council in respect of all claims arising under patent rights. Notice has now been received from Dick, Kerr & Co., Ltd., claiming patent rights in respect of part of certain electrical equipments which have apparently been supplied to the Council by the British Westinghouse Co., Ltd. The latter company, as sub-contractors to Mountain & Gibson, are also supplying the electrical equipments for the stores transport vehicles, upon the terms of the Council's contract with Mountain & Gibson. The receiver has asked the Council to accept the British Westinghouse Co.'s indemnity direct against any claims under patent rights in respect of these electrical equipments, so as to absolve him from the stringent provisions of the indemnity clause in the Council's contract, otherwise he states that he will be unable, in view of the claim made by Dick, Kerr & Co., Ltd., to proceed with the contract. We see no objection to this course, and we have accordingly authorised the transfer of the indemnity.

Battersea.—We learn from Messrs. Stegmann & Co. that in the recent placing of contracts by the Borough Council, their tender was accepted for arc lamps as well as for the motors.

Oldbury.—The U.D.C. has accepted the tender of the Birmingham and Midland Tramway, Ltd., for an overhead cable to the sewage-disposal works, at £99, and for poles, wiring and lamps for lighting the works, at £75.

Plymouth.—The Education Committee received the following tenders for the installation of electric light at Regent Street school:—

David Sale	(accepted)	£124
W. G. Heath & Co.		135
Lord & Shand		136
W. J. Corse & Co.		140

Rotherham.—The T.C. has accepted the tender of Messrs. Reavell & Co., at £405, for a motor-compressor, to duplicate the one at present in use adjoining the electricity station. The Council has further accepted the tender of Callender's Cable and Construction Co., Ltd., at £2,187, for the annual supply of cables; also the tender of the Reason Manufacturing Co. for the annual supply of electricity meters, and the tender of the Sheepbridge Coal and Iron Co. for the annual supply of coal (Glapwell), at 5s. 4½d. per ton. For engineering stores for the tramways department, the tenders of the following have been accepted:—

India-Rubber and Gutta-Percha Telegraph Works, Ltd.; Smith Bros., Ltd. (Rotherham); Joseph France; London Phosphor Copper and Bronze Co.; Vacuum Oil Co.; Robert Young & Co.; R. D. Nicol & Co.; R. Ingham Clark & Co.; Griffiths Bros. & Co.; Harland & Son; L. Kearsley & Co., Ltd.; Hindsford Foundry Co.; Alfred Wiseman; British Westinghouse Co.; Sanderson Bros. & Newbould, Ltd.; Tasker's Engineering Co.; Tempered Spring Co.; Tramway Supplies, Ltd.; General Electric Co.; L. Andrews & Co.; R. Bell & Co.; F. W. Crookes; W. Taylor & Sons; H. Garnett & Co., Ltd.

St. Helens.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the supply and laying of high-tension mains for the supply of current for the Sutton district; and that of the British Westinghouse Electric and Manufacturing Co., Ltd., for high-tension plant.

Stretford.—The U.D.C. has accepted the tender of the Vulcan Motor Co. for a 16-h.p. petrol-motor arc lamp wagon, with hydraulic lift, at £385. It has further accepted the tender of Messrs. J. Hodgkinson, Ltd, for a coal transporter, weighing, feeding and storage plant for the electricity undertaking, at £682.

Wallasey.—The U.D.C. on October 7th considered a recommendation of the Tramways Committee to accept the tender of the Brush Electrical Engineering Co. for 10 new cars, of the "long wheel-base truck" design, by which it is hoped to obviate the jolting and pitching which has been the cause of so many complaints by passengers on this line. After considerable discussion, the Committee's recommendation was approved.

West Bromwich.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., Wolverhampton, for a feeder booster.

West Ham.—The Guardians have accepted the Metallic Seamless Tube Co.'s offer for a 12 months' supply of metallic conduits and fittings, and white porcelain counterweights and accessories.

Yarmouth.—The T.C. has accepted the tender of Messrs. Myers, Rose & Co., Ltd., for 2,000 tons of Derbyshire fine slack coal, at 8s. 7d. per ton f.o.r. Yarmouth, for use at the electricity works.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 15th. At 7 p.m. Visit to the Model Engineer Exhibition, Horticultural Hall, Westminster.

Saturday, October 23rd.—At 7 p.m. At Caxton Hall, Westminster. Conversazione.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution House, Storey's Gate. Paper on "Heat Transmission," by Prof. W. E. Dalby.

Physical Society.—Friday, October 22nd. At 5 p.m. At the Royal College of Science, South Kensington, S.W. Paper "On Cadmium Amalgams and the Normal Weston Cell," by Mr. F. E. Smith, and other papers.

Institution of Electrical Engineers (Manchester Section).—Friday, October 22nd. At 7.30 p.m. At Midland Hotel, Manchester. Opening meeting for the session. Address by the chairman, Mr. S. J. Watson. A smoking concert to follow. [Other meetings will be held at the Physical Laboratory of the Manchester University.]

Electro-Harmonic Society.—Friday, October 22nd. At 8 p.m. At the King's Hall, Holborn Restaurant. First smoking concert of the season.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 23rd, 1909:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 18th.—"A" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Tuesday, October 19th.—"B" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Wednesday, October 20th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 21st.—"C" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Friday, October 22nd.—"D" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

(Signed) P. H. Campbell,
Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

P. & O. Batti-Wallahs' Society.—The Birmingham Local Section of this Society opened their social gatherings for this season with a smoking concert on Thursday, October 7th, at the Grand Hotel, Birmingham. Over 70 members and friends were present. The programme was contributed to chiefly by members, and a most enjoyable evening was spent. The chairman for the evening—Mr. J. P. Kemp—who is also chairman of the Local Section, in his remarks foreshadowed many other pleasant evenings to follow, the next being a Bohemian concert (ladies) on November 5th, to be held in the Grosvenor Room, Grand Hotel.

The Electro-Harmonic Society.—The first smoking concert of the twenty-fourth season, 1909-10, will be held in the King's Hall, Holborn Restaurant, on Friday evening next, October 22nd, commencing at 8 o'clock. The artists for the evening are Mr. Alfred Heather, Mr. Thorpe Bates, and the Chandos Part Singers; Master Lloyd Chandos, cornet solos; Mr. Bromley Carter, humorous dialect songs; Doraswami, Royal Indian Court musician; Mr. Barclay Gammon, humorous sketch.

Football Notes. — South Metropolitan Electric Football Club.—On Saturday last a match was played at Hither Green between the South Metropolitan Co.'s employés (Works *v.* Office and Rest), which, after a very good game, resulted in a win for the Works by 6 goals to 2.

Inquiries.—A correspondent wishes for the name and address of the makers of the "Daylight" arc lamp.

A correspondent wishes to know if tin has been, or can be, smelted direct from the ore with the electric furnace.

We are asked for the name of the maker of "Bauer" radiators.

Institution Notes.—Automobile Engineers.—Mr. J. S. Irving (Daimler Motor Co.) read a paper on "Electric Ignition on Motor Cars," at a meeting of the Coventry Graduates' Section of Automobile Engineers on October 4th. In the course of his paper, Mr. Irving said that when a single coil was used in conjunction with a high-tension distributor, it was of the greatest importance that the current in the primary should never be allowed to fall to a value near what had been called the "critical value" for the particular coil. In his experience, when the trembler was adjusted for any given voltage so that the note produced was pure and clear, a very slight decrease in current would cause the timing to be defective, owing to the region of the critical current being approached. Hence with the normal current flowing it was advisable to adjust the trembler to give a somewhat harsh and shrill sound, for then the current might be considerably reduced before the critical value was reached. When selecting a coil, regularity of working of the trembler for considerable variation of current was of more importance than length or fatness of spark. Further, a coil taking a small current was to be preferred to one taking a large current, since the trouble with the adjustment of the trembler blade would be decreased owing to the reduced sparking at the platinum points. Except for the fact that the engine could not be started on the switch, the plain coil with a rapid break on the half-time shaft was preferable to a trembler coil, since over a very large range of current—in fact, whenever the current was large enough to cause the passage of a spark in the cylinder—the timing was exactly the same. The advantage of a trembler might be retained by a switch so arranged that the trembler might be cut out, allowing the coil to act as a plain coil, a second condenser being provided. This system was adopted with the Bosch and dual ignition. He had experimented with a single coil and distributor working in conjunction with a single firing point on a shaft working at twice engine speed, instead of half-engine speed, and found a great improvement in the steadiness of the running of the engine, due to the firing point occurring at exactly the same piston position for every cylinder, so that the power of the explosion in each cylinder was alike, whereas with the ordinary type of segmented commutator used for multi-cylinder engines, there was practically a difference of sparking point in each cylinder, tending to uneven running. Mr. J. S. Napier, during the discussion, said he had had to design a car that was going to the South Pole, and thought of using dry cells for the ignition, because, if dry, they could not freeze. A member of the expedition had since told him that the dry cells were absolutely of no use, as a small quantity of liquid had to be put in, and when once they were used they froze hard. Consequently magneto ignition had to be resorted to, both types, fortunately, having been fitted.

Institution of Mining Electrical Engineers.—The general meeting of the Institution at Sheffield, on October 2nd, was well attended. The President, Mr. Wm. Maurice, said that the Council had been engaged in drawing up a "memorandum" specifying the objects for which the Institution was formed, and articles of association under which it purposed working. As regarded the objects of formation, the two principal clauses were expressed thus: (*a*) To consider means for minimising the risks attending the application of electricity to the industry of mining, and to promote the adoption of approved methods and devices tending to increase safety. (*b*) To promote the general advancement of electrical science in its applications to the industry of mining; to facilitate the exchange of information and ideas on this subject amongst the members of the Institution and otherwise; and, generally, to extend the experience, increase the efficiency, and elevate the status, of those engaged in such applications. Power would be taken to form a benevolent society for the assistance of necessitous members. The qualifications for membership of the Institution had been designed to admit everyone who was interested in its objects, while, at the same time, providing for the establishment of a special class for mining electricians. Specifically, membership of the Institution would consist of honorary members, honorary corresponding members, diploma members, associates and students. The President explained the qualifications of the respective classes, and stated that the General Council of the Institution (which was composed of representatives from branches) would conduct the management of affairs, the branches themselves being the bodies upon which all the practical work, reading of papers, holding of monthly meetings, &c., would devolve. The working arrangements for these branches were being pushed forward, and the regular meetings would commence, the Council hoped, in November. A London branch was in course of formation for the convenience of consulting mining electrical engineers, and of that large body of men associated with such work who were constantly engaged abroad but with London as their centre of operations. The secretary of this new branch was Mr. Reginald Krall, of Balfour House, Finsbury Pavement, E.C. With reference to the numerous accidents which had happened during the past few years in the use of electricity in mines, alarm had been expressed in certain quarters which had tended to suspend electrical development. The Council, therefore, had determined to appoint a small Committee to inquire into the causes and means of preventing accidents arising out of the use of electricity in coal mines, and to report at, it was hoped, the December meeting.

South Staffs. and Warwickshire Institute of Mining Engineers.—Mr. H. Johnstone (Inspector of Mines for South Staffordshire), the new president, on Monday addressed the Institute on the subject of accidents in coal mines, and stated that fine dry coal dust could be ignited by even a small electric arc.

Sheffield Society of Engineers.—Mr. H. O. Wraith, M.I.E.E., recently delivered a lecture before the society on the Home Office Regulations for the use of electricity in factories.

Electrical Firms and Airships.—The Siemens-Schuckert Works recently stated that the company had not taken up the construction of airships as a branch of business, but rather that the airship now building represents a study on a large scale which the company is making in the interest of the military authorities and for the purpose of promoting the problem of technical aviation at its own risk. In these circumstances, the company has no object in expediting the completion of the airship, the principal consideration in connection with which is the testing as fully and as far as possible of all its features before commencing actual trials.

McGill University, Montreal.—Mr. Carnegie, according to the *Times*, has given £20,000 to the general funds of this University.

Our Canals.—The Royal Commission on Canals and Waterways—by the way, we had almost forgotten that it was still sitting—expects to present its final report on the canals and inland navigation of Great Britain in the course of a few months.

Legal.—Z Electric Lamp Manufacturing Co., Ltd., *v.* Marples, Leach & Co., Ltd.—The Master of the Rolls and Lords Justices Moulton and Farwell had before them, on Tuesday last, an appeal by the plaintiff company, from the refusal of Mr. Justice Warrington in this Chancery action to order the defendants to give further and better particulars of their objection to the plaintiffs' patent. Mr. Colefax, in support of the appeal, said that the plaintiffs brought the action against the defendants for alleged infringement of their patent, and among other objections, defendants said that the plaintiffs' alleged invention was not proper subject matter for letters patent. What the plaintiffs wanted to know was against which of their claims that objection was urged.

Lord Justice Moulton: You are not entitled to particulars of public general knowledge.

Mr. Colefax: I want to know whether my friend is relying upon public general knowledge, and if so, I ought to know what it is he alleged against me.

Lord Justice Moulton said that the defendants had set out all the anticipations they relied upon.

Without calling upon counsel for the respondents, their Lordships dismissed the appeal.

London Electrobus Co., Ltd.—In the Creditors' Winding-up Court, on Wednesday, October 13th, the matter of the London Electrobus Co., Ltd., was mentioned. The petitioners were Messrs. Pritchetts & Gold, Ltd. When the case was called there was no appearance for the petitioners. Mr. Justice Swinfen Eady dismissed the petition.

Appointments Vacant.—The West Ham tramways manager has been authorised to appoint an additional general assistant at a salary of £100, rising to £120. Switchboard attendant for Newport, Mon. (25s.). See our advertisement pages to-day.

A Peculiar Phenomenon.—The following amusing comment on a recent letter has been mysteriously precipitated upon our desk:—

"I am much interested in the curious phenomenon described by Mr. Alfred Barnes in your issue of last week, but as he does not state the periodicity of the alternator, whether the exciter was rope-driven or direct-coupled, or whether he believes in Tariff Reform, even I can only surmise as to the cause of the strange effect.

"S. P. Thompson in his masterly work, "Electricité pour les Enfants," mentions the strange case of a man who received a strong shock by touching the opposite poles of a galvanic battery, and states that this could have been avoided by having the terminals covered with cotton wool. I would recommend this method to Mr. Barnes, or failing it, the whole machine should be dipped in a solution of sal-ammoniac and hung up to dry, the bearings being afterwards carefully wiped.

"S. Holmes.

"Baker Street, London."

"My poor friend Holmes has suffered so much of late from sleeplessness and from his practice of injecting morphia, that I am afraid his advice cannot be entirely relied upon.

"Watson, M.D."

Marconi's Wireless Telegraph Co.—As we go to press we have received a letter from the above-named company, pointing out that the recent agreement with the Post Office mainly concerns the Marconi International Marine Communication Co., Ltd., the parent company being interested principally as a shareholder. None of the stations belonging to Marconi's Wireless Telegraph Co., Ltd., are included in the agreement, nor does it affect the trans-oceanic business and stations of the company. A very small portion of the business of the International Co. has been transferred to the Post Office, and the manufacturing business of the Wireless Co. will be beneficially affected. The damage done to the Glace Bay station by fire was covered by insurance, and it is hoped that the trans-Atlantic service will be reopened early in the new year.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials. — On the occasion of his marriage, Mr. R. L. Torpy, deputy borough electrical engineer, Wimbledon, was presented with a canteen of plate and cutlery by his brother officers; also with a dining room clock fitted with chimes, by the employés of the Electricity Department.

At a special private meeting of the Morecambe T.C. on Monday, a letter was read from Mr. W. H. Hall, electrical engineer, resigning his position. It was resolved that the resignation be accepted, and that Mr. R. Wright, an engineer who has just completed a special report on the Corporation's undertaking, be paid 55 guineas for his services and be retained as consulting engineer for two years. The appointment of engineer will be advertised, the salary being £150 per annum.

General.—On Wednesday, 29th ult., a farewell dinner was given at the Midland Hotel, Manchester, in honour of Mr. K. K. von Krogh, who has resigned his position with the British Westinghouse Co. to engage in consulting engineering work in Norway, his native country. Mr. Newcomb Carlton, managing director of the British Westinghouse Co., acted as toastmaster. The general manager of works, the general sales manager, and some 25 other prominent members of the staff were present. The chairman, in a eulogistic speech, paid tribute to the excellent work accomplished by Mr. Krogh, and said that if consulting engineering should not prove as attractive or lucrative as anticipated, he would always be welcomed back at Trafford Park. In a number of subsequent speeches complimentary reference was made to the success attending his able co-operation with all branches of the organisation. Altogether a very enthusiastic send-off was accorded him. Mr. Krogh's business associates have presented him with several valuable mementoes, and his wide circle of English friends will wish him every success. Mr. Krogh, who has been with the British Westinghouse Co. about five years, received his technical training in Germany, at the Technical High School, Darmstadt. Here he was for one year assistant lecturer, and graduated as Diplom-Ingenieur in 1899. After serving his term of military service in Norway, he became associated for a short time with the British Schuckert Co. in London, and subsequently with Messrs. Siemens & Halske, of Berlin. In 1900 he joined the A.E G. in Berlin, commencing on the testing bed, and afterwards reorganising the transformer department, where, as designer and superintendent, he did pioneer work. In 1904 he accepted a position with the British Westinghouse Co. in the control department, and shortly afterwards was appointed superintendent of the transformer department. His sound technical knowledge and capacity as an organiser brought him rapid promotion, and within two years he was also appointed to the control of the arc lamp, insulating and winding, and motor and punch departments. Mr. Krogh has joined in partnership Jacob Prebensen Nissen, of Nedre Slotsgade 15, Christiania, who has for several years been prominently identified as consulting engineer with several large and important high-tension power transmission plants in Norway. The firm will in future be known as Nissen and von Krogh, and in addition to extensive power transmission work, will engage largely in industrial and municipal undertakings. They will also have a fully-equipped laboratory for carrying out electrical testing of all kinds.

The Board of Trade has appointed Dr. Alexander Russell, principal of the Electrical Standardising, Testing and Training Institution, to be an electrical inspector under the Croydon Corporation Electric Lighting Order, 1891, in succession to Mr. Hugh Erat Harrison, who died in August last.

Mr. William T. Taylor, M.I.E.E., is expected to arrive in London about October 22nd. He has just completed his two years' agreement with the Kashmir Government in connection with the erecting and operating of their hydro-electric system. Mr. Taylor is going into business for himself. His address will be "Glendower," 76, Greenham Road, Muswell Hill, London.

Mr. W. P. Miller, A.M.I.E.E., has severed his connection with the contract department of Messrs. Crompton & Co., Ltd., Salisbury House, London, E.C., and has entered into partnership with Mr. Lewis Radmore, of Messrs. Radmore & Co., 25-26, Ludgate Hill, Birmingham, where he will attend to the export engineering business, and will also undertake general inspection and testing work in the Midlands. Electrical manufacturers are invited to forward lists, &c.

Mr. James Healey, of Helsby, having terminated his engagement with Messrs. Hutchins & Co., Ltd., of Harlesden, London, N.W., owing to their having sold their business, has now taken up an appointment with the General Electric Co., Ltd., at Peel Works, Salford.

The staff of Messrs. Laurence, Scott & Co., manufacturing electrical engineers, of Norwich, have presented a silver-plated tea service to Mr. W. H. Davies, chief of the winding department, on his completion of 25 years' service with the firm.

It is announced in the *Times* that Mr. H. H. Mothersole, of London, has been appointed secretary of the North of England Engineering Employers' Association, in Newcastle-on-Tyne.

Mr. H. Ellis Thompson, till lately manager for Messrs. Donnison, Sillem & Co., of Great Portland Street, W., has been appointed chief engineer for Messrs. Tredegar & Co., of Westminster, St. Albans and Bow.

Obituary.—The death of Mr. Milo G. Kellogg, founder of the Kellogg Switchboard and Supply Co., U S.A., at the age of 60, is reported in *Telephony*. Mr. Kellogg was associated with Elisha Gray and E. M. Barton in the formation of the Western Electric Manufacturing Co. in 1872 for the exclusive manufacture of the Bell telephones, and was for a long period one of the chief officers of the Western Electric Co., its successor. He was a noted inventor of telephonic apparatus, and in one week was granted no fewer than 125 United States patents, the largest number ever issued at one time to any person.

The death of Mr. Hugh Blackburn, Emeritus Professor of Mathematics at Glasgow, occurred on the 11th inst., at the age of 86 years.

We regret to learn of the death, which occurred at Kensington on 11th inst., of Dame Elizabeth Anne, widow of Sir Samuel Canning, of submarine cable fame, who passed away only last year. Lady Canning was 80 years of age.

The funeral of Mr. C. J. Robertson, whose death we briefly announced in our last issue, took place at Ealing on Saturday last, and the interment at St. George's Cemetery took place in the presence of a large number of friends and workers from the Robertson and Osram lamp factories, and societies with which he was connected. Mr. Robertson was associated with Mr. St. G. Lane-Fox from 1879 to 1881, and therefore was interested in lamp-making "from the beginning"; he also was in control of the manufacture of the Gatehouse and Bernstein lamps, until the establishment of the Edison monopoly compelled the closure of the factories. Mr. Robertson next equipped and carried on a number of factories on the Continent, and on the expiration of the Edison patents, he returned to found the Robertson Lamp Works at Brook Green, in association with Mr. G. Byng, and the General Electric Co., at which works he remained as technical director and one of the managers until his death.

CITY NOTES.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Para Electric Railways and Lighting Co.—£700,000 5 per cent. first debenture stock.

And to allow the following securities to be quoted in the Official List—

Para Electric Railways and Lighting Co.—70,000 ordinary shares of £5 each, fully paid; and 14,000 6 per cent. cumulative preference shares of £5 each, fully paid.

Shawinigan Water and Power Co.—Further issue of $61,000 5 per cent. consolidated first mortgage bonds.

Drake & Gorham, Ltd.—The directors' report for the year ended June 30th, 1909, states that after payment of all charges, including bonuses due to staff, there remains a net profit of £2,282, which, with the sum of £1,328 brought forward from the previous year, makes a total of £3,610, which it is proposed to appropriate as follows:—A dividend at the rate of 2½ per cent. per annum, £3,125, carrying forward £485. The work carried out by the London office during the past year compares very favourably with the previous twelve months, and the agency business in Osram and tantalum lamps continues to expand; the orders, however, for installation work in the Northern district have, unfortunately, considerably decreased, and this is attributed to the depression prevailing within the last eighteen months, and the reduction in dividend is mainly due to this cause. A satisfactory feature of the past year is the large amount of work executed for old clients in connection with the modernising and extension of existing installations.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year ending June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st. The transfer books will be closed from 18th to 30th inst.

Germany.—The Rheydt Kabelwerk Gesellschaft, of Rheydt, is declaring a dividend of 8 per cent. for the last financial year. In the preceding 12 months the shareholders received no dividend.

Direct United States Cable Co., Ltd.—The board have resolved upon the payment of an interim dividend of 4s. per share, free of income-tax, being at the rate of 4 per cent. per annum for the quarter ending September 30th.

Stothert & Pitt, Ltd.—The directors recommend a dividend of 6 per cent. on the ordinary shares for the past year, placing £500 to reserve and carrying forward £1,587.

Western Union Telegraph Co., Ltd.—This company has published its quarterly report to September 30th, 1909, from which it appears that after providing for the usual capital calls for interest and dividends, there remains a surplus of $18,088,729.

Rosario Electric Co., Ltd.—The directors' report for the year ended June 30th, 1909, shows a balance at the credit of profit and loss account, after making provision for depreciation of buildings, plant, &c., of £35,014, plus £6,549 brought forward, making £41,563. The directors propose a dividend of 5s. per share on 14,513 ordinary shares (making 8 per cent. for the year), and an addition to the reserve of £15,000, leaving £9,282 to be carried forward. The lamps connected and power supply expressed in 8 c.p. were:—June 30th, 1907, 123,318; June 30th, 1908, 151,167; June 30th, 1909, 195,705. The receipts for lighting and power were:—June 30th, 1907, £64,313; June 30th, 1908, £73,131; June 30th, 1909, £91,338. The directors have ordered a 1,000 kw. steam dynamo to cope with the steadily increasing demand for both lighting and power. A more favourable price for coal has beneficially affected the results of the year's working, and the new condensing plant has reduced the amount of coal per unit.

Oriental Telephone and Electric Co., Ltd.—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 3 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on the 30th inst. The share transfer books will be closed from the 14th to the 27th inst.

Callender's Cable and Construction Co., Ltd.—The directors have declared an interim dividend of 5s. per share on the ordinary shares.

MARKET QUOTATIONS.

Wednesday, October 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£11	..
a Copper Sulphate	"	£18 10	..
a Lead, Nitrate	"	£26 10	..
a " White Sugar	"	£23 10	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	3¾d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
" Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %)	"	£10 15	..
a " Chlorate	per lb.	3⅝d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a " Cyanide (basis 100 %)	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	£5 dec.
b " Wire, in ton lots	"	£112	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£50 to £136	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c " Tube (brazed)	"	8¾d.	..
c " " (solid drawn)	"	7¼d.	..
c " Wire, basis	"	6½d.	..
c Copper Tubes (brazed)	"	8¾d.	⅛d. inc.
c " " (solid drawn	"	8¾d.	⅛d. inc.
g " Bars (best selected)	per ton	£71	£1 dec.
g " Sheet	"	£71	£1 dec.
g " Rod	"	£71	£1 dec.
e " (Electrolytic) Bars	"	£60 10	..
e " " Sheets	"	£77	..
e " " Rod	"	£65 10	..
e " " H.C. Wire	per lb.	7⅞d.	..
f Ebonite Rod	"	3/3	..
f " Sheet	"	3/-	..
n German Silver Wire	"	1/6	..
h Gutta-percha, fine	"	5/6 to 6/6	..
h India-rubber, Para fine	"	8/9	4d. dec.
l Iron Pig (Cleveland warrants)	per ton	51/9	9d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£13 10 to £13 15	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 12 6	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	1/- to 1/1½	..
p " " rolled bars & rods	"	1/1½ to 1/3	..
p " " rolled strip & sheet	"	1/2½ to 1/6	..
o Platinum	per oz.	111/6	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£134 10 to £135 10	dec.
n " Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£26 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Prospectuses.—*Val D'Or Rubber Estates, Ltd.*—This company has been offering 650,000 shares of 2s. each for subscription. The company is to acquire an estate of 2,860 acres in the Settlement of Penang, Straits Settlements.

Sungei Buaya (Sumatra) Rubber Co., Ltd.—This company, which has been offering for subscription at par 63,000 shares of £1 each, is acquiring the Bandar Kuala Estate, in the Serdang District. There are over 107,000 trees planted of ages ranging from one to four years.

The Sapumalkande Rubber Co., Ltd., and the Kimanis Rubber, Ltd., have also offered issues this week.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. on the ordinary shares.

Cuba Submarine Telegraph Co., Ltd.—The directors recommend a dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year to June 30th.

Aron Electricity Meter, Ltd.— The directors have declared a dividend of 3 per cent. on the preference shares.

Bank Rate.—The Bank Rate was yesterday raised to 4 per cent.

STOCKS AND SHARES.

Tuesday Afternoon.

Money conditions have swung into a position of predominance, and last week's rise in the Bank Rate, followed by an advance on Monday in the Berlin Bank Rate, caused a check to Stock Exchange business generally. It cannot, however, be said that the rise in either was at all unexpected. This is the season of the year when requirements in connection with the moving of the world's crops call for capital, and a stiffening of money rates in October is as annual an event as the harvest itself.

The dramatic success of the issue of the New York Telephone bonds sent the premium up to 3½ per cent. above the price at which the bonds were offered. When the allotments came out, there was a little selling by stags, and the quotation fell to 1½ premium, at which it remained but a short time, being doubled again in the course of the day. Telephone issues are steady, and United River Plates gained ⅛, the new shares rising in proportion.

Marconi shares declined another $\frac{1}{16}$ to 13s. 9d., in spite of the brave face officially put upon the £15,000 bargain with the Government, and the reply to certain critics who had been inquiring about the life of some of the patents, the building up of reserves, and so on.

Telegraph descriptions are somewhat featureless. Cuba shares gained ¼, and Western Telegraphs ⅛. Anglo-American Telegraph Deferred further declined. No change has taken place in the Trust Companies' issues. The stock and bonds of the American Telephone and Telegraph Company are both a point lower, it being suggested that some of the proprietors sold these in order to take up the New York Telephone scrip.

Electricity supply shares are mostly dull with movements few and far between. Metropolitan Ordinary rose ⅛, giving a market humourist an excuse for the remark that East Marylebone requires a good deal of illumination on its political affairs just now. City of London and Charing Cross and Strand both weakened. London Electrics are ⅛ down. Brompton and Kensiogtons are flat upon an incessant stream of small sales. Victoria Falls Power Preference continue to follow Chartered shares, and $\frac{1}{32}$ advance has brought the price up to 18s. 9d. middle.

Mexican Light and Power Common rose 3 and the Preference 2, on the accumulating testimony as to the importance of the company and the comparative non-importance of the accident to the dam, a mishap which, it is claimed, cannot recur because of the way in which the re-building is being done. The group is firm generally. No change is marked in Mexico Tramways, Rio or Sao Paulo Trams. Canadian General Preference improved to 120. British Columbia Electric Railway Preference has advanced. Calcutta Trams drooped, although the Debenture stock pursues its quiet rise. Anglo-Argentine Second Preference declined slightly. British Electric Traction Ordinary, Preference and First Debenture have recovered.

The Home Railway market bestirred its sluggish prices to revival on the improving Board of Trade Returns, but the movement lived no longer than usual, and the hardening of money-rates caused the weakening of Railway prices. Districts stand out as a bright exception, having risen to 16½ upon obviously inspired statements as to the financial progress which the company is making, and of which every Londoner will rejoice with every District stockholder to learn. With this rise in the price of the Ordinary it is a little singular that the 6 per cent. Debenture should not be realisable at the lower of the two prices quoted in the Stock Exchange Official List, where the stock goes out 143-145.

Metropolitan Consolidated is ¼ up, and the hope is expressed that, as traffics will so soon be running against normal "takes" of a year ago, the figures may justify a further improvement. The four months of Exhibition traffics are now practically over, and the failure of this season's gathering at Shepherd's Bush will be forgotten—except when the report appears—in the anticipation of better results accruing in 1910 from the Anglo-Japanese Exhibition at the White City. Underground Electric Railway 6 per cent. income bonds have again receded a point.

Manufacturing shares show some degree of irregularity. India-Rubbers—still called "Silvers," as the market colloquialism—rose 5s., and so did General Electric Preference. Dick, Kerr Preference are a shade easier. The full amount of the rise in armament shares was not retained. Rubber shares have moved wildly, hardening up after being distinctly flat. It is thought that some of the weaker holders of rubber shares have been shaken out on the fall, and that the market is in so much a healthier state for their disappearance.

Calcutta Tramways Co., Ltd.—The directors have declared an interim dividend of 2s. per share on the ordinary shares (being at the rate of 4 per cent. per annum, free of income-tax), on account of the profits for the half-year to June 30th.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Oct. 5th.	Closing Quotations Oct. 12th.	Business done week ended Oct. 12th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞— 3⅜	3 — 3½	..	..	+ ⅛	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	94 — 97	91¾	..	+1	5 3 1
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146 —148	145 —147	147½	..	—1	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	96 — 98	..	..	—1	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	61⅛— 63½	61½— 63½	..	..	..	5 2 3
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	104 —105	104¾	104	..	5 14 3
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21¾— 22	20⅞— 21⅛	21¾	21	— ⅞	1 17 10
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 9⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	88 — 90 xd.	89	88½	..	4 8 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½— 9¼	8⅝— 9⅜	8¾	..	+ ⅛	6 8 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17¼— 18¼	17½— 18½	..	..	+ ¼	5 8 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 11 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13¼— 13¾	13¼— 13¾	13¼	13 15/32	..	7 4 8
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	129 —133	129 —132	130½	129¼	..	5 6 10
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 — 87	85 — 87	86¼	85½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104 —106	105½	..	..	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12⅛	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102¼	..	..	3 16 11
900,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10½	10 3/16	..	5 8 3
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅜— 14⅛	13⅜— 14⅝	13⅞	13 9/16	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	..	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	53¼	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	94 — 97	93 — 96	..	..	—1	4 3 4
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	80 — 82	75 — 78	..	..	—4½	5 2 7
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	11/16— 13/16	⅝— ¾	14/9	14/4½	— 1/16	Nil.
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝— ⅞	⅝— ⅞	..	..	..	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝— ⅞	⅝— ⅞	16/3	16/-	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108	106½—108	107¼	107	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	122¼	121¼	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	5 9/16	5 7/16	..	4 7 3
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98⅜	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 15/32— 1 19/32	1 15/32— 1 19/32	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	86¾	..	..	4 11 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7¾— 8¼	7¾— 8¼	..	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	131 —134	131 —134	..	..	..	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6¾— 7	6⅞— 7⅛	7 1/16	7	+ ⅛	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5¼— 5⅝	..	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1 7/16— 1 11/16	1 7/16— 1 11/16	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13⅜— 13⅞	13½— 14	13 11/16	..	+ ⅛	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	15/7½	15/6	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9¼	8¾— 9¼	8 27/32	8 13/16	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½— 9½	8½— 9½	..	..	..	15 15 10
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Oct. 5th.	Closing Quotations Oct. 12th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝— 4⅞	4⅝— 4⅞	96/10½	93/9	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4½— 4¾	4 7/16— 4 11/16	90/-	..	— 1/16	5 6
978,2[illegible]0	Do. 4 % Deb. Stock	..	..	..	..	4 %	92¾—93¼	92¼ - 93¼	93	92½	..	4 5 10
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	103½	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅜— 4½	4⅜— 4½	90/-	88/9	..	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½— 1	½— 1	17/6	17/3	..	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅝	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	144 —149	146	..	..	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —125	120 —125	..	..	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —110	109 —112	111	109¾	+2½	4 9 8
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	102½	102¼	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
[illegible]	British Electric Traction	10	8 %	Nil	Nil	Nil	½— ⅞	¾— 1	16/3	11/10½	+ 3/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	1⅞— 2⅜	2 — 2½	47/6	43/9	+ ⅛	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	81½ — 84½ xd	82 — 85	83½	83	+ ½	5 17 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	62 — 66	62 — 66	..	..	..	6 16 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼— 7⅝	7¼— 7⅝	..	..	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,94[illegible]l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
1,716,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	39 — 42	..	..	+ ½	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	3/16— 11/16	3/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅞— 5⅜	4¾— 5¼	..	..	— ⅛	4 5 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¼— 5	4¾— 5	97/6	96/3	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	100 —103	102		+1	4 7 5
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅝— 11⅛	10⅝— 11⅛	10¾	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	6⅜— 6¾	6⅜— 6¾	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 — 2⅛	41/9	41/6	..	5 17 8
910,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 — 63	61 — 63	62⅛	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86½	85½	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	41½	41	..	5 11 1
1,[illegible]	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	80½ — 81½	80½ — 81½	81	..	..	4 15 8
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	⅞ — 1⅛	⅞ — 1⅛	..	..	..	13 6 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,0[illegible] of £50 Red.	.	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

† A period of nine months.

From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 5th.	Closing Quotations Oct. 12th.	Business done week ended Oct. 12th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	21/3	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16 xd	1 — 1⅛	..	..	— 1/16	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/16 — 5/16	3/16 — 5/16	10/-	5/-	..	24 0 0
17,139	Do. "A" shares, 01—017,139	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85 xd	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8 — 8½	8¼ — 8¾	..	..	+ ¼	5 14 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87 xd	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13¼	12½ — 13¼	..	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14¾ — 15½	15 — 15¾	15 11/16	15½	+ ¼	6 14 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾ — ⅞	¾ — ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
899,980	Do. do. 50,008 to 100,000	10	8 %	8 %	8 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼ — 2¾	2¼ — 2¾	48/9	..	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38 — 38½	38¼ — 38¾	39⅛	38	..	1 6 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 —67	65 — 67	65⅝	65	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	15¾ — 16½	16¼ — 16¾	16⅞	15⅞	+ ⅜	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 21/32	9/16 — 21/32	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	15/-	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 96½	94½ — 96½	95¾	92½	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	127 —130	127 —130	129	127¼	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	92 — 94	93⅛	92½	..	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35¼	35	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	103¼	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88	87⅜	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	34 — 36	33 — 35	33	..	—1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2¼ — 2¾	2¼ — 2¾	45/-	..	..	2 3 9
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80 xd	76 — 80	77	76½	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛ — 4⅝	4⅛ — 4⅜	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7¼ — 7¾	6½ — 7½	7¼	7 1/16	— ½	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7½ — 8	6½ — 7½	7⅛	7	— ¾	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 6
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4⅜ — 4⅞	..	..	— 1/16	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅜	3¾ — 4¼	..	..	— ⅛	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	98 —101	100¼	99½	+2	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½ — 4	3½ — 4	71/3	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½ — 11	10⅜ — 10⅞	10⅝	..	— ⅛	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	10 15/16	10⅞	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝ — ⅞	⅝ — ⅞	13/9	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞ — 5⅜	4⅞ — 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛ — 7⅝	7⅛ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	98 —101	100⅜	100¼	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1¾ — 2⅛	..	..	— ⅛	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5½	5 — 5¼	..	..	..	5 17 1
332,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	4⅛ — 4⅝	88/9	85/-	— ⅛	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	106	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	81 — 83	82 — 84	83	82½	+1	5 19 1
13,685 000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	70 — 74	73 — 77	76	71	+3	4 10 11
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	104 —108	106	104½	+2	6 9 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	86 — 88	87	86	..	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 —100	98 —100	..	..	+1	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 — 102	100 —102	..	..	+1	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼ — 13¼	12¼ — 13¼	..	..	..	5 6 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 15/32 — 1 19/32	1 15/32 — 1 19/32	31/-	30/9	..	5 7 1
100,000	Do. do. 6% Non Cum. Prof. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 1/16 — 1 3/16	21/9	..	+ 1/16	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅞ — 9¼	8¾ — 9	8⅞	8 11/16	— ⅛	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅞ — 3	2⅞ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	7/16 — 9/16	7/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1 3/16	1⅛ — 1 3/16	22/6	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103 xd	102—105	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅞ — 1⅛ xd	⅞ — 1⅛	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼ — 1¾ xd	1¼ — 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½ xd	74½ — 78½	..	..	..	5 14 8
308,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	29/32 — 31/32	15/16 — 1	19/3	..	+ 1/32	5 0 0
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8¾ — 9	8¾ — 9	8⅞	..	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 3/32	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 3 per cent., October 7th, 1909.

GERMANY'S EXPORTS OF ELECTRICAL GOODS DURING THE FIRST HALF OF 1909.

The following statement showing the quantity of electrical goods of various kinds exported from Germany during the six months ended June 30th, 1909, is taken from the recently issued official statistics; the figures for the corresponding period of 1908 have been given for purposes of comparison, increases and decreases being shown:—

		In double centners (220·4 lb.).		Increase or decrease.	
		1908.	1909.		
Dynamos, Motors, Converters, Transformers and Choking Coils, up to 5 Double Centners weight.—					
To	Austria-Hungary ...	3,600	3,500	—	100
″	Great Britain ...	2,000	1,200	—	800
″	Belgium	1,500	1,700	+	200
″	Italy	6,600	4,700	—	1,900
″	Netherlands	1,300	1,200	—	100
″	Russia in Europe ...	1,100	1,600	+	500
″	Spain	1,300	1,000	—	300
″	Other countries ...	9,400	8,200	—	1,200
	Total ...	26,800	23,100	—	3,700
Ditto, over 5 Double Centners in weight.—					
To	France	5,900	7,400	+	1,500
″	Switzerland	1,500	800	—	700
″	Netherlands	3,600	3,700	+	100
″	Belgium	10,400	5,600	—	4,800
″	Great Britain ...	12,000	5,100	—	6,900
″	Austria-Hungary ...	5,100	4,400	—	700
″	Italy	20,500	14,000	—	6,500
″	Russia in Europe ...	3,600	5,400	+	1,800
″	Norway	2,500	1,700	—	800
″	Spain	7,200	7,900	+	700
″	Argentina	6,300	3,200	—	3,100
″	Japan...	4,000	6,100	+	2,100
″	British S. Africa ...	3,800	4,200	+	400
″	Mexico	3,600	1,200	—	2,400
″	Other countries ...	18,000	11,300	—	6,700
	Total ...	108,000	82,000	—	26,000
Rotors and Commutators.—					
To	Great Britain ...	2,000	1,600	—	400
″	Austria-Hungary ...	1,300	1,100	—	200
″	Italy	2,100	1,400	—	700
″	Russia in Europe ...	1,600	1,400	—	200
″	Other countries ...	5,000	5,500	+	500
	Total ...	12,000	11,000	—	1,000
Accumulators and Plates, without horn or rubber, &c.—					
To	Denmark	2,100	3,900	+	1,800
″	Netherlands	900	2,500	+	1,600
″	Sweden	6,900	4,100	—	2,800
″	Argentine	2,200	1,900	—	300
″	Other countries ...	4,900	5,000	+	100
	Total ...	17,000	17,400	+	400
Cables.—					
To	Netherlands	12,500	13,600	+	1,100
″	Belgium	19,800	17,600	—	2,200
″	Great Britain ...	16,300	6,700	—	9,600
″	Denmark	10,300	9,100	—	1,200
″	Sweden	17,900	16,400	—	1,500
″	Spain	4,200	3,600	—	600
″	Argentina	12,700	17,800	+	5,100
″	Japan	4,800	2,300	—	2,500
″	Uruguay	3,200	700	—	2,500
″	Italy	3,900	5,800	+	1,900
″	Norway	5,300	3,100	—	2,200
″	Brazil	1,700	2,000	+	300
″	Other countries ...	49,200	71,000	+	21,800
	Total ...	161,800	169,700	+	7,900
Arc Lamps.—					
To	Belgium	240	200	—	40
″	Russia in Europe ...	290	300	+	10
″	Great Britain ...	380	350	—	30
″	Argentina	300	260	—	40
″	United States ...	220	390	+	170
″	Other countries ...	1,570	1,740	+	170
	Total ...	3,000	3,240	+	240
Incandescent Lamps.—					
To	Austria-Hungary ...	250	340	+	90
″	Italy	400	340	—	60
″	Great Britain ...	1,400	1,470	+	70
″	France	300	520	+	220
″	Russia in Europe ...	360	640	+	280
″	Other countries ...	1,890	2,250	+	360
	Total ...	4,600	5,560	+	960
Telegraph and Telephone Material.—					
To	France	370	830	+	460
″	Great Britain ...	1,300	1,100	—	200
″	Italy	740	600	—	140
″	Austria-Hungary ...	300	600	+	300
″	Switzerland	390	410	+	20
″	Belgium	680	1,400	+	720
″	Netherlands	420	370	—	50
″	Russia in Europe ...	640	610	—	30
″	Denmark	370	350	—	20
″	Other countries ...	1,990	1,930	—	60
	Total ...	7,200	8,200	+	1,000
Electrical Apparatus for Lighting, Power, &c.—					
To	Belgium	2,700	2,500	—	200
″	Great Britain ...	3,400	2,300	—	1,100
″	Netherlands	1,550	1,800	+	250
″	Spain	1,700	2,800	+	1,100
″	Switzerland	1,300	1,200	—	100
″	Italy	3,900	3,800	—	100
″	Austria-Hungary ...	3,100	3,200	+	100
″	Russia in Europe ...	2,500	3,900	+	1,400
″	Sweden	2,500	1,100	—	1,400
″	Argentine	2,600	1,800	—	800
″	Chile	1,500	660	—	840
″	Japan...	1,260	870	—	390
″	Uruguay	1,200	320	—	880
″	British S. Africa ...	900	620	—	280
″	Other countries ...	6,790	7,130	+	340
	Total ...	36,900	34,000	—	2,900
Electrical Measuring and Recording Instruments.—					
To	Great Britain ...	220	340	+	120
″	Italy	680	900	+	220
″	Austria-Hungary ...	770	900	+	130
″	Switzerland	250	240	—	10
″	Denmark	180	140	—	40
″	Sweden	410	210	—	200
″	Russia in Europe ...	390	610	+	220
″	Spain	320	330	+	10
″	Argentine	190	320	+	130
″	Other countries ...	1,290	1,610	+	320
	Total ...	4,700	5,600	+	900
Carbons, Brushes, &c.—					
To	France	1,200	800	—	400
″	Switzerland	1,100	500	—	600
″	Austria-Hungary ...	1,500	1,200	—	300
″	United States ...	2,500	5,500	+	3,000
″	Great Britain ...	6,100	5,000	—	1,100
″	Italy	2,500	2,100	—	400
″	Other countries ...	8,200	8,400	+	200
	Total ...	23,100	23,500	+	400

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"W. E. S." writes:—"Two braided aerial lines have been erected entirely on private land for the purpose of supplying power at 220 volts. Passing over are a number of P.O. telegraph and telephone wires at right angles to power wires. Has the owner of the power wires to fix guard-wires over his cables, and bear the expense of fitting fuses, &c., on the telephone and telegraph lines?"

⁂ The question raised in the above query may be answered by reference to the Electric Lighting Act, 1888. Before that Act the Postmaster-General only had power (by virtue of the Electric Lighting Act, 1882) to demand that his lines should not be injuriously affected by wires laid under and by virtue of a provisional order. By the Act of 1888, however, he may call upon the owner of any line which is "injuriously affecting" his telegraph lines to take steps to protect him. But what is "injurious affection"? By Sec. 26 of the Act of 1882, a telegraph line is deemed to be injuriously affected by a work if telegraphic communication by means of such line is, whether through induction or otherwise, in any manner affected by such work, or by any use made of such work." It would seem from this that the Postmaster-General has no power to compel the erection of guard-wires. It is understood that where wires cross at right angles there is no danger to be feared from induction.

THE QUACK IN THE ELECTRICAL MARKET.

By DOUGLAS SUTHERLAND MARTIN.

Prettyboy was an electrical engineer; that is to say, he had spent three years at college, had hung about works in the Midlands for another five, and was now waiting for something good. By way of passing the time he applied himself to the interesting occupation of foisting upon a diffident public certain worthless articles remotely connected with engineering —such as sparking plugs that would not spark, revolution counters which would only read while he held them in his hand and jockeyed with the spring at the back, and lampholders which had as much tenacity in them as an india-rubber monkey.

He rented two rooms and a cupboard at the top of a block of buildings in High Holborn, and called himself "The United International Electrical Manufacturing Co., Ltd." He slept in one room, interviewed possible partners in the other (hence the name "office"), and kept the stock in the cupboard. As he would airly remark to a friend, "Turned myself into a company, you know. Simply had to, to protect myself, you know. . . . Yes, good name. Thought it out myself. . . . Capital? Oh, of course, that varies. I pay for the rooms by the month, you see, so that brings it down a bit at times. We were doing rather well a few weeks ago. I sold a couple of sparking plugs and a 'Nokkit' gas-lighter in the same morning. . . . Initial capital? Oh, I raised a tenner from an uncle of mine, and tapped various other sources, and shoved 30 quid odd in myself. We had about £43 after buying what's in the cupboard."

That is how he would unburden himself to a College pal. If his interviewer were a possible partner, or a likely client from the diffident public, his manner was rather different. He would with dignity point to the chair (5s. 11d.) opposite an elaborate picture of some German machine shops. He would adjust his glasses, toy with a slide-rule, and offer the chap a pamphlet.

"Of course," he would say in his most impressive manner, "we are kept pretty busy. Owing to the rapid revival of trade consequent upon the recent speech of the American President" (or the death of the Shah, or the new Bulgarian Tariff), "I am compelled to lay down fresh plant every month, and I badly need extra help in the executive offices. Though it is a constant strain, it nevertheless means increased efficiency if one can give close personal attention to all the details of a business such as ours. I am, nevertheless, thinking of engaging a partner, a man whom I could trust, a man such as yourself."

Here Prettyboy would cough, and see if the other chap was going to say anything. If he wasn't, Prettyboy would resume.

"A man may endeavour to obtain a position with our firm. In entering such a firm as the United International Electrical Manufacturing Co., a firm, it is true, with a considerable manufacturing business, but a firm, also, with an established connection in buying and selling, the advantages accruing to the individual in question are obvious. We are happy to confer such advantages, merely stipulating that in lieu of bringing a fresh connection to the concern, the newcomer shall purchase, say, a couple of hundred shares in the company, thus obtaining a real live interest in the business; also," but this he muttered to himself, "about quadrupling our beastly capital."

At this point the victim would grow rather red and mutter something about having already invested his capital. If Prettyboy gleaned that the chap really hadn't any brass at all, he would simply close the interview, and bring out about thirty circulars and pamphlets. While the chap was reading them, Prettyboy would go to the cupboard outside, bring in some of the stock, and show him how it worked; offer him a cigar, show him to the door, and fairly load him up with untruthful literature. Then he would go back to the office, smoke a pipe, and wait for the order or orders which generally followed.

One day Prettyboy thought he would do Tottenham Court Road—a thoroughfare which hitherto had been spared bombardment by the United. So he lit a cigarette, took his bag, locked the office door, and sallied forth.

First he tried an ironmonger's. Then he sold half-a-dozen fancy spanners to a bike-shop chap (and gave him 43 circulars), and then, at the entrance to a dirty-looking tobacconist's, he saw a board up with "The Colonial Engineering Supply Corporation" on it. He thought he would try it. He inquired at the counter and was told to walk upstairs. He walked up about one hundred and fifty ricketty stairs, and again saw the sign hung out on a landing. He knocked at the door and asked for the manager. He was shown into a room which struck him as being very much like his own. Around the walls were hung flaming blue prints illustrating the wonders of engineering. Upon the broken-down old desk were 11 paper weights (he counted them) made of turbine buckets, bits of three-core cable, and sections of non-slip covers. In the chair was the manager, a sporting-looking chap of less than thirty. Prettyboy placed his bag on the floor and advanced, hat in hand.

"I have been instructed," he began, "to wait upon your firm and to bring before your notice some of the more recently introduced novelties. I represent the U.I.E.M.C., Ltd." To this statement he attributed the look of stupefaction, almost of horror, upon his listener's face, though there was hardly anything really in the bare announcement of the name of his firm to cause a chap to curl up in his chair and gasp as if he had been stung. "I specialise in the accessories department, and amongst other things I should like to show you a little device—"

"For heaven's sake, stop!" came in a hoarse cry from the chair.

Prettyboy stopped.

"You wish me to buy a worthless article?"

"You'll pardon me, Sir," chipped in Prettyboy, "but you go too fast. Sir, I am no quack. This device, as you will see—"

"You come to me! You!"

"I?"

"You, William Prettyboy!"

Prettyboy gasped. He drew back, with his hand to his head, white to the lips.

"I know you," cried the man in the chair. "Did I not work with you at college ten years ago? Do you not recognise in me Wilkins, the patent crank? Did I not help you in the labs., in the Drawing Office? Did I not coach you in hydraulics? Did I not lend you money? Ah! this is too hard a blow! After these years you come to me and try to sell me some dirty revolution counter! But hold! I will have my revenge!" He rose and walked hurriedly to a cupboard by the window, and returned with a large box. "See here!" he cried, with a horrible laugh, "here is a lampholder, which would not hold a solitary lamp on all this earth. It would blow any fuse, and having blown all fuses, would shut down any station. It is worthless. See here! Here is a sparking-plug which once took a car from Hyde Park Corner to Knightsbridge, and which will never spark again. It is worthless. See here! Here is a clock device for boiling shaving-water every morning at ten past seven. Ugh! It would never warm a thimble-full if you left it on for a month. Here is a burglar-alarm, here is a stop-watch, here is a gas-lighter. Take the lot! Take them and hang the things round your bedroom to show you the worthlessness of your calling, you ——."

He sank back into his chair exhausted. Prettyboy took advantage of the lull.

"But, say, how did you come by those articles?"

"Bought 'em!"

"Where?"

"Some in Birmingham, some in the East End, some imported, some——"

"And you are selling them?"

"Trying to!"

"So you are in the trade?"

"What trade?"

"The noble trade of bringing before the notice of the public at immense expense articles which cannot fail to be of universal service as time-savers, as money-savers, as ——"

"Oh, help!"

"As money-savers, as ——"

"Man, I recite that creed every day, and I am not the only one. There are thousands at it. College men, driven out of work by the competition, loafing for two years, then aking up anything that offers. If nothing offers they try Canada, or else set up as "The United Internationall All-British Electrical Fundamental X Y Z."

"We're pals, anyway, Wilkins?"

"We were—once."

"We are, man. Let's amalgamate!"

"What's the use?"

"Double the capital; increase your plant. If you haven't any plant, buy some."

"Start a young works, you mean?"

"Yes, and make the stuff ourselves. We'll call it The United ——'"

"'The Colonial,' if you please!"

"Oh, anything! The United Colonial, British, Foreign and International Electrical Mechanical Anti-Vaccination Manufacturing Corporation. Head office and works ——"

"The workhouse, old man!"

TUITION BY CORRESPONDENCE.

Although no one will maintain for a moment that any means of instruction can possibly be as efficient as that which involves the personal attendance of the pupil in the presence of his teacher, and, in the case of technical and scientific subjects, practical work in the laboratory, there can be no doubt that where oral instruction is for any reason unobtainable, tuition by correspondence forms a very effective substitute. Of this fact we have not only abundant evidence, but also personal knowledge; we speak, therefore, with the confidence born of experience. It is true that in this as in every profession, there have been instances of inefficiency and incompetence which have brought down upon the system undeserved reproach; but these abuses are apt to provide their own remedy, and our remarks are intended to apply only to those institutions which are conducted on sound lines by honourable men with a staff of fully qualified instructors.

Tuition by correspondence is no new thing; it has been practised in this country for nearly 20 years to our knowledge, on a large scale, and with a highly organised system. We have in mind in particular an undertaking which has for many years prepared non-resident students for the examinations of London University, with marked success, and there are several institutions engaged in the instruction of students of engineering. It is with one of the latter that we are especially concerned in this article.

For several years past the International Correspondence Schools, an institution which came into existence some 18 years ago in the United States, has had a branch establishment in London, which has quietly been developing an extensive connection, and laying the foundations of a wide-spread organisation. Instruction was at first carried on with the aid of the admirable text-books and scheme of lessons evolved in connection with the system in the United States—where the business had grown to such an extent that a fully-paid capital of over £2,400,000 was engaged, and the roll of past and present students numbered over a million. It was soon found, however, that while there was abundant scope for the Schools' activities in this country, their progress was hindered by the very marked, if not important, differences between American and British practice. With characteristic energy and enterprise, the directors decided to create a new series of text-books, written by British experts, and based entirely on British practice; at the same time it was resolved that a headquarters should be erected in London worthy of the magnitude and importance of the undertaking, and early in 1909 the International Correspondence Schools, Ltd., was formed with a capital of £200,000 for this purpose. Since that date rapid progress has been made. A large and handsome structure—"International Buildings"—has been erected in Kingsway, the greater part of which is devoted to the work of the Schools; the new text-books have been hurried forward towards completion at a rate never equalled even in America, the output averaging 100 pages a day *continuously*, and a "field staff" has been called into existence with upwards of 40 branch offices in the United Kingdom alone; the London establishment, however, deals with the whole of the British Empire except Canada, which of course is more conveniently worked from the American centre, and branches have been established in all parts of the Empire. It will be seen, therefore, that the I.C.S. must be regarded as a new and important factor in the education of the British worker.

The question naturally arises, and very pertinently, whether the work of the I.C.S. is or is intended to be in competition with that of the many technical colleges and schools that are scattered throughout the country. The answer, on the authority of the organisers, is emphatically in the negative. It is at once admitted that where a student is in a position to attend in person properly organised courses of instruction, it is preferable that he should do so. But there are innumerable instances in which this course is impossible. The exigencies of his business may require a student to move about from place to place, or his hours of work may be such as to preclude his attendance at regular classes. Again, many a man, while willing and anxious to improve his knowledge, is unable or reluctant to sally forth from home at fixed hours after his day's work is over, though he will readily settle down at home to study for an hour or two. There is also a very large class of men who cannot associate with their own subordinates and apprentices at evening classes without serious loss of prestige, or of dignity—real or imaginary—yet who would, and do, eagerly avail themselves of instruction such as that provided by the I.C.S., for they realise that the younger generation is growing up with higher scientific and technical attainments than they themselves possess, and that they must take steps to prevent their being outstripped in the race of progress. Even highly placed officials have taken and are taking the I.C.S. courses, and students who have taken the diplomas of first-class colleges find that they can with profit pursue their studies in some special branch of their profession with the aid of the Schools. The work of the latter, therefore, is to be regarded as complementary to that of the technical institutions, and also as supplementary to it, but not as competitive.

International Buildings, Kingsway.

One great advantage possessed by a correspondence institution is due to the character of the students who take up its courses. None but earnest, dogged and industrious workers are either willing or able to plod through the curriculum and obtain the certificate awarded to the succesful student who has satisfied his teachers that he has done justice to the courses prescribed and has assimilated the instruction provided. To this fact we are disposed to ascribe many of the successes claimed for their pupils by the I.C.S. and similar organisations; they have the very best material to work upon, and character combined with knowledge is bound to make a way for itself. It is not alleged that every student who commences a course perseveres to the finish—such a contention would be too Utopian for belief; it rests with the student to maintain his efforts without ceasing, and the reward is to him who deserves success by commanding it.

Male Staff of the I.C.S. Headquarters.

These comments and reflections are prompted by a visit which we recently paid to the headquarters of the I.C.S., for the purpose of investigating the aims and methods of the schools. We were not unfamiliar with the main features of their work, for we have watched their progress for years past; but the new developments appeared of sufficient importance to justify a closer acquaintance with them. Our observations satisfied us that the organisation of the system had been carried to a remarkably high pitch of excellence, and that the methods of carrying on the work were efficient and thorough. Although the dispatch of lessons in rotation is carried on almost mechanically, with the aid of elaborate card indexes, the examination of the solutions of problems and of the answers to questions sent in by the students is performed with minute and painstaking care. It is not sufficient for the right answer to be given—every step in the working is checked, and any error is at once detected and brought to the notice of the student. This, be it noted, is absolutely essential to the inculcation of correct ideas and the avoidance of a fictitious impression of progress on the part of the learner. Not only are the regular papers thus individually revised, but also any questions that the student may put forward in connection with the subject he is studying are conscientiously replied to by the instructors, and students are encouraged to ask such questions. Backward students are placed in the charge of special instructors, whose task it is to accelerate their progress by individual attention and instruction. The full record of every student is always accessible on file, and he is visited in person at regular intervals by the local field staff, no matter where he may reside, so that he is constantly kept up to his work and in intimate touch with the schools.

Record and Mailing Department.

There are some 17 "Schools," or subjects, embracing all the principal branches of industry, and these are sub-divided into 200 different courses of instruction. Each course is complete in itself—for instance, if electrical engineering is taken up, the necessary amount of mathematics, physics, chemistry, &c., is included, *ab initio*, and it is stipulated that unless a student can show that he already possesses the required degree of knowledge in the associated subjects, he must work through every branch of the course prescribed. Besides receiving a complete set of the text-books necessary to his course of instruction, the student is supplied with a duplicate set in the form of separate lessons, which he can therefore carry in his pocket, and otherwise subject to hard wear, without compunction. In the Mechanical Engineering course alone, which has cost £10,000, there are 131 of these pamphlets, comprising 6,300 pages and 3,851 illustrations. He is also provided with a simple but sufficient set of instruments (in the case of a course in drawing, for example) and with apparatus for carrying out elementary experiments in such a subject as electricity and magnetism. But we cannot enter further here into the details of the system. We have read students' answers, seen them corrected, and watched the staff at work filing, correcting, dispatching, accounting, writing text-books, illustrating them (every illustration is redrawn for reproduction by a specialist), editing, &c., and we can only say that any person who feels any doubt as to the stability, *bona fides*, efficiency or magnitude of the undertaking had better pay a like visit to the headquarters. He will be convinced. We give a few illustrations of the I.C.S. establishment in Kingsway, where a floor area of 14,600 sq. ft. is allotted to the work, and a staff of 172 persons is employed.

THE MURRAY PHOTO-PRINTING SYSTEM.

(*Concluded from page* 485.)

In the experimental model of this instrument provision has only been made for the exposure of a comparatively short length of photographic paper, which is afterwards developed and fixed separately. In the machine for commercial use a continuous roll of photographic paper, together with developing and fixing tanks will be provided.

This new machine is believed by the inventor, Mr. Donald Murray, to be specially suited for working on submarine cables in conjunction with the Brown cable relay.

For such an instrument as has been described to be commercially useful for Press work, some means of manifolding the messages is necessary.

THE TROLLEY OMNIBUS.

Those who attended the recent Municipal Tramways Convention had an opportunity, on the last day of the conference, of inspecting the very first demonstration line in this country of the system of rail-less electric traction, numerous instances of which, however, have for some years past been successfully at work on the Continent, where conditions are more favourable to the fostering of new methods, either because restrictions are absent or the spirit of adventure is higher—perhaps both.

It is, at any rate, very noticeable that while substantial working progress has been made with this new system in France, Germany and Austria, there appears to be some difficulty in this country in convincing private capitalists or public officials and municipalities that this is a sound proposal with great economic advantages and able to occupy a large field with satisfactory results.

Even those who have been brought to see the uses and advantages of the rail-less trolley appear to be waiting one upon the other to take the first steps—we will not say for the purpose of profiting by the possible mistakes of others;

it is rather a case of letting "I dare not," take the place of "I would," or who shall "bell the cat?"

True, there is this to be said for delay in pushing on: no one seems to know the exact measure of power which official red tape can exert over the development of this new method, or which Governmental department is to supervise it and how far. It may be the Board of Trade, or the Local Government Board, or the Home Office, or even the new Department which is to look after new or improved main roads, and will therefore have an eye on all possible sources of revenue. Parliament itself may have to be consulted by means of Provisional Order or Private Act, for the installation of a rail-less trolley system implies the securing of powers to erect overhead wires and poles carrying electric energy along public roads, and also to enforce the payment of fares by passengers, unless the provisions of Hackney Carriage Acts and similar enactments can be made to apply.

So far as the technical or engineering aspect of the movement is concerned, there is no such ground for criticism. On the contrary, substantial progress has been made, and this could be clearly seen at the demonstration above referred to, when the members of the Tramway Conference inspected the experimental line installed by the Railless Electric Traction Co., Ltd., in the depôt at Hendon belonging to the Metropolitan Electric Tramways, Ltd.

Here was shown a line—perhaps ½ mile or so long—equipped as for actual work, and embodying a great many additions and refinements not to be found on the Continental lines, but considered necessary in this country, where higher standards of work are called for.

The overhead work is, of course, different very materially from that employed in tramway service, seeing that both positive and negative conductors are overhead. The wires for this purpose are set fairly close together—about 11 in. centres—so as to reduce as much as possible the size and weight of the double collector attached to the car.

This is of the under-running type, as in tramway work, kept up by means of springs at the base on car roof; but seeing that the car is not confined to one track, but must draw in and out of other traffic, the double collector pole has a lateral swing up to 90° on each side, also controlled by springs.

The form of collector at present employed is practically a small inverted four-wheeled round frame, pivoted at the centre for horizontal movement and at the side for vertical play. It has, therefore, a universal movement to allow for uneven roads, &c.

A pair of wheels, placed tandem, runs under each trolley wire, and two separate poles, with hinged tops, serve to carry the collector frame, their bases being secured to the car-roof fitting through springs, as above mentioned.

While this is the arrangement so far at work, the Railless Electric Traction Co., Ltd., have an alternative method, which employs three wires overhead, the two outside ones being positive and the centre one—placed at a lower level, so as to make sure of prior contact—being negative and permanently connected with the whole framework of the vehicle.

As india-rubber tires are, of course, employed on the car-wheels, the whole car is insulated from the earth. If, as will often be the case (where, for instance, the trolley omnibus runs on a route which forms an extension of electric tramways), the supply of current is from the usual 500-volt circuit with earthed return, it is absolutely necessary, in order to prevent possible shocks to passengers, that the car framework and fittings should be carefully and continuously earthed.

Tramway engineers are familiar enough with compensation claims for shock to passengers, and in some of these it is quite possible that owing to dry rails, perhaps covered with dust and sand, the whole four wheels of a tramcar may be insulated from the rails just at the instant when some unfortunate passenger, getting off or on the car, touches a brass platform stanchion or other metal part of the car, and so gets a more or less severe shock, which a clever advocate will invest with a well-nigh fatal importance.

To prevent the possibility of this, the Railless Traction Co. have devised the triple trolley head and triple trolley hanger; the three trolley wires in this case consist of two outer positives—13½ in. centres apart—and the middle negative at a lower level, so that the triple trolley head cannot make contact with the positives before doing so with the negative.

Unless, however, the Board of Trade or Parliament, or whoever the authority may be with power to settle these details, should insist on such provision, there does not seem to be quite sufficient reason for the excessive precaution. Good motor and circuit insulation has proved quite satisfactory on the Continental lines; and rather than see three overhead wires, it might be preferable to have a separate and distinct source of energy for the rail-less trolley system with the negative insulated from earth altogether, if that be possible or permissible.

As an additional precaution against possible short circuits to the car-frame, the Railless Traction Co.'s equipment provides each car with a visible or audible leakage indicator, which continues to act and give warning until the circuit is broken or the leak found and set right.

The type of vehicle employed on the demonstration line at Hendon is probably one that will have a permanent use. It has a single-deck body, with seating capacity for 22 passengers inside, and two additional seats on the rear platform. This body is mounted on a special chassis or frame which carries two separate 25-H.P. B.T.-H. railway motors mounted with their spindles parallel to the car frame.

These motors each drive one-half of a cross-countershaft by means of bevel gear; on the outer ends of the countershaft are chain wheels which transmit the drive through separate chains to the road wheels.

The latter are, therefore, independently driven—one by each motor; and no differential is required. In the other design standardised by the Railless Traction Co., one motor only is used, and a differential gear is then required. The former method has obvious advantages, and is on the whole to be preferred.

Control is of the usual kind, employing grid resistances, and in the two-motor equipment series-parallel working is also used, but the company point out that this is not so important with rail-less cars as in tramway service, the demand for energy with the former being more continuously heavy, and not merely so at starting.

It would be interesting to test in such work as this the type of commutation-pole motors with variable field strengths, now being designed for special power duty by many of the leading makers.

The question of current consumption is, of course, a very important one, but can hardly be dealt with in this brief notice; if only for the reason that, as energy for power purposes may now be obtained for very little, if any, above 1d. per unit in the majority of cases, an increased consumption for rail-less cars of even double the average on a tramway (owing to the greater road resistance) is easily outweighed by the absence of the cost of maintenance of the track no longer required, together with the saving in interest as compared with that on the much larger capital outlay for a tramline.

This fact is by now pretty well admitted, otherwise the rail-less car would still have to justify itself from the engineer's standpoint.

There are, of course, some comments permissible upon the car itself. It is possible that this new system of traction will offer some opportunity for a *six*-wheeled car to prove what it can do.

By driving on the middle pair and steering from the front and back pairs—interconnected in a suitable way—the weight should be much better distributed, there should be no fear whatever of side slip, and the steering itself, while apparently more difficult or hard, should really prove very flexible.

The six-wheel frame has been tried with petrol vehicles, but not very successfully. It should be an easier matter with electric working, and we hope to see it done.

The passenger seats should also be fitted across the frame and not lengthways. This adds to the width of car, but that should not matter where the vehicle does not keep to a fixed track and where clearances need not be definite.

The Railless Electric Traction Co. are to be congratulated on the work they have done, and it is to be hoped that they will now have some opportunity of installing several of these lines at once in active public service and not merely for experiment.

Some of our chief local authorities have at length decided to install one or more lines as extensions or feeders to their municipal tramways, and it is to be hoped they will push on now without delay. Others will then step in with more confidence, and we shall see the traction world—for some time past almost lifeless in the direction of tramway or light railway building—again occupied with the development of a reasonably economical method of improved transit, more particularly in districts that otherwise could not hope to benefit for a long time to come from modern traction improvements.

The Metropolitan Electric Tramways have in this way shown once more that the country is always, in the first instance, indebted to private enterprise for improved methods; they are to be congratulated on it, and a hope may be expressed that the credit of thus showing the way will also be accompanied by very profitable working on any routes they may equip.

NOTES ON TRADE ABROAD.

(*Continued from page* 568.)

Japan Leaping Ahead. We recently alluded to the statement of S. Kondo regarding the coming electrification of railroads in Japan by the utilisation of water-power. As illustrating the important electrical advance that is taking place in that speedily-getting-into-line country, necessitating the setting up of a Bureau of Electricity (with S. Kondo as chief) in connection with the Department of Communications, we may quote from an American Exchange one or two interesting figures. In five years, it appears, the demand for electric power has been multiplied by six or seven, rising from 58,000 KW. to 380,000 KW. The proportion generated by hydraulic power has risen from 16,000 to 62,000, and permits have been granted for another 158,000 KW. Out of 817 registered manufacturing industries, 198 use electricity.

It was recently stated in the *Bulletin Commercial*, of Brussels, that there are good openings in Japan for all kinds of electrical machinery and appliances. It appears that there would be more tramway work put in hand but for the lack of capital at present. The Tokio Electric Light Co., which already has the largest undertaking in Japan, is just about to add considerably to its works and to its generating and transforming plant. The Tokio Jetsudo Kabushika Kaisha is also about to extend.

The *Times* "Financial Supplement" of October 8th contained, in its "British Oversea Trade" series, the second article on "Relations with Japan." The writer concludes thus:—

> It used to be asserted, especially in Consular reports, that British manufacturers' interests would be better served by sending direct representatives to Japan than by relying on the resident middleman. Certainly that is true with regard to highly specialised kinds of work. But in the vast majority of cases the resident middleman leaves nothing to be desired in point of industry, shrewdness and enterprise, to which qualities he adds the invaluable advantage of experience. So, too, a fashion prevailed some years ago of extolling the German at the expense of his Anglo-Saxon rival. Events have not justified that discrimination. Admirable as the German undoubtedly is in science and theory, recent records do not show that the Anglo-Saxon has much to learn from him as a practical man of business.

India's Future Dependent upon Hydro-Electrics. Reverting to our comments on the future of electrical enterprise in India and the important part that hydro-electric schemes may be expected to fill in connection therewith, we observe that the Indian Government has announced that there are at present no laws relating to the development and use of water power in India, and that the terms of licences granted for water-power electric schemes are settled by special agreement based on the merits of the case advanced. Our contemporary *Indian Engineering*, in discussing this matter, remarks that, although laws may be considered unnecessary at present, it would do no harm if the provincial governments were enjoined, "seeing that electrical enterprise is still in its infancy in India," to exercise due liberality in imposing terms; otherwise "it is difficult to see how it will be possible to attract capital for such schemes, the establishment of which is essential to the industrial development of India." If our contemporary had been writing on the subject in the heart of the City of London it would have been even more urgent in its advice, for it would then have known how it is practically impossible to get an interest taken in far more immediately promising hydro-electric proposals, or even cut-and-dried schemes, in Norway and other countries far nearer home than India. We hope not only that the Government, when it deals with the matter, will make the terms of concessions as easy as it possibly can, but that the raising of English capital for such projects will soon be a matter of far less difficulty. Otherwise this country, however good its hydraulic engineers may be, and however well equipped its manufacturers may then be for executing larger hydro-electric work than they have done here, will not get its share of Indian electrical development business.

Germans In Argentina. The interest that Germany is taking in Argentina is a matter of more or less common knowledge. A Consular official in Buenos Ayres has lately reported to the American Government on one of the various ways in which this interest bears fruit. He says that every year hundreds of very highly trained young Germans—men who can speak, read, and write Spanish and English when they land in Buenos Ayres—go out to Argentina to engage in business, and nearly all succeed, because their efficient and practical training and adaptability to local conditions, combined with acuteness of mind, render them very valuable to their employers, and later give them such self-reliance that they usually succeed when in business for themselves.

What decimal point of one per cent. of the import business that they are able to influence is likely to come to the British manufacturer? While the British Isles are sending abroad far too many failures who cannot find employment here, many of them because they are unfit, other countries are sending out men well equipped for the commercial competition, and it is not surprising that they are reaping the only benefit that is reasonable as the outcome.

Call on the British Consul. We have no doubt that British travellers could sometimes obtain a good deal of valuable assistance by calling at the British Consular offices in each town where such exist. The American Consuls are, in their endeavours on behalf of American trade, often urging U.S. representatives to call upon them. In the case of Kobé, Japan, the Consul has complained that although his office receives letters on their behalf, travellers never call, preferring to send any sort of a messenger to fetch their correspondence. He shows that often a call for advice concerning local conditions or local firms, and an interchange of opinions, might be time profitably spent. We would urge British travellers to make free use of British Consuls and Consular officers. The more they do this sort of thing, the more likely is it that pressure will be put upon the authorities at home, leading to the appointment of commercial agents at each office of importance.

Prepare for the Russian Boom. The St. Petersburg correspondent of the *Anglo-Russian Gazette*, writing on "The Development of English Trade in Russia," emphasises the need for sending out English agents and appointing English resident representatives, but, above all, English commercial travellers. Writing on the language requirements, the writer says: "It is an erroneous idea to suppose that the only language required is Russian. In the Baltic Provinces, for instance, you will do little business unless you can speak German. In Poland the traveller must know either French or Polish, whereas, in Odessa and St. Petersburg, German, English and a smattering of Russian will carry you through, and in Moscow less of the two former and more of the latter will meet all demands. The deeper you go into the so-called Russia proper, the more Russian will, of course, be required, and in many places the mother-tongue is predominant." Later he adds: "Many Englishmen, scattered all over the country, with a good or fair knowledge of Russian and German, will be found prepared to act as pioneers and travellers for English enterprise and commercial undertakings, and their services should be of great value to those desirous of finding a market for their capital and goods in Russia. Place your business in the hands of experienced travellers knowing Russia, and the Russian and German languages, and you will do a prosperous trade."

In the same journal there are interesting articles on "The Coming Boom" and "The Passing Hour." "Technicus," the writer of the latter, refers to the coming electrification of Finnish railways. There appears to be great activity in railway circles in Finland just now, and the question of electrical working is to the fore :—

> Inasmuch as less than 7 per cent. of the 3,000 odd miles of railway in Finland is owned and operated by companies, the great bulk of the work of providing electrification will devolve upon the Government. The ultimate aim is to secure the electrification of all the railways in Finland, but for the present efforts will be limited to the line which runs from Helsingfors, through an industrial and thickly-populated countryside, to St. Petersburg, after which the important branch line from Viborg to Antica will receive attention. These initial electrification projects represent a distance of about 300 miles, and would derive their power from the well-known falls of Wallinkoski, on the River Wuoksen, which is the outlet, near Viborg, of Lake Saima into the Gulf of Finland. It is stated that single-phase transmission will be adopted, and there are to be 14 sub-stations. It is estimated that when the equipment is installed and in working order, the electrification will result in an economy of more than £50,000 a year.

The writer adds :—

> I have not heard which country will supply the electrical plant, but as not a fifth part of the electrical machinery and apparatus imported by Finland is of British origin, the bulk hailing from Sweden and Germany, it is very doubtful whether British manufacturing enterprise will have a "look-in" in connection with, at least, this initial portion of the electrification scheme. This is not, therefore, a matter upon which British electrical engineers can congratulate themselves. It is to be hoped that they will not fail to figure in some of the subsequent contracts, for the electrification of Finland's 3 000 miles of railway represents opportunities eminently worth cultivating.

As showing the expectations of increased trade between Russia and ourselves, it may be mentioned that there is a British movement on foot to establish a regular steamship service between the south-west of England—particularly Bristol—and the Baltic ports. A director of the Bristol Harbour Board (Mr. Hardestone) arrived in Riga last week to study the commercial conditions, as well as shipping and other matters there, and he subsequently proceeded to Reval and St. Petersburg.

The Brush in Spain.

There are Budgets and Budgets. We are pleased to observe from the last issue of the Brush Budget that the Brush Electrical Engineering Co., Ltd., is doing well in Spain. The following quotation will speak for itself :—

> We have been encouraged by the growth of our business in Spain to increase the value of our Spanish agency, situate at Calle Pelayo, 12, Barcelona, by providing means for more rapid delivery of motors and other manufactures. Since her separation from burdensome foreign possessions, the improved prosperity of the peninsular has attracted salesmen of all nations to endeavour to secure a share of expanding business. It is gratifying to find that Spanish buyers are showing an increasing appreciation of the unequalled quality of British goods. Barcelona, which is the centre of Spain's busiest industrial district, has many ties with British commerce.

There is no doubt that there are many opportunities for electrical enterprise the other side of the Pyrenees. We enter on the same ground as do other manufacturers in most respects—the financial support of the Germans is one of their points of advantage—yet, compared to our own, we understand that the turnover of German electrical manufacturers in the Spanish market last year was very large indeed. Our informant could not for the life of him say why it was that British engineers were so far behind, unless want of attention to the market and lack of selling initiative were the causes. It is gratifying to quote the Brush experience that Spanish buyers are showing an increasing appreciation of British goods—is it due to the fact that they are now getting to know more about our manufacturing abilities than they did ? We hope that our electrical business there will increase rapidly from this time forth.

British-Born Consuls.

> I quite understand the English standpoint and that the English feel that Anglo-German commercial rivalry makes it desirable for Britain's commercial interests to be represented by a British-born subject in Berlin. I dare say it is believed that there are occasions when a German banker, acting as British Consul-General, might be brought into conflict with British interests. I can, however, conscientiously say that during the 11 years that I have been Consul-General there has never been any clash between British and German commercial interests in Berlin.

In these and other words Dr. Von Schwabach addressed Reuter's representative on the subject of his retirement from the office of British Consul-General in Berlin. No one, with any idea of what is becoming, will attempt to consider the matter from the point of view advanced in the doctor's last sentence. We have none of us any desire to argue on particular cases in such a matter, especially when a man has retired, but the principle is a very important one for all interested in British trade welfare abroad. The mere fact that Dr. Schwabach having occupied the office, can quite understand our agitation for British-born representatives in foreign countries, is enough for us without any labouring of the point. We hope that the decision of the Government to appoint Mr. Harry Boyle as the first paid British Consul-General is the beginning of a new policy which shall ensure British care for British commercial interests. The wrong policy of the past has been allowed, though not enthusiastically approved we believe, by the Foreign Office, on the score of economy—that is, British trade interests have been in the more or less zealous care of a German because the United Kingdom desired to save a few thousands a year. It has been a penny wise and pound foolish policy, and we hope that the present action heralds the approach of a saner condition of things. We cannot imagine any Cabinet with business men in it allowing the old order of things to continue for six months after their taking up office—that is, assuming that those business men knew what was being done by Consuls of some other countries to help our foreign rivals. The Electrical Review has already asked for a further half-a-million a year to be expended upon the British Consular service with a view to making it equal to, or better than, that of other countries, and rendering it of such value as it ought to be to British manufacturers at home. We observe that a correspondent of an evening paper is hoping for other reform, such as permitting Consular agents to write articles for the trade Press. This may be open to argument.

Foreign Trade in September.

The gradual improvement in our foreign trade continued during the month of September. The imports increased by £1,458,891, and the exports by £1,179,818 on the corresponding months of 1908. The re-exports advanced by £1,176,329. The increased exports consisted chiefly of manufactured articles. There was a considerable fall in new ships, owing to special items coming into last year's return, and a decrease of £88,538 in machinery, but iron and steel goods showed an improvement of £242,507. Last month we showed that the total of electrical goods and apparatus (other than machinery and telegraph and telephone wire) exported during the eight months was £239,932 better than in the similar period of 1908. We are now told that this item for the nine months is £246,348 better than in 1908, so that the month of September shows a continued, though small, improvement of its own amounting to £6,416. As a matter of fact, the actual figures were £151,800 for the month, against £145,384 in September, 1908.

The Buenos Ayres Exhibition.

We learn from our contemporary the *Railway Gazette*, at whose offices at Westminster the Buenos Ayres Exhibition Department is giving out particulars regarding space, that many leading British electrical and engineering firms have already signified their intention to display their manufactures at this Exhibition which is to be held from May to November, 1910. The enormous extent of the market and its promising nature, has led a number of firms to take this enterprising step with a view to getting a good foothold for British manufactures or strengthening whatever hold they already have. The list of names given by our contemporary includes such firms as British Westinghouse, Crossley, Chloride Electrical Storage, Dick Kerr, Hadfields, Mather & Platt, Rashleigh Phipps, Veritys, Applebys, Stothert & Pitt, Robey, Saxby and Farmer, Broughton Copper, Joseph Booth, Alfred Herbert, Hick Hargreaves, J. E. Hopkinson, Vickers Sons and Maxim, Worthington Pump Co., &c. The list for space does not close until December 31st, but the firms named are a sufficient indication that British electrical and allied firms do not intend to allow to slip through their fingers this splendid opportunity of making a thoroughly representative showing in what for many years to come will be a market well rewarding rational efforts that may now be made. In the past month's trade returns mentioned above the advance in iron and steel exports is largely accounted for by increased orders from the Argentina market for railway iron. We look for a continued increase year by year now in this direction, meeting the railway constructional requirements of these and other foreign territories which are in the throes of development demanding transportation facilities as a first aid in their efforts. Where the electric railway goes the electrical engineer is in at the beginning, but where the railway is steam the demand for all sorts of electrical service and appropriate manufactures comes only a little later. We are delighted that our firms are intent on securing this market now.

From Buenos Ayres to Chile is not a far cry, a few hundred miles across country, and the kind of development that is taking place there just now may be gathered from the news recently announced in our pages that the Chilean Government has decided on the electrification of 1,150 km. of railways beginning with a modest 184 km. as an experiment. It was stated last week that an American financial house had made an offer to the Government to lease all the State railways at an annual rental amounting to 3 per cent. on the capital invested. It was added that the proposal was being considered. We hope it will rest at that, for if trade once followed the flag, it more often nowadays has a knack of running in the wake of finance—when the money is found by countries other than our own!

Tramps Abroad.

With reference to our comments of last week on foreign travel, it will be fitting to introduce here some lessons that the intending traveller to the South American market should learn before he steps out. No one set of advices can be given which will be applicable to all markets, but there is a good deal in what follows which may be useful for general guidance, although the comments are based upon the contents of a report which was prepared with special reference to South America. American Consul Chamberlain reviewing the trade-getting methods of American Commercial travellers in Pernambuco district, frankly told American firms that they did not understand how important it was to have good men. Cheap travellers "invariably turn out to be expensive, and often permanently ruin a market for the careless firm that employs them." Some of the men were engaged, apparently purely because they could speak Spanish, but "their ideas of business methods in general were hazy and they were absolutely ignorant of the simplest formulæ of foreign trade"—yet they represented firms well known throughout the United States! We need not enter into details of the amusing blunders they committed in their journeyings from place to place, raising a loan here and another there, because of short-sightedness in arranging credits at home, and at times—though representing leading U.S. firms—being in "absolute distress," "penniless"; another went with a fine lot of samples and $1,000, but owing to the duties on his samples absorbing as much as $600, a pretty chapter of accidents followed, to his own and his employer's discredit, because of insufficient knowledge or calculation in advance. Consul Chamberlain says the following considerations must be weighed by inexperienced houses who wish to establish or increase their trade in Brazil:—

> There is an abundance of trade here always, and that it is worth going after can easily be seen by studying the statistics showing the purchasing power of the country. To secure a share in this trade it is absolutely necessary to send representatives. A deaf and dumb person, however, who knows how to do business and keep cheerful, is a far better representative than a linguist who never saw a letter of credit or an order blank.
>
> American firms in arranging to send a man to do $50,000 worth of business should not send one whom they cannot trust with a letter of credit for $3,000. Remember that a man who travels through South America and keeps his expenses down to $10 a day is doing it cheaply. A book-keeper on the Amazon gets $500 gold a month and finds it difficult to live within that income.
>
> If the representative of a firm is to be away more than a year, he should give bond. It will steady him and his principals will not be so reluctant to back him up when he needs help in an emergency.
>
> People, customs, banking systems and business ways are different in South America from those that obtain in the United States. A traveller in his first trip encounters new and peculiar circumstances, and if he is harassed by improper and insufficient connections with his base of supplies he will fail, and South America will be regarded as being too "pioneering" and too expensive, when the truth is that a cheerful word from home and prompt backing would have saved the situation even after a bad start. It must be remembered that the traveller is on the spot and dealing with a network of trade regulations that are not experienced in the United States. When he lands, the Custom House holds his samples until the duties are paid, and they have to be paid in a certain way; sometimes it takes three days, and it always requires a professional despatcher. When he gets on shore, a revenue officer calls for the local tax on commercial travellers. This tax varies in different cities from $30 to $300. Besides these details, he will find railways with triple baggage rates. One man paid $50 gold on his baggage from Sao Paulo to Rio de Janeiro, a distance of about 300 miles, only to find later that there is a special scale for sample trunks that would have cut the bill two-thirds.
>
> If one has a good representative who does not talk Portuguese, a line of samples may be given him that will do the "talking."

Suggestions for the "Commercial."

For the guidance of the commercial traveller about to visit South America the following schedule of suggestions is offered by Consul Chamberlain:—

> "Do not start out before you are an experienced salesman. To be able to take an order automatically, and take it right, is an essential—just as necessary as to be able to get the order. A slip of the pencil or a little misunderstanding as to terms has often permanently lost a good customer.
>
> "Your salary and an average of $10 gold a day for expenses is the least you can work on comfortably.
>
> "Map out your trip before starting, remembering always that your time is not money to the people you are going to deal with, and that if you are going to try to hurry them you might as well stay at home.
>
> "If you have five days in a town, spend three getting acquainted. You will find that many a merchant who is altogether overstocked when you first see him, if he takes a liking to you, after a few days will find several empty shelves.
>
> "If it is your first trip, call at the Consulate at once. You can save time by learning there how to clear your baggage, where to put up, by getting a list of firms buying your line and by learning on what days you can get boats or trains to the next port, &c.
>
> "If you are empowered to give credits, arrange introductions from the New York branches of the South American banking systems to their different managers. Three concerns would cover the whole coast, east and west. On the east, either the London and Brazilian Bank, London and River Plate Bank, or British Bank of South America. On the west coast, the Grace system. Consuls are not allowed to give any opinion on the financial standing of firms or individuals, and for such information you will be more or less dependent upon the banks. A letter of credit is the best kind of introduction to a banker.
>
> "Do not start out with the idea that you can wire for money at any time. Counting in the charges for cabling and bank discount it costs between $20 and $25 to send $100 to any town in this district, and even then there are few firms at home that know how to go about it.
>
> "Keep up your spirits. A quiet cheerful salesman can place an order in an overstocked house when a gloomy man finds it hard work to draw an order from a merchant who needs the goods. Business is not always exclusively business here—sympathy is apt to be mixed with it."

Points for Brazil.

In his report on the trade of Brazil last year, the secretary to H.M. Legation at Rio de Janeiro insisted strongly on the necessity for using the Portuguese language in British catalogues, and he added that a good knowledge of the same language by representatives of British firms would be invaluable, though where this was not possible a competent interpreter should be secured. In the case of machinery business the traveller must be an engineer, or else have a practical knowledge of the working of the machinery he is trying to sell. Among other reasons for this is the fact that he may sometimes have to discuss the goods with the foreman or manager in a technical manner, with men who would regard him with more or less disdain if he were unable to discreetly talk of and explain what he wanted them to buy.

(*To be continued.*)

New Financial Company.—The Thomson-Houston Co., according to *La Lumière Electrique*, is going to establish, with the assistance of the principal financial firms of Paris, foreign banks, and the Metallgesellschaft, a company with a capital of £200,000, called the Société Centrale d'Industrie Electrique, with the object of creating throughout the world companies of all kinds using electricity, and of taking part in all projects of the same description.

Belgian Enterprise in Russia.—*La Lumière Electrique* states that out of 1,412 km. of electric tramways in Russia, 1,169 km. belong to Belgian companies, the remainder being in the hands of municipalities.

TARIFF REFORM.

By R. M. M.

The valuable tables published by the Electrical Review are of great interest to those of an inquiring nature. Are they also a guide to the personality of different station engineers, their committees or directors? The multiplicity of different rates of charging is broadly expressed in many cases by "maximum demand." Take the printed rate without inquiry into method of charge, and we see more and more stations adopting the same figures for the high units—that is a step towards standardisation. A common basis of charging is next wanted, be it 365, 400, 300, or 600 hours at maximum demand, and it will be possible for lamp makers and others to give on their pamphlets useful costs which do not give the consumer a lot of trouble to arrive at a true comparison for his district. One realises—in time—that a consumer, unless he is an engineer, is a lazy person as far as electricity and calculations go; 1,000 hours do not represent much to his mind, and 1,000 hours at 3d. is valueless to him for comparison; he *might* know that he averaged 3½d. per unit per annum, but would he know that his house averaged 850 hours or so per annum?

Now, with a common basis of charge for maximum demand towns, say, 300 hours at 7d., and the remainder at 3d., 2d., or 1d., it is fairly easy to make proper comparisons and to give "prospective" consumers a better idea of what they are likely to pay.

One set of rates which do not appear in the tables, but which are a subject of curiosity to many, are those dealing with arc lamp lighting. There are towns in which it is possible to obtain 5,000 C.P. for 2½d. an hour, however small the remainder of the installation be—that is a good stiff proposition for the gas people to be up against. For this reason, and from the point of view of the business department, it is all right, but how can an encouragement to burn lamps on the peak load help a station? To be paradoxical, the same stations very likely will have a "maximum demand" system of charging for incandescent lighting. Is the explanation that the peak load has left the evening for good and all, and what used to be peak is now hollow, or is it that there is any amount of spare plant?

Again, with regard to power, we see rates given as, say, 1½d. to 1d.—the bare statement looks quite promising, but when he begin to work out figures! One reduces his charges according to quantity alone; one by discounts based on load factor (taken by means of the maximum demand indicator); one charges two rates based to a certain extent on load factor, but mainly on time; and the next, *horribile dictu*, even bases his charges on load factor obtained from units and horse-power installed. The last-mentioned basis gives power engineers a pleasing exercise for brains—to circumvent the tariff, make things pay, and gain more consumers.

An imaginary case may be quoted. At a mill the subject of motors comes on the tapis, and is very favourably received. The firm wish to go systematically in for the maximum possible efficiency and saving obtainable by means of electric driving. Of course, a number of motors, one to each large machine, and grouping for the small machines, is discussed and considered very satisfactory; then the question of price from the supply station comes up—the tariff is based on units per horse-power installed.

Most engineers know the diversity factor of their own district, and that likely to be obtained in a large mill. How can a mill obtain a low price on a tariff based on horse-power installed, and at the same time obtain the maximum saving, unless the tariff is very liberal indeed, and only in effect considers, say, 50 per cent. of the horse-power installed?

The power engineer who has done all the spade work for the mill job cannot see his way to reduce the cost of driving to show a profit, and either "fakes" the tariff or throws up the job; the manufacturer, who has given the estimates, is only human and does not wish to see the job fall through, and so, after allowing the station some time to reconsider the tariff basis or to "fake" it, steps in, suggests and books the order for a dynamo driven from existing steam plant. This case is partly imaginary, perchance, but part is founded on fact.

One method which suggests itself for dealing with such a tariff is for the power engineer to specify motors capable of standing 50 or 100 per cent. overload continuously!

THE TRAINING OF ELECTRICAL ENGINEERS.

The Engineering Session at University College, London, was opened on Wednesday afternoon, the 6th inst., by a lecture upon "Electrical Inventions and the Training of Electrical Engineers," delivered by Prof. J. A. Fleming, D.Sc., M.A., F.R.S., the chair being occupied by the President of the Institution of Electrical Engineers, Mr. W. M. Mordey. The first part of the lecture was devoted to a statement of the rapid growth of the industry since its practical commencement about the year 1837, its gradual division into various branches, and a reference to the large sums of money now invested in electrical enterprises.

A good general education was a necessary preliminary to a successful engineering career, and the lecturer did not favour the introduction of engineering courses into ordinary public school work. He would rather devote what time was possible to gaining a knowledge of modern languages and good English diction. In choosing an engineering career for his son, a parent should not be decided merely by a liking for taking part in scientific experiment; a sound constitution, and the possession of ability, coupled with determination and perseverance, were also necessary. On entering college a student should first be trained in the principles of pure science, and afterwards, in the laboratory, taught how to apply those principles to technical work. An engineering degree might be useful, but was not essential. The main thing was to acquire a thorough general knowledge of engineering work, and, in his opinion, a year's practical works training interposed between the second and third year's college courses was often very useful.

Towards the close of a student's course of training it was necessary that he should consider in what direction he should look for his life's work. The Post Office were offering a few appointments for highly trained workers, wireless telegraphy offered a wide scope, electricity supply, traction and lighting was another and electrical manufacturing a fourth—if, at present, rather overcrowded—field. Each of these wanted special qualifications, and no one man could be an expert in all, but all more or less needed in addition to scientific knowledge and technical skill, commercial experience. The engineer of to-day was not merely the man who did things, he was the man who did things in the best way at the least cost, and business training, which could only be obtained after leaving college, was essential. Tact in dealing with men, the power to determine whether the results to be obtained from a given outlay would compensate for the risk, organising ability—these powers were developed in after life, but were needed for success in the higher branches of nearly every department of the industry, particularly, however, in electricity supply, and in manufacturing.

The lecturer then spoke of the value to students of visits to works, either at home or abroad, and illustrated his remarks by a series of lantern views of Swiss water power stations.

The remainder of the lecture was devoted to a consideration of some of the fields in which future progress in electrical engineering work would probably be made. Amongst these the manufacture of fertilisers was awarded a prominent place. Briefly describing how the electric furnace was made use of in the industrial fixation of nitrogen, he showed how, shortly, 140,000 H.P., and eventually 400,000 H.P., would be used by one company for this purpose alone, the waterfalls of Norway being utilised as the source of power.

The direct utilisation of the sun's energy, the wireless transmission of power, the improvement of lighting and heating appliances and the development of electrically-propelled vehicles were also referred to, the lecturer concluding by impressing on his hearers the supreme importance of character, and urging upon them the advice, "Whatsoever thy hand findeth to do, do it with thy might."

Mr. Mordey, in proposing a vote of thanks to the lecturer, spoke of the pitfalls which beset the college-trained youth on first entering a works, and emphasised the need for doing the work allotted to him as well as any workman, so that when it was necessary to find foremen and managers these posts would naturally fall to his share. He referred to the small proportion of patents which proved commercial successes, expressing the opinion that the greater part of the profit made out of them went to patent agents, who at any rate were sure of their fees.

He thoroughly agreed with what had been said as to the need for character, it was this as much as anything which had given the British engineer the world over such a high reputation.

The "Model Engineer" Exhibition.—Sir Hiram Maxim will perform the opening ceremony at the "Model Engineer" Exhibition at the Royal Horticultural Hall, Westminster, at 12 o'clock to-day (Friday). Over 200 entries have been received in the competitions, including a large number of model aeroplanes of all types.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GIBRALTAR.—No duties are levied on electrical materials.

GOLD COAST.—The following goods are admitted free of duty:—All goods imported for the use of His Majesty's troops or His Majesty's ships; all goods imported with the sanction of the Governor of the colony for the service of any public department of the colony; apparatus and structural material for telegraphs, telephones and electric lighting; cranes, &c., and machinery necessary for working the same; instruments and appliances for scientific purposes and research; machinery for electrical, manufacturing, pumping, mining and gold-dredging purposes, and machinery for use in the preparation of any natural product of the colony or the development of any industry in connection with such product; plant, material and rolling stock for tramways; railway plant, material and rolling stock; vehicles possessing their own means of propulsion. Goods not specially mentioned in the Tariff 10 per cent. *ad valorem.*

Note.—No person may establish or use in the Gold Coast Colony any apparatus or installation for the purpose of electrical communication by wireless telegraphy without a licence from the Governor.

GREECE.—Invoices and consignment notes should state the gross weight of packages and net weight of contents, which should be fully described, and the country of origin stated. When various descriptions of merchandise are packed together, the net weight of each class should be stated separately. Certificates of origin should be supplied for ordinary merchandise. A statutory declaration of origin is, however, accepted. Unenumerated goods which, according to the letter or spirit of the tariff, are not capable of being, by analogy, embraced in any class of the tariff, are dutiable at the rate of 20 per cent. *ad valorem*, the value of the goods for calculation of *ad valorem* duty being the market value at the place of importation, excluding the amount of Customs duty payable.

The following duties are payable:—

Drachma = $9\frac{6}{10}$d., or 25 drachmas = £1.

Oke = 2 8 lb.

Iron in plate bars (without grooves like rails), in plates of all dimensions for building and other purposes; in ties for walls; in rolls, hoops, strips, &c.	free.
Steel in bars, sheets or pieces	"
Copper in blocks, bars, or sheets ...	40 drachmas per 100 okes.
Brass in sheets up to 5 cm. in width	free.
Wire for telegraphs, or for other purposes of all kinds, of iron, steel or copper, pure or alloyed with other metals	free.
Articles of porcelain of every kind, white and plain	50 drachmas per 100 okes.
Lamps and all other kinds of fancy or artistic ware	7 " " "
Glassware not specially mentioned in the Tariff, white, plain or pressed of one colour but tinted in the mass...	30 drachmas per 100 okes.
Ditto cut or engraved	75 " " "
Ditto decorated with gold or colours, or tinted in the mass with more than one colour and articles of crystal	150 drachmas per 100 okes.
Iron rails, points and bridges of cast-iron for railroads	free.
Iron pipes, T-iron and other girders...	8 drachmas per 100 okes.
All kinds of wrought-iron goods not polished, burnished, or gilt but only tinned, varnished, glazed, painted or filed	25 " " "
All kinds of wrought-iron goods polished, burnished, gilt, or galvanised	50 " " "
Lamps of all sorts, of iron	1 " " oke
Boilers of all kinds	free.
Articles of copper not specially mentioned:	
Plain and of coarse workmanship ...	50 drachmas per 100 okes
Chased, gilt or enamelled	2 " " oke
Decorated with precious metals ...	3 " " "
Articles of brass or bronze:	
Common wares	1 drachma " "
Chased, gilt or enamelled	2 drachmas " "
Ornamented with precious metals ...	3 " " "
Lead pipes	25 " " 100 okes
Electric telephones, microphones, electric bells, buttons for electric bells and electric light, indicating boards for electric bells and telephones, telegraph apparatus, and parts of all the above	6 " " oke
Railway or tramway cars for goods or passengers	10 % ad val.
India-rubber or gutta-percha in sheets, bands, pipes, hose, &c., combined or not with other materials ...	free.
Other manufactures of india-rubber or gutta-percha not separately mentioned	500 drachmas per 100 oke
Dynamo-electric machines	free.
Electric lamps:	
If of glass	1 drachma per oke
If of plain porcelain...	50 drachmas per 100 okes
If of porcelain, inlaid, coloured or gilt	200 " " "
All others	According to material of which made.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,957. "Improvements in and relating to electric motor-controlling apparatus." J. Whitelaw and B. A. Malkin. September 27th.

21,978. "Improvements in automatic telephone exchanges for calling one of several subscribers on the same line." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in Germany.) September 27th. (Complete.)

21,998. "Improvements in electric cables." A. E. Tanner and E. A. Claremont. September 27th.

22,029. "Socket and plug for electric lamps and other apparatus utilising electric current." A. Denereaz. September 27th. (Complete.)

22,032. "Improvements in or relating to electric pocket lamps." J. Lewy September 27th. (Complete.)

22,072. "Electric vibration pad." C. Heitman. September 28th.

22,087. "Improvements in or relating to trolley-arms or collectors for electrically-propelled vehicles running without rails" E. M. Munro and Railless Electric Traction Co., Ltd. September 28th.

22,125. "Improvements in the illumination of looms by means of electric lamps." A. C. Koechlin, (Date applied for under Sec. 91 of the Act, July 16th, 1909, being date of application in Germany.) September 28th. (Complete.)

22,133. "Improvements relating to pads or cushions for telephone receivers and similar instruments." H. A. Cutmore. September 28th.

22,141. "Improvements in and relating to switching devices for alternating current circuits." A. C. Heap. September 29th.

22,142. "New and improved method for transmitting power by surface contact." September 29th.

22,149. "Automatic working of tramway points as applied to electric cars for the streets." J. J. Armstrong. September 29th.

22.227. "Improvements in flame arc lamps." C. E. G. Gilbert. September 30th,

22,234. "Improvements in apparatus for electrically operating planing machines and the like reciprocating tools." Lancashire Dynamo and Motor Co., Ltd., and G. E. Mason. September 30th.

22,273. "Improvements in and relating to electric-filament lamps." J. Meszaros, S. Fawns and A. E. McCracken. September 30th. (Complete.)

22,302. "Improvements in or relating to a method of working arc lamps in series with incandescent lamps." A. Heimann and W. Schaffer. (Date applied for under Sec. 91 of the Act, October 1st, 1908, being date of application in Germany.) September 30th. (Complete.)

22,385. "Improvements in or relating to electric switches and the like." T. G. Howe and F. H. Taylor. October 1st. (Complete.)

22,450. "Improved magnetic switch." D. S. Davies. October 2nd.

22,452. "Improvements in alternating-current generators and motors and applications of them." H. V. Flinn. October 2nd.

22,454. "Improvements in electrical capstans, electrical cranes, and other electrical lifting, winding, or hauling appliances." Royce, Ltd., and R. D Hulley. October 2nd.

22,458. "Metal-filament lamps having filament carriers arranged elastically." O. Krause. (Date applied for under Sec. 91 of the Act, June 10th, 1909, being date of application in Germany.) October 2nd. (Complete.)

22,491. "Improved apparatus for rectifying alternating currents." E. Giglio. (Application for Patent of Addition to No. 17,742, 1909.) October 2nd.

22,507. "New or improved apparatus for use in connection with telephones for recording and registering the number of calls made." F. E. Churcharn and H. J. Gore. October 2nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of and Apparatus for Controlling the Voltage of Dynamo-Electric Machinery, Especially Applicable to Variable Speed Generators. W. Stansfield and J. J. Hatt. 12,704. June 13th.

Electrical Devices for Producing Periodical and Intermittent Motion. W. Vetter and C. Mürer. 19,151. September 11th.

Electric Motors for Driving Submerged Pumps. W. R. Macdonald. 19,384. September 15th. Post-dated March 11th, 1909.

Electric Arc Lamps. H. Jaburg. 19,395. September 15th.

Electric Telegraphy. A. Muirhead. 19,450. September 16th.

Dynamo-Electric Machines for Operating Rolling Mills and the like. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 19,485. September 16th.

Regulation of Dynamo-Electric Machinery. Akt. Ges. Brown, Boveri et Cie. 19,921. September 22nd. (Date applied for under International Convention, February 3rd, 1908.)

Electric Lighting Arrangements for Dressing Tables, Mirrors and the like Articles. E. M. Ashley. 26,145. December 3rd.

Incandescent Electric Lamps. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 26,267. December 4th.

THE
ELECTRICAL REVIEW.

VOL. LXV. OCTOBER 22, 1909. No. 1,665.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY.
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO,
4, Ludgate Hill, London, E C.

THE POSSIBILITIES OF THE ELECTRIC VEHICLE.

THE more one ponders over the position of the electric vehicle in this country, the more certain it appears that some drastic treatment is required for the species of "sleeping sickness" which has, apparently, settled on this particular form of locomotion.

Probably, however, the position is not generally realised. Many of us are accustomed to a feeling of chagrin when we see smoking factory chimneys, especially new ones, hard at work within a stone's throw of a central station; we feel that something is wrong. Yet, curiously enough, there are very few of us who do not treat the remarkable absence of electric vehicles from the streets of our large cities as quite a matter of course.

If we are not mistaken, the electric vehicle suffers in this country only from lack of enterprise, such feeble efforts as have from time to time been made by the makers of these cars having met with no encouragement from the central station engineers, who have everything to gain, and having been absolutely swamped by the propaganda of the petrol car maker.

Yet for city work in congested districts, the simple, noiseless, easily operated and repaired electric car has an undeniable advantage over any other type of vehicle on the street—especially with the present trend of taxation towards its rivals. For some indication as to what may be accomplished by a little pushing, one turns to the United States, where the electricity supply companies in New York, Chicago, Philadelphia, Boston and other centres have come to regard the electric vehicle as equally worthy of attention with the motor, radiator, flatiron, &c.

It is estimated that fully 10,000 electric cars are now in use in the States; New York City claims the largest number of commercial electric vehicles in use, the number being about 1,000, and Chicago claims similar honours as regards pleasure vehicles with some 3,000 in service.

Los Angeles and neighbourhood boasts 575 electric cars, and Brooklyn 300, of which one delivery company operates 40. In the case of Los Angeles, Mr. W. J. Grambs, in a recent Convention paper, stated that the rate for energy for battery charging varied from 2 to 6 cents per KW.-hour; in private garages the average income per month per vehicle was $5, and the total monthly income from public garages—the details per vehicle not being available—was from $50 to $200 per garage. Mr. Grambs considered that it was reasonable to estimate a yearly income of $19,500 from the electric vehicles in Los Angeles.

Mr. J. T. Hutchins, dealing with the electric vehicle business of the Rochester Electric Supply Co., said that the sales of energy for battery charging had increased from 285,470 units in 1906 to 495,490 units in 1908, or by 73 per cent., and the income correspondingly from

$12,458 91 to $19,796 56, or by 56 per cent. Some explanation of this improvement is found in the fact that the Rochester company has an organised department looking after this class of business, which takes particular care of the vehicle owners, and assists them in every possible way.

In the case of the Brooklyn Edison Electric Illuminating Co., the services of a battery expert have been retained, with a view to educating and instructing the users of electric vehicles in the care of their batteries.

As showing the progress made in commercial vehicles in America, a few years ago a 1,000-lb. load-car weighed complete 4,850 lb., and ran 25 miles at a cost of $0·036 per mile; now a similar car is in use weighing only 3,240 lb., and running 40 miles at a cost of $0·011 per mile.

At the same Convention, some specific examples of the use of electric delivery vans were given. Thus one two-ton truck replaced two two-horse trucks working 12 months, and one additional two-horse truck during the winter months; the cost of horse haulage for two years was $9,325, while the cost of the electric truck over 2½ years was:—

Energy, tires, driver, maintenance	$3,937
Interest on cost	690
Depreciation (25 per cent.)...	1,285

or a total of $5,912, showing a saving on the longer period of $3,413.

A St. Louis Brewery saved 50 per cent. on haulage by adopting electric wagons; this concern has 50 wagons in service after six years' experience of their use.

The records of the express delivery companies show for ½-ton wagons, daily mileages of from 30 to 50, making from 30 to 175 stops; and for 2-ton wagons, daily mileages of 32 to 47 miles with 125 to 180 stops.

The comparisons are, of course, mainly with the horse-drawn vehicles which encumber the streets of cities and towns.

Now, the fact that our American cousins can, and do, successfully employ the electric vehicle cannot be put down to any inherent difference between the characteristics of the two countries; it is simply a case of lethargy here and enthusiasm there. In the States, the vehicle maker, battery maker, motor maker, and tire maker, all boom the electric vehicle, hand in hand with the central-station authorities and assured of their co-operation. In this country the electric vehicle maker is scarcely known—possibly as a result of the scant encouragement he has received; the central-station authorities, intent on bettering their day loads by popularising power, heating, ventilating and cooking devices —all excellent in their way—have apparently forgotten the great possibilities of the midnight and early morning load which the charging of battery vehicles can very well give them, and overlooked the fact that, as an American contemporary puts it, "an automobile uses more current for its storage batteries in one month than a cigar lighter does in 10 years."

Some central station engineers fully appreciate the fact that they must sell light, heat, motive power, &c., and that their business by no means ends at the consumers' meters, as the commercial departments which operate in conjunction with their undertakings bear witness; it is, therefore, but a step further to add the electric vehicle to the list of electrical appliances, for we may be sure that electrical vehicle makers will not stand in the way.

Indeed, with the relations at present existing between the London supply undertakings, municipal and company, it should not be either difficult or individually expensive to impress upon the London public the possibilities of the electric car, by means of a striking co-operative exhibit at the large motor shows—in which the vehicle maker would no doubt assist.

Many engineers have with commendable discretion offered favourable terms to day-load consumers who agree to keep off the peak load, and with successful results; they would doubtless be equally glad to give even more favourable terms to garages and charging stations for supplies between mid night and 6 a.m., when their plant is practically idle.

But even favourable rates and vigorous publicity will no wholly meet the case; the various supply undertakings mus show faith in their wares, and themselves use the electri vehicle where they now adopt the petrol car—in fact, th various Corporation departments offer a good field for pre liminary work.

Once the central-station engineers grasp the problem they will probably realise that to use a petrol car for cit work is very much on a par with lighting the electricit works by gas.

Investments in Electrical Undertakings.

The electrical industry in this countr is generally accepted as offering fe attractions to investors, and some figure appearing in the September issue of *Th Investors' Monthly Manual* draws a comparison between investments of different classes, which is of interest.

In this article arguments are put forward both in favour o and against the policy of confining investments to on particular class of security; and an example is taken of a individual having invested £10,000 ten years ago i different forms of security, and the market value of hi securities in 1898 and 1908 is given.

From the figures given below, which are extracted from the article in question, it will be seen that the investor who selected electrical securities would have found that his securities had depreciated during the ten years in question to a greater extent than the other securities dealt with. British railways came next in full value.

It will be seen that the fall in capital value in the electrical investments during the ten years in question was from £10,000 to £4,970; British railways fell from £10,000 to £6,409; telegraphs and telephones rose from £10,000 to £10,582; and foreign railways rose from £10,000 to £20,769.

The electrical investments referred to are these:—

Securities.	Value 1898.	Value now.	Difference.
Charing Cross, West End and City	£1,000	£324	— £676
City of London	1,000	411	— 589
County of London	1,000	563	— 437
London Electric Supply	1,000	586	— 414
South London Electric	1,000	523	— 477
Westminster Electric	1,000	424	— 576
British Electric Traction ...	1,000	43	— 957
Dublin United Tramways ...	1,000	688	— 312
Provincial Tramways	1,000	667	— 333
City of Birmingham Tramways	1,000	741	— 259
	£10,000	£4,970	—£5,030

At first sight it would be assumed that the electrical securities selected for investment must have been of an abnormally precarious nature, but on examination it cannot be said that these securities would have presented themselves as of a doubtful character when the investment was made ten years ago, and the heavy fall in capital value can only be stated to be an indication of the unsatisfactory state of the electrical industry from an investor's point of view. There are of course, as our readers are aware, many reasons for this. A number of the companies are those which were depressed for years by the London Power Bill controversy, and at the last meetings of some of these the consequent enormous depreciation in market values was referred to in detail. But the phenomenal depreciation shown in B.E.T.'s is not to any large extent due to that cause.

It might further be stated that the electrical investments in question, confined as they are to investments outside the manufacturing industry, might be called the "cream" of electrical investments. If the manufacturing industry had been included, the fall in capital value would have been still greater; but in the course of ten years many new factors have arisen in British electrical manufacturing, and these would have to be taken into account in making a fair study of the matter.

Technical Guarantees.

An article appeared in our esteemed contemporary the *Engineer* on September 24th, dealing with "Technical Guarantees in Engineering Contracts," which should be read with interest by engineers and others concerned with contract work. Competition has increased so greatly of late years that it is a difficult matter to decide on the best offer when considering a number of tenders. In some quarters price is the only consideration, but most engineers recognise that, despite the tendency towards standardisation, there are many variations in the design and construction of machinery which influence the results obtained in practice.

Too much reliance must not be placed on guarantees given by contractors before acceptance, especially those of an exceptional nature. High-class firms are naturally loath to give guarantees of steam consumption or efficiency which cannot be obtained in practice, though the insertion of truthful figures in a form of tender may lead to the loss of a contract, for it is well known there are firms which are willing, in order to obtain work, to give guarantees for efficiency or delivery that they know cannot be realised, and also to accept almost any price or conditions of contract.

Municipal engineers are frequently called upon to give expert advice on technical matters, and should possess the strength of character to recommend their committees to reject tenders quoting low prices or unduly favourable guarantees. Penalties and powers of rejection are difficult to enforce and unsatisfactory to all concerned, and if they know that the firm giving the most favourable offer has failed elsewhere to meet its obligations regarding operation and reliability, they should not allow their committees to recommend the acceptance of such tenders without protest.

Complaints are heard at times that some foreign concerns have not been too particular in the undertakings that they give, though some purely British concerns have not been free from blame in this respect. It is not an edifying spectacle when competition for an important undertaking resolves itself into an auction of exaggeration; it may be difficult to reject a tempting offer, but it should be done, for if a contract is accepted under guarantees which are not fulfilled, any subsequent enforcement of penalties may be regarded as an acknowledgment of weakness or incompetence on the part of the engineer which he is naturally reluctant to make.

The responsibility for the present state of affairs rests more with engineers and the fashionable system of control by lay committees than with contractors. As long as people ask for what they know they cannot get, and expect marvellous results and the best workmanship at lowest prices, contractors will be found willing to make the necessary promises, hoping to wriggle out of their undertakings at a later date.

Heat Transmission.

Every subject connected with engineering has been treated pretty completely in detail by the many workers in each particular branch; but no one man has known the whole subject. Each writer has elaborated a small portion at a time. The result is that to acquire a full knowledge of the work done upon any branch, it is necessary to search through innumerable publications. Some men present their work to the public in the form of a paper read before some Institution; others, perhaps, unconscious of the full value of something they have done or thought out, bury their work in an obscure chapter of a book, and others publish more or less casually in the technical Press. On this account, in order to facilitate the study of heat transmission in boilers, Prof. W. E. Dalby, in a paper presented to the Institution of Mechanical Engineers on October 15th, has placed before the members an index of the literature dealing with this subject. This index covers about 35 pages, and gives the date of publication, the title of the paper or book in which the article was published, the author's name, and the library where the publication may be found. The working up of this index, and the study of each paper to the extent necessary to give the abstract that is to be found in the Institution library, must have involved great labour.

The author indicates in his opening remarks the general nature of the problem of heat transmission across a boundary. Heat radiation into space from a black body is proportional to the fourth power of the absolute temperature. This explains why the first heating surface in a boiler is so very much more efficient than the later heating surface.

Prof. Dalby also gives a diagram of the several curves that have been drawn by different men, from Newton to Petavel, as published by Prof. Callendar in *Nature*. All the curves pass through two common points, at zero temperature, and at 1,800° F. (abs.) and 7,000 B.TH.U. radiation per sq. ft. per second.

All this has been repeatedly demonstrated practically by various experimenters, who have divided the water space of boilers into sections, and found the heat given to each section. The facts emphasise the absurdity of too much striving after heating surface and of too liberal air supply to a furnace, while they uphold the contention for high-temperature furnaces, so necessary for smoke prevention.

The transmission of heat by conduction and convection takes place first through a cold film of gas clinging to the plates, and then through the surface of contact of gas and plate. Next there is the path through the solid plate, and then a breaking-out resistance into the clinging water film on the water side of the plate, after which there comes the general mass of water. In addition, there is the resistance of soot on one side and scale and oil on the other side to be considered. The metal plate resistance is hardly worth counting as such, for a 1-in. copper plate only offers a resistance of 1, as compared with 2 for the water film $\frac{1}{200}$ in. thick, and 97 for the gas film, also $\frac{1}{200}$ in. thick. Thus the material of the plate and its thickness hardly count if in metallic continuity.

Hirsch showed that vegetable grease was more dangerous than mineral oil upon furnace plates, and generally the most dangerous greases were those that were more easily decomposed.

Breckenridge found nearly 10 per cent. loss of efficiency with a scale of $\frac{1}{32}$ in. to $\frac{3}{64}$ in., and deduced the loss as varying as the square root of the thickness. The structure of the scale has greater influence than the thickness.

It ought to be an excellent thing to destroy the gas and water films which cling to the plates. Hence the value of high velocity of gases and of whirling movements or brush effects. The serious effect of films probably explains to some extent the heat peg theory, for it must be difficult for films to adhere to projecting heat pegs swept by the flames which fail actually to touch the plates.

The author notes finally how Cornish boilers still remain substantially as they have been for a hundred years. Nor have water-tube boilers shown much better results. Much, of course, depends on the mechanical needs of a vessel to carry pressure. Safety has to be the predominant factor, and this is what fixes types, and puts early limits on many proposed departures from the existing state of things. We must certainly express gratitude for the exceedingly valuable index thus presented to engineers.

MODERN ELECTRICAL MACHINERY: ITS DESIGN, COST AND EFFICIENCY.

By L. CROUCH.

The present article can be little more than a series of remarks concerning a number of curves collected by the author and placed in a form which it is believed will prove generally convenient. These curves (figs. 1-9A) deal with the weight, speed, cost, efficiency and power factor of direct and alternating-current generators and motors, and may be taken as typical of modern design in these matters. Much has been written from time to time concerning the determination of such figures during the design stages of machine construction, but little has been published, in a manageable form, to enable the general user or the mechanical engineer to determine the general properties of the motor required to operate his tool or crane, &c. In the past, very clumsy work has frequently been turned out by good works, owing to the lack of co-operation between the mechanical and electrical departments. For instance, the engineers designing a crane were insufficiently informed of the size, weight and speed of the motor that would probably be used to operate it: the result was, in many cases, that a motor, unsuitable electrically, had to be fitted to conform to the mechanical conditions already fixed upon. Though such grave errors would not be likely to occur to-day in any but the most imperfectly-controlled works, it is still very difficult for a user, having a small grinding mill or machine tool or pump, &c., to drive, to obtain any idea of the size, weight and cost of the machine necessary for the purpose. True, he can apply to a standard maker of electric motors, and his needs will usually be carefully examined and advised upon, but it is undeniably convenient to have such information ready to hand and covering all likely ranges of conditions, even if only in an approximately accurate form. Many tentative ideas only need reference to such curves as are presented below to decide their impracticability or feasibility, as the case may be, and small users, in particular, are frequently very reluctant, rightly or wrongly, to seek advice from manufacturers. Their apparent dread of committing them elves by making such a request probably hinders the installation of electrical machinery, on a small scale, very considerably.

Let the average user become aware that a 20-H.P. motor, suitable for driving his pump, say, would weigh 700—1,000 lb., cost £60 to £70, run at any desired speed between limits of about 100 and 1,000 R.P.M., and have an efficiency of 87 to 90 per cent., and he would at once realise its advantage over a steam engine, and would be possessed of sufficiently concrete ideas on the subject to induce him to follow up the matter. Thus, even from the point of view of an advertisement of the merits of the electric motor, the accompanying curves will be found useful by canvassers and others. However, the writer finds them useful in a higher degree than the above. In the preliminary designing of an electrical installation, whether of generators or motors, with direct or alternating current, the curves here given will be found to present the desired information in a handier form than is possible by any scheme of tabulation.

Little can be *written* on the present subject if the object in view is to be attained; the whole aim is to concentrate as much information as possible *graphically*: hence, the remainder of this article is confined to remarks on the general conclusions to be drawn from figs. 1 to 9A, which are fully keyed to enable their use without continual reference to the letterpress. In the earlier curves, several types of motors and generators are discriminated between, but in the later figures mean curves have been drawn giving as representative results as possible, the only discrimination then drawn being between direct and alternating-current machines and between the full load, three-quarter load and half-load efficiencies and power factors.

The various classes into which machines are divided for the present purpose (in figs. 1-7) are, first, direct and alternating-current machines, motors and generators, and, further, ball-bearing machines, machines with ordinary bearings, and in the case of alternating-current motors, machines with "wound" and "squirrel-cage" rotors respectively. The basis to which all quantities are here referred is that of horse-power, a KW. scale being added for convenience to those sheets dealing with generators.

Fig. 1.—The curves in this diagram need little comment, being very consistent, and exhibiting no striking peculiarity.

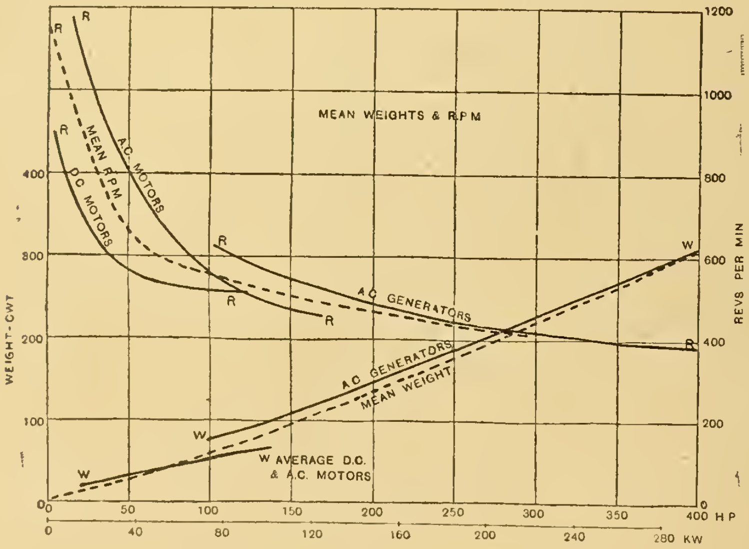


Fig. 1.—Weight, Speed and Output.

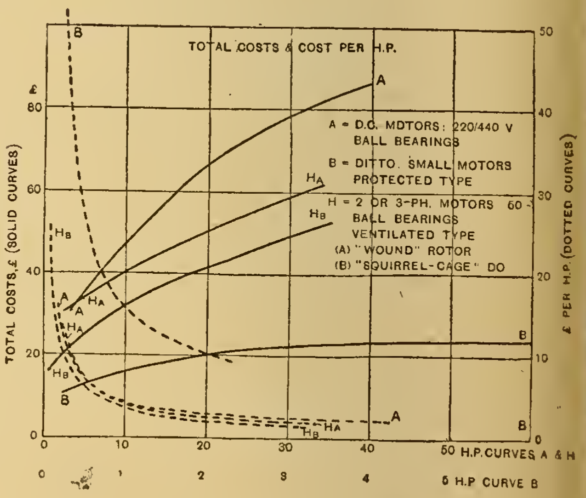


Fig. 2.—Cost and Output.

Some difficulty is, of course, experienced in deducing a mean curve between R.P.M. and horse-power for electrical machinery, since, by the use of different rotor speeds, a given carcase can be rated at widely different horse-powers, while, conversely, for a given horse-power, a wide range of speeds (usually from 2 to 4 : 1) can be secured by the use of different carcases. The curves shown, however, represent the R.P.M. at which it is preferable to run the motor if possible. In the case of alternating-current machines, the exact speed is, of course, determined by the number of poles and the periodicity of supply. It is noticeable that in the smaller units, A.C. machines usually run considerably faster than direct-current machines of the same horse-power. Above 100 H.P. output, the speed of electrical machinery becomes considerably more standard.

The weight of motors and generators naturally reflects the variability of the R.P.M. for a given horse-power. By using a small carcase and a high R.P.M. to obtain a given output a much lighter design results than if a large low-speed machine be preferred. The dotted curve (fig. 1) is representative of average practice. The slightly concave nature of the curve shows that the weight increases rather more rapidly than if it were strictly proportional to the horse-power. This effect is mainly due to the increased material necessary in the largest machines to provide mere mechanical rigidity.

Fig. 2.—The main points to be noted with regard to the curves in fig. 2 are :—(1) The rapid decrease in cost per horse-power as the total horse-power of the motor increases ; and (2) the cheapness of alternating-current motors, particularly of the short-circuited rotor type.

A small motor of, say, ¼ H.P., may cost about £50 per horse-power, whereas a machine of 10—40 H.P. will require an expenditure of only £4 to £2 per horse-power. The shape of the curves shows the extreme inadvisability of installing machines of less than 10 H.P., provided units of the latter or greater output can be fully employed. Above outputs of 10 to 20 H.P., the cost per horse-power decreases much more slowly. The cost of slip rings and brushes, &c., is approximately constant for all sizes of motor between 5 and 30 H.P., so that the cost curves for machines with "wound" and "squirrel-cage" rotors are almost parallel to each other throughout. The costs on this sheet of curves refer to ball-bearing motors, but the costs are little different if ordinary bearings be specified ; indeed, if the smaller units of a "line" of machines built up to high horse-powers be used, their cost may well be greater than that of the machines dealt with in fig. 2. The reason for this is that ball-bearings are seldom used on motors of over 40 H.P. output, so that all machines so fitted are essentially small-capacity designs, and hence lighter and cheaper than the smallest machines of ordinary motor classes in which are preserved some of the heavy features of design essential in the larger units, but unnecessarily increasing the cost of the smaller machines.

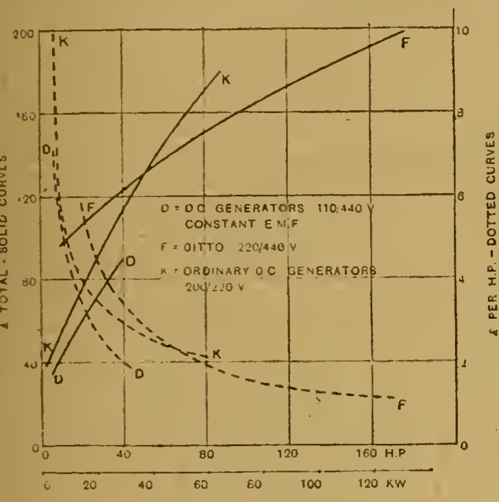


Fig. 3.—Cost and Output.

Fig. 3.—The curves of fig. 3 form a closely concordant set necessitating little remark. The high cost per horse-power of some of the smaller units is again to be noted. The price per horse-power of the medium-sized machines (say, 40 H.P.) is about the same as that of the corresponding machines in fig. 2, but the larger units (160 H.P.) fall still further in specific cost, finally reaching £1·20 per horse-power, and excellently illustrating the economy of installing as large units as possible.

Fig. 4 treats of alternating-current generators of outputs ranging from 2 to 300 KW. ; four types of machine are dealt with, viz., single-phase machines, two or three-phase machines, belt-driven and direct-coupled in each case. The key to the reference letters is inset in fig. 4. The ascending order of total cost of the types dealt with is :—Direct-coupled two or three-phase machines (cheapest), belt-driven two or three-phase machines (5 per cent. to 10 per cent. dearer), one-phase direct-coupled machines, one-phase belt-driven (again about 5 per cent. to 10 per cent. dearer than the direct-coupled machines). Only the mean cost per horse-power for the four types has been plotted, for the sake of clearness. It will be seen that the specific costs are here considerably greater than in figs. 2 and 3, though the type of curve is unaltered. On this point more is said below. The ascending order of weights of the four types is the same as that of the costs, so that the cost per cwt. is about the same throughout. These alternators are of considerably heavier build than the machines dealt with in figs. 2 and 3, and to this fact much of their increased cost is due.

With regard to the speed of the machines—the belt-driven units run from 15 per cent. to 25 per cent. faster than the direct-coupled machines, the greatest *percentage* difference of speed being naturally on the slower (*i.e.*, the larger) units. The higher speed of the belt-driven machines tends to decrease their cost per KW., but the necessity for a pulley and, usually, a third bearing, together with the longer bed-plate and heavier foundations entailed, generally overbalance this tendency.

Fig. 5.—In fig. 5 are collected the chief results of figs. 2, 3 and 4, together with other information, the whole covering a range of horse-power from 10 H.P. to 400 H.P. (*i.e.*, up to 300 KW.). From these curves it appears that direct-current motors are cheaper than alternating-current machines, except in small units. This statement must not be accepted as final, since much depends on the maker, on the exact requirements of the purchaser (speed, frequency, &c.) and on the accessory equipment necessary. The dotted curves (fig. 5) may be accepted as sufficiently accurate for any normal alternating or direct-current machines within the range of horse-power dealt with. The case of the alternating-current generators is rather a special one. The machines here appear unduly expensive, but in larger units their cost per horse-power is much reduced. The class of alternator represented by this curve is heavier than is always necessary and, in a later article, the writer hopes to go more fully into the question of the cost of alternators. This cost is very dependent on the specification to which the machine is built (voltage regulation, power factor, &c.), and is, in most cases below 500 H.P. output, considerably greater than that of the corresponding D.C. generator.

In figs. 6, 7, 8 and 9 are treated the most important constants of electrical machines from the operative point of view—viz., the efficiency and power factor obtainable under various conditions of loading. The importance of high efficiency and power factor is frequently imperfectly realised : in general, the higher the efficiency and power factor of a motor or generator the higher its capital cost, and since the running cost of the whole equipment is less the higher the efficiency, and the cost of much of the accessory apparatus (in the case of A.C. machines) is less the higher the power factor, it is clear that any increase in the efficiency and power factor of an electrical machine has a definite capital value.

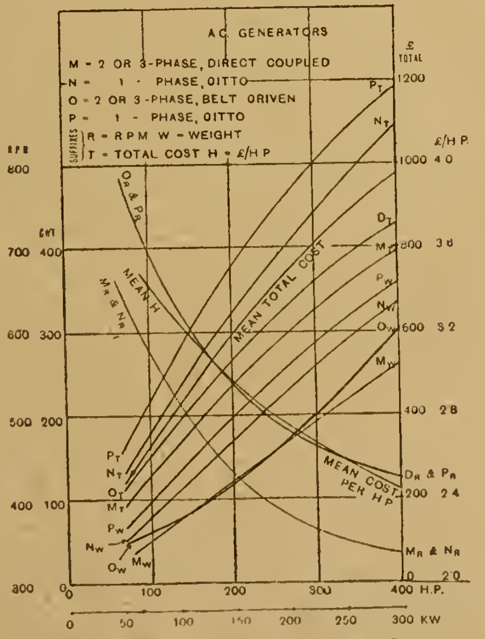


Fig. 4.—Speed, Weight, Cost and Output.

The extra amount which it will pay the purchaser to expend per added 1 per cent. of efficiency or rise of power factor, is such that the interest on this capital outlay equals or is less than the net working economy attributable to the improved efficiency or power factor (after allowing for the capital cost of all accessory equipment and for any increase in certain items of the running cost necessary to secure the higher efficiency or power factor). The bonus which may be offered for every 1 per cent. higher efficiency and power factor above the value specified in the tender may thus be readily determined in every case. The purchase of a low efficiency motor, because it is capitally cheap, is not necessarily a good investment in the long run. The problem is entirely a commercial one, and may be solved as such.

The lettering attached to the curves of fig. 6 and the succeeding figures is to be thus interpreted :—The capital letters refer to the keys inset in the various figures, the numeral $\frac{1}{2}$, $\frac{3}{4}$ or 1 refers to a $\frac{1}{2}$, $\frac{3}{4}$ or full-load test respectively ; η means that the curve deals with the efficiency of a machine, while $p\,f$ denotes that the power factor is the function dealt with.

Fig. 6, dealing with direct-current and alternating-current ball-bearing motors, shows that over the range of horse-power treated there is little to choose between direct and alternating-current machines, the alternating-current machines having the advantage, particularly at half-load. The latter is not necessarily always the case : by varying the design and somewhat raising the cost per horse-power, a very high efficiency can be secured on a direct or alternating-current machine at practically any desired load. The very considerable drop in efficiency as the output of the motor falls below 10 H.P. is to be noted, and forms a further disadvantage consequent on the use of small machines. It is to be noted that the power factor falls considerably faster than the efficiency as the load falls from its normal value. Thus the efficiency of a 30-H.P. alternating-current motor (fig. 6) falls from 89 per cent. on full load, to 87·5 per cent. on half-load, whereas the power factor falls from 89 per cent. to 83 per cent. over the same load range. The fall in efficiency from full to three-quarter load is usually only one-half to two-thirds that occurring between three-quarters and one-half full load, and such a distribution is very desirable, since a motor properly chosen for its load will usually run at between three-quarter full and its full rated output.

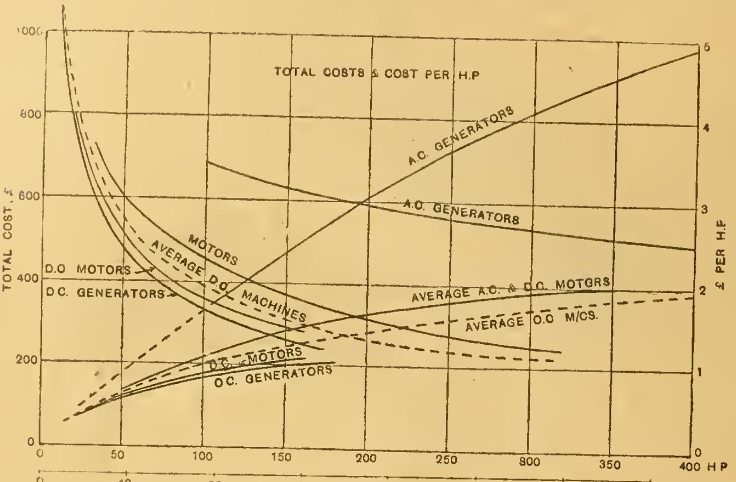


Fig. 5.—Average Curves of Cost and Output.

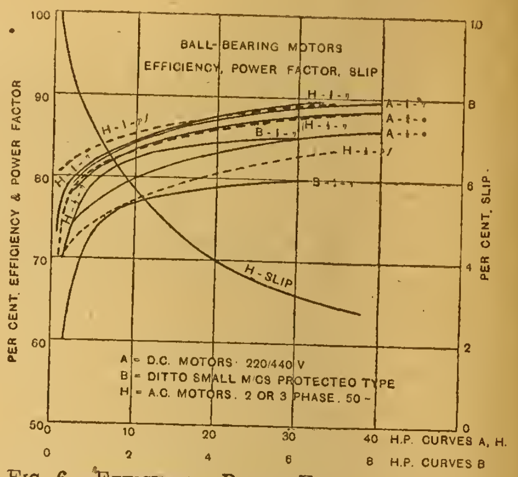


Fig. 6.—Efficiency, Power Factor and Slip ; Ball-bearing Motors.

Fig. 7.—The curves of fig. 7 clearly show the generally acknowledged superiority of direct-current motors in the matter of efficiency of larger units. The direct-current machines have an advantage of from 2 per cent. to 3 per cent. at full load and slightly more at half-load. The very considerable fall in power factor of alternating-current motors from full to half-load is again shown, and is here more serious than in fig. 6, chiefly owing to the greater slip, which is, for instance, now 4 per cent. at about 50 H.P., whereas in fig. 6 it is then only about $2\frac{1}{2}$ per cent. Apart from these points there is little to note in fig. 7 beyond those already noted for fig. 6. The efficiencies are, in general, the same in both cases. The ball-bearing machines have naturally a slight advantage in this respect.

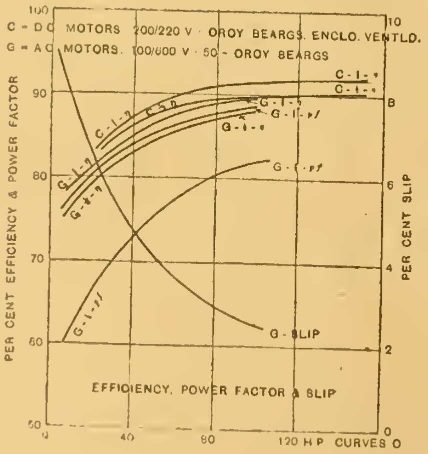


Fig. 7.—Efficiency, Power Factor and Slip ; Motors with Ordinary Bearings.

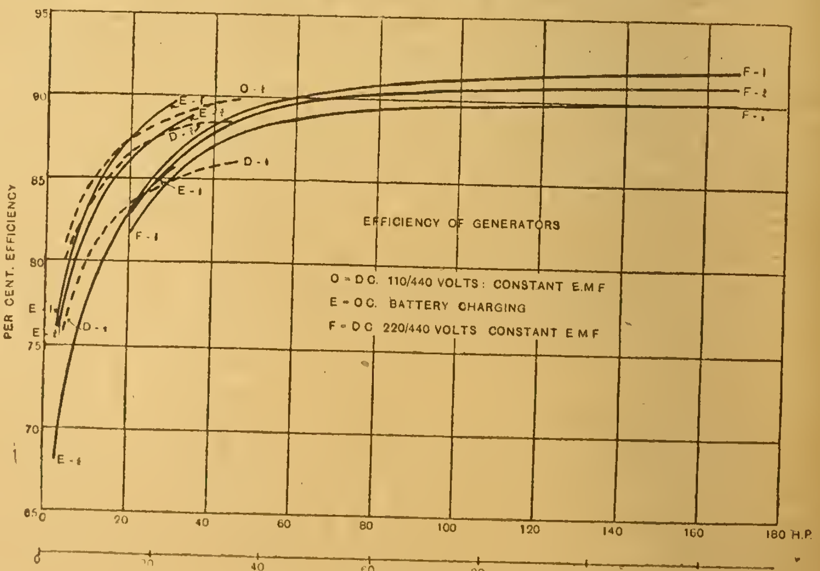
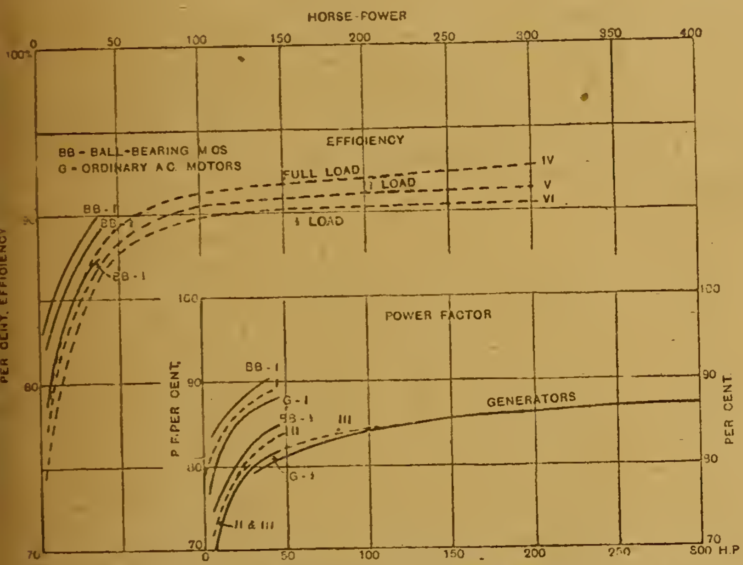


Fig. 8.—Efficiency of Generators.

Fig. 8 deals with the efficiency of generators, the curves shown being based on three types of machine covering a range of outputs from 3 H.P. to 180 H.P. (2 KW. to 140 KW.). The curves lie close together and enable average efficiency curves to be deduced, as in fig. 9. The efficiencies agree closely with those given for D.C. motors in figs. 6 and 7, and this would be expected, since there is no inherent difference between a direct-current motor and generator. The remarks regarding the $\frac{3}{4}$-load efficiency being greater than the mean of the full and half-load efficiencies again apply. The efficiency of 93 per cent. obtainable in 170-H.P. generators at full load is not exceptional : an even higher efficiency can be secured, and on smaller machines, by the exertion of special care in the design of the machine. At the present day the efficiency of some units in the series of a given type of machine is frequently slightly sacrificed to obtain a convenient standardisation of machines, whereby a minimum number of parts and patterns will cover a maximum range of motors or generators as regards output and speed.

Figs. 9 and 9a.—The curves on this page form a convenient summary of the results expressed in full by figs. 6, 7 and 8. Ball-bearing machines are discriminated from those fitted with ordinary bearings, since the increased efficiency consequent on the use of the special bearings amply compensates their adoption, on small motors particularly. The power factors of alternating-current machines are summarised in the inset diagram, fig. 9a. The dotted curves I, II, fig. 9a, show the mean power factors to be expected from normal alternating-current motors on full and half-load respectively, while curve III deals with alternating-current generators of the type already referred to (figs. 4 and 5). The efficiency curves IV, V and VI, fig. 9, show reasonable values to be assumed for the efficiency of electrical machinery in general (excepting those machines fitted with ball bearings, which are separately dealt with) on full, ¾ and ½-load respectively.



Figs. 9 and 9a (inset).—Summary of Results given in Figs. 6, 7 and 8.

No further comment is necessary on this family of curves, except to reiterate that electrical machinery, having an efficiency varying from 80 per cent. to 95 per cent. on full load (less by only about 1 per cent. to 2 per cent. on three-quarter load and 3 per cent. on half-load) has assumed a position in modern engineering and manufacturing practice, the importance of which it is difficult to over-estimate, and which it would be impossible to fill by any other means.

It is the author's sincere hope that the present set of curves may lead to a yet more general appreciation of the merits and possibilities of electrical machinery, and be as useful to others in roughing out designs of every description as they have proved to himself.

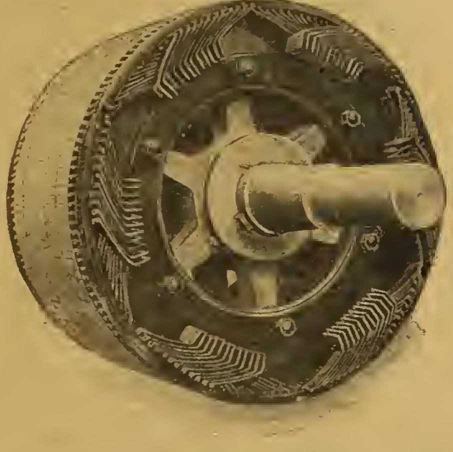
The L.C.C. Stores Appointment.—It will be remembered that the L.C.C. advertised a short time ago for a Chief Officer of Stores at £1,000 a year. It was reported to the Council on Tuesday that there were 300 applicants for the position. Of these 36 were selected for interview, and 35 responded. The Stores Committee then reported that in their opinion none of them were so fitted for the appointment as Mr. F. W. Mackinney, one of the assistant clerks of the Council, who for nearly three years has been entrusted by the clerk of the Council, with the work of store reorganisation which has been carried on under the directions of the Stores Committee, who accordingly recommended his appointment. The Stores Committee submitted, with the name of Mr. Mackinney, the names of five of the candidates. Each of these has been seen by another Committee, which endorsed the opinion of the Stores Committee that Mr. Mackinney should be appointed to the position. To comply with Standing Order No. 86, three names were submitted, as follows:—Mr. E. J. Allen, Mr. G. H. K. Kingdon, Mr. F. W. Mackinney.

The matter came before the Council on Tuesday, and the recommendation was adopted by 37 votes to 13, after discussion, in the course of which objection was made to the way in which the appointment had been carried through.

A NEW TYPE OF CASCADE INDUCTION MOTOR.

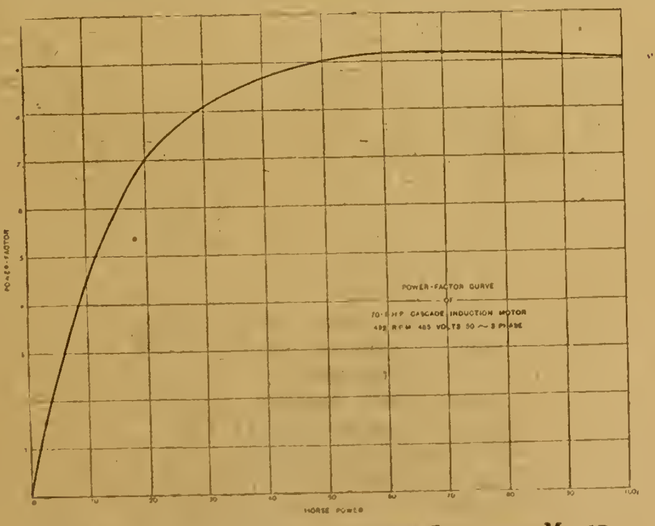
By M. I. WILLIAMS-ELLIS, M.Inst.M.E.E.

The cascade induction motor is no new idea, although there are few examples that have given a really good account of themselves, being generally an inefficient and cumbersome form of apparatus. But a motor of this type has now found its way into both the English and foreign markets, which is a most practical and highly efficient machine, being manufactured by the Sandycroft Foundry Co., under the patent rights of Mr. L. C. Hunt, M.I.E.E.



Rotor of Cascade Motor.

Being the first in this country to adapt the above type of machine for haulage use, I have no hesitation in putting forward the figures obtained as the result of a test taken by me of a 70-b.h.p. cascade motor haulage set that I have erected for Messrs. The Buxton Lime Firms Co. at their quarries in Derbyshire; this is the second set that they have had erected for such work. The motor is connected to a 500-volt 50-cycle three-phase circuit, and as a drop in the line had to be allowed for, the machine was designed for a pressure of 485 volts. Both sets have given full satisfaction, and have proved themselves well suited to the work, the chief advantages being total elimination of slip rings, with the full characteristics of a slip-ring motor. The windings on both stator and rotor are of a simple nature, and the machine is controlled through 12 tappings taken from the parallel windings of the stator and worked in pairs, each pair being finally short-circuited when the machine has reached approximately its final speed. Both machines are of the 12-pole



Curve of Power Factor of Cascade Induction Motor.

type, while the air-gap is kept very short, and for this reason, to provide against a bearing wearing the slightest shade, a simple device for recentring has been added.

The above motors are each connected through double-reduction gearing to a set of four drums giving a rope speed of 4½ miles per hour, which is a maximum safe working speed upon roads as laid in this class of quarry work. The motors themselves have raw-hide pinions fitted, and in spite of the humidity of the locality I have found such pinions work without the slightest sign of wear or detrimental effect due to climate, in conjunction with haulage motors erected some four years back.

The efficiency of a Cascade motor is naturally expected to be low, and for this reason the full-load efficiency of 85 per cent. was specified, while the actual tests gave the following: Full-load efficiency, 88·5 per cent.; half-load efficiency, 87 per cent.; 1½ load efficiency, 89 per cent. The specified overload was 100 per cent.: the actual overload developed on test was 110 per cent.

Final Temperature Reached after 4½ Hours' Run.—Stator winding, 62° rise; surface of stator winding, 48° rise; stator core, 67° rise; rotor copper, 46° rise; rotor core, 55°.

The following are test figures of a 70-B.H.P. three-phase "Cascade" motor, 50 cycles, 492 R.P.M., 485 volts, taken by the writer for the Buxton Lime Firms, in 1909.

Wattmeter readings.	Per phase. Volts.	Per phase. Amperes.	8-pole alternator. R.P.M.	Motor. R.P.M.	Power factor.
59,900	490	76·8	770	—	·918
57,270	485	73·5	760	490	·929
61,500	483	80	760	490	·92
57,690	485	75·2	750	485	·91
58,050	479	76·2	760	490	·92
57,690	483	75·4	750	480	·91
63,420	489	81·5	760	485	·92
58,200	492	74·5	770	500	·91

NO-LOAD READINGS.

4,030	488	18·65	760	500
4,020	488	18·65	760	500

INSULATION TEST.

2,000 volts A.C. for three minutes from all windings to earth.

SOME NOTES ON REFRIGERATING MACHINERY.

By FRANCIS H. DAVIES, A.M.I.E.E.

As a desirable class of load for electricity supply undertakings, there is no doubt that refrigerating machinery occupies a prominent place. Generally speaking, its period of maximum work is in the summer when the station output is at its lowest ebb, and the load factor is in almost all instances good, as in the hottest weather the machinery has often to be run 24 hours daily. In short, where there is any chance of succeeding, it is well worth while to make a special effort to cultivate load of this nature, and the following outline of refrigerating practice is offered as a help to this end.

Leaving out of the question exceptional cases, such as natural ice skating rinks, there are two broad purposes for which freezing plant is employed: (1) The manufacture of ice in can, cell, or plate form; (2) The cold storage, freezing or chilling of goods, such as foodstuffs, furs, tobacco, beer, &c. For either of these purposes there are at present two leading types of machines on the market, one of which operates on the ammonia compression system, and the other on the carbon dioxide principle. It is not necessary to go into the relative merits of the two, upon which point there is, of course, some divergence of opinion. Both are successfully employed, and to the supplier of electricity it matters little which system is adopted. Fig. 1 is a diagram showing the action of a plant employing anhydrous ammonia (NH_3), a liquefied gas. Following its course from and back to the compressor, the ammonia gas under high pressure is delivered to the condenser, being there cooled by the action of the circulating water and converted into a liquid. It is now allowed to expand into the refrigerator coils, where it turns again into a gas, producing an intense degree of coldness. After passing through the coils the gas flows back to the compressor, and the operation starts over again.

The refrigerator may take several forms, according to the purpose for which it is to be employed, and the degree of efficiency required from it. For cooling a store, the most usual course is to place the refrigerator coils in a part of the room partitioned off from the rest, circulating the cold air through the room or rooms by means of a fan, and if more than one room is used, through wooden ducts fitted with dampers.

There are, however, elaborations of this system involving the use of brine circulating pipes, &c., which, though interesting, are rather beyond the scope of a cursory review. Particulars may be obtained from numerous makers, and they should certainly be investigated before any serious work is undertaken.

As previously indicated, refrigerating apparatus is used either for cold storage, freezing, or chilling. The former consists in maintaining in a sound condition perishable goods which have previously been either frozen or chilled. Freezing speaks for itself, and chilling consists of reducing the temperature of articles to not lower than 35° F. Some makers recommend 34° F. as the best all-round temperature for cold storage, but it should be noted that various goods require different temperatures, and to secure the best results this point should be carefully looked into.

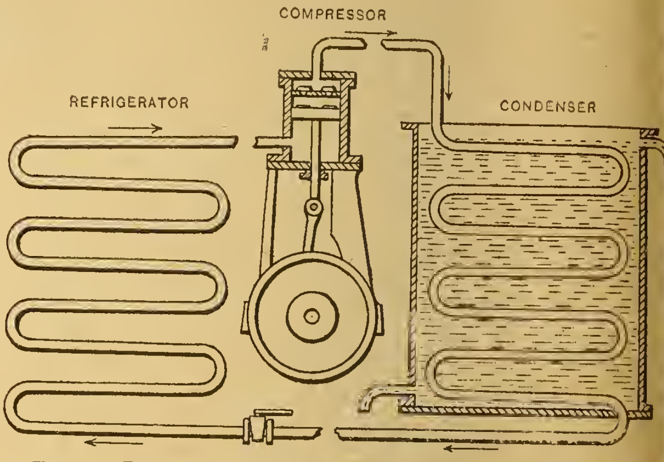


FIG. 1.—DIAGRAM OF THE AMMONIA REFRIGERATING SYSTEM.

To give a few examples taken from common practice. Eggs require a temperature of 34°, fresh meat 35°, cheese 32°-33°, fresh fish 25°-30°, game 25°-28°, furs 35°, and frozen rabbits as low as 15°.

A most important point in cold storage or freezing installations is the method of insulating the refrigerating chamber. All six sides must be thoroughly lagged, and the usual practice in well-planned installations is to allow, in the following order, 1 in. air space from the wall, one layer of 1 in. tongued and grooved boards, two layers of waterproof paper, 6 in. of slag wool or silicate cotton, two layers of waterproof paper, and one layer of 1 in. tongued and grooved boards. If considered desirable, the inner layer of boards and the air space may be dispensed with, but in this case the wall should be given a good coating of waterproof paint.

So much of the efficiency of an installation depends upon the lagging of the chamber, that too much attention cannot be accorded it. Unfortunately, the average butcher or provision dealer's cold storage room is generally not at all well lagged, and this constitutes one of the greatest difficulties in persuading him to substitute a freezing plant for the usual archaic method of filling the store with blocks of ice. Without proper insulation the best results cannot be promised, and while a man may be willing to go to the expense of installing the machinery, he generally objects to having to rebuild or alter the walls of his store.

Since even a small butcher with his primitive ice-box will often expend 20s. to 40s. a week on ice during the hot weather, it is possible even under bad conditions to show him a monetary saving; but bad lagging will necessitate longer hours of running, and that is the rock upon which many negotiations have split. To reduce the hours of running, a very efficient accumulator system which gives a good reserve of cooling power has been introduced by the Pulsometer Engineering Co., and other firms. It will meet cases where Sunday or all-night running is out of the question, but it, of course, involves additional capital expenditure.

As conditions vary so considerably, it is impossible to give hard and fast figures to apply to any case; the power required, and therefore the cost, may, however, be estimated from the following figures given by Messrs. Ernest West and Benyon, Ltd. :—

Internal capacity of insulated cold rooms at 34° F. cb. ft.	B.H.P. required by compressor.
350	2
700	2½
1,100	3¼
1,600	3½
2,800	4
4,000	5
7,000	6½
9,000	8

In conclusion, it many be of assistance to append some arguments which may fairly be employed in support of refrigerating plant *versus* the ice box. First, there is the question of monetary saving, which is particularly noticeable in the case of large plants. Owing to loss by melting during carriage, the cost of ice in outlying districts is often very high, and in such cases it is a simple matter to show and guarantee a saving that should prove a powerful inducement. In effectiveness there is also much to say in favour of a machine, and a great deal against the ice box. Temperature cannot be properly controlled by the latter; the air in the room is damp; the ice, if natural, may come from very unhygienic sources, and the ice and its bin take up a deal of room in the very place where it cannot be spared.

Upon all these points the refrigerating machine obviously shows up to advantage; there is better circulation and dry air, and—an important point—the temperature is easily regulated. The question of capital outlay is often one of some difficulty, and can only be met by some form of hire-purchase scheme. Roughly speaking, the price of a small installation to deal with a storage room of 700-800 cb. ft. capacity is £90, the room itself, the motor and accessories being extra. The majority of firms will be found quite willing in hopeful cases to supply plants on trial, and by this means, coupled with the unquestionable advantages offered, it is quite possible to do much good work among butchers and provision dealers.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Magnetising Current of an Induction Motor.

The magnetic fluxes in an induction motor can be divided up as follows :—

1. The working flux.
2. The stator leakage flux.
3. The rotor leakage flux.

The stator current will produce a magnetic flux in the stator, and the induced current in the rotor will produce another flux perpendicular to the stator flux; the resultant of these will be the working flux, and the current taken by the stator to produce this flux will be the magnetising current (that is, the resultant of the stator and rotor currents).

The stator leakage is that part of the flux which does not enter the rotor, but passes from tooth to tooth; therefore it does not affect the rotor conductors, but it appears in the form of self-induction in the stator windings.

The rotor leakage is that part of the flux which is formed in the rotor core, and does not enter the stator; this produces a back E.M.F. in the rotor windings, and will tend to demagnetise the stator, so causing an increased stator current to overcome this. The stator and rotor leakage increase with the load. If a motor is running unloaded the magnetising current taken will be sufficient to maintain the resultant flux due to the stator and rotor currents.

In the case mentioned by "Troubled" there will be no rotor flux or leakage due to rotor current, therefore the current taken by the motor will only be that necessary to produce the stator flux and leakage. The magnetising current taken by a single-phase motor will be much greater than that taken by a polyphase motor per phase, as there is a large current in the rotor which is almost wattless; this current is sufficient to produce a flux at right angles to the stator flux, and this causes an increased stator current.

If the motor in question is a single-phase one, the fact of its being open-circuited will decrease the stator current considerably.

W. Dancer.

Manchester Exhibition Accounts.

In answer to the numerous inquiries from exhibitors and others as to the delay in publishing the above, I would say that this has been occasioned entirely by the special conditions under which the Exhibition was organised, but I hope that the trade will be satisfied with the results that have now been put before them.

C. S. Northcote,
Late General Manager to the Exhibition.

London, S.W., *October* 14*th*, 1909.

Coefficient of Self-Induction.

In quoting a few lines from our previous letters your reviewer, we think, hardly does us justice. Our statements, of course, should not be construed apart from their context; and your readers, recognising this, will see that the meaning suggested by your reviewer cannot fairly be read into our letters. For this reason we are well content to leave the matter in their hands.

With the statement in italics at the end of your reviewer's last letter we find ourselves unable to agree. In a strict academic sense it is, of course, true; but we think that to abandon Maxwell's coefficient merely because it is not constant throughout a half wave, would be to take a course which, if logically followed, would effectively destroy every ordinary alternating-current calculation. By substituting for irregular waves their equivalent sine waves, the coefficient, as defined by Maxwell, may be made to serve in vector equations; provided that the density in the iron does not approach saturation. A complex number is, as we have pointed out, involved in the coefficient when so used, unless iron losses be neglected.

All this follows from, and is exemplified in, the work of Steinmetz, S. P. Thompson, and many others. In case, however, your reviewer does not admit the authority of such writers, we might perhaps refer him to an author whose dictum we have reason to think he will not question. In Dr. Russell's second volume of "Alternating Currents" he will find under the equations for a transformer an expression for Maxwell's coefficient in terms of the reluctance of an air circuit. Dr. Russell further points out, that to an iron circuit with constant permeability, these equations are applicable; and in subsequent calculations not only does he assume the permeability as constant, but he also attempts to justify the neglect of iron losses—of which neglect at least *we* are not guilty.

We think that perhaps we may congratulate ourselves on one result of this correspondence, viz., that it has apparently caused your reviewer to modify his opinion as to the relative usefulness of the two forms of the coefficient of self-induction.

On August 6th he writes, in comparing the use of Maxwell's coefficient with that commonly adopted by electrical engineers, "We are, therefore, at a loss to understand the greater convenience of the coefficient used by electrical engineers."

On October 15th he writes of Maxwell's coefficient that it "cannot be used in vector equations at all."

C. F. Smith,
William Cramp.

Municipal School of Technology,
Manchester, *October* 18*th*, 1909.

Applications for Employment.

For some time past there have been advertisements in your columns from persons who claim to be able to set out applications in such a striking way as to attract the notice of prospective employers and enhance their chances of success. For the benefit of those who are striving to obtain posts, would any of the Review readers kindly say if they have ever availed themselves of these offers, and if by following their advice they have succeeded in obtaining posts which they honestly believe they could not have secured if they had made out their own applications?

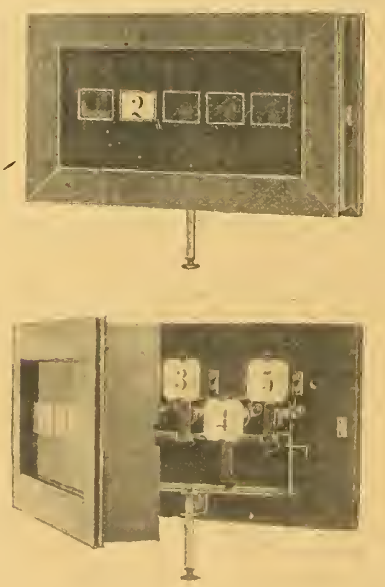
Luckless.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Novel Indicator Board.

A vertical indicator board recently brought out by Messrs. Mix & Genest, of Schöneberg-Berlin, is provided with a drop of extreme simplicity, the vane stem being designed to work also as the armature of an electromagnet. Unlike the usual type of indicator, in which the jacks rotate or oscillate round an axis after being disengaged, the design of this "vertical" board is based on a simple falling motion.

A short distance in front of the electromagnet is an extension of the vane stem, which, when set, rests obliquely to the vertical on a projection from the lower part of the frame. As soon as the electromagnet is traversed by a current the magnet attracts this stem, drawing it into a vertical position. Directly the current is interrupted the vane is disengaged, and the drop falls into position behind the window.



Figs. 1 and 2.—"Vertical" Indicator Board.

The drop is replaced mechanically by a slide working from beneath; the rod protruding from the box is connected inside the latter with a horizontal bar, which when lifted presses against the angular end of the vane stem, and this being raised strikes an inclined slide which sets the jack in an inclined position. Very little energy is required to actuate the indicator, and the size and weight of the board are reduced to the minimum.

The Wilkinson Thermal Column.

Mr. Geo. Wilkinson, borough electrical engineer, Harrogate, has devised a new apparatus for returning water condensed in steam pipes, &c., to the boilers without loss of heat. The "Thermal Column," as it is called, consists essentially of two chambers—the sump and the receiver—connected by a pipe, the sump being placed at a low level so that water draining from the steam range, separators, jackets, &c., will flow into it by gravitation, while the receiver is situated 5 or 6 ft. above the tops of the boilers, with which it is connected by a pipe with a non-return valve. In operation, water collects in the sump until it seals the rising pipe, thus cutting off the latter and the receiver from the supply of live steam. Directly this happens, the pressure in the receiver drops, and the water in the sump is forced up the pipe into the receiver, until steam re-enters the pipe and establishes equilibrium of pressure in the two chambers, while the water raised flows from the receiver into the boilers. To provide against excessive rushes of water into the sump which might overcharge the receiver, an automatic relief valve is fixed on the latter, but such flooding does not occur under normal conditions. The apparatus, we are informed, has been in successful operation for nearly 12 months at the Harrogate Electricity Works, where it may be seen by those interested. It will be noticed that the column has no opening to the atmosphere, so that there is no loss of heat by evaporation—the only loss being the slight radiation from the lagged surfaces of the chambers and pipes; there are no moving parts, and the operation is entirely automatic. The system is applicable to the steam heating of buildings, as well as to power stations.

A Dioptric Sign.

The Dioptric Sign Co., Ltd, of 4, York Buildings, 78, Duke Street, Liverpool, have introduced a system in which each letter is fitted with a dioptric lens and lighted with a single lamp, the effect being uniform illumination of the whole of the letter, as shown in fig. 3 herewith. It is claimed that this constitutes a great advance over present practice, and affords means of concentrating the light in a particular direction if desired, or of producing an effect of automatic flashing, due to the movement of the observer. The letters are built up separately in galvanised steel cases, and measure 15 in. × 12 in. A dioptric sign measuring 22 ft. over all is being erected at a Liverpool theatre.

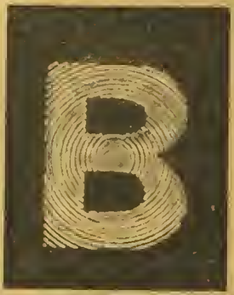


Fig 3.—Dioptric Letter Sign.

New Reflector Sign.

Messrs. W. Leonard & Co, 4, Soho Street, Oxford Street, W., are placing on the market a combined window lighting and advertising reflector, shown in end view in fig. 4. It will be seen that while the advertising device—which consists of a frame containing a letter plate, interchangeable with similar plates bearing different legends—is illuminated, light is also reflected backwards upon the contents of the show window, and the spectator is not dazzled. Spring lamp-holders are used to lengthen the life of the metallic-filament lamps, and the frames can be made in any size desired.

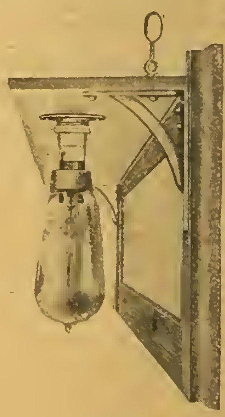


Fig. 4.—Reflector Advertising Sign.

Magnetic Storms.—An interesting discussion, aroused by the storm of September 25th, has been going on in *Nature* and elsewhere, between Sir Oliver Lodge and Dr. C. Chree. The former claims that the phenomena are consistent with and strongly support the theory that such storms are due to the emission of vast multitudes of electrons from the surface of the sun during a solar eruption, as evidenced by the appearance of "spots on the sun." The stream of electrons, projected at an immense velocity in the form of a conical beam, has a magnetic effect calculated to be equivalent to that of hundreds of millions of amperes, and as the beam passes over or near the earth, the magnetic disturbances pass from positive, through zero, to negative. Dr. Chree points out, however, that the disturbances are not limited to the declination, as Sir Oliver appears tacitly to assume, but take place also both in the meridian and in the vertical component of the earth's magnetic force, and the storm does not correspond to a disturbing force in a fixed direction, waxing and waning, but is irregular and oscillatory. Moreover, the average duration of such storms is not 9 hours, but 30 hours. Dr. Chree does not combat or support the emission theories, but calls for reservation of judgment and minute study of the records with an unbiased mind.

LEGAL.

Electric Installations in Mines.

[Prosecutions by the Home Office.]

Throughout the West of Scotland more than ordinary interest was taken in the prosecutions which, on Wednesday last week, at the instance of the Home Office, were taken against Mr. Andrew Salmond and Mr. James Salmond, the manager and general manager respectively of the Ferniegair pit, near Hamilton, belonging to the well-known coal-producing firm of Archibald Russell, Ltd. The complaints which were the outcome of the recent explosion at Ferniegair Colliery, by which three men lost their lives, were heard in the Hamilton Sheriff Court, the presiding judge being Sheriff Thomson.

The charge against the general manager (Mr. James Salmond) was that of having on June 27th, 1909, failed to have, in the completely insulated electric circuit in use for the cutting of coal in Ferniegair pit, an earth or fault detector kept connected up in the generating station, to show immediately any defect in the insulation of the system in use in the pit. Accused at a previous diet had denied the charge, and on Wednesday he was prepared to adhere to his plea, the counsel for the defence being the Hon. Wm. Watson, advocate, Edinburgh. At the outset of the proceedings, however, Mr. Wm. Thomson, Procurator Fiscal, Hamilton (who appeared for the Crown), intimated that he would not proceed with the charge against Mr. James Salmond, the general manager of the colliery.

Thereafter, the manager, Andrew Salmond (a son of the previous respondent), was called to the Bar, and the charges against him included the specific complaint already detailed, as libelled against his father, together with the further offence of having on June 27th, in the Virtuewell seam of Ferniefair Colliery, failed to keep the electric cables for the portable electric coal-cutting machine protected with either galvanised steel-wiring armouring, extra stout braiding, hose-piping, or other effective covering. The charge-sheet further bore that, on the date in question, the outer braiding of the trailing cables had been exposed and worn in different parts, and that there had been failure on the part of the respondent to have the exposure of the insulating sheath of cables promptly repaired. Accused denied the charge, and were defended by the Hon. Wm. Watson, advocate, Edinburgh.

Before witnesses were called, the Fiscal said he intended to drop the first charge, that of failing to have an earth or fault detector in connection with the generating station. It had now been ascertained that there was such a detector, although it was not at its proper place.

The chief witnesses for the Crown were Mr. J. M. Ronaldson, H.M. Inspector of Mines for the Western District of Scotland; and Mr. Robert Nelson, Electrical Inspector of Mines, London. The latter's evidence was regarded as the most important, and he deposed that following the explosion on June 27th, he had examined the electrical fittings of the pit on July 1st. Very special attention, he said, had been directed by him to the condition of the trailing cable attached to the coal-cutting machine in the Virtuewell seam. The trailing cable consisted generally of two copper wires covered by rubber insulation, on the top of which there was a cotton braiding. Above that again there ought to be a rope or leather covering. In the present instance he thought there were both layers of rope and leather constituting the outer covering to the trailing cable. In accordance with the provisions of the Act, the india-rubber insulation was not a proper protection for mechanical damage—the material protection being the rope or leather covering. As examined by him, after the explosion, the trailing cable was only partly effectively covered. He observed that at three or four parts of the cable the outer covering was entirely gone, and the only protection to the live wires was the cotton braiding and the india-rubber insulation. With this condition of affairs, three things might have occurred, all of which would have been prejudicial to the pit and the men working therein. First, there might have been a fall from the roof, which would have cut the cable in two. Then, if that happened when the motor was running there probably would have been sparking. Then, again, the cable might have been trampled under foot, and in that event a man standing on it would have sustained a shock. Such a shock might have been sufficient to kill a man. It altogether depended on the nature of the ground and the intimacy and closeness of the contact. Witness said he would not go the length of saying that the defects which he saw on the trailing cable had been caused by the force of the explosion. If such had been the case, he saw no reason why the explosion should have selected different parts of the cable and left the remainder.

In cross-examination by the Hon. Wm. Watson, Witness said that if the defects had been due to hard bodies or substances falling against the trailing cable, he would have expected that the underneath part of the covering would have been clean. He particularly noticed, however, that the exposed parts of the cable had the appearance of having been dragged along the floor of the mine, and had been subjected to contact with considerable coal dust. After explosions he had specially noticed that the rubber was very clean. Personally, he had inspected electrical plant in mines subsequent to three explosions, so that he could speak with some authority on the subject. He was appointed an electrical inspector of mines in November of last year, and he had considerable experience of electrical plants in connection with mines, both on the surface and underground.

In reply to Sheriff Thomson, Mr. Nelson said he was bound to admit that apart from the apparent defects in the outer braiding, the trailing cable appeared to be in good condition.

For the defence, evidence was given by John Wishart, electrical coal-cutting machineman, Larkhall, and Thomas Wright, machineman, William Place, Ferniegair, to show the precautions which the management of the colliery took to ensure that defects in the electrical fittings were promptly attended to.

Alexander Anderson, managing director of the firm of Messrs. Anderson, Boyes & Co., Ltd., electrical, mining and mechanical engineers, Motherwell, stated that he had examined the trailing cable on July 26th, a month after the explosion. He was then informed that the cable had undergone no alteration whatever from the condition it was in immediately following the blast. On the occasion of his examination he observed that there were two parts of the cable where it was exposed, and where the dielectric was specially exposed. There was a third instance where the covering was injured, but there was no exposure of the cables or the proper insulation. In his view, he regarded it as possible that these defects might have been caused in the course of the explosion. He did not make that statement with absolute certainty, but the defects to the cable could have happened through the *débris* being thrown about.

The Fiscal, in pressing for a conviction, said it had been sought to be made out that the defects found in the trailing cable, subsequent to the explosion, were caused by the blast. He maintained that such a contention was far from being sound, because they had the clear and conclusive evidence of the two mines inspectors to demonstrate that the condition of the cable was not of recent origin, but had been in existence before. They could not definitely say that these defects brought about the explosion, but of this they were certain—that there had been gross negligence on the part of the management of this colliery, resulting in the loss of three lives.

Sheriff Thomson, without calling upon counsel for the defence to address the Court, said he thought the trailing cable was undoubtedly quite sufficient to start with. Then they had it on evidence that the cable was thoroughly overhauled and repaired six weeks before the accident. From the evidence he thought it was proved that these defects were not caused by the explosion, but that they must have existed before it. Apparently they were not of quite recent origin. It was probable, but by no means certain, that they existed before the shift began, and, of course, it might be that they occurred in the course of the shift. If they existed before the shift began, then there was gross negligence somewhere. From the evidence led that day he did not find any neglect of duty on the part of the machineman, and on the assumption, which he stated previously, that the defect arose before the shift began, the only inference he could draw was that the negligence lay with the machineman primarily, and only secondarily, if at all, with the manager. So far as the latter official was concerned, he did not find that he was negligent in his supervision. He did not find that he was negligent in any system of examination or repairing, and he did not hold he was negligent in the enforcement of any rule. In the whole circumstances he could not see that any responsibility had been brought home to the respondent, and therefore he must dismiss him from the bar.

The verdict of the Sheriff was received with some applause in Court.

Western *v.* Barr.

In the King's Bench Division, on Monday, October 18th, judgment was given in default of appearance of the defendants in the action of Messrs. G. Western & Sons *v.* Messrs. Louis Mortilmas Barr and Co. Plaintiffs claimed the sum of £119 15s. 6d. in respect of supplying electrical fittings, &c., to defendants' premises.

Mr. Justice Hamilton ordered judgment to be entered for the amount claimed, and costs.

McMullen *v.* Sunderland District Electric Tramways Co., Ltd.

At the Sunderland County Court, on 13th inst., before Judge O'Connor, Isabella McMullen, of Silksworth, sued defendant company for £25 damages in respect of injuries received.

Mr. H. M. McLean, for the defendant company, admitted liability to the extent of £15, which had been paid into Court.

The Plaintiff stated that on April 30th last while crossing the road at Silksworth she was injured by a falling wire. She was bruised, and received a severe shock, and was in bed for a month.

After hearing further evidence, his Honour gave judgment for the plaintiff for £23 with costs.

Trenery *v.* Liverpool Corporation.

In the Liverpool Court of Passage on Wednesday last week, before Mr. W. F. K. Taylor, K.C., and a common jury, the hearing was concluded of an action brought by Mrs. Trenery against the Liverpool Corporation to recover damages for personal injuries. Mr. Rigby Swift was counsel for the plaintiff, and Mr. Wooll for the defendant Corporation. The case for the plaintiff was that on the night of Saturday, June 19th, Mrs. Trenery, with her husband, boarded a Smithdown Road tramcar at the junction of Hope Street and Myrtle Street. The car was very full, people standing up inside as well as on the platform. Plaintiff secured a seat, and her husband stood near the door holding a strap. She intended to alight near Parliament Street, where there was a request stop, and she rose from her seat, but on the instant the car stopped and the passengers were flung about, and plaintiff was thrown to the floor. She was picked up in a collapsed condition, and developed floating kidney, with which she had been in bed for several weeks.

Mr. Wooll, for the Corporation, urged that the Corporation could not be held liable, seeing the car had been stopped suddenly out of consideration for the public. He held that every tramcar passenger must be prepared for a sudden stoppage. The conductor rang the emergency bell of five rings as he saw a crowd of people waiting to get on the car. He called Sir James Barr, Dr. Paul and Dr. Brannigan to say that the effect of such a fall would not give rise to a floating kidney, and it must have been contracted prior to the accident.

John A. Johnson, the tramcar conductor, said he stopped the car by using the emergency signal in order to avoid scuffling between the passengers, as might have been the case if they went to Granby Street, where a number of people were waiting. Plaintiff was the only one who complained.

Mr. Wooll quoted one of the Tramway by-laws, apprising passengers that they must be prepared for sudden stoppages whenever it was necessary to avoid impending danger.

Mr. Rigby Swift complained of the system in vogue in the tramways department, whereby the reports of their officials were sent to the town clerk's department, and were, therefore, not accessible to the legal advisers of injured passengers for the purpose of litigation against the Corporation.

The jury returned a verdict for the plaintiff, assessing the damages at £153 and costs. Judgment was entered for that amount.

Mr. Wooll asked for a stay of execution, on the ground that there was no negligence, but his Lordship refused to grant it.

Electricity in Fife Coal Pits.

Sheriff Shennan, Dunfermline, has dismissed the objections to the relevancy of the charge against the manager and representative of the Fife Coal Co. and the certificated manager at Foulford Colliery. They are charged with having contravened the special electrical rules by having defective apparatus in Foulford Colliery. It was contended that the plant and apparatus were installed before the coming into force of the special rules for the use of electricity in mines. Special Rule 55, the Sheriff points out, permits such plants to be continued in use unless the inspector should otherwise direct. It is contended, on the other hand, that the Inspector of Mines did otherwise direct by letter, and the prosecutor would fail if he could not prove the notice.

Mr. D. Connel, on behalf of the Fife Coal Co., asked his Lordship to give them time to have their evidence collected, and the Sheriff fixed proof for November 18th.

Babcock & Wilcox, Ltd., *v.* Spearing.

In the Court of Appeal on Saturday, the 16th inst., Lords Justices Vaughan-Williams, Buckley and Kennedy had before them the case of Babcock & Wilcox, Ltd., *v.* Spearing, on the appeal of the plaintiffs and cross-appeal of the defendant against an order of Mr. Justice Bucknill in Chambers affirming an order of the Master. In the course of the hearing an advertisement which appeared in the Electrical Review was referred to.

Mr. S. H. Emanuel, for the plaintiffs, said that the point involved in the two appeals was really the same. It was whether certain documents disclosed in the defendant's affidavit of documents should be open for inspection by the plaintiffs. The defendant opposed inspection on the ground that, as he alleged, the documents contained nothing which would assist the plaintiffs' case. The Master, in Chambers, ordered that one of the documents, namely, an agreement dated July 27th, 1908, and made between the defendant and Edwin Danks & Co. (Oldbury), Ltd., should be open for inspection, but as to a batch of other documents he refused inspection. This order Mr. Justice Bucknill affirmed. The facts were as follows: On May 16th, 1903, the defendant, Arthur Horace Spearing, entered into an agreement with the plaintiffs for the settlement of an action for alleged infringement of patents which was pending against the defendant and others at the suit of the plaintiffs. Amongst other things, it was agreed by the defendant that he would not undertake the sale or manufacture of any water-tube boilers in competition with the plaintiffs. There was a proviso in the agreement that so far as sale was concerned, that restriction should only apply for a certain period, which period had now elapsed. The agreement, however, remained valid for ever in regard to the undertaking not to manufacture. The question of whether that agreement was reasonable and valid was the subject of an action in the Chancery Division, in which specific performance was granted. The present action was for alleged breach of the agreement not to manufacture water-tube boilers, an injunction being asked for. Amongst other things, the defendant had published an advertisement in the Electrical Review, in which he represented himself as a manufacturer of water-tube boilers with works at Oldbury, Birmingham, and the plaintiffs alleged that he had tendered in competition with them for the manufacture of such boilers. In other words, they said that he was manufacturing or undertaking the manufacture of water-tube boilers. In reply, the defendant said that he was not manufacturing or undertaking the manufacture of boilers, but that he was selling them under an agreement with Messrs. Edwin Danks & Co., Ltd., of Oldbury, Birmingham. Defendant admitted that the Water-Tube Boiler and Engineering Co., of Oldbury, was himself.

Lord Justice Buckley: The defendant says that Messrs. Danks, under an agreement with him, are entitled to manufacture. They may be his agents for manufacture.

Mr. Emanuel: Yes, and we say that we are entitled to have inspection of that agreement. The Master who saw the agreement so held, but he refused inspection of tenders by the defendant, which we say are tenders for manufacture.

Mr. Disturnal, for the defendant, submitted that the plaintiffs were not entitled at this stage of the litigation to inspection of either the agreement or the tenders. The whole question was whether the defendant was undertaking to manufacture, and that would have to be decided at the trial. The defendant's case was that he only sold boilers which were manufactured by Messrs. Danks, who were an old-established firm of boiler makers. The documents when examined so far from showing that the defendant was manufacturing showed that he was not manufacturing.

Lord Justice Kennedy: Then you ought to be only too delighted to show them.

Mr. Disturnal submitted that as Messrs. Danks were rival manufacturers with the plaintiffs, the defendant ought not to be called upon to disclose the tenders, which would show the names of the customers and the prices.

After some further discussion, their Lordships intimated that in their view the agreement and all the other documents in question ought to be open for inspection, and it was directed that the plaintiffs should have inspection, but that in the case of tenders they should be furnished with copies with the prices and names of customers left out. Order accordingly.

Lingwood *v.* Braulik.

In the City of London Court, on Friday, before Judge Lumley Smith, K.C., a claim was made by Frank Lingwood, clerk, 93, Elboro Street, Southfields, against Mr. George Braulik, proprietor of the Victoria Electric Works, 8, Lambeth Hill, E.C., to recover the sum of £3 5s. wages due, and damages for alleged wrongful dismissal.

Plaintiff said he was in the defendant's service for three years as a clerk, latterly at 32s. 6d. a week. He had compiled a book of cost prices of all the electrical goods dealt in by the defendant, and when the defendant made the discovery, he was instantly dismissed from his employment. He had prepared the book for use in the office. It was not done for use in a competitive firm's service. He was now employed by the General Electric Co., Ltd. He had since burned the book.

Defendant said he was very surprised to find that the plaintiff had compiled a cost prices book. They were all of a private and confidential nature, and included the names of the manufacturers from whom he bought all his electrical goods. Plaintiff had collated the information from index cards, and was guilty of a breach of confidence. He might have given the information to any competitors. If the plaintiff had parted with the cost prices to other firms, defendant's business would have been got away from him, and his prices cut.

Judge Lumley Smith said that betraying one's master's confidence was not consistent with a proper discharge of duty. If it had been merely a record of what different firms charged he would not have thought anything of it, but it went further than that. It was a record of transactions which the master had been having for some considerable period with different firms, and that could only be useful for the purpose of being carried away after he left the service. He thought it amounted to a breach of confidence. On the whole, the master was justified in dismissing the plaintiff. Judgment for the defendant, with costs.

British Westinghouse Electric and Manufacturing Co., Ltd., *v.* Braulik.

Mr. Justice Joyce in the Chancery Division on Monday, delivered a considered judgment in this action which was brought by the plaintiffs for an injunction to restrain the defendant from infringing letters patent granted to them in 1902 for an improvement in arc lamps. The facts sufficiently appear from the following judgment:—

Mr. Justice Joyce said the invention claimed by the patent in this case is: "An arc lamp having downwardly-pointed electrodes, and provided with both downward and horizontal feed mechanism so arranged that a certain amount of operation of the horizontal-feed mechanism takes place before the downward-feed mechanism is permitted to operate, subject to the disclaiming note." The disclaiming note is: "The lamps to which this, my invention, applies, are of the type in which the current is supplied to the electrodes through electrode-holders in which the upper ends of the electrodes are firmly clipped, and which are capable of being lowered simultaneously through the same distance, and about one of which the corresponding electrode can swing under the action of a device acting near its lower end, and I limit my claim to lamps of this description." Apparently the original claim was too wide, and by the disclaiming note the plaintiffs restrict the application of their invention to a particular kind, or particular kinds, or to a specified type of arc lamp, in such arc lamp claiming any and every arrangement whereby a certain amount of the operation of the "horizontal feed mechanism," a term previously defined, takes place before the "downward feed mechanism," a term also previously defined, is permitted to operate. He does not claim some specified or any particular apparatus or mechanism to effect the purpose indicated. The patent is not for any particular contrivance or device to effect a certain object, but generally for every mode of effecting that object in any arc lamp having certain specified characteristics. The specification, by letterpress and drawings, in which it is admitted on the part of the plaintiffs, for it could not be denied, that there are several errors and inaccuracies, purports to show a mechanism quite easy to contrive, the object being given whereby such an arrangement as claimed can be effected in the particular type of arc lamp to which the invention is intended to apply, but it does not claim this specific mechanism or any other particular mechanism. Now, assuming the validity of the plaintiffs' patent, if I rightly understand what the defendant is doing, it appears to me that his lamp is an infringement. But I think the real and serious question in the present case is the validity or otherwise of the plaintiffs' patent, and this is impugned upon two grounds:—First, it is said that this patent is invalid for want of subject matter; and, further, that the patent was completely anticipated by the invention claimed in Graham's specification. As has been said, and as I have said before, I do not intend to describe and explain the details of these various lamps or to discourse upon the scientific nature of what I do not understand. Lord Justice Bowen pointed out in the Fleet Case in 2 *Times* Law Reports, that it is no part of the function of the Court to qualify itself as an expert. The Court, in such a case as this, has to act upon the evidence of experts whose qualifications and opinions are tested by cross-examination, and the Court weighs the evidence so given and tested. Thus proceeding, to my mind, the result of the evidence is this: That there being a well-known contrivance or arrangement, common, if not universal, in the kind of arc lamps in ordinary use, this patent is taken out for the application of such contrivance or arrangement *mutatis mutandis* to a precisely similar, if not the very same, purpose in a particular specified type of arc lamp, namely, that described in the claim as limited by the disclaiming clause. This contrivance or arrangement as employed in the vertical arc lamp in common use at the date of the patent is variously described in the evidence. To make use of it in the manufacture of any new or other type of arc lamp, I think was a perfectly natural and the obvious thing to do, and there does not appear to have been the slightest difficulty in doing it. It might, no doubt, have been done in various ways, in any one of which there might possibly be invention and consequently subject matter for a patent; but, in my opinion, there could not, in the circumstances, be a good patent merely for the use in any new or special kind of arc lamps of that which was already known and commonly adopted in the ordinary arc lamps for practically the same purpose. Rightly or wrongly, I think the objection founded on want of subject matter to be, in the circumstances, a good and valid objection to the patent, and that is what is claimed; there is no invention to support the patent, and consequently, in my opinion, this action fails. As to the other objections, I do not think it can be denied that the invention described in Graham's American specification is within the claim of the patent in question, and that the lamp described in such specification would work in the manner which the patentee claims as his invention, and for which he has obtained his patent. Upon the whole, I think that the plaintiffs' patent, if otherwise valid, has been anticipated by Graham's patent, if not by others; but the ground upon which I decide this case is, that in the so-called invention of the patentee as claimed, there was no real invention or subject matter to support a patent. The result is, that I dismiss the action with the usual consequences.

Mr. Gray: I ask your Lordship to certify that the particulars of objections were reasonable and proper. I dare say my friend and I can agree the certificate, if your Lordship would prefer it in that form.

Mr. Justice Joyce: If you agree, I will certify it.

Mr. Russel Clarke: We should have to agree.

Mr. Justice Joyce: Is there any question about it?

Mr. Russel Clarke: I do not think there is.

Mr. Gray: There were some things which were not referred to, and, of course, I cannot get my certificate as to those.

Mr. Russel Clarke: I do not suppose there will be any difficulty.

Mr. Justice Joyce: There will be liberty to mention it to me if you cannot agree.

Mr. Gray: I do not think it will be necessary.

Mr. Justice Joyce: Very well, then the action will be dismissed with costs.

We learn from the British Westinghouse Co. that they have lodged notice of appeal.

Holmes v. Associated Newspapers, Ltd.

Mr. Justice Neville this week was occupied in the Chancery Division with the hearing of a patent action—Holmes *v.* Associated Newspapers, Ltd.—by which the plaintiff claimed an injunction in respect of an alleged infringement of letters patent No. 9,802 of 1898, granted for an invention for a combination of electric motors for driving printing presses, &c.

The plaintiff was represented by Mr. Walter, K.C., and Mr. J. Hunter Grey; and Mr. Astbury, K.C., and Mr. Kerley appeared for the defendants.

Mr. Walter explained that the action was brought in respect of the motors of an electrically-driven printing press exhibited by the defendants at the White City and supplied to them by Kohler Bros., of U.S.A. and England, who, it was understood, took all responsibility in the matter. Having explained the methods of modern printing, the speed at which modern presses worked, the great length of paper used, and the consequent necessity for smooth working, counsel said the patent in question was for a system of coupling up electrically-driven motors for the purpose of driving printing machinery, by which method the full power of the motor could be applied without shock, with the advantage that the armature shaft of the main motor was in motion before it was called upon to exercise its full driving power—that was to say, that at the same time that a small motor was doing its work, an overlapping took place, and the current began to come on the large motor. While the small motor was running doing its work, the current was turned on to the large motor, causing the latter to speed up until it overlapped the small motor, and eventually took up the load. By this arrangement a gradual movement was obtained, and the small motor was in action until up to the time when the full power came on. The result was that there was no jerk. The attempt to produce a slow movement by driving from a single large motor when coupled with a printing machine resulted in danger not only to the printing but also to the motor, due to overheating. In order to start a large motor, as his Lordship might understand, there was an enormous amount of power necessary to overcome the inertia of the printing press. The full current went through the machine, and if the whole of the energy was turned on at once, part was turned into heat and was apt to melt the insulation and destroy the armature. It was in order to provide against those difficulties that the patent in question was directed. To carry this principle into effect they provided a direct and simple connection between the main shaft of the driving motor and the spindle of the printing press and then between the two motors. Then by means of a reversing gear the auxiliary motor could be left at rest when the big motor gathered speed and took the load. That was the invention which the plaintiff claimed was both novel and useful. A number of specifications had been put in which were relied upon as anticipations, but none of them seemed to have accomplished what the plaintiffs had done by the same means, and he (counsel) would deal with them when he had heard what his friends on the other side had to say about them. As he understood Mr. Astbury accepted his explanation of the working of the invention, he would be able to deal with his witnesses quite shortly.

Mr. Dugald Clerk, called in support of the plaintiff's case, in answer to Mr. Walter, said that he had had considerable experience of electrical contrivances and machinery. He had read the specification of the invention in question, and it dealt with the difficulties of working modern printing presses electrically.

Mr. Walter: What are those difficulties?

Witness said that modern printing presses carried paper in very large rolls, and the paper was usually of a very tender nature. A very little jerk would break the paper, and it was consequently very important that every press should be started very gently, and it was also necessary as well as starting the press gently, that full power should be obtained almost immediately after the paper had been adjusted before the press was started. Those essentials were given by the plaintiffs' combination. The arrangements in the specification were such that all the operations must follow in a mechanical sequence, and therefore you got a smooth starting. The main motor spindle ran faster than the press spindle, and therefore there was leverage. With a small motor the leverage the small motor had on the large motor was much less than the leverage of the large motor on the press. Having a mechanical series there was very little leverage, and the result was that you got a smooth starting. The tendency was to start the motor smoothly and with very little jerking. He had looked at all the papers connected with the case very carefully, and he found all the essentials of the plaintiff's specification in the defendants' machine. He did not find the plaintiff's invention described in any of the prior specifications relied upon as anticipations.

Cross-examined by Mr. Astbury, Witness said that when using only one motor the difficulty at starting was the keeping up of the slow speed, so as to get gradually up to the high speed. Much greater power was required to start the machine after it had been at rest than was required to keep it going once it was in motion. It followed, therefore, that when using one motor, if the energy was sufficient to enable the machine to start, it would take up its power much too quickly in order to enable it to do the preliminary operations. It would produce a check, and a check that would tend to tear the paper. In some respects the action of the plaintiffs' and defendants' machines was different. The sequence of action was not always the same.

Evidence was given by Mr. Madge, of the *People*, and other gentlemen connected with newspapers, who spoke to the utility of the plaintiff's invention and the impossibility of using electric motors for printing machines before, and the hearing was adjourned.

On Wednesday Mr. Walter, K.C., summed up the case for the plaintiff. Without opening the case for the defence, Mr. Astbury, K.C., proceeded to call his evidence, and Mr. Henry Hopwood, of the Patent Office, gave formal evidence as to the production of certain documents of 1898 that had been produced and were relied upon by the defence. The hearing was again adjourned.

Northern Electrical and Ventilating Co., Ltd., v. D. Yates Gregory.

Before Mr. W. F. K. Taylor, K.C., presiding judge, at the Liverpool Court of Passage, on October 18th, plaintiffs claimed from defendant, who was a theatrical manager of Douglas, I.O.M., the recovery of £51 12s., the price of a dynamo supplied by them.

Plaintiffs' case was that in May they delivered to Gregory a dynamo complete with all accessories, without a warranty, which he required for the purpose of a bioscope entertainment at Douglas. The charge made by plaintiffs was £51 12s., which Gregory now refused to pay. The company declared that the dynamo was used in the Isle of Man all the season without complaint, and that it was one such as defendant required. Defendant, however, offered to pay £25 for the dynamo, which was refused. On the writ being issued, a counterclaim was put in for the price of an electric lighting engine, which plaintiffs had supplied him, and which he declared was defective. Evidence was given in support of plaintiffs' case.

Defendant, in evidence, asserted that the dynamo was purchased by him with a warranty that it was a first-class electrical machine, and that it was competent to accomplish the work required of it. It was, however, not a first-class machine, and could not do the work, and he claimed that it was not worth more than £30, which had been paid into Court.

Mr. Kennedy (for plaintiffs) pointed out that no complaint had been made about the engine until the claim was put in in respect of the dynamo.

Mr Cuthbert Smith (for defendant) replied that his client had been away. He asked that a substantial amount should be taken off the sum of £68 15s. which had been paid for it, because the machine was older than it was represented to be, and had not given satisfaction.

His Lordship gave judgment for plaintiffs on the claim for £43 12s., and also found for them on the counterclaim, with costs.

Armorduct Manufacturing Co. *v.* The General Incandescent Co.

On Monday Mr. Justice Ridley and a special jury in the King's Bench Division had opened before them an action, in which the Armorduct Manufacturing Co., of London and Birmingham, sued the General Incandescent Co., of Great Eastern Street, E.C., for damages for alleged conversion by the defendants of certain goods belonging to plaintiffs.

Mr. Montagu Lush, K.C., said the plaintiffs, as well as the defendants, had depôts in different towns in the country. In 1904 a Mr. S. Haynes, who traded as "The Electrical Stores, S. Haynes, agent," was plaintiffs' agent, but there appeared to be a discrepancy between the goods in his stock and the money he had paid over, and it was found that he had also been acting as the defendants' agent. His agency with the plaintiffs was terminated, and afterwards he was appointed as manager of the defendants' depôts at Nottingham and Derby. The allegation of plaintiffs was that the defendants had received the £170 (which was the value of the goods plaintiffs' had missed), and that amount had been paid into their account by Haynes, acting as their agent. Defendants denied the allegations. Counsel added that judgment had been secured against Haynes for £160, but it had not been satisfied.

On defendants' behalf, Mr. Lewis Thomas, K.C., contended that there was no case to go to the jury.

His Lordship, however, said he thought there was. Haynes, acting quite rightly, told the defendants that he had sold certain of plaintiffs' goods, but acting in accordance with his agreement, he paid all the money he had received to his employers, the defendants, who should have paid plaintiffs their share. He thought it was plain that defendants kept the money, and the case was, in his opinion, undefended.

The hearing was resumed on Tuesday, when Mr. W. J. Moore, the managing director of the defendant company, gave evidence.

The jury returned a verdict in favour of the plaintiffs, and his Lordship entered judgment accordingly, ordering the payment to plaintiffs of £58 8s. and an inquiry for account as to the balance that might be due.

A stay of execution was granted.

TRADE NAMES AND TRADE DESCRIPTIONS.

By A BARRISTER-AT-LAW.

Every trader who relies on his good name and the good name of the article which he deals in to assist in the promotion of his business, is naturally solicitous with regard to the way in which the law will protect him. It is true he may become the proprietor of a registered trade mark; but it is not proposed, in the present article, to deal with the English law of trade marks—properly so called. What it is desired to show is that, according to the law of England, the fraudulent use of a trade mark or name will be made the subject of judicial control.

Apart altogether from the law of trade marks, the English Courts have and will exercise an inherent jurisdiction to prevent one trader adopting the title of another's goods with a fraudulent intent. Again, the law of England will restrain what is known as "passing off." Thus, suppose the steel made by a particular firm were to become known throughout England as "Elephant Steel"—so well known that anyone buying "Elephant Steel" would know, or assume, that it was the product of the firm in question. Suppose that, in these circumstances, another steel merchant were to stamp his bars with the words "Elephant Steel," the Courts would interfere to prevent his committing this fraud upon the public. This principle would be held to apply whether plaintiff or defendant was a foreigner trading in England. So it is apprehended that if an American firm of steel merchants had acquired what we may term a customary title to a certain name, their use of it would be protected. Again, if an English firm had acquired the right we have indicated, it would not be competent for the American firm to make infringing articles in America, and import them into England to deceive "His Majesty's subjects." Such a proceeding would be restrained and prevented, if the offenders could be got hold of.

The fact that the misuse of a name will be prevented was well illustrated in the case of Aerators, Ltd., *v.* Automatic Aerator Patents, Ltd., which was heard by Mr. Justice Farwell early in June, 1903. There the plaintiff company, who are the proprietors of the well-known "sparklets," sought to restrain the defendants from using the name "Automatic Aerator Patents, Ltd.," on the ground that it so nearly resembled the name of the plaintiff company as to be calculated to deceive. Sec. 20 of the Companies' Act provides that no company shall be registered under a name identical with that by which a subsisting company is already registered, or so nearly resembling the same as to be calculated to deceive, except in certain cases, which are not material to the present discussion. It follows from this that a company has greater rights than an individual in respect of names which are identical, for while John Smith cannot always prevent another John Smith using his own name, John Smith, Ltd., could prevent the registration of any other company as John Smith, Ltd. Mr. Justice Farwell, however, declined to grant an injunction, for the reason that, giving words their ordinary meaning, no one was likely to be deceived. Further, it was not competent for any company or person to claim the sole proprietorship of any word in common use. "For example," said his Lordship, "suppose a company had registered the name of 'Motors, Ltd.,' and another the name of 'Automobiles, Ltd.,' it appears to me impossible to say that they could thereby prevent all other companies from using as part of their titles these two words, which, so far as I know, are the only words which represent the fashionable locomotives of the day, although their sole trade was the manufacture or sale of motors or automobiles. . . . . . In considering whether a name is calculated to deceive, it is, as I have said, material to see what that name is; and if the name is simply a word in ordinary use, representing a machine or an article of commerce, the probability of deception is out of all proportion less than it would be in the case of an invented or fancy word, or even of the name of a place."

Even if a man uses his own name in connection with his business, with intent to defraud, the Courts will prevent him.

In Holloway *v.* Holloway, 13 Beav. 209, the defendant, Henry Holloway, commenced selling pills as H. Holloway's pills in boxes similar to those of the plaintiff, Thomas Holloway, with a view to passing off his pills as the plaintiff's. He was restrained by injunction. Again, where a man named Day having obtained the authority of one Martin to use his name, set up in business as Day & Martin, and sold blacking in bottles with labels similar to those of the well-known firm, he was restrained by injunction. These two cases illustrate the proposition that "fraud vitiates everything." In the absence of fraud, however, a man may use his own name in his own business, no matter what may be the consequences to his neighbours. The case of Turton *v.* Turton may be regarded as a leading authority in support of this proposition. The plaintiffs had for many years carried on the business of steel manufacturers in Sheffield under the style of "Thomas Turton and Sons." In 1886 they were registered as a company, and added the word "Limited" to the above title. The defendants were John Turton and his two sons. John Turton had commenced a business very similar to that of the plaintiffs in 1869, in partnership with one Lawton, under the style of "Turton and Lawton." In 1875 Lawton retired, when John Turton took his sons into partnership under the style of "John Turton & Sons." Owing to the confusion caused by the similarity of names, the plaintiffs sought an injunction to restrain the defendants from carrying on the business of steel merchants and manufacturers under this name, or any name so closely resembling their own as to be calculated to deceive. Much evidence was called as to the confusion which had arisen in Sheffield, but the defendant deposed that the new name of his firm had been adopted for the sole purpose of making known the fact that his two sons had become partners. When the case reached the Court of Appeal, their lordships refused to grant an injunction. The late Lord Esher said:—

"It is not alleged, and it certainly is not proved, that the defendant did anything in the way of his trade which tended to give any other meaning to the name in which he carried on his business, or which could give any other meaning to it, than the mere fact that he did carry on his business, and was in partnership with his sons. The plaintiffs have no right to say a man may not use his own name. Upon principle I should say it is perfectly clear that if all a man does is to carry on the same business, and to state how he is carrying it on, that statement being the simple truth, and he does nothing more with regard to the respective names, he is doing no wrong, and there is no *prima facie* case against him."

The law on this subject may be thus summarised:—

1. A man will not be restrained from simply carrying on business in his own name, even though confusion may arise.

2. A man will be restrained from carrying on business in his own name dishonestly, *i.e.*, when he not only uses his own name, but uses it in such a way (that is, in conjunction with other circumstances) as to represent that his business or his goods are the business or goods of another trader.

3. If a trader has a trade name for his goods which denotes those goods solely in the market, and distinguishes his goods from similar goods of other traders, so that the trade and the public, when asking for goods under that name, mean and intend to get particular goods emanating from one particular trade source (although they may not know such trader's name), then he is entitled to be protected by the Court against other traders using that name in such a way as to be calculated to pass off other goods as his.

The doctrine of "passing off" may also be illustrated by reference to numerous decisions. In one case, it was held that there was no monopoly in the use of the word "magnolia" as applied to metal, as it had become well known in the trade as a substance peculiarly adapted for bearings in machinery. Where, however, a brewer had manufactured ale at Stone for a number of years, so that his ale came to be known as "Stone ale," an injunction was granted to restrain the defendant, who had only recently come to the town, from selling ale under the appellation of "Stone ale," or "Montgomery Stone ale." (Montgomery *v.* Thompson (1891), A.C., 217.)

As a trade name is really acquired through the laches of the market, so, too, a trade name may be lost through the laches of the owner. If the owner of a trade name allows his rivals to use his trade name on their goods without objection it will cease to be his trade name. It will become, in legal phraseology, *publici juris*, *i.e.*, common property. What is the test whereby to ascertain whether that which was originally a trade name has become *publici juris*—*i.e.*, common property? It becomes so when it ceases to be distinctive—when it ceases to denote solely the original man's goods in the market. Of course, it ceases to denote his goods solely if it is habitually used on similar goods by other traders. But this state of things—habitual use by other traders—can only arise with the acquiescence, *i.e.*, by the sanction, of the original trader. If when he becomes aware that another or others are using his trade name he takes legal proceedings to stop that use, presumably he will succeed; if he does not, then he will be held to have acquiesced in what is being done, and will be precluded from interfering afterwards. If, therefore, a trader becomes aware that his rights to his trade name are being invaded, he must take steps promptly to assert and protect those rights, if he wishes to preserve them, and he must not content himself with a mere protest, or even with a threat of legal proceedings; but if the infringer sets him at defiance, he must follow up his threat with the proceedings he threatened.

In the generality of cases between trade rivals which come before the Courts the plaintiff says: "I complain that you have passed off your goods as mine, which they are not." In some cases, however, the plaintiff says: "You are passing off my goods as yours, which they are not." It seems that the Courts are inclined to prevent the latter form of piracy, just as much as they will prevent the former.

The case of Bullivant *v.* Wright, 1897, 13, T.L., R. 201, illustrates what kind of passing off will be restrained by the Courts. The plaintiffs were wire-rope manufacturers and contractors for aerial tramways and cableways. The defendants, who were also wire-rope manufacturers, published a trade catalogue, which contained (*inter alia*) two diagrams, or pictures, of aerial cableways which had been designed and erected some years before by the plaintiffs' predecessors in title. The plaintiffs alleged that the publication of these diagrams by the defendants in their catalogue was a representation that the same had been erected by the defendants. They claimed an injunction to restrain the further publication of the catalogue, and an order for the delivery up of all the catalogues in existence. As a matter of fact, what the defendants had done was to supply new wire cables as they were required during several years. Mr. Justice Kekewich, in the course of his judgment, said: "No reasonable man, seeing these pictures in a book of this kind, would have any doubts that the defendants intended it to be understood that they had erected the tramway. It is as distinct a representation to that effect as if it had been expressed in plain language. . . . If it is proved to the satisfaction of the Court in a case of this kind that the defendants did in truth say that the plaintiffs' goods were theirs, I think that, as between rivals in trade, the Court would be justified in drawing the inference that the wide circulation of such a statement would necessarily damage the plaintiffs quite as much as in the ordinary case of the passing off of goods." These observations seem to show that if the plaintiffs had been able to show that they had themselves erected the cableway, they would have had judgment; but the case was decided against them on another point. We may draw the following conclusion:—That if Jones sells or advertises boots and shoes manufactured by himself in such a way as to make the public believe they are Brown's, and so obtain the benefit of Brown's good name, he may be restrained by injunction.

In a Scotch case, Parozone Co., Ltd., *v.* Johnson Gibson (1904, 21 R.P.C. 317), the plaintiff company invented and applied the name "Parozone" to a bleaching fluid made by them, and it was admitted that they were entitled to the exclusive use of that name as indicating fluid manufactured by them only. Gibson, another trader, also made a bleaching fluid, but said that he never sold it as "Parozone," and when asked for that substance explained that his fluid was not "Parozone." The plaintiff company proved that on five occasions to two persons Gibson, or his servants, sold his fluid in answer to a request for "Parozone," and without explanation. They further proved that Gibson pointed out to two former shop-girls the jar where he kept "Parozone," and that it was a matter of daily occurrence for Gibson's fluid to be sold to customers who asked for "Parozone" without explanation. Gibson proved that on some occasions he had explained that his bleach was not "Parozone." It was held on these facts that the plaintiff company were entitled to the injunction.

It is next necessary to deal with the provisions of the Merchandise Marks Acts, which prevent a trader from passing off his goods as those of another trader, and make him criminally liable. The first section of the Merchandise Marks Act, 1887, makes it an offence, among other things: (1) to forge a trade mark; (2) to falsely apply to goods any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive; (3) to apply any false trade description to goods; and (4) to cause any of these things to be done. But it is not to be an offence if the person charged proves that he "acted without intent to defraud." Trade mark in this and the provision next referred to means a trade mark registered at the Patent Office, but it also includes certain foreign and Colonial trade marks, for which the Act itself must be consulted. Sec. 2 (2) makes it an offence to sell or expose for sale, or possess for the purposes of sale or any other trade purpose, any goods or things to which a false trade mark or a false trade description is applied, or to which any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive is falsely applied. But it is not to be an offence if the person charged proves—"(*a*) that, having taken all reasonable precautions against committing an offence against this Act, he had, at the time of the commission of the alleged offence, no reason to suspect the genuineness of the trade mark, mark, or trade description; and (*b*) that, on demand made by or on behalf of the prosecutor, he gave all the information in his power with respect to the persons from whom he obtained such goods or things; *or* (*c*) that otherwise he had acted innocently."

Forging a trade mark is defined by the Act as follows: "A person shall be deemed to forge a trade mark who either—(*a*) without the assent of the proprietor of the trade mark makes that trade mark, or a mark so nearly resembling that trade mark as to be calculated to deceive; or (*b*) falsifies any genuine trade mark, whether by alteration, addition, effacement or otherwise; and any trade mark or mark so made or falsified is in this Act referred to as a forged trade mark. Provided that in any prosecution for forging a trade mark, the burden of proving the assent of the proprietor shall lie on the defendant."

Applying a trade mark or mark or trade description to goods is defined by the Act: "(1) A person shall be deemed to apply a trade mark or mark or trade description to goods who (*a*) applies it to the goods themselves; or (*b*) applies it to any covering, label, reel or other thing in or with which the goods are sold or exposed, or had in possession for any purpose of sale, trade or manufacture; or (*c*) places, encloses, or annexes any goods which are sold or exposed, or had in possession for any purpose of sale, trade or manufacture, in, with, or to any covering, label, reel, or other thing to which a trade mark or trade description has been applied; or (*d*) uses a trade mark or mark or trade description in any manner calculated to lead to the belief that the goods in connection with which it is used are designated or described by that trade mark, hall mark or trade description; (2) The expression 'covering' includes any stopper, cask, bottle, vessel, box, cover, capsule, case, frame or wrapper, and the expression 'label' includes any band or ticket. A trade mark or mark or trade description shall be deemed to be applied whether it is woven, impressed, or otherwise worked into, or annexed, or affixed to the goods, or to any covering, label, reel, or other thing; (3) A person shall be deemed to falsely apply to goods a trade mark or mark who without the assent of the proprietor of a trade mark applies such trade mark, or a mark so nearly resembling it as to be calculated to deceive; but in any prosecution for falsely applying a trade mark or mark to goods, the burden of proving the assent of the proprietor shall lie on the defendant."

A trade description is defined by Sec. 3 of the Act as any description, statement, or other indication direct, or indirect, as to certain things not material for the present purpose. A false trade description is defined by the same section, as follows:—"The expression 'false trade description' means a trade description which is false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description, whether by way of addition, effacement, or otherwise, where that alteration makes the description false in a material respect; and the fact that a trade description is a trade mark, or part of a trade mark, shall not prevent such trade description being a false trade description within the meaning of this Act. The expression 'goods' means anything which is the subject of trade, manufacture or merchandise. The expressions 'person,' 'manufacturer, dealer or trader,' and 'proprietor,' include any body of persons corporate or unincorporate. The expression 'name,' includes any abbreviation of a name." The description must be false "in a material respect" —which means that it must be materially or substantially false, and not necessarily wholly false; and it may be remarked that the section does not extend to mere verbal descriptions.

The first offence described consists in doing something illegal to goods; the second consists in dealing with goods to which something illegal has been previously done. The first is aimed mainly at manufacturers, the second at sellers, wholesale or retail, not being themselves the manufacturers of the fraudulent goods.

As to the first offence, it is not to be held to be committed when the person charged proves (the burden of proof is, of course, on him) that he "acted without intent to defraud." This does not mean intent to defraud any particular purchaser or other individual, but intent to defraud generally by passing off an article as different to that which it really is. It does not cover what are mere cases of inaccuracy of description.

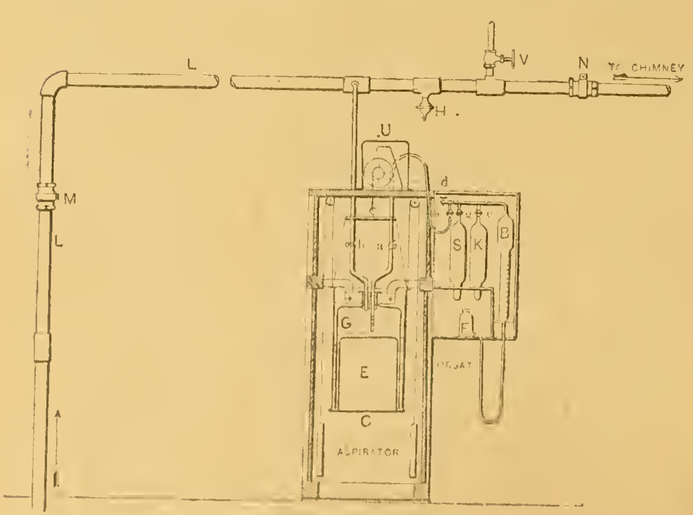
The following case is a convenient illustration of the way in which this Act is interpreted by the English Courts. It has been laid down that where trade usage confines a generic name to one *species* of the *genus*, it may be a false trade description to apply the name to another *species*. The defendant sold a mixture composed of sulphate of soda and nearly 50 per cent. of crystallised sulphate of soda under the description "soda crystals." Both crystallised carbonate of soda and crystallised sulphate of soda could accurately be called "soda crystals" chemically; but it was proved that in the trade the term "soda crystals" was not applied to crystallised sulphate of soda at all, nor was it usually applied to crystallised carbonate of soda containing more than 2 per cent. of sulphate of soda. It was held, by a majority of the Court, that this was a false trade description. One judge, however, decided that the description "soda crystals," being a true description chemically, could not be a "false trade description within the Merchandise Marks Act, 1887."

A DESCRIPTION OF THE METHODS OF GAS-SAMPLING AND TESTING EMPLOYED BY THE HAMBURG SMOKE ABATEMENT SOCIETY.

By JOHN B. C. KERSHAW.

The engineers of the Hamburg Vereins fur Fenerungsbetrieb und Rauchbekämpfung have adopted a special form of aspirator and testing apparatus for the control of boiler and furnace firing, in preference to the more generally employed automatic CO_2 recording apparatus, for the following reasons :—(1) Automatic recording apparatus is often complicated in construction and easily gets out of order; (2) the percentage of CO_2 alone is not sufficient to enable the engineer to judge of the completeness of the combustion, or of the absence of unburnt hydro-carbon gases and of carbon monoxide.

The sampling and testing apparatus in use at Hamburg has been thoroughly tested, and is now installed on nearly 400 of the boilers under the control of the Society, with most excellent results. The apparatus is shown in diagrammatic form in fig. 1. The sample of gas is drawn constantly (using natural or artificial draught) from the exit flues by means of the pipe L, and as it passes over the aspirator C, a small portion of the gas-flow is sucked down into this by the action of clockwork on the bell E. The aspirator above this bell is filled with water covered with a film of paraffin oil, and the rate at which the bell sinks and the gas is sucked into the space G above it, is controlled by a pendulum and simple clock-work arrangement at U, the speed of which can be varied to suit the length of the firing shift. At the end of 8 or 12 hours (*i.e.*, when the firemen change), the clockwork is stopped, and the average sample of gas stored in the space G is tested for carbon dioxide and for oxygen, by aid of the Orsat apparatus shown on the right-hand side of the aspirator, a rubber tube being employed to connect the aspirator and Orsat apparatus.



Arrangement of Apparatus.

Two tests of the average sample of gas are made, and the aspirator is then emptied by raising the bell E, and by opening the taps *a*, *c* and *d*.

By closing *a* and opening *b*, and by starting the pendulum of the clock again, the apparatus is set for taking the next average sample—no attention being required for 8 or 12 hours—according to the length of the firing shift.

The pipe L is kept free from soot and rust deposits by blowing steam or compressed air through it (at regular intervals) by means of the tap at V; and snap samples of the exit gas can be taken when desired without stopping the aspirator, by connecting the cock at H with the tap on the Orsat apparatus at *d* by means of a thick rubber tube.

The absorbing solutions used in the Orsat apparatus are caustic potash for the CO_2, and an alkaline solution of pyrogallic acid for the oxygen. These solutions require renewal every three or four weeks.

The percentage of unburned hydro-carbons and of carbon monoxide in the exit gases is calculated from the total percentage of carbon dioxide and oxygen, the total of these two constituents when perfect combustion has occurred, fluctuating between 19·0 per cent. and 19·5 per cent., according to the kind of coal used.

The following tables show the working of the method in practice, with the basis upon which the bonus for good work and fines for bad work are calculated :—

Date. 1907.	Time.	Shift.	Fireman.	Boiler No.	Average percent. CO_2.	Average per cent. CO_2 × O.
June 22...	6½ a.m. to 5½ p.m.	Day	Muller	1 and 2	11·3	19·4
June 22-23	6 p.m. to 6½ a.m.	Night	Lange	2	11·0	19·5

Bonus Table for Good Percentages of CO_2.

Fuel burnt, about 7,000 kg. in 12 hours at M. 16 per 1,000 kg.
Temperature of the exit gases, 290°—320° C.

Average percentage CO_2.	Fuel saved, in kg.	Value of fuel saved, in Mark.	Bonus addition to wages, in Mark.
8·0	—	—	—
8·5	165	2·60	·15
9·0	360	5·75	·30
9·5	490	7·85	·40
10·0	645	10·30	·50
10·5	740	11·85	·60
11·0	900	14·45	·70
11·5	1,005	16·20	·80
12·0	1,120	17·95	·90
13·0	1,260	20·20	1·00

Fines Table for Incomplete Combustion.

Average percentage of CO_2 and oxygen.	Fuel burnt unnecessarily in kg.	Value of fuel wasted, in Mark.	Fine, in Mark.
19·4	—	—	—
19·0	80	1·25	·10
18·7	225	3·10	·15
18·4	315	5·00	·25
18·1	460	7·35	·35
17·8	610	9·75	·50

Similar tables can be worked out for each boiler installation, taking into account the class of fuel and the amount used per shift.

With the aid of these tables the labour involved in calculating the bonus or fines for each stoker's work is reduced to a minimum, and the men are given a very real incentive to saving fuel and preventing waste.

Freight on Glass Shades for South Africa.—We learn from Mr. F. B. O. Hawes, the secretary, that the National Electrical Manufacturers' Association has obtained a concession from the South African Steamship Conference regarding the freight of electric light glass shades. Hitherto these have been rated in the first-class rate, while gas-lamp shades were carried at the second-class rate (a lower figure). The matter was taken up with the conference by this Association, and the South African lines in the conference have agreed that, in future, common glass shades for electric lights, packed in cases, shall be carried at the second-class rate.

THE LEA AUTOMATIC WATER RECORDER.

According to an article in *Power*, the Lea recorder should be a most useful instrument in the investigation of steam engine behaviour. We gave a brief description of the instrument in our issue of October 23rd, 1908.

As is known, this instrument measures the output of water from a steam engine condenser. The water is collected in a steady tank whence it flows into a notch tank and escapes over a V notch of 90°, 45°, 22½° or other equal division of 90°. The height over the apex of the notch is measured by a float in a tank connected to the notch tank by a pipe of suitable size, which serves to prevent rippling yet is big enough to give prompt levelling. The peculiar feature of the machine is that the movement of the float is transferred to the pen of the recorder by means of a spiral groove on a drum that is rotated by a toothed rack attached to the above float stem. The spiral groove has an increasing spiral pitch from zero, so as to give a pen motion on the formula $H^2 \sqrt{H}$, where H is the height of the water service above the apex of the V notch. Where H is measured in inches and F is the flow in cubic feet per minute, the amount of $F = 0{\cdot}305\ H^3 \sqrt{H}$. With such a spiral, therefore, the pen movement is proportional to the volume of water flowing, and practically to the weight of flow, since the float sinks deeper in warmer water and corrects automatically for temperature. The V notch has the valuable property that for all values of H the coefficient has the same value and it is proportionate to the angle. Its value 0·305 is for the notch angle of 90°. For small amounts of water the notch may be quite narrow and the flow will be similarly less, the coefficient for 9° being 0 0305, and so on.

If one of these instruments be watched at work, it will be found very promptly to respond to any change that may be made in the *régime* of the engine. Thus, if the hand regulated cut-off for the low-pressure valves be changed to a less economical point, the water consumption will increase, and the increase will begin to be recorded in a few seconds after the change of cut-off has been made. A few seconds are, of course, needed for the increased steam to appear as water flowing to the air pump. Very soon, steadiness of action is attained and the flow is recorded steadily at a higher figure. If such a change were made in an engine under ordinary test conditions, a whole day might be given over to the run. To try the effect of half a dozen points of L.P. cut-off would easily extend to a week's run. With a steady load such a series of tests could be made either in a series of steps of, say, 10 minutes' duration each, or by means of an index plate on the shifting wheel of the cut-off gear, it might be arranged that the wheel should be moved so many degrees every 10 seconds, so that the recorder would trace a steady curve from earliest to latest cut-off, and the height of the curve at each minute would coincide with the water consumption of the engine with the cut-off then in action. Similarly, a series of tests could be made for which only the pressure varied, or the temperature of superheat, or the amount of condensing water, or the use of steam in the reheater or jackets, or the load on the engine. What now amounts to elaborate and expensive tests would be rapidly made with an accuracy beyond what would be likely to attend a long test during which so many items might vary.

The recorder proves what has become recognised by engineers —that a steam engine is a very regular machine. Give it a set of standard conditions to work with and it will produce the same indicator card for hours. There is, therefore, no occasion for long tests. A boiler test has to be of some considerable duration, because it is impossible to make an accurate estimate of the fires at any time, and a long run is made in order to reduce to a minimum the relative importance of the terminal inexactitudes, and of the steady running figures. But this is quite absent in an engine test. There is no terminal uncertainty to be taken into consideration. The rate of steam consumption of an engine is always taken when the engine has attained a permanent condition of temperature, and that being attained the rate of steam consumption is simply read off the recorder diagram.

The experimental conditions are then varied a step, a few minutes allowed for the cylinder to change its mean temperature and readings taken every minute then until no change occurs. A whole curve of results can be plotted out in a few hours, and accurate estimates of the effect of varying conditions found. It is pointed out that the best and most rapid and accurate results can be obtained where each engine possesses its own condensing plant.

Condensers common to two or more engines can be suitably recorded, but a variation made upon one engine is liable to be more or less vitiated by any change in the other engines. And the change in the steam used by one engine will bear a more insignificant ratio to the total than where only one engine is dealt with.

Jet condenser engines can be similarly dealt with, but the records of steam used can only be calculated by the aid of temperatures in apportioning the total flow between the injection water and the working steam. There may be cases where the injection water can also be measured before use, as well as after, the difference then counting as steam condensed. The instrument seems to bring a step nearer the complete automatic measurement of everything about a station.

New Arc Lamp.—Messrs. Veritys, Ltd., inform us that they are placing on the market for this lighting season a new arc lamp of exceedingly simple construction. This lamp is listed for 3-4 amperes and 5 amperes; it burns for 60 hours, and is of their own make.

BUSINESS NOTES.

Consular Notes.—France.—The British Consul at Lyons reports that the products of the French metal industry find it increasingly difficult year by year to keep a footing in foreign markets—much more to find new outlets abroad, and those best qualified to judge urge the Lyons manufacturer to concentrate all his efforts upon the development of the home market, and the supplanting of the foreigner, more especially the German, who is leaving no stone unturned to capture the French trade. Lyons and its district are noted for the construction of steam engines of all kinds, petrol and gas engines, and small locomotives for narrow gauge railways, while the important locomotive works of the Paris-Lyons-Mediterranean Railway Co. at Oullins have a complete plant for repairing large railway engines. The output of the Lyons boiler-making industry, though hard pressed by foreign competition, also runs into large figures yearly. Rolling stock, metal girder work and cables are also flourishing branches of the trade. With regard to the last-mentioned industry—very important by reason of the enormous development of hydro-electricity within recent years—it seems to be only a matter of time before aluminium takes the place of copper for cables, thus finding a fresh use for its large output in the water-power works in the Alps. The copper and aluminium industry is very flourishing. The electro-metallurgical industry suffered throughout 1908 from the effects of the general crisis, the most serious symptom being a heavy fall in prices, particularly in the case of aluminium, where a decline of 50 per cent. in the market rates was registered. The official statistics for 1908 of the output of the chief products of the electric furnace (special iron alloys and aluminium) which had made great strides during the three previous years, are not yet available, but the export figures seem to indicate that production received a check (see below.) It is said, indeed, that the crisis in this industry was aggravated by over-production, especially of aluminium, during the period 1905-7, further contributing to the fall in prices.

Production and Exportation of Electro-Metallurgical Products During the Years, 1906-8.

	1906.	1907.	1908.
Special alloys of Iron—			
Production ...	13,700,000 kg.	15,700,000 kg.	—
Exportation ...	7,758,000 kg.	8,149,000 kg.	9,585,000 kg.
Aluminium—			
Production ...	3,396,000 kg.	4,686,000 kg.	—
Exportation ...	1,473,000 kg.	1,118,000 kg.	1,331,000 kg.

The most important branch of the electro-chemical industry consists in the manufacture of nitrates. Cynamide is now being regularly produced by works at Notre Dame de Briançon (Savoy), and important new works which the Nitrogene Co. is building will begin to turn out nitric acid and nitrate of lime in the course of the present year (1909).

The development of water-power grows apace in the valleys of the Dauphiné and Savoy, and every year sees fresh falls laid under contribution and harnessed in the service of industry, thereby adding many thousands to the already large total horse-power now developed by white coal in the mountainous districts of south-eastern France, and involving the erection of new works, either for the manufacture on the spot of various metallurgical and chemical products, or for the generation of electric power for transmission over many scores of miles for traction and industrial purposes generally. In the Grenoble district alone, seven new companies for exploiting the hydraulic forces of the Dauphiné Valley were formed in 1908 with an aggregate share capital of over 10,000,000 fr. (£400,000), of which six were for generating and distributing electrical energy for a variety of industrial purposes, including the lighting of the town of Grenoble, and the remaining one for driving paper mills at Voiron—the waters put into harness for these enterprises being those of the Drac, a tributary of the Isere, its affluents the Champa and Gresse, the Odole, a small affluent of the Romanche and the Lake of Aignebelette, in the Chambéry district. Though by no means the most important industrially of these new companies, the Lignes Electriques is perhaps, the most interesting, as showing the great distances over which electric power is now commonly sent by overhead wires; for the object of this enterprise is to construct a line for the transmission of power from the power station in the Grenoble Alps to Gier, in the Loire coal basin, with eventual extension into Central France.

As an outcome of the isolation of Paris from the rest of France during the post office strike in the spring of the present year, experimental wireless telegraph stations were temporarily established on the heights commanding Lyons and Grenoble, thus connecting those military centres with each other and with the Eiffel Tower station in Paris. The Consul understands that similar installations have been made at Toulon.

Catalogues and Lists.—The General Electric Co., Ltd., 71, Queen Victoria Street, London, E.C.—New list (No. F1,350) of 24 pages, relating to an interesting variety of electric advertising signs, also a number of shop lighting fittings, including lanterns and reflectors. The Osram lamp has led to the addition of quite a new department to the shop-fittings branch, and some very effective designs are introduced to meet the demand occasioned by the prevailing popularity of Osram lighting fittings among shopkeepers. Reflector fittings for direct and in verted lighting, cluster lights, automatic time switches, electric flashers for signs and advertising devices, "Striplite," also the "Pixielite" strip for decorations and temporary lighting, are well shown. Those who are interested in this increasingly important department of electricity supply business should write to the company for a copy of this "Signs of the Times" list.

MESSRS. THOMAS L. SCOTT & CO., LTD., 28, Martin's Lane, Cannon Street, E.C.—Leaflet briefly describing Scott's patent flexible trolley wire suspension.

THE CRYPTO ELECTRICAL CO, 155 and 157, Bermondsey Street, London, S.E.—Leaflet illustrating, describing and giving prices of their single, two and three-phase A C. motors of ½ to 20 H P., which, owing to extension of their works, they have been able to put through in larger quantities and at reduced prices.

THE PATENT FILE AND TOOL CO, LTD., 8, White Street, Moorfields, E.C.—Leaflet describing their "Dreadnought" milling file; a second pamphlet details their "Smooth on" compound, cement and other specialities.

THE REASON MANUFACTURING CO., LTD., Brighton.—Eight-page pamphlet containing a detailed description, with clear interior views of the mechanism, of their hand-wound time switches.

MESSRS. PARMITER, HOPE & SUGDEN, Hulme Electrical Works, Ellesmere Street, Hulme, Manchester.—Eight-page "Progress Sheet" (No. 4), in which are described the "Ajax" 1910 pattern K-type ironclad switches, Lyon ironclad switch and fuse, Hope's "N" type fuse, new "M" pattern ironclad fuseboards, "Ajax" ironclad power boards and motor panels. Prices are tabulated.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 224 (12 pages) containing a full description, illustrated and set out in the B.T.-H. well-known standard form, of the firm's enclosed oil switches. Dimensional drawings and diagrams, also tabulated prices, are given. The switches are specially designed to provide a totally-enclosed oil switch which can be fitted with any of the usual automatic accessories, and which can be operated with perfect safety by unskilled workmen. They are claimed to be capable of meeting the most severe requirements on systems up to 3,000 volts.

THE KUL BEARING CO., 1, Mill Lane, Blackburn.—Leaflet and sample tin of Kul, a greyish powder which, it is claimed, when poured into the usual lubricating devices of a bearing that is running hot, will prevent any stoppage due to hot bearings and ensure continuous running until time allows of their overhaul.

THE NATIONAL ELECTRIC SIGNS CO, LTD, 112, Bath Street, Glasgow.—Brochure describing the Universal electric sign, which exhibits phases containing over 40 illuminated letters or numerals, and conveying any announcement within its scope; a continual succession of such announcements is automatically shown, thus adding endless variety to the other excellencies of the electric sign as an advertising medium.

MESSRS. GEO. M'CARTNEY & CO., Burnside Works, Cumnock, N.B.—Postal card drawing attention to switchgear manufactures, of which they make a speciality.

THE ABBEY ELECTRIC CO., 17, Victoria Street, London S.W.—Four-page list giving illustrations (interior and exterior) together with full particulars of prices of their improved pattern "Abbey" flame arc lamp. The firm have appointed Mr. J. W. Beswick, Temple Chambers, 33, Brazennose Street, Manchester, as their representative in Manchester and district.

THE AMERICAN METAL HOSE CO., 173, Lafayette Street, New York City.—Price leaflet of flexible arms for portable electric lamps.

MR. G. BRAULIK 8, Lambeth Hill, E C.—Small leaflet relating to his "Eclipse" metallic-filament lamps stating their good points and prices.

Mawdsley's Contracts.—The following is a list of contracts that MESSRS. MAWDSLEY'S, LTD., of Dursley, either have now in hand, or have recently completed:—

Nine motors aggregating 510 H P., for equipment of granite quarry.

Fourteen motors aggregating 480 H.P., for new rubber factory in Manchester.

Booster sets, for Agent-General for the Cape, and for the Crown Agents for the Colonies.

Variable speed motor for coupling to Reavell compressor.

Dynamos and boosters, for new generating stations at Tewkesbury and Chippenham.

Hydro-electric installation, comprising turbine dynamo and motors, for sugar factory in Mauritius; and in addition a large number of lift and other motors.

Employment Register.—Some time ago an Employment Register was instituted by the Society of Engineers for the use of professional engineers seeking employment. The principal features of the register are as follows:—

1. No fees of any kind are charged, the cost of management being defrayed by the Society.

2. Qualified engineers of all grades may have their names recorded, though in making a selection from a number of equally suitable men preference is naturally given to members of the Society, for whom the register was originally instituted.

3. Only a few names of probably suitable candidates are put forward for each vacancy, so as to facilitate the employer's choice as much as possible.

4. Every effort is made to get personal knowledge of candidates, together with full details of their qualifications, before sending in their names.

We are informed that a number of well-qualified men, representing the various branches of engineering work, are now available, and it is thought that if the register were better known it would be widely used and appreciated by all who require draughtsmen, inspectors, and other classes of assistants. Employers are invited to send inquiries by telephone or in writing to the secretary, Mr. A. S. E. Ackermann, 17, Victoria Street, S.W., stating their requirements as regards age, qualifications, salary, &c.

Venner Time Switches.—Among recent orders booked by MESSRS. VENNER & CO. are the following: 100 time switches for Bedford, and 48 for Cork, both of these following on several previous orders; also an order from the North Metropolitan Electric Supply Co. for time switches for controlling the street lighting at Hertford.

Trade Announcements.—MR. H. C. BARLOW has resigned his position as representative of the Electrical Co., Ltd., Manchester Branch, and commenced business as H. C. Barlow and Co., at 52, Chapel Street, Salford, Manchester, where he will make a speciality of switchgear, electrical accessories, metallic-filament and carbon lamps, cables and flexibles, flame arc lamps, &c.

MESSRS MAWDSLEY'S LTD, of Dursley, have appointed Mr. S. Mansel Jones, of Western Mail Chambers, Cardiff, and Wind Street, Swansea, as their sole agent in South Wales for the sale of Mawdsley Zone patent dynamos and motors.

For Sale.—On November 3rd and 4th MESSRS. B. NORMAN & SON will offer for sale by auction, at 73, Golden Lane, E.C., a variety of plant and fittings, including electric motors, apparatus, telephone and electric light fittings, in *re* D. Bernstein and Co. (deed of assignment). Particulars appear in an advertisement to-day.

Book Notices.—*Drawings for medium-sized Repetition Work.* By R. D. Spinney, A.M.I.M.E. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.—The large amount of repetition work which now obtains in manufacturing engineering is due to a general recognition of the advantages of standardisation. Motor-car work, with which the author deals exclusively, has instanced this perhaps more strikingly than any other industry. It is now fully recognised that not only is it cheaper to produce details in large quantities because of the reduction in the "share" cost of specials tools, jigs, &c., but also that standardisation assists manufacture for stock and considerably reduces the idle periods of all machine tools. The responsibility of the draughtsman has consequently been increased, for the slightest waste on a poorly-designed detail may represent a considerable financial loss when multiplied by the number of such details produced. The author in this small volume deals with the drawings for repetition work, the word "drawings," as the author defines it, covering the visible result of the draughtman's labours, and including the fullest necessary instructions for the buying and making of the component parts of machines. He takes the one reasonable view of the drawing—that it is only justified as it contributes to the efficient manufacture of machines, and is not something to be coloured and indexed *ad infinitum.* The first three chapters are devoted to "system." The method of preparing shop drawings and lists is treated in detail. The fourth chapter, headed "Tolerances," deals with the methods of measurement in workshops, the necessary difference of size for various classes of "fit" and the allowable variations from nominal dimensions. The method of marking dimensions on drawings must ensure that time is not wasted in obtaining unnecessary accuracy, and also that the tolerances do not add up producing trouble in assembling. A very suggestive chapter on designing is perhaps one of the best, and the author gives several examples showing how the amount of work on a detail can be reduced by a little forethought. A short chapter on office routine brings the work to a close. The book is well produced, and worth the money expended by the draughtsman who wishes to understand his work.

British Standard Specification for Keys and Keyways. (Report No. 46). London: Crosby Lockwood. Price 2s. 6d. net.—The report is divided into two sections, the first being a specification for the steel bars from which the keys are to be cut, and the second dealing with the proportions of keys and keyways recommended. The specification requires a minimum tensile breaking strength of 36 tons per sq. in., with an elongation of 12 per cent. on the test piece specified. A list of standard sizes is given, and the margins of manufacture to be allowed on merchant bar are defined. With regard to the second section of the report, the information which the Committee obtained from engine builders and others has been supplemented by the results of their own experimental work, and the standard sections for sunk keys given are based on data obtained from these two sources. At present only sunk keys (taper and parallel) are dealt with. Recommendations as to tolerances on the finished key and keyway are included. The experimental work was done by Mr. P. A. Ransom.

The Patent Road to Fortune. By a Successful Traveller on it. Hull: Burtt Brothers. Price 3d. net.—Many have said, as the outcome of bitter experience, that the "Patent Road" leads to the workhouse; this little book, while it does not profess to teach invention, tells how to patent an invention, how to set about working or selling it, and a vast number of other matters of interest to those who wish to get rich by this pathway. It is clearly and pleasantly written, and covers in brief the whole field of patent law and procedure; apart from the title, it does not paint too rosy a picture. It includes sections on trade marks and copyright.

University of London, University College, Calendar, 1909-10. London: Taylor & Francis, 1909.—This bulky volume of some 680 pages testifies, by its bulk alone, to the rapidly-growing importance and activity of the reconstituted University of London. The Calendar, of course, deals with University College in particular, but this being the original foundation, and the principal constituent of the University, may be regarded as the body, with the associated teaching institutions as members. Full details are given in the Calendar of all the departments and staff, the various curricula, examination papers (occupying 200 pages), lists of graduates and students of the College, scholarship regulations, &c. Dr. J. A. Fleming is Pender Professor of Electrical Engineering, with Prof. W. C. Clinton as assistant; Mr. H. M. Hobart is Lecturer on Electrical Design, and Mr. G. B. Dyke demonstrator. We have previously drawn attention also to the post-graduate courses in engineering, which will be conducted by specialists of the highest standing. Courses on Railway Engineering and Surveying have already commenced, and Mr. Hobart's course on Electrical Design begins on the 27th inst.

"Differential and Integral Calculus." By A. E. H. Love. London: Cambridge University Press. 1909. Price 5s.

"Cape Colony To-Day." Second edition. Issued by the Cape Government Railway Department.

"Prospectus of the Royal College of Art, London." Wyman and Sons. Price 3d.

A new monthly review dealing with municipal government matters is to appear shortly, under the title *The Local Government Review*.

"Voltage Ratio in Synchronous Converters," and "Electromotive-Force Wave-Shape in Alternators," by Comfort A. Adams; and "Pole-face Losses," by C. A. Adams, A. C. Lanier, C. C. Pope and C. O. Schooley. Reprints from the *Proceedings* of the American Institute of Electrical Engineers.

Bankruptcy Proceedings.—H. P. Allison.—An application for an order of discharge was made on Wednesday last week, to Mr. Registrar Giffard, at the London Bankruptcy Court, on behalf of Harry Pigott Allison, who traded in partnership with Joseph Grace Smith Cunnington, at 7, Great Newport Street, St. Martin's Lane, W.C., under the style of Laing, Wharton and Cunnington. Mr. E. Leadam Hough, Senior Official Receiver, reported that the firm failed last May with provable debts £6,923, and assets which had realised, or were likely to realise, £2,495. The offences reported by the Official Receiver were: (1) insufficiency of assets to pay 10s. in the £ to the creditors; and (2) trading with knowledge of insolvency. Mr. Hansell appeared in support of the application, and asked for the discharge to be granted, subject to his client consenting to judgment of £200. He submitted that it was a very unfortunate case for the applicant, who for some years was engaged as chief electrical engineer to a firm in India. Owing to ill-health, he had to throw up that engagement, and return to England. He entered into partnership with Mr. Cunnington, and they were persuaded to buy the business of the Improved Electric Supplies, Ltd., which proved to be a bad bargain, and brought about their failure. His Honour agreed with the learned counsel's view of the case, and granted an order in the terms suggested.

Eric Eaton, electrical engineer, Alexandra Road, Ashton-under-Lyne.—A receiving order was made on October 14th on debtor's own petition.

Dissolutions and Liquidations.—The X Electric Accumulator Co., Ltd.—A meeting of creditors has been called for October 27th to consider a proposal for finally winding up, as there is no hope of ever realising anything. It is now nearly 12 months since the company went into voluntary liquidation, and the sole asset which remained was an interest of 10 per cent. on the net profits of the X Syndicate, Ltd., a company formed for the purpose of purchasing from the debenture-holder's Receiver the entire property of this company. The X Syndicate, however, has been similarly unsuccessful, and some weeks ago the debenture-holder took possession, and the plant and machinery were sold by auction. Since then an application has been made to the Court for a compulsory winding-up order. Under these circumstances, after consultation with some of the large creditors, a meeting had been called as above.

La Capital (Extensions) Tramways Co., Ltd.—This company is winding up voluntarily, with Messrs. E. A. Lazarus and F. Thursby as liquidators.

Improved Electric Glow Lamp Co., Ltd.—A meeting is to be held at Salisbury House, E.C., on November 22nd, to hear an account of the winding up from the liquidator, Mr. F. F. Fuller.

Cutler, Wardle & Co., Ltd., electrical engineers, Manchester.—Mr. A. G. Mellors, in reporting upon the now completed realisation of this estate, regrets that no surplus is available for the unsecured creditors; indeed, there is not sufficient to pay off the debentures. The summary shows receipts amounting to £1,439 from the sale of stock-in-trade, machinery, patent rights and factory, also collection of book debts. After settling business expenses, preferential creditors for rents, receiver's remuneration, payment of first debenture and interest (£518), and a first and final dividend of 14s. 2d. in the £ on further debenture claim and interest (£378), there is a balance remaining of only £1 17s. 1d.

The Lighting of Blackpool Aviation Grounds.—The British Westinghouse Co. are lighting the Aviation Grounds at Blackpool with 36 of their "Arcturus" flame arc lamps. These have outdoor choking coils for running the lamps four in series on a 200-volt 83-period circuit.

LIGHTING and POWER NOTES.

Amble.—The local Council, which is considering the desirability of adopting electricity as a mode of lighting, has appointed Mr. Cecile A. Esmarch, M.I.M.E., of Newcastle, to advise the Council on a lighting scheme for the town and to report.

Aspull.—The U.D.C. has sealed the transfer of the prov. order to the Lancashire Electric Power Co., who will pay £308 as consideration.

Blackpool.—The returns from the electricity department for September show a decrease on the total works output, as compared with the corresponding period last year, by 11,303 units; private lighting showed a decrease of 11,002. For the half-year ended September the output has decreased in private lighting by 24,604; public lighting increase, 6,289.

Bahamas.—Electric light has just been installed by the Bahamas Government at Nassau, the total estimated cost being £15,500 for a system of direct current and large cables. The generators are driven by suction gas engines. It will probably be necessary to expend another £1,000 on a storage battery to provide for a day supply for industrial purposes and for an all-night service.

Barnes.—Application is to be made to the Local Government Board to sanction a loan of £4,100 for mains and £3,000 for house services. The electrical engineer reported at the last meeting of the Council that extensions of mains estimated to cost £500 would be required to supply a number of houses. The engineer mentioned that it was now the exception in the district for a builder to put in gas pipes for lighting. To enable local wiring contractors to advertise electric heating and cooking apparatus they are to be charged in future at the flat rate of 1½d. per unit, provided their displays of fittings are satisfactory.

Bootle.—The T.C. has decided to extend the mains at a cost of £1,070 to supply the works of Messrs. Williams, Harvey and Co., Ltd., and other consumers in the neighbourhood.

Braunton (Devon).—The P.C. has definitely decided to support the electric light scheme submitted by Messrs. Crompton and Co., Ltd. The company offer to take about £400 of the necessary capital (£3,500) to be raised, and for public lighting energy will be supplied at 8s. per annum per 50 c.p. lamp.

Brighton.—The Aldrington electric lighting, upon which some £9,000 has been spent, resulted in a loss of £452.

Canada.—The Aylmer (Ont.) municipal electric light works was completely wrecked by a boiler explosion, and an engineer was killed, last week. An adjacent factory and buildings were destroyed by fire, and many buildings were damaged. The damage is estimated at £40,000.

Chadderton.—The U.D.C. has consented to the application of Oldham T.C. to supply electricity to consumers in the Chadderton district.

Continental Notes.—France.—La Société de Distribution d'Energie Electrique du Rhone is the name of a new company which has just been formed in Lyons, with a capital of £60,000.

Belgium.—The Compagnie Continentale du Gaz is establishing a large new central electric lighting station at Droogenbosch; the contract for the generating plant for the same, as well as for the mains, has been placed with the Société Union Electrique A.E.G., of Brussels. The contract comprises a 2,000-h.p. steam turbine and alternator, and a similar set of 1,000 h.p.

Italy.—According to the *Gas World*, Messina, after having been in darkness for many months since the earthquake there, has had a service of electric lighting restored, "which is said to show up the rows of wooden houses very well."

Dundee.—The competition between the electricity and gas departments came in for criticism at a meeting of the T.C. For the better lighting of Lochee the sub-Committee accepted a tender by the electrical engineer of 16 flame-arc lamps of 54,000 c.p. at an annual cost of £144, against a tender by the gas manager to supply 31 lamps of 11,000 c.p. at an annual cost of £156. Replying to criticism, Mr. Richardson, the electrical engineer, said he was driven to competition; if ever he got anything he had to fight hard for it against gas. The recommendation in favour of electricity was adopted.

Evesham.—The T.C. has deferred full consideration of the proposed application for a prov. order for E.L. by the Stratford-on-Avon Electricity Co., Ltd., pending the receipt of more definite information as to the wishes of the ratepayers.

Fife.—The electric power station at the Rosyth naval base is being pushed forward, but pending its completion it has been decided to put down a temporary plant; 16 electric cranes, supplied by a Leeds firm at a cost of £10,000, will soon be at work.

Glasgow.—The T.C. is making strenuous efforts to eradicate the smoke nuisance in Glasgow, and firms are asked in their own interests to introduce the latest stoking appliances. This week it was reported that the North British Locomotive Co. had recently installed 20 motors (with an average of 35 h.p. each), obtaining power from the Corporation Electricity Department.

Hull.—A stand is being made by users of electricity for lighting purposes for the same discount which is granted users of current for power. The Hull Chamber of Trades has forwarded a pointed communication to the Electric Light Committee, urging this point. Mr. Bell, the electrical engineer, stated in reply to questions, that the reason why discounts were allowed off motive power accounts and not off lighting accounts, was that the latter are rendered quarterly, while motive power accounts are rendered monthly. It would not be feasible to render lighting accounts monthly. Councillor Costello urged that users of light to the value of over £20 per annum should be allowed a discount if they made payment within 14 days. Eventually the matter was referred to a sub-Committee, to be considered in connection with the estimates.

Grassington (Yorks.).—The electric lighting installation in the village was inaugurated on the 15th inst. Energy is generated by a small plant erected on the river, and using water power. The official opening ceremony is to take place in a few days' time.

India.—It is understood that the Oudh and Rohilkhand State Railway is arranging to fit Stone's system of electric lights and fans to four first class, four composite first and second class, and four second class carriages.—*Indian Engineering.*

Llansamlet.—A scheme of electric lighting is being promoted for the Glais district by Mr. Evan Lewis, of Graig-y-pal.

London.—Marylebone.—Hot water is to be supplied to the lavatories in the Town Hall by means of small Therol electrical heaters. The cost of supplying and fixing the apparatus will be £45, and the annual cost for energy, which will be supplied at 1d. per unit, will be about £10.

Stepney.—The Blyth's Wharf generating station is to be opened by the Mayor on the 27th inst., when any machinery that may be ready for use will be set in motion by the Mayoress. Application is to be made to the L.C.C. for a loan of £10,250 for mains extensions.

The L.C.C. is to submit to the B. of T. proposed agreements between the London Electric Supply Co. and Westminster, and St. James' and Pall Mall Companies, for it to determine whether these fall within Sec. 3, London Electric Supply Act, 1908; also a copy of the Highways Committee's report on the above, and on an agreement between the South Metropolitan Co. and West Kent Co. If the B. of T. approves the agreements, the Council suggests certain amendments, mainly with a view to safeguarding its purchasing powers.

East London Electrical Exhibition.—On Tuesday afternoon last the joint Electrical Exhibition, promoted by the Shoreditch, Hackney and Stepney Borough Councils, was opened by Mr. W. M. Mordey, in the Pitfield Street Baths, Shoreditch, a large gathering of the civic representatives of the three boroughs being present. Amongst the prominent exhibitors mention may be made of Messrs. Siemens Bros. & Co., who make a feature of their O.S. wiring system, tantalum lamps and fittings, cables, cells, batteries, &c., and in the Machinery Hall have a stand devoted to switchboard and testing instruments of the latest type. An interesting little appliance on one of their stands is a portable motor-driven vacuum pump, of compact arrangement and mounted on wheels—a device which in some form or other deserves more attention than it has hitherto received. Messrs. Simplex Conduits, Ltd., exhibit their conduit specialities, heating and cooking appliances, and metal-filament lamps, and Messrs. Marryat & Place show a miscellaneous collection of electric plant, including an interesting example of the Moissan electric furnace. Street lighting specialities figure on the stands of Mr. Haydn T. Harrison and the Reason Manufacturing Co., which latter firm is also showing electrolytic meters, demand indicators, &c. Mr. Harrison also watches over the interests of the Thorpe Meter Syndicate, who show their recently introduced electrolytic wattmeters, time-lag circuit-breakers and motor starters. Messrs. Worssam & Son have an attractive motor-driven refrigerating plant suitable for country house installation, while Messrs. Ferranti, Rashleigh Phipps & Co.—who exhibit electric signs—Pooley & Austin, Tyler & Freeman, and many others are responsible for interesting exhibits.

Norwich.—The T.C. has been recommended, at the termination of the existing contract with the Gas Co., to convert the gas lamps in the city to electric ones.

Port Glasgow.—The question of introducing electricity has been discussed by the T.C. at various times during recent years, but the members have not been unanimous as to the course to be followed and nothing definite has been done. A few of the councillors are of opinion that plant should be laid down at the refuse destructor works, while others hold that the better plan would be to obtain a supply from Greenock. Some months ago a petition was presented to the Council by the shipbuilders and other large employers of labour in the town asking that the Council should endeavour to come to terms with Greenock. Negotiations were carried on between the two burghs for some time, but latterly the matter was allowed to drop. Last week the Messrs. Lithgow, who are reconstructing the Bay area, reopened the subject in connection with the lighting of the shops in the new area, and the T.C., at a meeting in committee, agreed to approach the Greenock Corporation with a view to obtaining a supply of electricity from that burgh.

Ravensthorpe.—The U.D.C. has given consent for the Yorkshire Electric Power Co. to use overhead lines to the Mirfield boundary for supplying energy to Brighouse.

Rhyl.—At a meeting of the D.C. held last week, it was announced that an offer had been made for some of the old plant at the electric light works, which will be superseded by the new oil engine. The clerk was instructed to ask the sanction of the L.G.B. to the sale.

Rochdale.—The T.C. has approved of an agreement to supply electricity in bulk to Littleborough U.D.C.

South Africa.—Potchefstroom.—The T.C. has held a special meeting to consider several important matters, including a municipal electric lighting scheme, which is estimated to cost £15,000, and the consideration of which has been provisionally sanctioned by the Government.

Southampton.—At the last meeting of the T.C., it was agreed that Parliamentary powers be sought to carry on the work of "free or assisted wiring, to install wires, fittings, &c., through a contractor, but not otherwise, and to hire out arc lamps, heating apparatus, and cookers either at a rental or on the deferred payment system." On the motion for the adoption of the recommendation, Mr. Hirst moved as an amendment that the whole question of the financial position of the electricity department be referred to the borough treasurer for report, and in the meantime the matter of free or assisted-wiring be adjourned. The amendment was, however, lost. It was further decided to obtain Parliamentary powers for the reconstruction of certain tramways and the acquisition of certain properties.

Stafford.—The T.C. has fixed the following scale of discounts for consumers of over 3,000 units per quarter:—From 3,000 to 4,000, 15 per cent.; from 4,000 to 5,000, 17½ per cent.; over 5,000, 20 per cent.

Surbiton.—The U.D.C. has received from the L.G.B. sanction to a loan of £1,266 for the extension of the electricity works.

Swansea.—The B. of G. has asked the borough electrical engineer to prepare a scheme for lighting Blocks 1, 2 and 3 of the workhouse.

Widnes.—With the object of showing the B. of T. that it is in earnest, the T.C. has decided to have plans and estimates prepared for an electrical station at an estimated cost of £4,100. The E.L. order was obtained four years ago, and the Council is negotiating with a company connected with the Salt Union, which offers to supply current to the town.

Worsley.—The U.D.C. has sealed the transfer of the E.L. order to the Lancashire Electric Power Co.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The question of the price of the electrical energy supplied to the Suburban Tramway Co., came up for discussion recently. The secretary of the Tramway Co. contended that, instead of complying with the terms of the agreement and the reference to him, and fixing a price for every unit actually supplied, the arbiter had ordained the company to pay a standing charge of £900 per annum, irrespective of the number of units that may be actually supplied. Mr. Kemp moved that intimation be made to the company that, so far as the Council was concerned, the decree arbitral was accepted as final and binding, and that a remit be made to the Committee to give effect to this resolution. A long discussion ensued. The amendment was adopted by 16 to 13 votes.

Australia.—The South Australian Government has recently obtained a report from Mr. W. G. T. Goodman, chief engineer of the Adelaide Tramways Trust on the electrification of the Glenelg suburban railway line, which he estimates would cost £201,760. The city terminus of the line is in King William Street, along which the steam trains operate at present; they also operate in the main street at Glenelg, and in both these instances it is pointed out that electric working would be much preferable to steam. Mr. Goodman proposes certain alterations in the routes with a view to giving a double track throughout; the length of route considered amounts to 7 miles 28 ch. He further recommends that the Tramways Trust should have running powers over the King William Street lines, with a view to avoiding the placing of four tracks in that thoroughfare, and that the gauge should be altered to the standard. Mr. Goodman foretells a better, safer and speedier service, greater convenience at termini, and a satisfactory financial result. The system would operate with the overhead trolley.

Blackpool.—A net increase of £1,496 has been taken in receipts on the cars during the season from April 1st to October 7th. The total receipts were £42,536, compared with £41,040 in the corresponding half-year of 1908. There had been an increase of 182,515 in the number of passengers.

Bournemouth.—The annual church parade of the Corporation Tramways employés took place on Sunday. As a matter of fact, a good proportion of the men did not take part in the actual parade to church, at least three contingents of about thirty on each occasion being taken in the Corporation motor-'bus, a singular commentary on the Sunday traffic decision at the Council meeting in the previous week.

Brazil.—In connection with the frequent opening of new tramway services by the Rio de Janeiro Tramway, Light and Power Co., the *Brazilian Review* says: "Now that the service all over the zone is being improved every day, the scoffers of some months back have turned their scoffings to blessings, and readily admit that not only is the amount of work done almost incredible, but that the service is gradually approaching that perfection which the company has set up as its ideal.

Continental Notes.—Germany.—A fresh dispute has arisen between the Grand Berlin Tramway Co. and the city of Berlin as a result of the former's claim to have received from the magistrate the exclusive monopoly for the working of tramways in general, and in particular of the tramways from the Stellin

Bahnhof to the Central Vichhof and from the Vichhof-Rudolf Virchof to the Kraakenhans, which have been constructed and are operated by the municipal council. The company contends that these lines have caused it to lose £2,000 during the past year, and that the city is responsible for the loss. According to the working return of these particular tramways for the year, a considerable surplus has been realised, and the company therefore demands the payment by the city of the £2,000 mentioned as compensation, and reserves other claims for the future. In addition, the company notifies that other claims will be presented in connection with the three municipal tramways which it is proposed to construct in the south of the city.

Belgium.—La Société des Tramways Bruxellois has applied for a concession for a new line of electric tramway in Brussels between the Gare de Luxembourg and the Place Dailly.

Italy.—In connection with the Socialist demonstrations, the whole of the tramways and cabs in Rome suspended service on the 14th inst.

Austria.—It is reported from Vienna that the negotiations in respect of the projected conversion of the city railway to electric traction are expected to be brought to a conclusion during the forthcoming winter. The expenditure on the work is computed at from 40,000,000 to 50,000,000 florins, which would presumably be raised by a city loan, and the transformation would be undertaken by the Laender Bank in conjunction with the Siemens-Schuckert Co. The conversion represents one of the fondest wishes of the mayor, and is said to be only possible simultaneously with the municipalisation of the undertaking. At present the railway belongs in equal thirds to the Lower Austrian District, the Austrian State and the City of Vienna, and the management of the line is in the hands of the Austrian State Railway Administration in return for a small payment by the three parties concerned. The mayor hopes that after transformation the railway will yield results as favourable as the electric tramways, but it is declared that the surplus realised by the latter will become a deficit if the demands made by the employés for higher wages, which are not unjustified, are granted. The principal difficulty in regard to the suggested transfer of the railway to the Municipal Council lies in the circumstance that the latter is not inclined to pay anything for taking over the undertaking, whereas the other two co-proprietors are not disposed to agree to the change without compensation. It is possible that the present co-operation of the Laender Bank will bring the negotiations to a fresh stage.

The new Ronstal railway in the south of the Austrian Tyrol was completed and set in operation on October 11th. It is 37 miles in length, and connects Trient, Clep and Malé, and a branch line nearly 15 miles long leads from Dermullo to Fondo-Mendel. The railway is the longest electrically-operated overland line in Austria, and is the first to be constructed by the department of the State Railway Administration for the account of the concessionaires. The maximum rise in the main line is 53 metres per 1,000 metres, the gauge is 1 metre, and the speed amounts to about 12½ miles per hour. Power is supplied by the electricity works of the town of Trient, on the Sarca, and is distributed to the line from three transformer stations. The rolling stock comprises 10 four-axle passenger motor coaches, each capable of accommodating 44 persons, 12 passenger trailer coaches of the same capacity, 12 covered and 15 open goods wagons, each of 7 tons carrying capacity, and 3 mail coaches.

Switzerland.—The St. Gall-Speicher-Trogen Railway Co., of Trogen, has obtained a concession for the construction of a single-track, metre-gauge electric railway, 5½ miles long, on the St. Gall-Walzenhausen route, *via* Trogen and Heiden, with a branch from Kaien to Rehetobel. The concession will expire on May 16th, 1949. The line is to be built in two sections: (1) Trogen to Heiden, including the above-mentioned branch, and (2) Heiden to Walzenhausen. The total cost of the work is estimated at £43,000.—*Board of Trade Journal.*

Spain.—The Compania Nacional de Tranvias has applied for a concession for the construction of an electric tramway in Barcelona, called the Sans Extension, being an extension of the company's existing lines.—*Board of Trade Journal.*

Cradley Heath.—The U.D.C. has decided that it is desirable to enter into an agreement with the Dudley, Stourbridge and District Electric Traction Co. for the construction and working of a tramway from Brierley Hill to Cradley Heath, if satisfactory terms can be arranged between the company and the Brierley Hill, Quarry Bank, Rowley Regis and Cradley Heath Councils.

Falkirk.—Owing to the severe gale which visited the district on the 14th inst., many trees were blown down on to the telegraph wires and tramway trolley lines, completely blocking the tramway service in places. The obstructions were removed and services renewed on the 15th inst.

Handsworth.—The District Council, at a meeting last week, considered a report dealing with complaints against the South Staffordshire Tramways (Lessee) Co., against whom action has been taken; also an application to Parliament for powers to construct a network of tramways in the district.

The Parliamentary Committee has been notified that the Birmingham City Council proposes to make representations to the L.G.B. with respect to the extension of the city boundaries (in which the U.D.C. does not acquiesce).

Leeds.—At the meeting of the Corporation Tramways and Electricity Committee on Monday, reference was made to the success of the year's working in the tramways department. The half-yearly statement was satisfactory, and there was promise of another good financial year. There has been a fairly substantial increase in revenue to meet extra expenditure necessitated by repairs and renewals of permanent way. An application has been received from Otley for the extension of the tramway system to that boundary from Guiseley, and the matter has been placed in the hands of a committee. Mention was made of a proposed extension of the electricity undertaking to Thwaite Gate, and questions were also under consideration regarding the supply of electric power for sewerage plant on the new estate at Templenewsam, and for similar works at Headingley, so that there were indications of very considerable future progress.

London.—The L.C.C. on July 16th, 1907, concurred in the proposal to refer to arbitration the question whether the expense incurred by the G.P.O. in providing heat coils, fuses, &c., for the protection of telephone and telegraph wires in the neighbourhood of tramways worked on the overhead trolley system of electric traction, should be borne by the Post Office or by the tramway authority concerned. The arbitrator appointed by the B. of T. has now decided that the cost shall be borne by the latter. The case for the tramway authorities was undertaken by the Tramways and Light Railways Association, and by the award the Association is required to pay half the arbitrator's fee in addition to its own costs. The Council is to pay £10 to the Association as a contribution toward the costs incurred by it in the arbitration proceedings.

The City and South London Railway has introduced a reduced scale of fares to season-ticket holders, and with a view to accelerating the traffic, experiments are now being made with automatic signals.

Lower Bebington.—The U.D.C. has under consideration the question of the extension of the Birkenhead tramways from New Ferry to Bolton Road, Port Sunlight.

Newcastle-on-Tyne.—As a result of the measures taken by the tramways manager to carry out the reduction in working expenses decided on by the Tramways Committee, the employés are going to lodge a protest with the latter against reducing the staff.

When entering Manors North Station on Wednesday evening last week, an electric train left the metals and tore up the permanent way for some distance. Two of the carriages were considerably smashed, and a young man was injured.

Queensferry (Edinburgh).—At Linlithgow C.C. recently a letter was read from Messrs. Deas & Co., asking whether the Council would consent to a tramway being constructed between Cramond Brig and South Queensferry. The chairman explained that about four years ago a company applied for a provisional order to lay a tramway over the same road, and the Council opposed the scheme on the ground that the road was not wide enough for a tramway and the ordinary traffic. After discussion, it was agreed that the clerk should acknowledge the letter, and that any further communications on the subject should come before Linlithgow District Committee.

Swindon.—The T.C. has decided to offer a bonus to tramway motormen on their attaining a minimum consumption of energy, as fixed by the Committee for the tramways.

West Fife.—The tramway company is pushing ahead with the new tramway system. Immediately after the B. of T. inspection it will commence a service between Cowdenbeath and Dunfermline. The system will then be extended, and before the end of the year Lochgelly will also be linked up.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postal Department has twice invited tenders from manufacturers who are prepared to supply telephones made in Australia, but so far no tenders have been received. The Government is most anxious to have the instruments made in the Commonwealth.

It is estimated that in order to put the telegraph and telephone systems of the Commonwealth in a state of high efficiency, an expenditure of £1,828,152 would be necessary, to meet existing requirements alone. Speaking on the subject in the House of Representatives, Mr. Reid said that the Postal Department had got its bad reputation because it had never had a chance to do its work properly. The officers were not inefficient, but had not been afforded an opportunity to show what they could do, and had never had the proper appliances for the work.

Bahamas.—The annual Colonial Report for the Bahamas for 1908-9 states that the revenue of the Telegraph Department was £1,668 and the expenditure £548, as against £1,248 and £545 respectively; 4,251 messages were dealt with, 377 of which were to and from Great Britain. The previous year's traffic was 3,847 messages.

There are 225 telephone stations now working in Nassau and suburbs. The revenue for 1909-10 is put at £912 10s. and expenditure (inclusive of interest and sinking fund) at £516 16s. The system is owned by the Government.

Brazil.—The *Brazilian Review* reports that the contract between the Government and the Amazon Telegraph Co. for the duplication of the subfluvial cable between Para and Amazonas was signed on September 28th. The work is to be completed within 15 months, and a reduction of 20 per cent. in the rates, or 30 per cent. if the traffic exceeds 600,000 words per annum, is to be made.

Cable Interruptions:—

Tourane-Amoy	June 17, 1909
Assah-Perim	July 8, 1909
Dakar-Conakry	Aug. 20, 1909
Balikpapan-Kwandang	Sept. 2, 1909
Cheiksaid-Perim	Sept. 15, 1909

Canada.—Yesterday the King was to perform the ceremony of opening the doors of the Royal Edward Tuberculosis Institute in Montreal by "touching a button" at West Dean Park, Chichester. The shortest line of the Commercial Cable Co. was to be employed, with relays and repeaters at all intermediate points, so that the signal would go through without manual aid from start to finish. It is believed that this is the first occasion on which an opening ceremony has been performed by wire at a distance of 3,000 miles.

The extension of rural telephone lines in Ontario and the West has been astonishing. These lines, usually 10 to 20 miles in length, are built by the farmers, who find the poles and give free right of way, doing all except the technical work themselves, so that the great advantage of telephone communication costs the rural people very little.

French Postal Strike Sequel.—It is reported that the new Minister, M. Millerand, has reinstated 455 of the 586 post office servants who were dismissed in connection with the postal strike last March. The opportunity has been taken to leave out employés not recommended by their former chiefs.

South Africa.—The system of farm telephones which has proved so successful and advantageous in Canada and the United States has attracted attention in South Africa, and the various Governments have been approached with a view to its introduction.

The falling off in telegraph traffic has enabled the Government of Cape Colony to give additional facilities for trunk telephone service, with the aid of the telegraph wires set free.

Wireless Telegraphy.—The Admiralty have decided to erect a wireless telegraph station at Wick. An acre of ground has been leased and provision will be made for a staff of 12 men. The station is to be equipped with the latest appliances for long-distance communication, and is expected to be in working order early next year.

It is reported that the airship "Zeppelin III" has been proved capable of communicating by wireless telegraphy with stations at a distance of 300 miles. Nevertheless, the experts consider that, to ensure successful communication, wood must be substituted for aluminium in the construction of the frames of airships of the rigid type.

Wireless Telephony.—Under the heading "Caveat Emptor," the *Cape Times* of September 15th severely criticised a prospectus issued by the Collins Wireless Telephone Co., of Newark, U.S.A. It was stated in the prospectus that the capital of the company was £200,000, divided into 1 million shares of $1 each, of which the inventor of the system concerned—Mr. A. F. Collins—had retained 600,000, while, according to the special representative of the company in Cape Colony, of the remainder 250,000 had been sold in America and foreign countries. Mr. J. J. Kelly, the representative in question, was placing these on the market in South Africa at 13s. each. The *Cape Times* drew attention to several discrepancies in the statements issued on behalf of the company, and to the magnificent claims to the effect that the profits from subsidiary companies were estimated in millions during the next few years.

CONTRACTS OPEN and CLOSED.

OPEN.

Alsace.—November 1st. The municipal authorities of Forbach are inviting tenders for the concession for the establishment and working of an electric tramway in the town.

Altrincham.—October 23rd. Electric light installation at the County High School for Girls. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester. (Returnable deposit £1 1s.)

Australia.—Victoria.—Accumulators for the P.M.G. See "Official Notices" October 1st.

Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Epsom.—November 2nd. Eight D.C. long-burning flame arc lamps for the U.D.C. See "Official Notices" to-day.

Llandudno.—October 30th. Hand tower-ladder for trimming arc lamps, for the U.D.C. See "Official Notices" October 15th

L.C.C.—November 1st. Brass and other castings and fittings, lamp glasses, carbons, insulating materials, cables and lamps, for the L.C.C. See "Official Notices" to-day.

Leyton.—October 26th. Installation of electric light and water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" October 8th.

London.—November 3rd. Electric lighting installation at the Buxton Street Elementary School, Whitechapel. See "Official Notices" to-day.

Luton.—October 29th. Vulcanised bitumen cable for the Corporation. See "Official Notices" to-day.

Manchester.—October 25th. Steel girder tramway rails, for the T.C. (returnable deposit, £1 1s.); J. M. M'Elroy, General Manager of the Tramways, 55, Piccadilly, Manchester.

Mountain Ash.—October 25th. Electrical stores for the U.D.C. electricity undertaking. See "Official Notices" October 8th.

Radcliffe.—October 27th. Cable for the U.D.C. Electricity Department. See "Official Notices" October 15th.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 KW. each, for disposal. See "Official Notices" September 24th.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Warrington.—November 2nd. Arc lamp lowering gear for the Corporation Electricity Department. See "Official Notices" to-day.

CLOSED.

Barnes—The District Council has accepted the tender of the Union Cable Co, Ltd., at £413, for 1,760 yards of cable.

Belgium.—La Société des Ateliers de Constructions Electriques, of Charleroi, has just secured a contract from the Société des Forges de Clabecq (Belgium) for the establishment and equipment of a large electric power plant. The contract includes three dynamos of from 1,100 to 1,600 KW. capacity, six electrically-operated pumps, three electric motors of about 1,200 H.P. each for the operation of the rolling mills, and seven electric cranes.

Bootle.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables, at £815.

Burslem.—The T.C. has accepted the following tenders:

Mr. Jas. Grant, Burslem.—Extension of the electricity works, £1,400.
Messrs. Babcock & Wilcox, Ltd.—Boiler, £1,100; and pipework, £118.
Messrs. Siemens Bros. Dynamo Works, Ltd.—Belliss-Siemens generator set, £2,922.
I. Storey & Sons.—Condenser, £1,600.
Messrs. Crompton & Co., Ltd.—Switchgear, £100.

Glasgow.—The T.C. Committee on Sewage recommend for acceptance the offer (£3 869) of Messrs. Lowdon Bros. & Co., Glasgow, in connection with the electric power contract for Shieldhall sewage works.

Government Contracts—During the past month the following contracts have been accepted by the Government Departments named:—

War Office.

Electric lamps.—Edison & Swan United Electric Light Co., Ltd.; British Thomson-Houston Co., Ltd.
Telephone sets and parts.—British Insulated and Helsby Cables, Ltd.

General Post Office.

Paper core cable.—British Insulated and Helsby Cables, Ltd.; Johnson and Phillips, Ltd.
Cables, submarine.—Telegraph Construction and Maintenance Co.
Detectors and leather cases.—General Electric Co., Ltd.
Generators.—International Electric Co.
Wire, copper, hard drawn.—T. Bolton & Sons, Ltd.: British Insulated and Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated with the London Electric Wire Co., and Smiths, Ltd. Wilkes, Son and Mapplebeck, Ltd.

Johannesburg.—The following tenders for electrical supplies have been accepted by the municipality:—

Dick, Kerr & Co.—Tramway spares, £650.
Telegraph Manufacturing Co.—Two tramway feeder pillars, £45; 2,700 yards ·0025 armoured cable, £145; 2,700 yards troughing, &c., £1,845; 100 yards ·5 cable, £87; 200 yards ·25 cable, £104; 150 pairs fuse-boxes, £62; overhead tramway sundries, £ 56; 12 disconnecting boxes, £ 07.
Blane & Co.—Five electric freight-cars, £2,895; 1,000 yards ·006 cable, £60.
Henley's S.A. Telegraph Co.—600 yards ·125 cable, £162; 300 yards ·13 cable, £102; 2,300 yards ·05 cable, £400; 600 yards 7/1 single cable, £43.
Western Electric Co.—Four 100-KW. transformers, £351.
Reunert & Lenz.—Four tons insulating compound, £86.

London.—L.C.C.—The Education Committee has received the following tenders for installing electric light, &c., at Paddington Technical Institute:—

Brit. West. E. & M. Co., (accepted)	£259	G. Harland Bowden & Co.	£306
Whitehead Bros.	260	D. J. Macdonald	310
Tilley Bros.	266	M. S. Smith	311
R. Bridger	268	Johnson & Phillips, Ltd.	313
Westminster Ventilating Co.	280	W. A. Lawrence	320
Pinching & Walton	290	G. Weston & Sons	349
R. H. and J. Pearson, Ltd.	296	R. N. Cunningham & Co.	378
Foote & Milne, Ltd.	298	E. E. Beaven	378
Sweet Bros.	299	T. L. Hellyar & Sons	447

The British Westinghouse Co. are authorised to sub-let the wiring to G. Foster, Curtis & Co. (Camden Town).

In connection with the electrical equipment for the L.C.C. Paddington Technical Institute, tenders were invited by the L.C.C. from six firms for the supply of a condensing plant. Three of the firms, however, stated that they had not suitable patterns, and they did not therefore submit tenders. The tenders received were as follows:—

Isaac Storey & Sons, Ltd. (accepted)	£216
J. H. Carruthers & Co.	270
Clarke, Chapman & Co.	439

Lowestoft.—At the last meeting of the Council, the Electricity Committee recommended the acceptance of the tender of Messrs. Aubert Grenier & Co., at £783, for feeder cables. The recommendation was referred back with instructions to the Committee to call for fresh tenders. Two Babcock & Wilcox chain grate stokers are to be provided to boilers at a cost of £330. The Council has accepted the tender of the Vacuum Oil Co. for the annual supply of oils to the electricity undertaking at the following prices:—Cylinder oil, 2s. 4d. per gallon; crank chamber oil, Vacuum Etna engine, 1s. 4d. per gallon; 600 W, 2s. 4d. per gallon.

Randfontein.—The Randfontein Estates Gold Mining Co., of Johannesburg, have accepted the tender of the Telegraph Manufacturing Co. for the supply of various cables, amounting to about £18,000; also 20 section pillars. The total lengths amount to about 70,000 ft. of E.H.T. three-core paper-insulated cable, for a working pressure of 6,600 volts; the sizes range from ·1, ·125, ·2, and ·25, and the price includes both the laying and jointing. The same firm is also carrying out the laying of cables for light and power for the Admiralty at the Simonstown new docks.

Swinton and Pendlebury.—The U.D.C. has accepted he tender of Messrs. Heenan & Froude for a refuse destructor, at £6,730. The Horsfall Destructor Co. tendered at £6,764.

Taunton.—The T.C. has accepted the tender of Messrs. J. Goodland & Sons for 2,500 tons of coal, at 15s. 4d. per ton, for he next 12 months.

FORTHCOMING EVENTS.

hysical Society.—Friday, October 22nd. At 5 p.m. At the Royal College of Science, South Kensington, S.W. Paper "On Cadmium Amalgams and the Normal Weston Cell," by Mr. F. E. Smith, and other papers.

nstitution of Electrical Engineers (Manchester Section).—Friday, October 22nd. At 7.30 p.m. At Midland Hotel, Manchester. Opening meeting for the session. Address by the chairman, Mr. S. J. Watson. A smoking concert to follow. [Other meetings will be held at the Physical Laboratory of the Manchester University.]

lectro-Harmonic Society.—Friday, October 22nd. At 8 p.m. At the King's Hall, Holborn Restaurant. First smoking concert of the season. See "Notes" last week.

nstitution of Electrical Engineers (Leeds Section).—Wednesday, October 27th. At 7.15 p.m. At the University, Leeds. Presidential address by Mr. W. M. Rogerson, and a paper, "Notes on Superheated Steam," by Mr. A. B. Mountain.

stitution of Mechanical Engineers.—Friday, October 29th. At 8 p.m. Extra meeting. Resumption of discussion on Prof. W. E. Dalby's paper on "Heat Transmission."

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 31st, 909:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 25th.—"A" Company. Hopkinson Cup competition, 7 p.m.

Tuesday, October 26th.—"B" Company. Hopkinson Cup competition, 7 p.m.

Wednesday, October 27th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 28th.—"C" Company. Hopkinson Cup competition, 7 p.m.

Friday, October 29th.—"D" Company. Hopkinson Cup competition, 7 p.m.

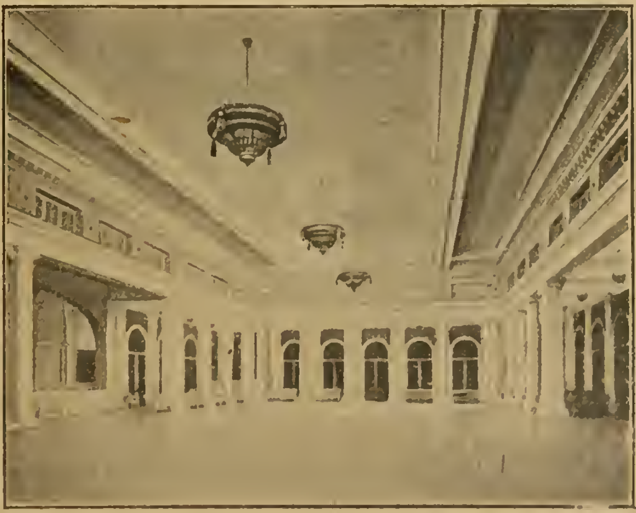
(Signed) P. H. Campbell, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

Late Legal.—Electric Peat-Coal Case Appeal.—An appeal by the defendant, Mr. George Darlington Simpson, from a verdict and judgment in the action of J. C. Barker *v.* Earl Mayo and Others, tried by Mr. Justice Lawrence and a special jury, was in the lists for hearing before Lords Justices Vaughan-Williams, Buckley and Kennedy on Wednesday. On it being called on, Mr. Thompson, representing Mr. Simpson, asked for an adjournment. There had, be said, originally been an appeal by the plaintiff, and Mr. Simpson, thinking he would have the benefit of counsel representing the other defendants, intended to appear in person. A few days ago, however, he was informed that that appeal would not be proceeded with. Being alone on this appeal, he desired the assistance of counsel, but had not yet had time to give the necessary instructions. Their Lordships allowed the appeal to be adjourned for a fortnight.

The British Aluminium Co.—Mr. Justice Swinfen Eady, in the Companies' Winding-up Court on Tuesday, had before him the petition of Dick, Kerr & Co., Ltd., and A. Schonfield & Co., for the compulsory winding up of the British Aluminium Co., Ltd. Mr. Younger, K.C., said he appeared for the company on both petitions, and he had to ask that they should stand over for another month. The petitions were originally presented in July last. The company was of very great magnitude, and was doing a very great business. It was very desirable that there should be a proper reconstruction, the figures to be dealt with being enormous. A scheme of arrangement had been sanctioned, but it was necessary that the arrangement should be further matured. Mr. Martelli, for the petitioners, said he did not oppose, and his Lordship agreed to the adjournment, as requested by Mr. Younger.

Indirect Illumination.—Our American electrical contemporaries have lately alluded to an interesting example of indirect illumination by tungsten lamps. The *Canadian Electrical News* says that indirect illumination in its most recent application consists in entirely covering the source of light with a scientifically-designed mirrored reflector which casts the light on the ceiling, whence it is distributed back throughout the room. This gives the nearest approach to daylight ever secured by artificial illumination. This method is in use in many residences, offices, banks and hotels, and has recently been installed in the new ball-room or auditorium of the South Shore Country Club, of Chicago, one of that city's largest clubs. This is a magnificent separate building connected by a passage-way with the main club house, and is 86 ft. × 140 ft. in size, constituting practically one large room. A 12-ft. promenade, as shown, on all four sides, is separated from the main room by 30 Ionic columns. The ceilings of this promenade are 20 ft. high, divided in 12-ft. panels. In each of these 28 panels is hung a fixture, containing a single "I-comfort" indirect illuminating unit, as shown. The ceiling of the main auditorium is 28 ft. high, and, as shown in the illustration, contains three large chandeliers hung at equal distances in the large panel of the ceiling. Each of these chandeliers contains 23 "I-comfort" indirect lighting units. The passage-way to this building from the main club house is illuminated with three fixtures in each cross panel, each fixture containing a single indirect lighting unit. Every one who enters the auditorium is immediately impressed with the magnificent results obtained. Many expressions as to its being the most beautiful illumination seen in any part of the world are heard, and not one who sees it but realises that a great advance step has been made in interior illumination. During a ball the scene is one of unusual splendour. The colours of the different gowns are brought out with a distinctness that is most surprising. Plans were originally prepared to light this auditorium by direct illumination, and the cost of the direct lighting fixtures approximated $2,000. The fixtures containing the indirect



The Lighting of a Chicago Ball-Room.

light units cost complete, installed, about one-half this sum. The 97 "I-comfort" inverted units used in this installation (69 in the three large central chandeliers and 28 in the small fixtures around the promenade) each using a 100-watt tungsten lamp, make a total of 9,700 watts. At 8 cents per KW.-hour for current, it will be seen that the cost of illuminating this space is but 77 6/10 cents per hour. The fixtures are made of composition (instead of solid metal), such as is coming into general use in European countries, where elaborate designs are desired, and are given a metallic finish that similates a solid metal fixture.

Municipal Undertakings in Germany.—A consideration of the question of municipal socialism in various countries has just formed the subject of articles published by the *Kolnische Zeitung*. As far as Germany is concerned, it is stated that municipalisation has become the work of communal bureaucracy, and that the principal object now is to municipalise the means of transport, particularly the tramways. According to Herr Fuchs, the development of electricity works, on the other hand, has proceeded too rapidly, especially in the small towns, under the pushing influence of large electrical works which desire to earn money by supplying the equipment, but not by operating the works. Thus, a reaction in favour of private industry has already occurred by the advent of the Rhenish-Westphalian Electricity Works Co., and its agreements with various Rhenish towns in regard to supply and participation in the profits. This company enjoys the most favourable conditions imaginable for producing on the cheapest scale, in consequence of a direct connection with collieries, coke works, and power works, whereby economy in coal is gained, and coal freights are avoided. Being enabled to sell at low prices, the company has secured a number of large consumers whose requirements, according to time and quantity, are so far equalised that the power station on the whole is said to be uniformly loaded during each hour of the day and night. The situation is rendered all the more complete by the mutual agreements with some large industrial companies which have their own generating plant, so that both parties need not install standby plant. Instead of embarking upon a contest with the small communal works in the district, the company succeeded in concluding agreements of long duration with various towns on the basis that the communal works should undertake the sole supply of energy for lighting and of power to consumers on a small scale, leaving the custom of the large power users to the company which also undertook to furnish energy to the communes, and to give them a share in the profits. Such agreements offered undeniable advantages to the towns concerned, as they were thereby enabled to utilise their plant to the fullest capacity, and at the same time have current at their disposal in any required quantity. As a consequence, not only small localities, but also such towns as Essen and Mulheim have become associated with the company, and certain towns have subscribed a large portion of the share capital, whilst others merely appear as large consumers acting as distributors in their respective districts. The agreements within the limits already mentioned, give the company the exclusive right for a number of years. As soon as this development had shown that the combination of large areas of supply was more economical than the establishment of small individual stations, a new departure in public activity began in this particular branch, in the sense that various communes united to erect joint works, as, for instance, the Mark Electricity Works, but these works have not been in existence sufficiently long in order to form an opinion of their prospects. It is added that the 2,590 German communes (2,309 town, and 281 country), are provided with electricity works to the extent of 40·7 per cent., and 41·1 per cent. of these are owned by the local authorities. All towns having a population in excess of 50,000, are equipped with electricity works. In the case of tramways, not one-half of the undertakings in towns of 50,000 to 100,000 inhabitants, or even in towns having a larger population than 100,000, is under municipal ownership or working, and municipal and private tramways are often to be found in the same town.

Electricity in American Mining.—In the *Mining and Scientific Press* of San Francisco, we find the following:—"Electricity is being more and more substituted for steam in mining operations, and in many situations notable economies result. At the Butte-Balaklava the saving is estimated at more than 60 per cent. At the Tucson Mine in Leadville it is reported at over 70. These great savings are possible because of the high cost of steam in isolated plants. In Colorado, temporarily, there is more power available than the market demands. The completion of the Shoshone plant and the building of transmission lines of the Central Colorado Power Co. has made electric power available in Lake, Summit, Clear Creek and Gilpin counties at a time, when, for various reasons, mining is less active than usual. The cheapness of the new power is a not unimportant influence in the mining revival which is beginning in these old districts. Incidentally, it is interesting to know that a recent comparison of rates shows that, for the smaller installations, this electricity developed by water-power and transmitted 100 miles or so across the mountains, is being sold at approximately the same rates as by the Commonwealth-Edison Co. in Chicago, where the electricity is steam-generated from coal hauled 100 miles across the prairies. This is one way of removing mountains."

A Manchester Charge.—With further reference to this prosecution, which was mentioned on page 602 last week, the hearing was resumed on Tuesday. Several witnesses were called, the result being that all the defendants were committed for trial at the Sessions.

Electric Lighting at Doncaster Aviation Grounds.—The grand stands and other permanent buildings on the Doncaster Race Course are lighted by gas, as they date from pre-electric lighting days, and have not been modernised in accordance with the spirit of the times, except by the addition of an electric lift for the use of the King, when he patronises a race meeting. The hangars or sheds for the accommodation of the aeroplanes are, however, new and temporary buildings; accordingly provision had to be made for lighting them, so that the mechanics might be able to make adjustments and repairs after dark. Also it was essential that these machines should be guarded by night to prevent either wanton destruction or acidental fire; so light had to be provided for the use of the watchmen and mechanics. The latter never leave their machines, and when not working, sleep alongside the aeroplanes they are in charge of. Owing to the light, inflammable nature of flying machines, and also on account of the petrol used as the fuel for the engines, the only form of illuminant that can be considered is, of course, electric light. At Rheims Aviation Meeting, which was held at a distance of some four or five miles from the town, a portable steam plant was installed to drive the electric generator. The Doncaster Corporation have gone one better, for at very short notice they have arranged to light the hangars off a traction feeder (not having a lighting feeder within reach). Two drums of cable for some street lighting extensions had just been delivered, so this cable was laid on the surface of the ground between the terminals of the traction feeder, and the temporary sub-station at the hangars, a distance of several hundred yards. This cable was protected by boards laid over it. A 15-H.P. 460-volt motor, constructed by Electromotors, Ltd., of Manchester, was connected by belting to a 40-ampere 220-volt dynamo of Rhodes make, so that the voltage employed in the hangars might be kept within safe limits. As the load on the racecourse tramway feeder is but a small one after dark, no special voltage regulator was rigged up, beyond a water resistance and an ordinary shunt regulator, which will be hand regulated by a switchboard attendant. The switchboard used sees service normally in the electricity works test room. Inside the hangars incandescent lamps are provided, while outside the fronts of these buildings, which are in a line, four flame arc lamps are installed. In Mr. Cody's hangar, in accordance with this aviator's instructions, what he calls search-lights are fitted up. These merely consist of a bunch of lamps under one reflector, which is tilted so as to throw the light on the part of the aeroplane upon which the mechanics happen to be working. Everything connected with the Doncaster Aviation Meeting seems to have been hurried and rushed, so great credit is due to the borough electrical engineer, Mr. E. S. Rayner, and his staff for the promptitude with which they formulated and carried out a scheme for the electric lighting within a very brief period after the time at which the Aviation Committee discovered that artificial lighting was essential. The work was actually completed before the temporary sub-station structure—a lean-to on one of the hangars—was ready, and before the hangars were in shape to receive the machines.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (LEEDS LOCAL SECTION).—The programme for the new session has been received, and includes the following items:—

October 27th, at Leeds.—Presidential address by Mr. W. M. Rogerson. Paper by Mr. A. B. Mountain: "Notes on Superheated Steam."

November 17th, at Sheffield.—Paper by Mr. W. T. Maccall: "Some Experiments on Single and Stranded Fuses."

December 15th, at Leeds.—Paper by Mr. G. Wilkinson and Mr. McCourt: "Metallic-Filament Lamps."

January 26th, 1910, at Sheffield.—Paper by Mr. H. E. Yerbury: "Equitable Charges for Tramway Supply."

February 23rd, at Leeds.—Paper by Mr. W. B. Woodhouse: "Notes on Overhead Lines."

March 16th, at Sheffield.—Paper by Mr. E. S. Saunders: "Electrical Machinery for Iron and Steel Works."

April 20th, at Leeds.—Annual general meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER LOCAL SECTION).—The opening meeting of the present session will be held to-day at the Midland Hotel, when the chairman, Mr. S. J. Watson, will deliver his address, and the smoking concert will follow. The next meeting will be held on November 2nd at the University.

The Manchester Students' Section will open the session with a supper and smoking concert on November 9th.

INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW LOCAL SECTION).—We have received the programme for the new session, which opens on November 16th, with the chairman's inaugural address. The annual dinner will take place on December 1st. The Students' Section opened on Friday last.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—On Wednesday evening, October 13th, Mr. Henry Adams, M.Inst.C.E., read his presidential address before a very large and interested audience at the Institute (St. Bride's). The title of the address was "Standardisation," and Mr. Adams dealt with the matter from many points of view, giving the engineers plenty of useful information to deal with at their first discussion evening of the session (Saturday, October 30th). It is interesting to note that specific dates have been assigned to these instructive evenings, which no doubt will enable members to arrange to keep the dates open more freely than if this had not been done.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The annual meeting of the society will be held in the Engineering Societies Building, New York, December 7th to 10th, 1909. Papers are to be presented on electric driving, discussing the economic as well as the technical phases of the subject; upon apparatus for the measurement of flow of air, steam and water; tests of lubricating oils, steam turbine nozzles and steam turbines; governing rolling-mill engines; the use of moist fuels; boiler joints, pump valves, a new type of pile-driver, and other engineering subjects.

Motorist Committed for Trial.—At Dartford on Monday, Mr. Clifton Robinson, son of Sir J. Clifton Robinson, of the London United Tramways, Ltd., was committed for trial at the Maidstone Assizes, bail being allowed, on a charge of causing the death of Thomas Goulding and his wife by running into them with his motor-car while they, accompanied by their seven children, were returning to London after hop-picking at Malling.

Whitworth Scholarships.—Scholarships (tenable for three years) have been awarded to Arthur W. Judge, John Airey, Henry S. Rowell and Hubert Mawson.

German Electrical Works.—According to a Berlin Reuter dispatch, it appears that statistics have just been issued by the Union of German Electrotechnicians, showing that there were on April 1st last 2,050 electricity works in Germany, providing with power not only the places where they are situated, but also 2,600 places in their vicinities, in all 4,650. The total capacity of Germany's electrical works amounts to 1,200,000 KW. In Germany there are 93 works with a capacity of more than 2,000 KW. About two-thirds of the existing works are in private hands, the other third belonging to the municipalities or the State.

The Copper Market.—Mr. Thomas W. Lawson, of *Frenzied Finance* fame, has recently issued another manifesto dealing with the copper market and the rumours which have been in circulation regarding important pending developments. He says that the big copper deal which has been hinted at during the past six months is the formation of a copper metal trading company with a capital of $150,000,000. This company will confine its business to buying, selling and trading in metal. It is claimed that it will be able to control 1,500,000,000 to 2,000,000,000 lb. of copper; that it will buy on low markets and sell on high, thus minimising violent fluctuations in the metal price, and thereby enabling producers and consumers alike to plan ahead intelligently. The bulk of the new company's stock will be owned by the large producers; the company's management will be two of the most representative copper producers and one of the great copper users, and one of the prominent electrical magnates will be on the board of directors. One of the principal features of the new enterprise, and one that is expected to work radical changes in the conduct of the copper trade in the United States, will, it is said, be the issuing of warehouse receipts for the metal.—*Ironmonger.*

Inquiry.—A correspondent inquires for the makers of "Dermatine" and "Dnrite."

Concert.—At Swadlincote Town Hall on October 6th, the second annual concert in aid of the funds of the Burton and Ashby Light Railway Athletic Society was held. The arrangements were in the hands of Mr. Wm. Barton, chief clerk, and Mr. R. O. Baldwin, traffic manager, of the Light Railways Department.

Model Exhibition. — An exhibition of engineering models, promoted by the Society of Model Engineers, was opened on Friday last at the Royal Horticultural Hall, by Sir Hiram Maxim. Among the exhibits—some of which were as much as 16 ft. in length—was the "Antiforge" pen, which writes by perforating the paper with an electric spark. The British School of Telegraphy showed a wireless installation, with which, on the opening day, communication was accidentally established with an Atlantic liner.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Morecambe T.C. on Monday decided to appoint Mr. Wm. Ryde Wright, of London, as consulting engineer for the electrical undertaking for two years, at a fee of 100 guineas per annum, and 3½ per cent. commission on any further capital expenditure.

Mr. J. R. S. Barkshire, resident electrical engineer at the Royal Naval Ordnance Depôt, Bull Point, was married on September 25th last, at the Stonehouse Wesleyan Church, to Miss Mabel Westlake, of Stonehouse.

There was recently a heated debate in the East London Town Council over the position of the electrical engineer with that body, during which personalities were freely indulged in. Ultimately the following resolution was carried, with two dissentients:—"That the Council proceed to enter into an agreement with the electrical engineer in terms of his letter, and that the special remuneration be paid, provided that the electrical engineer prove to the Council that the cost of generating current does not exceed 2½d. per unit in terms of his report." The terms of Mr. Lambe's offer are that he shall be paid at the rate of £510 per annum, together with a special remuneration of £350 in connection with the relaying of the tramways track and the equipment of the West Bank power station.

Mr. R. Macaulay, of the Durban municipal electric power station, has been appointed station engineer at the Bloemfontein electric power station; on leaving Durban he was presented with a gold watch and case of pipes as a token of regard by his fellow employés, with whom he had been associated for over seven years.

Mr. H. Hearn, of the Natal Government electric power station, has been appointed electrical engineer to the Municipality of Kroonstad.

The following appointments have been made in connection with Marylebone electricity undertaking:—Messrs. K. A. E. Boshell (general manager's private secretary and personal clerk), £3 17s. per week; C. B. Metzner (filing clerk), £1 10s.; W. S. Hind (representative), £2 15s.; A. Palmer (representative), £2; G. Medworth (representative), £2; J. Thompson (clerk), £2; H. Moreby (do.), £1 12s. 6d.; W. E. Barter (do.), £1 15s.; T. E. White (do.), £1 15s. The seven officers last-named belong to the Sales Department. The Electricity Committee has considered a letter and memorial from four members of the staff complaining of their dismissal by the general manager, and asking that an opportunity be given them for resignation, and that their cases may be considered under the Superannuation Act. The Committee has decided, in view of the powers of appointment and dismissal conferred upon the general manager, that his discretion cannot be interfered with. As to the suggestion that gratuities be awarded under the Superannuation Act, the Committee did not think that any action should be taken.

Tramway Officials. — Mr. W. Hunton, assistant engineer, was on Thursday last presented with a case of razors and set of instruments by the staff and employés of the Sunderland District Electric Tramways, Ltd., on his leaving the company's service.

The employés of the Brighton Corporation Tramways Department on 14th inst. presented a number of useful gifts to Mr. W. N. Brookes, traffic superintendent, on the occasion of his marriage. Mr. W. Marsh, the manager, made the presentation.

General.—Mr. James F. Gill has opened an office at 25, Castle Street, Liverpool, as a consulting engineer, and is specialising in power installations, transmissions, and general economy tests.

Mr. Hooghwinkel, of Messrs. Hooghwinkel, Anthony Brown and Partners, has just returned from Canada, where he has been inspecting an important electric water-power scheme. Mr. Hooghwinkel reports that he is much impressed with the necessity for electrical manufacturers to arrange for proper representation in that part.

Mr. J. D. MacKenzie has taken up the position of manager of the National Electric Signs Co., Ltd., Glasgow.

According to *Indian Engineering*, Mr. T. R. Roberts, Telegraph Superintendent, M. and S.M.R., has been granted a further extension of service for one year up to October, 1910. The Madras and Southern Mahratta Railway have, besides the telegraph superintendent at Bellary, a telegraph engineer (Mr. H. H. L. Prendergast) stationed at Arkonam.

A marriage has been arranged between Mr. J. Walter Saaler, manager of Messrs. Bruce Peebles & Co., Ltd., Manchester office, and Miss Frances Redfearne Knott, daughter of the late Mr. Walter Knott, of Southsea, and niece of the late Surgeon-Colonel Dr. Knott, medical adviser to the Portsmouth Corporation.

Mr. C. S. Northcote, M.I.E.E., informs us that owing to the lease of 2, Queen Anne's Gate having been disposed of, his present office address is 6, Old Queen Street, Westminster, where he will be pleased to hear from his numerous trade friends, on any business that is likely to interest him.

Obituary.—We regret to learn from friends in Australia of the sudden death, which occurred last month, of Mr. Oswald Haes, of the firm of Haes & Eggers, of Sydney. Mr. Haes, who passed away while on a visit to Melbourne, had been engaged in electrical work in Australia since 1891, when he arrived there from England, as the representative of the Brush Electrical Engineering Co., Ltd. He was a member of the I.E.E., and was a founder of the New South Wales Electrical Association, to the presidency of which he was several times elected. According to the Melbourne *Argus*, Mr. Haes negotiated the purchase in 1899 of the supply undertakings of the New Australian Electric Co. and the A. U. Alcock Electric Light Co. by the Melbourne Electric Supply Co., and the transfer to the City Council of the city portion of these undertakings.

NEW COMPANIES REGISTERED.

Tramways (Conduit) Point Syndicate, Ltd. (105,328).—This company was registered on October 7th, with a capital of £300 in £1 shares, to acquire, deal with and turn to account inventions for improvements appertaining to tramway and railway construction, particularly relating to the conduit point system. The subscribers (with one share each) are:—H. C. Howard, 70A, Basinghall Street, E.C., chartered accountant; Dr. J. MacCormac, Blackwater, Hants, anæsthetist; W. H. Ockenden, 40, Turney Road, West Dulwich, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are H. C. Howard (managing director) and Dr. J. MacCormac; remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Carmarthen Electric Supply Co., Ltd. (105,409).—This company was registered on October 14th, with a capital of £10,000 in £1 shares (5,000 5 per cent. pref.), to acquire from J. B. Saunders & Co. the benefit of the Carmarthen Electric Lighting Order granted to them under the Electric Lighting Acts, 1882 and 1888, for the supply of electrical energy in Carmarthen, and to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—A. E. Bower, 9, Brockley Grove, S.E., clerk; Miss G. W. Barnett, 8, Tressillian Road, Brockley, S.E., clerk; Miss M. E. Gill, 91, Wickham Road, Brockley, S.E.; W. A. Schultz, 50, Cannon Street, E.C., chartered accountant; C. M. Cockerton, 182, Upper Thames Street, E.C., printer; F. Martin, 29, Queen Street, E.C., solicitor; R. A. Reeves, 68, Raleigh Road, Hornsey, N., clerk. Minimum cash subscription 25 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification of managing director, 100 shares; of ordinary directors, 200 shares; remuneration as fixed by the company. Registered office, Salisbury House, London Wall, E.C.

Anglo-German Wireless Syndicate, Ltd. (105,371).—This company was registered on October 12th, with a capital of £200 in 1s. shares, to adopt an agreement with Baron Eghert von Lepel, Gen. Baron von Gayl and Dr. W. Burstyn and others trading as the Drahtlose Telegraphic-system von Lepel, and to carry on the business of electricians, engineers, battery makers, founders, generators, distributors and workers of and dealers in electricity, land, submarine and aerial telegraphy, &c. The subscribers (with one share each) are:—A. F. Simpson, 7, Stratford Mansions, South Molton Street, W.; G. Elkin, 27, Mill Hill Road, Acton, secretary; W. H. Page, 1, Balcaskie Road, Eltham, gentleman; T. Burrett, 80, Gwynne Road, Clapham Junction, S.W., clerk; F. Thurston, Oakleigh Road, Croydon, cashier; W. Groom, 27, Mayes Road, Wood Green, N., clerk; E. A. Harbert, 1, Spring Villas, Bloomfield Place, Ealing, electrician. Minimum cash subscription, £10. The first directors (to number not less than four or more than eight) are Baron Eghert von Lepel, Gen. Baron von Gayl, W. Burstyn, Sir Thomas Myles, Kt., A. Holt and Viscount Massereene and Ferrard; qualification, £1; remuneration, £100 per annum, divisible. Registered office, Audrey House, Ely Place, E.C.

Electric Smelting Co., Ltd. (105,361).—This company was registered on October 11th, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of and dealers in machinery for the treatment of ores and the generating of electricity, &c., to acquire the right to use any secret or other information relating to the treatment and reduction of ores, or relating to magnetic separators, and to adopt an agreement with M. Ruthenburg. The subscribers (with one share each) are:—H. Jacques, 45, Lancaster Road, Kensington, W., clerk; T. W. Doran, 17, Aden Grove, Green Lanes, N., clerk. Private company. The number of directors is not to be less than two or more than five; M. Ruthenburg is one of the first directors and may retain office while holding 1,000 shares. Registered by Ingle, Holmes, Sons and Pott, Capel House, E.C.

Kinetic Co., Ltd. (105,415).—This company was registered on October 14th, with a capital of £5,000 in £1 shares, to take over the business of electrical and general engineers, manufacturers of, and dealers in, electric, water and other engines and apparatus for blowing organs, air compressors and exhausters, &c., carried on by E. J. Jackson and J. H. Swanton at Lincoln, as the Kinetic Co. The subscribers (with one share each) are:—C. Steele, Telegraph Street, E.C., solicitor; S. J. Tilley, Devonshire House, Oxford Road, Kilburn, accountant. Private company. The number of directors is not to be less than two or more than five; the first are E. J. Jackson and J. H. Swanton (both permanent); qualification, 50 shares; remuneration as fixed by the company. Registered office, Rosemary Lane, Lincoln.

Franco-British Electrical Co., Ltd. (105,381).—This company was registered on October 12th, with a capital of £1,500 in £1 shares, to acquire the business carried on at 99A, Charing Cross Road, W.C., as the Franco-British Electrical Co., and to carry on the business of gas, electrical and general engineers, illuminating decorators and contractors, &c. The subscribers (with one share each) are:—A. E. Spearman, 76, Elgin Avenue, Maida Vale, W., clerk; T. J. Alexander, 40, Overhill Road, East Dulwich, S.E., clerk. Private company. Table "A" mainly applies. Registered by W. B. Styer, 11 and 12, Fenchurch Street, E.C.

A. A. Rupprecht & Co., Ltd. (105,433).—This company was registered on October 15th, with a capital of £1,000 in £1 shares, to carry on the business of mechanical, electrical and general engineers, electricians, machinists, founders, &c. The subscribers (with one share each) are:—A. A. Rupprecht, Carlton House, Lower Regent Street, S.W., engineer; E. L. Grant, Carlton House, Lower Regent Street, S.W., engineer; A. R. Martin, Carlton House, Lower Regent Street, S.W., gentleman. Private company. The number of directors is not less than two or more than five; the first are A. A. Rupprecht, E. L. Grant and A. R. Martin. Registered office, Carlton House, Regent Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Munster Electric Lighting Co., Ltd. (100,269).—Particulars of £1,000 debentures created September 17th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, at Fethard and Callan, Ireland. No trustees.

Church Stretton Electric Supply Co., Ltd. (80,857).—Charge dated September 30th, to secure £50 (supplemental to a charge dated March 17th, 1909). Property charged: Certain freehold hereditaments at Crossways, Church Stretton, Salop. Holder: E. Bond, 43, Thurloe Square, S.W.

Goring and Streatley Electric Light and Power Co., Ltd. (101,223).—Particulars of £3,000 debentures created April 20th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Trust deed dated September 14th, 1909, to secure £85,000 6 per cent. prior lien debentures. Property charged: Concessions and immovable property in Costa Rica, and the company's undertaking and property, present and future, including uncalled capital. Trustees: City Safe Deposit and Agency Co., Ltd., 13, Throgmorton Avenue, E.C.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—This company's annual return was filed on September 30th, when 2,041 shares had been taken up out of a nominal capital of £30,000 in £10 shares. £5 per share has been called up on 1,195 and £10 on 250 shares, resulting in the receipt of £8,475. £5,960 is considered as paid on 596 shares. Mortgages and charges: £6,835 7s. 1d.

Electrolytic Alkali Co., Ltd. (64,360).—Issue on September 27th of £2,950 debentures, part of a series of which particulars have already been filed.

Electro-Mechanical Brake Co., Ltd. (98,276).—A memorandum of satisfaction in full (*a*) of mortgage dated April 15th, 1909, securing £575, and (*b*) of charge dated June 7th, 1909, securing not more than £1,500, has been filed.

Crompton & Co., Ltd. (27,200).—Issue on July 19th of £100 debentures, part of a series of which particulars have already been filed.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,218).—Issue on October 1st of £1,700 5 per cent. debentures, part of a series of which particulars have already been filed.

Edmundson's Electricity Corporation, Ltd. (52,013).—This company's annual return was filed on August 31st, when the entire capital of £800,000 in £5 shares (80,000 ordinary and 80,000 preference) had been taken up. £734,000 has been paid on 66,800 ordinary and 80,000 preference, and £66,000 is considered as paid on 13,200 ordinary. Mortgages and charges: £572,000.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on October 6th of £100 debentures, part of a series of which particulars have already been filed.

Halifax and Bermudas Cable Co., Ltd. (28,972).—This company's annual return, made up to September 30th, has been filed. The entire capital of £50,000 in £5 shares has been taken up. £50,000 is considered as paid. Mortgages and charges: £10,000.

Yale Electric Power Co., Ltd. (60,493).—This company's annual return was filed on October 9th, when 668 shares had been taken up out of a nominal capital of £20,000 in 800 shares of £25 each. £25 per share has been called up on 600 shares, resulting in the receipt of £14,981 5s. £18 15s. remains in arrears. £1,700 is considered as paid on 68 shares. Mortgages and charges: Nil.

Warren, Beattie & Co., Ltd. (70,585).—This company's annual return was filed on September 8th, when 400 deferred and 796 ordinary shares had been taken up out of a nominal capital of £10,000 in 400 deferred and 1,600 ordinary shares of £5 each. £2,300 has been received on 460 ordinary and £3,680 is considered as paid on 400 deferred and 336 ordinary. Mortgages and charges: £2,000.

Dick, Kerr & Co., Ltd. (63,407).—This company's annual return was filed on October 14th, when 305,000 preference and 260,000 ordinary shares had been taken up out of a nominal capital of £650,000 in £1 shares (350,000 preference and 300,000 ordinary). £265,000 has been received, and £300,000 is considered as paid. Mortgages and charges: £265,430.

Metals Corporation, Ltd. (70,569).—This company's annual return was filed on September 2nd, when 17,532 shares had been taken up out of a nominal capital of £25,000 in £1 shares. £1 per share has been called up on 2,432, and £2,425 has been received. £7 remains in arrears. £15,100 is considered as paid. Mortgages and charges: Nil.

Dargue, Griffiths & Co., Ltd. (48,858).—A memorandum of satisfaction in full on July 17th, 1909, of mortgage dated May 25th, 1908, securing the liability under certain guarantees, has been filed. Also charge by way of indemnity on the company's undertaking and property, present and future, including uncalled capital, dated October 2nd, 1909, to secure £3,000. Holder: E. Griffiths, 51, North John Street, Liverpool.

Northampton Electric Light and Power Co., Ltd. (28,640).—Issue on October 12th of £400 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Brisbane City Electric Light Co., Ltd.

The directors' report for the half-year ended July 31st, 1909, which was submitted to the meeting held in Brisbane on September 14th shows that during the half-year the output was 1,035,429 units, as against 960,715 for the corresponding period of 1907, being an increase of 7½ per cent. Comparing the revenue from the sale of electricity for the same periods, the increase has been 11¼ per cent., while the revenue from all sources has increased 7½ per cent. The results of the half-year's working have been such, that after placing £500 to the credit of the franchise purchase sinking fund account, £150 to the accident insurance account, and a substantial sum to the credit of renewals, replacements, and contingencies account, there remains a credit balance of £2,686, which, with the balance brought forward from last half-year, makes a sum of £4,622 to be disposed of. The directors recommend that a dividend, at the rate of 6 per cent. per annum, be paid on the preference shares, and a dividend at the rate of 7 per cent. per annum be paid on the ordinary shares, in proportion to the amount paid thereon; they also recommend a bonus at the rate of 2 per cent. per annum on the ordinary shares, in proportion to the amount paid thereon. The payment of the above-mentioned dividend and bonus, together with the dividend duty, will absorb £3,218, leaving a balance of £1,404 to be carried forward. During the half-year, all the machinery and plant, as well as the underground mains, have worked well, and have been maintained in a state of high efficiency, and the thanks of the shareholders are again due to the staff for the good work performed. During the half-year the 700-KW. turbine plant mentioned in the last report has been installed, and has, during the last week, been taken over from the contractors. The anticipation of the directors has been justified in connection with this plant, as the maximum load in the station increased 27 per cent. during the half-year. Good progress has been made in the extension of mains in the Valley area, and also in the laying of ducts for feeders from the new power house to the Queen Street area. The plans for the new waterside (William Street) power house had been completed by the company's architects, who were at the date of the issue of the report calling tenders for the erection of same.

United Electric Tramways Co. of Caracas.

This company held its meeting in London on Tuesday. The report for the period of 18 months from January 1st, 1908, to June 30th, 1909, which was then submitted, states that the working of the tramways during the time that the electrification of the lines was in progress was carried on for account of contractors, who paid all expenses including the costs of the London administration up to March 15th, 1908, and consequently the accounts of the company commence only from that date. The results of the operations of the local company from March 16th, 1908, to June 30th, 1909, before charging mortgage interest, which is payable to this company and amounted £13,175, were as follows:—Gross receipts £42,000, operating expenses £31,654, net receipts £10,346. The improvement in the political and internal condition of Venezuela is reflected in the steadily increasing passenger traffic of the tramways. The local company is under contract to carry meat from the public slaughter house to the city, but from causes in operation prior to the purchase of the tramways, this service was carried out by a local railway company. The result during the period covered by the accounts was a loss to the local company of Bs. 11,091. This arrangement is now ended, and the local company will in future carry the meat, upon which a considerable profit is anticipated. The total length of track which has been electrified is 13¾ miles. Two miles of new lines are in course of construction, which, when completed, are expected to give facilities for greater economy in working and also a considerable additional traffic. The profit and loss account shows that after meeting interest on the first mortgage debenture stock, paying all costs of administration and placing £425 to sinking fund for redemption of mortgage debenture stock, a balance remains of £394, which is carried forward. The mortgage of the property of the local company to this company has been duly completed and vested in the name of the Consolidated Trust, Ltd., the trustees for the debenture stockholders.

Monte Video Telephone Co., Ltd.

The directors' report for the year ending July 31st last show, after providing for all working expenses in Monte Video and London, a net profit for that period of £19,931, as against £19,401 for the previous year. The interim dividends paid on May 1st last absorbed the sum of £4,343, leaving a balance of £15,588, to which should be added £2,797 brought forward from last year, making an available balance of £18,385. After applying £11,000 to depreciation of the company's property and plant, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving a balance of £3,042 to be carried forward. There has been a moderate increase during the year in the number of subscribers and in revenue.

Cuba Submarine Telegraph Co., Ltd. — The directors' report states that the total receipts of the six months ended June 30th were £17,706, while the expenses amounted to £6,635, leaving a balance of £11,071, to which has to be added £6,788 brought forward from last account, giving a total of £17,859 to be dealt with. The sum of £3,000 has been added to the reserve fund, which now stands at £114,000. The dividend on the preference shares will absorb £3,000, and leave £11,859, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax, the balance, £7,059, being carried forward to the current half-year. An interruption occurred in May to the Batabano-Cienfuegos 1891 cable, which was speedily repaired, and all the cables are now in good working order.

Reduction of Capital.—Electricity Supply Co. for Spain, Ltd.—A petition for confirming a resolution reducing the capital from £205,000 to £105,000 is to be heard in London on November 2nd.

Parsons Marine Steam Turbine Co., Ltd.—A final dividend of 5 per cent. and a bonus of 2½ per cent. are recommended, making 12½ per cent. for the year; £5,000 is written off patent rights, and £10,532 is carried forward.

Austria.—The balance-sheet of the Vereinigte Electricitäts Gesellschaft, of Vienna, for the last financial year shows a net profit of 599,104 crowns, as compared with 590,035 crowns in the preceding 12 months. A dividend at the rate of 6 per cent. is being maintained.

Ferranti, Ltd.

The directors' report for the year to June 30th, 1909, shows that the profit on trading was £29,218, and after crediting discounts and interests and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, bad debts and directors' and trustees' fees, there remains a balance of £12,240, which has been applied as follows: Interest on prior lien debentures, £818; interest on first mortgage debenture stock, £5,000; interest on bank loan, £1,115; amount charged in respect of depreciation, £5,000 = £11,933, leaving a balance of £307. This sum has been deducted from the balance standing at the debit of profit and loss account at June 30th, 1908, reducing the amount to £1,830. The commercial depression has continued during the whole of the financial year, and the results show a falling off as compared with the previous year.

Prospectuses.—*The Nilambur Rubber Estates, Ltd.*—250,000 shares have been offered for subscription. The company owns among its estate property in Southern India about 3,000 acres suitable for rubber. On 1,029 acres there are planted 132,256 Para rubber trees of ages ranging up to three years.

Cuban Telephone Co.—An issue of £1,050,000 5 per cent. first mortgage convertible bonds has been offered in this country at £92 per cent.

Washington Traction Co.—400,000 shares of $5 each have been offered at £1 each. The company is to construct and operate an 88-mile electric railway in the State of Washington, and to supply electric power for all purposes.

Cleveland and Durham Electric Power, Ltd.—The *Financial Times* Darlington correspondent says that the annual report shows that during the year ended June 30th investments in associated companies increased by £7,987. Capital expenditure on works amounted to £14,084, which small total was due to continued trade depression and consequent diminished amount of new business. The gross profit for the year was £2,098, and after providing for debenture and other interest there remained a debit balance of £4,909. From this was to be deducted £1,252, the amount brought forward from the previous year, leaving a debit balance of £3,657 to carry forward. Connections to the company's system showed an increase of 9,744 H.P., and an additional 3,500 H.P. had been contracted for. The extension of the mains system from North Bank, River Tees, to Murton had been completed, and the company's system in the Tees district had been connected up with that of the Newcastle and Durham County Distribution Companies on Tyneside.

Stock Exchange Notice.—Application has been made to the Committee to allow the following security to be quoted in the Official List:—Rosario Electric Co.—Further issue of 2,553 6 per cent cumulative second preference shares of £5 each fully paid.

Official Announcement re Companies.—The following are to be struck off the register in three months, unless cause is shown to the contrary:—

Chitty Dynamo and Motor Co., Ltd.
French Victoria Accumulator Co., Ltd.
Gutta-Percha Corporation, Ltd.
H. M. Salmony & Co., Ltd.
Phœbus Solder and Electric Soldering Fluid Co., Ltd.
Premier Electric Lamp Syndicate, Ltd.
Smokeless Chimney Co., Ltd. (Registered July 21st, 1899.)
Special Telephone Directories, Ltd.
Steam Boilers Circulators' Co., Ltd.
Warrington and District Electric Light and Power Co., Ltd.

Mexican Light and Power Co.—A dividend has been declared of 3½ per cent. on the preference shares for the six months ending October 31st.

Mexico Tramways Co.—A dividend of 1½ per cent. is announced for the quarter ended September 30th.

The American Westinghouse Co.—According to the *Electrical World* the Westinghouse Electric and Manufacturing Co., on September 29th, announced that regular dividends upon the preferred stock would be resumed, and declared a quarterly dividend at that time of 1¾ per cent. There was also declared a dividend of 3½ per cent. on account of the accumulations overdue since October, 1907, upon the preferred stock. This stock is entitled to 7 per cent. per annum cumulative, and 12¼ per cent. back dividends were due. There is outstanding $3,998,700 of this preferred stock. "No information has been given out as to how soon the earnings of the company will permit a dividend upon the assenting stock, of which $56,000,000 is authorised and $37,000,000 is outstanding. It is believed that the back dividends upon the preferred stock will be entirely liquidated before the other matter is taken up. The Westinghouse concern announces a very satisfactory expansion in business, sufficient working capital, and altogether a very good financial standing."

Bank Rate.—The Bank Rate was yesterday raised from 4 to 5 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Oct. 13	2,740	— 87	19	29,476	— 608	..	..
Ayr	,, 16	421	— 30	22	8,527	— 103	8	..
Bath	,, 16	1,569	— 94	41	32,340	+ 1,350	..	..
Belfast	,, 15	7,833	+ 214	27	109,625	+ 4,614	37	..
Birkenhead.. ..	,, 17	2,186	+ 2	23	31,082	— 398	13·63	..
Birmingham Corp.	,, 9	13,831	+ 639	28	181,459	+ 4,611	56·5	..
Blackburn	,, 13	2,166	— 271	29	32,814	— 1,140	13·97	..
Blackpool-Fleetw'd	,, 16	863	— 299	15	19,740	+ 921	..	..
Bolton	,, 17	4,745	+ 137	29	68,641	— 201	26	..
Bournemouth ..	,, 13	3,169	— 16	28	51,241	+ 207	21·96	..
Bradford	,, 9	9,925	— 15	27	137,333	+ 3,568	54·81	..
Brighton	,, 17	1,899	+ 31	29	30,616	+ 1,358	9·5	..
Bristol	,, 15	11,354	+ 736	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 8	475	+ 2	40	8,792	— 80	3·65	..
Barnsley	,, 8	337	— 27	,,	6,767	— 356	..	..
Barrow	,, 8	467	— 39	,,	9,416	— 653	5·37	..
Cavehill	,, 8	177	+ 1	,,	3,630	— 78	..	..
Devonport ..	,, 8	746	— 293	,,	14,860	— 3,822	8·85	..
Gateshead ..	,, 8	2,053	— 60	,,	39,916	— 503	11·25	..
Gravesend ..	,, 8	453	— 13	,,	8,541	— 113	6·5	..
Greenock	,, 8	1,229	+ 160	,,	22,548	+ 1,157	7·25	..
Hartlepool ..	,, 8	496	— 18	,,	9,557	— 205	6·72	..
Kidderminster ..	,, 8	205	— 6	,,	4,457	— 178	..	..
Leamington ..	,, 8	387	+ 2	,,	7,197	+ 250	..	..
Merthyr	,, 8	408	— 51	,,	8,593	+ 31	2·9	..
Metropolitan ..	,, 8	12,923	— 232	,,	250,489	+18,590	22	..
Middleton ..	,, 8	667	— 66	,,	13,697	— 948	8·5	..
Mid. Joint Com'tee	,, 8	12,158	+ 95	,,	229,210	— 2,024	..	..
Oldham—Ashton	,, 8	1,158	— 73	,,	22,613	— 1,310	9·13	..
Peterborough ..	,, 8	313	— 40	,,	4,849	— 416	5·31	..
Potteries	,, 8	3,790	+ 95	,,	71,383	— 1,002	29	..
Rothesay	,, 8	279	..	,,	9,517	+ 177	2·75	..
Southport.. ..	,, 8	561	— 66	,,	11,962	— 341	8·17	..
S. Metropolitan..	,, 8	1,648	— 237	,,	32,454	— 534	..	..
Swansea	,, 8	2,235	+ 263	,,	39,225	+ 1,104	12·5	..
Tynemouth ..	,, 8	445	— 43	,,	10,388	+ 744	3·75	..
Weston-s Mare ..	,, 8	229	— 12	,,	6,808	+ 393	3	..
‡Worcester ..	,, 8	581	— 35	,,	11,389	— 163	5·75	..
Wrexham — ..	,, 8	202	— 17	,,	4,004	— 153	..	..
Yorks. Wool. Dist.	,, 8	1,969	— 23	,,	36,827	— 91	17	..
Miscellaneous ..	,, 8	424	— 5	,,	8,506	+ 135	..	..
Burnley	,, 16	2,611	+ 219	..	..	..	..	..
Burton-on-Trent ..	,, 17	587	+ 13	29	7,856	— 193	6·63	..
Bury	,, 17	2,437	+ 127	$28\frac{4}{7}$	34,625	— 471	22·5	..
Cardiff	,, 9	4,439	+ 68	28	62,942	+ 670	..	..
Carlisle	,, 16	357	— 6	41	6,919	— 327	..	..
Chatham and Dist.	,, 14	1,866	— 55	41	34,171	+ 1,573	14·98	..
Cork	,, 14	1,034	+ 60	41	18,604	— 544	9·89	..
Croydon	,, 1	3,452	+ 584	..	41,869	+ 2,665	11·25	4·75
Darlington	,, 16	367	— 20	29	5,406	— 400	..	..
Darwen	,, 15	511	— 4	28	7,190	— 205	4·36	..
Dover..	,, 9	427	— 30	28	6,394	— 428	4·75	..
Dublin	,, 15	10,974	+ 192	..	89,518	— 1,574	54·25	..
Dundee	,, 13	2,499	— 58	$21\frac{4}{7}$	26,210	— 534	15	..
East Ham	,, 18	2,012	+ 111	28½	29,138	+ 3,686	8 52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 16	35,621	— 711	..	336,829	— 5,156	94½	5
Hastings	,, 14	2,024	— 219	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeson	,, 13	272	— 19	28	3,892	— 243	..	..
†Ipswich	,, 9	399	— 4	28	11,981	+ 118	10·5	..
Kilmarnock.. ..	,, 16	293	— 3	22	3,352	— 117	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	,, 13	2,583	— 278	41	54,791	— 714	39	..
Leeds	,, 9	13,891	+ 48	28	190,978	+ 4,101	54	6
Leicester	,, 16	4,828	+ 16	..	..	..	..	..
Leith	,, 9	1,232	+ 91	21	13,580	+ 1,734	9	3
†Liverpool	,, 2	11,158	— 285	$39\frac{2}{7}$	422,058	— 2,122	58 5	..
‡L.C.C.	,, 2	77,924	+2,454	..	974,119	+36,151	124·7	2·375
London United ..	,, 16	11,910	—2,193	..	254,171	—27,427	..	..
Lowestoft	,, 16	886	— 18	3	448	— 22	3·5	..
Manchester ..	,, 16	30,399	—1,501	29	435,205	— 4,697	105	..
Newcastle	,, 16	7,964	+ 173	..	111,540	— 1,397	..	..
Newport	,, 9	1,340	— 1	27	18,709	— 311	14·5	..
†Oldham	,, 10	1,878	+ 42	28	53,662	— 3,747	23·75	..
†Pontypridd.. ..	,, 9	410	— 16	27½	11,616	+ 1,014	5·5	1·75
Portsmouth.. ..	,, 16	8,900	— 124	29	64,733	+ 1,793	14·5	·75
Preston	,, 13	1,513	+ 32	..	..	..	..	..
Rotherham	,, 14	1,169	— 86	28	16,768	— 849	10	·66
Salford	,, 11	9,195	— 659	$27\frac{3}{7}$	128,968	— 3,985	..	..
Sheffield	,, 17	11,934	+ 796	$29\frac{3}{7}$	166,268	— 209	39·62	2·6
Southampton ..	,, 13	2,181	— 5	28	81,818	— 427	..	..
Southend-on-Sea ..	,, 13	950	+ 23	29	17,006	+ 2,350	..	..
South Shields ..	,, 16	1,115	— 6	$28\frac{3}{7}$	16,569	— 81	..	..
†Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 13	815	— 41	15	6,763	+ 226	..	..
Wallasey	,, 16	1,802	+ 11	$28\frac{3}{7}$	27,643	+ 700	..	·22
Walthamstow ..	,, 16	1,283	— 9	29	19,894	+ 286	9	..
West Ham	,, 9	4,768	+ 94	27	64,955	+ 3,977	15·13	·49
Wolverhampton ..	,, 13	1,914	+ 193	28	23,528	— 503	14·25	1·75
Baker St.-Waterloo	,, 16	6,585	+ 270	15	44 610	+ 200	4·25	..
Cen. London Rly...	,, 16	11,126	—5,839	15	75,829	—37,272	6·32	·55
Char. +, Ens. Hamp.	,, 16	7,610	+ 745	15	54,940	+ 5,715	7·75	..
City & S. Lon. Rly.	,, 16	6,256	+ 212	15	46,058	+ 1,498	7·3	..
Dublin-Lucan Rly.	,, 15	282	+ 12	15	2,479	+ 84	7	..
G.N. and City Rly.	,, 16	2,800	+ 10	15	19,224	— 21	3.5	..
G.N., P'y. & Brmtn.	,, 16	11,155	+ 670	15	75,615	+ 1,120	9·25	..
L'pool Overh'd Rly.	,, 17	2 604	— 34	15	22,836	+ 23	6·8	4·8
Llandudno-Col. Bay	,, 15	887	— 2	46	13,441	+ 2,150	..	..
Mersey Railway ..	,, 18	8,870	+ 140	15	28,928	+ 1,103	4·5	..
Metropolitan Rly...	,, 17	32,683	—1,805	..	238 815	— 5,187	21·5	..
Met. District Rly...	,, 16	20,178	+ 280	15	142,853	+ 5,731	24	..
Anglo-Argentine ..	,, 14	83,546	+ 5,832	..	1,605,110	+98,062	..	..
§Auckland	Sept. 10	13,038	+ 195	36	124,707	+11,020	22·3	1·38
Bombay (B.E.T.) ..	,, 16	6,034	+ 102	37	92,819	+ 5,482	..	..
§Brisbane	,,	15,800	+1,310	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta ..	Oct. 16	7,085	+1,874	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Sept.	4,269	..	..	31,584	..	20·5	..
Madras	Oct. 15	1,331	+ 135	..	24,811	+ 756	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	,, 15	2,712	+ 169	..	57,861	+ 682	28	2·4

* Compared with the corresponding period of 1908. † One week only, ‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

VARIOUS causes—of which money is the principal—conspire to hinder the course of free business in Stock Exchange markets, and the markets generally have fallen into a sort of jog-trot condition. There are spasmodic gasps of strength in the Home Railway market, and there is a good deal of activity amongst rubber shares.

Prompted, no doubt, to some extent by the success of the New York Telephone issue, the Cuban Telephone Company has this week been offering £1,000,050 of 5 per cent. First Mortgage Convertible bonds at 92. It cannot be said, however, that this was received with a superabundant amount of enthusiasm, and before the lists closed the price was quoted "round about par"—*i.e.*, 92—in the market. The New York Telephone scrip commands a premium of 3 for cash, and ¼ more for special settlement.

The breath of improvement in Home Railway prices has not electrified any of the quotations with which these paragraphs are more particularly concerned. Indeed, Metropolitan Consolidated has sagged away, and Districts, too, are down after their rise of last week. The company's 6 per cent. Debenture stock fell 2, to 142, and, in view of the manifestly improving fortunes of the company, this security may be worth notice by the investor, yielding, as it does, 4¼ per cent. on the money at the present price, and with dividends due in January and July.

Baker Street and Waterloo 4 per cent. Debenture changed hands at 99¾ on Monday, Charing Cross and Euston Fours at 96 and Piccadilly Debenture at 96⅝ on the same day. Piccadilly 4 per cent. Preference stand at 8¼, at which the return is a trifle under 5 per cent. on the money. The Brighton Railway's electrified portion is expected to be open for traffic on December 1st next.

The feature in the rubber market is the amazing rapidity with which prospectuses of new issues continue to be poured out, practically every day bringing one or more fresh undertakings to the attention of the public. Somewhat a novelty is the offer at 2s. per share of 250,000 Nilambur Rubber Estates shares of 3s. each, with 1s. 6d. paid up. The offer is made by the London Financial Trust, and the shares are available in respect of an option to subscribe for shares which was granted at the time the company was registered.

After a sharp shake out of weaker holders, the rubber share market has hardened up again, and prices exhibit a quiet amount of steadiness which will, if maintained, serve a more excellent public purpose than all the wild gyrations, slumps and booms that have attended the rubber market throughout the current year.

Some of the authorities in the electric lighting companies aver that the famine price of rubber, the raw material, will make little perceptible difference in the expenditure, although, of course, it must exercise a certain influence. The outlook for the electricity supply prices is rendered none the rosier for the rise in rubber, but then people have ceased to take any particular interest in these descriptions. The price-lists overleaf show no alterations amongst the Metropolitan shares. In Bromptons the fall has been stayed; perhaps certain strong representations from the Stock Exchange helped to check the drop, but the prices are still flat. Hove shares have come down 7s. 6d., of which 4s. is due to the *ex* dividend marking. River Plates continue to ascend; the Ordinary are now up to $1\frac{9}{16}$ middle.

The Mexico-Canada group is quieter than usual. Mexico Trams are unchanged, and Rio Trams at 93 are *ex* a dollar dividend. The 5 per cent. first mortgage gold bonds at 95 and the 5 per cent. mortgage bonds at 85 show very little change. British Columbia Electric Railway stocks are very strong. The Deferred is up 7 and the Preferred 1.

British Electric Tractions are quoted nominally a trifle easier, but the First Debenture is again the turn harder, and the Preference shares are ⅛ better.

In the Telegraph department the few alterations are mostly due to the deduction of dividends. Anglo-American Deferred is, perhaps, the strongest feature. Direct United States shares recovered part of their dividend, Eastern Extensions the whole of theirs. Marconi shares are dullish, and in the Trust group nothing noticeable has happened. Telephone issues are steady. United River Plate Ordinary have gone over 7, and Monte Videos are better by a shade.

Babcock Preference gained $\frac{1}{16}$. So did British Westinghouse Preference: those fully-paid shares of £5, which stand at 7s. 6d.Romptons and Ediswan partly-paid shares are rather lower.

Montreal Light, Heat and Power Co.—A dividend of 1¾ per cent., at the rate of 7 per cent. per annum, for the past quarter, is announced.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Oct. 12th.	Closing Quotations Oct. 19th.	Business done week ended Oct. 19th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3 — 3½	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 97	95 — 98	..	..	+1	5 2 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	145 —147	..	..	..	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	61½ — 63½	61 — 63	..	..	— ½	5 3 2
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	102 —103	102¾	101	—3	5 16 6
8,220,770	Do. do. do. Deferred	Stock	½%	1⅞%	1 %	8/-	20⅞— 21⅛	21¾— 22	22	20 11/16	..	1 17 10
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	102½	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 9⅜	8 — 8⅝	..	..	..	4 14 1
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88 — 90 xd.	88 — 90	89¼	88½	..	4 8 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝— 9⅜	8⅝— 9⅜	9⅛	..	..	6 8 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½— 18½	17½— 18¾	..	..	..	5 8 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13¼— 13¾	13⅜— 13⅞	13 3/16	..	+ ⅛	6 4 7
48,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —132	127 —130	130	127½	—2	5 7 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 — 87	84 — 86	85⅝	84¼	—1	4 0 11
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104½—106½	105⅛	104¾	+ ½	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12 1/16	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103⅜	102	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10 7/16	..	..	5 8 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅝— 14⅝	13⅝— 14⅛	13⅝	13 17/32	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26½— 27½	26 11/16	26⅝	+ ½	6 10 11
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51½— 53½	51½— 53½	52	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 96	93 — 95	93¾	..	— ½	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	75 — 78	77 — 79	77	..	+1½	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝— ⅞	¾— ⅞	..	..	+ 1/16	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝— ⅞	¾— ⅞	..	..	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108	107 - 108½	107	..	+ ½	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	122	121	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	5 7/16	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98¾	98½	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 15/32— 1 19/32	1 15/32— 1 19/32	30/-	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86½— 88½	86¾	..	+ ½	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 — 102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7¾— 8¼	7⅝— 8⅛	..	..	— ⅛	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	131 —134	129 —132	..	..	—2	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞— 7⅛	7 — 7¼	7¼	7 1/16	+ ⅛	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5⅜— 5⅝	..	..	+ 1/16	4 8 10
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 58,008	2½	Nil	2½%	2½%	2½%	1 7/16— 1 11/16	1 7/16— 1 11/16	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13¼— 14	13¾	13 9/16	..	5 0 0
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	15/7½	14/-	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9¼	8¾— 9¼	9	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½— 9½	8½— 9½	9¼	..	..	15 15 10
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝— 4⅞	4⅝— 4⅞	96/3	93/1½	..	5 2
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	..	..	..	5 6
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	92¼— 93¼	92 —93	93	92½	— ¼	4 6
882,867	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅜— 4½	4 7/16— 4 9/16	90/-	88/9	+ 1/16	4 7 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1 7/16— 1 9/16	..	..	+ 1/16	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½— 1	½— 1	..	..	..	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¼— 3½	2¼— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	151 —156	151½	148	+7	5 2 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —125	121 —126	122	..	+1	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	111½	110½	..	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	100 —102	..	..	—2	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	3 %	Nil	Nil	Nil	¾— 1	⅝— 1	15/7½	15/-	— 1/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 — 2½	2⅛— 2⅝	46/-	45/-	+ ⅛	6 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82 — 85	82½— 85½	84	83½	+ ½	5 9 1
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	62 — 66	62 — 66	..	..	..	5 17 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7½— 7⅞	7½— 7⅞	..	..	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16— 7/16	¼— ½	..	..	+ 1/16	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	39 — 42	40 — 43	..	..	+1	9 6 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4¾— 5¼	4⅝— 5⅛	..	..	— ⅛	4 7 10
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —103	101 —104	103½	..	+1	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜— 11⅛	10⅜— 11⅛	10½	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5¾	5⅜— 5¾	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105—107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 1/16— 2 3/16	43/-	42/8	+ 1/16	5 19 1
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	61 — 63	60 — 62	62½	60½	—1	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	80½— 81½	80 — 81	80¾	80	— ½	4 16 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	⅞ — 1⅛	½— 1	..	..	— ⅛	15 1 8
180,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.   † A period of nine months.   ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 12th.	Closing Quotations Oct. 19th.	Business done week ended Oct. 19th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
280,000	Dick, Kerr & Co., 1 to 280,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	8 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100—103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/16— 5/16	5/32— 9/32	..	..	— 1/32	27 5 4
17,189	Do. "A" shares, 01—017,189	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 3/16— 1 7/16	1 3/16— 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8¼— 8¾	8¼— 8¾	..	..	..	5 14 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87 xd	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
98,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103¼	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13¼	12½— 13¼	12⅝	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	15 — 15¾	15 — 15¾	15 11/16	15⅝	..	6 11 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2¼— 2¾	51/3	51/-	..	13 12 8
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38¼— 38¾	37¾— 38¼	38⅜	37¾	— ½	1 6 2
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2⅝%	2¾%	65 — 67	65 —67	..	..	..	4 2 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16¼— 16¾	16½— 17	16⅞	16¼	+ ¼	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	9/16— 21/32	19/32— 11/16	13/-	..	+ 1/32	6 10 11
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16— 13/16	23/32— 27/32	..	..	+ 1/32	6 7 0
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½— 96½	94½— 96½	96	..	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	127 —130	127 —130	128¾	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	92 — 94	93	92	..	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	86½	86	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	34⅝	34 9/16	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	103⅜	103⅛	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88	87	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	33 — 35	32 — 34	34	32½	—1	
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,668	1	Nil	..	6 %	6 %	2¼— 2¾	2 — 2½	45/-	40/-	— ¼	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	7⅜	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4⅞	4⅜— 4⅞	87/6	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	..	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅝— 10⅞	10⅝— 10⅞	11	10⅝	..	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	12½	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	6 1 8
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10 23/32	10¾	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	104 —107	106	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 8 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	58	57⅞	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅛— 7⅝	6¾— 7¼	6 15/16	6⅞	— ⅜	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	99 —101	100⅝	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1¾— 2⅛	1⅞— 2¼	41/3	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5¼	4⅞— 5¼	..	..	— 1/16	5 14 3
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	82⅞	82	..	4 0 11
$8,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	82 — 84	..	..	..	5 19 1
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	73 — 77	72 — 76	73½	72¾	—1	4 12 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	105 —109	106¾	106½	+1	6 8 5
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	86 — 88	86½	86	..	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	97 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	99 — 101	..	..	—1	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 13¼	12¼— 13¼	..	..	..	5 6
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 15/32— 1 19/32	1½— 1⅝	31/-	..	+ 1/32	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	22/6	..	..	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
86,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	23/1½	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102—105	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	32/6	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½— 78½	74½— 78½	76¼	75¼	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	15/16— 1	15/16— 1	19/6	19/3	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8½— 9	8½— 9	..	..	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 4 per cent., October 14th, 1909.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 608.)

EFFECTS OF TELLURIC CURRENTS ON CABLE-BREAK LOCALISATION.

The writer has already referred to the possibility of localisation tests having to be made on a cable from which a strong *positive* current is found to be flowing. Allusion is not here made to the ordinary *positive* current due solely to the copper-iron couple at the break, but to a much stronger current produced, may be, by abnormal terrestrial magnetic conditions which have caused a strong telluric current of one sign or another to flow from the testing end of a broken cable.

Under normal conditions the application of the usual *negative* testing current causes the current of *positive* sign due to the copper-iron couple at the break to be, as it were, swamped, and the copper polarised in such a manner as to give a current from the break in a *reverse* direction, that is to say, of negative sign.

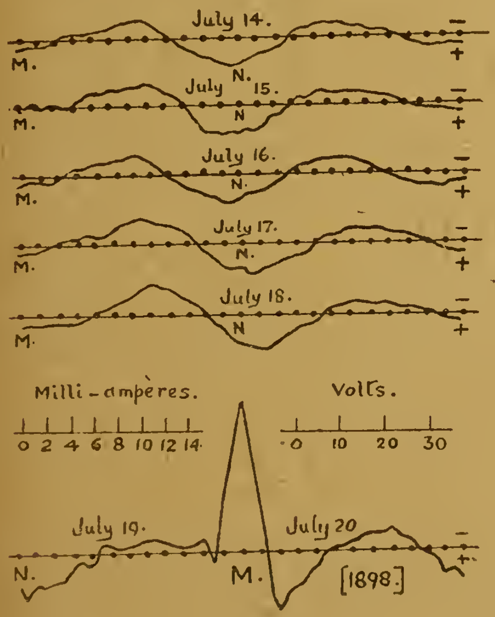


FIG. 47.

Clearly, under these normal conditions, the ordinary testing routine with negative currents of various strengths would give the usual results according to the Kennelly or the Schaefer law, under which conditions, the higher the testing current used, the lower would be the apparent resistance at the break, and *vice versa*.

If, however, the *negative* polarisation current be swamped by a strong telluric current of *positive* sign, the normal fall of bridge balances obtained on a cable will be completely altered, and it may be that with normal testing currents zinc to line, the higher battery powers will be found to produce the higher bridge readings, and the lower powers the lower bridge readings, with consequent necessity for resorting to a carbon testing current. This is a somewhat involved question, and one that the writer would wish to see thoroughly dealt with in future editions of existing excellent text-books on submarine cable electrical tests.

Exact knowledge of actual conditions regarding the resultant testing current passing into a cable influenced by a strong telluric current one way or another is given by a mil-ammeter between the other apparatus and the cable. The mil-ammeter has, of course, long since been reckoned indispensable for cable-break localisation purposes.

Fig. 47 shows a few out of many days' telluric current observations made at Cape Cod in July, 1898, under the direction of the writer on a length of 1,562 nautical miles of Atlantic cable—core 660 Cu/400 G.P. per N.M.—making earth at the distant end, in mid-ocean. (CR = 2,637 ohms approx.) at sea temperature.

In the diagram dots mark off hours as abscissæ of the curves, while the accompanying scales of milli-amperes and volts facilitate evaluation of the curve ordinates.

Observations made July 14th to July 18th inclusive, may be taken to indicate normal telluric current conditions across the North Atlantic.*

Inspection of curves—or of the figures in the following table—for any one of the days on which earth currents were normal, July 18th, for instance, will show that at Cape Cod at 7 a.m. on that day a negative E.C. at 7 volts P.D. (*a*) flowed from the cable, whereas later on, at 1.30 p.m., the E.C. was at a P.D. of 8 volts *positive* (*b*).

Towards eleven o'clock on the night of July 19th a "magnetic storm" gave signs of approach, and is found duly recorded in the portion of the curves for July 19th and 20th, given in fig. 47 with midnight instead of noon in the centre of the horizontal time-line, so that the configuration of this telluric disturbance may be more clearly shown. The main feature of this disturbance is seen to be the 33-volt peak *negative* (*c*) covering over two hours, followed by a back swing peak of a maximum 13 volts positive (*d*) abnormal variation. This disturbance subsequently was proved to have synchronised with similar abnormal variation photographically recorded on the horizontal force and declination magnetometers at Greenwich, Kew, Stonyhurst and Paris. Here, then, are four instances, viz., *a*, *b*, *c*, *d*, where, had a localisation test been undertaken, E.C. conditions would have been found somewhat diversified. The column giving effective milliamperes under normal bridge conditions (ratio = 1,000 : 1,000) affords evidence of what contrary E.C. conditions may be met with at various times by a cable electrician on his starting to localise a break.

Instances.	Date (1898).	Time, New York.	Earth current (E.C.).			
			Volts.		Milli-amps.	Effective milli-amps. under normal bridge conditions.
			+	−		
(*a*)	July 18	7 0 a.m.	—	7	2·7	2·1
(*b*)	" "	1.30 p.m.	8	—	3·0	2·4
(*c*)	" 19/20	midn't.	—	33	12·5	10·1
(*d*)	" 20	2.0 a.m.	13	—	4·9	4·1

The figures in the foregoing table do not, of course, exactly give telluric current values, seeing that these must necessarily be affected by the slight voltage pertaining to the natural battery (Fe — Cu) couple at the cable break. In fact, the natural positive current from the battery couple at the break must itself be modified in the presence of a much more powerful telluric current which must necessarily polarise the exposed copper at the break one way or another, additional complications and reactions thus arising in any true analysis of what really takes place at the break, and so—*ad infinitum!*

GRAPH PROOFS OF CABLE-BREAK TEST CONDITIONS.

Here follow graph proofs by the writer illustrative of the foregoing remarks on the *Polarity of Test Currents*.

In figs. 48 and 49, the galvanometer used on the bridge is taken—for simplicity of illustration—as being like an electrometer, or on a circuit of practically infinitely high resistance, as through a condenser. The inward or outward deviation of the lines of potential-fall at points coinciding with G_1 and G_2 is thereby avoided, and the diagram simplified.

Fig. 48 shows test conditions at moment of application of *positive* or *negative* testing P.D.'s to a cable already affected by a natural *positive* P.D. at the break.

If from any cause—such, for instance, as a strong *positive* telluric current—the natural P.D. at the break is maintained *positive*, then fig. 48 shows how, when this is so, dual tests to scale zero with *negative* currents must necessarily be useless, as the higher testing current neg. C_2 produces the higher apparent resistance T_1, as read on the bridge at t_1, whilst the lower current neg. C_1 produces the lower apparent resistance T_2 as read upon the bridge at t_2.

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* See article on "Atlantic Earth Currents." By E. Raymond-Barker. ELECTRICAL REVIEW, May 4th, 1899.

On the other hand—as shown by fig. 48—a dual test with *positive* current becomes effective and affords rational results. Here the higher of the two currents, pos. C_2 is seen to be productive of the lower apparent resistance T_3 indicated by the bridge reading t_3, whilst the lower current pos. C_1 brings about the higher apparent resistance T_4, as shown by the higher bridge reading t_4.

Fig. 49 shows a reversed, and what might be termed the orthodox condition of things, viz., that state of affairs that the cable electrician expects to find when he starts to localise a cable break. Here, the application of *negative* testing P.D.'s has polarised the exposed copper at the break so that the former weak positive Cu — Fe battery-couple P.D. has become reversed to *negative*. This negative P.D. at the break now opposes the *negative* testing P.D.'s, so that—contrary to the conditions existing in the former fig. 48—the higher and lower P.D.'s, viz., neg. C_2 and neg. C_1 respectively bring about lower and higher apparent resistances T_1 and T_2, as observed at the corresponding bridge balancing resistances t_1 and t_2.

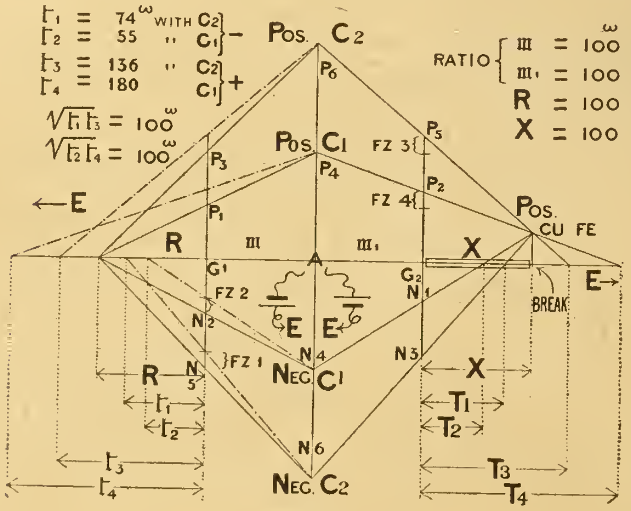

FIG. 48.

A similar state of affairs as regards polarity of P.D. would prevail—though to a greater degree—in the event of a strong *negative* telluric current flowing, so to speak, from the break towards the testing station, opposing, therefore, any applied testing current of *negative* sign, for well-known reasons, the right polarity to test with whenever practicable.

Fig. 48 and fig. 49 include graph illustration of so many other points connected with Wheatstone bridge tests on cables traversed by earth currents, that some additional interpretation may here be given.

Bridge ratio resistances $m = m_1 =$ (say) 100^{ω}. Balancing resistances $R =$ cable $X = 100^{\omega}$ respectively to earth at E, and at break.

To bridge apex A may be applied higher and lower battery powers of either sign, viz. : Neg. C_2, C_1, or pos. C_2, C_1, these severally producing at various easily recognisable points potentials N_1 —— N_6, and P_1 —— P_6.

T_1 and T_2 = observed resistances of cable by bridge readings (to scale zero) t_1 and t_2 under *negative* testing currents.

T_3 and T_4 = observed resistances of cable by bridge readings (to scale zero) t_3 and t_4 under *positive* testing currents.

R, m, m_1, and X each being $= 100^{\omega}$, linear measurement of the various balancing resistances t_1, t_2, t_3, t_4, will show that by construction in, say, fig. 48 :—

$$t_1 = 74^{\omega} \text{ under higher power } \textit{negative},$$
$$t_3 = 136^{\omega} \quad ,, \quad ,, \quad ,, \quad \textit{positive}.$$

Then $X = \sqrt{74 \times 136} = 100^{\omega}$ the correct C R of cable here obtained by Dressing's geometrical mean.*

Again, in fig. 48 by construction, the linear measurement :—

$$t_2 = 55^{\omega} \text{ under lower power } \textit{negative},$$
$$t_4 = 180^{\omega} \quad ,, \quad ,, \quad ,, \quad \textit{positive}.$$

Then $X = \sqrt{55 \times 136} = 100^{\omega}$ the correct C. R. of cable by Dressing's geometrical mean. This mention of the geometrical mean has, of course, no practical bearing on tests to a break. It is merely illustrative of the comprehensiveness of graphs, figs. 48 and 49.

Reasoning similar to the above applies also to the extracting of parallel values from fig. 49, but in the reverse order, owing to the E.C. potential in that graph being *negative* instead of *positive*.

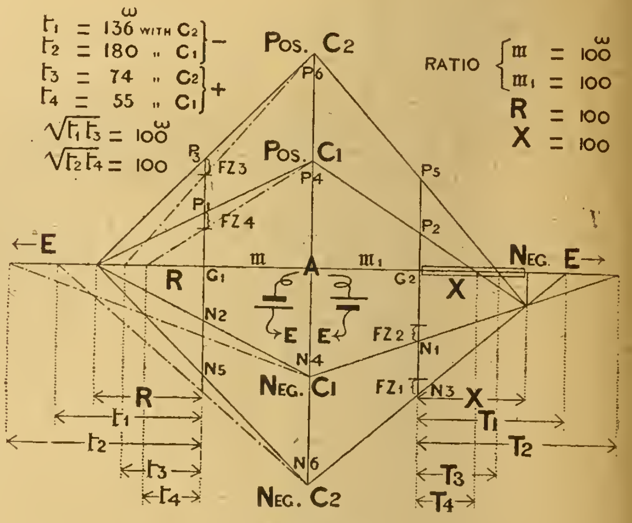

FIG. 49.

The bracketed values FZ_1 . . . . FZ_4 show, each in its place, that excess of potential on one side of a balance, to which is due the galvanometer deflection, constituting what is known as *false* or *cable* zero.

(*To be continued.*)

THE SYSTEMATIC FILING AND STORING OF RECORD CHARTS.

By CRITICUS.

THE question of filing and storing of record charts is an important one, and yet it is safe to say that very few central stations can boast of a really good system. A well-appointed drawing office affords a good example as to what should obtain in this particular department ; here, a few seconds' time is usually sufficient for the production from store of a drawing, print, &c., and there is no reason why even the small-sized stations should not possess an equally satisfactory system at a minimum of first cost and subsequent upkeep.

The usual method, where any attempt at all is made for the systematic filing of records, is to use an ordinary letter file, or some modification thereof. But this arrangement soon becomes unwieldy, as, even where only two or three recording instruments are kept, as in the case of, say, a small lighting station, the record charts quickly accumulate, and if additional files are not used for storing—which means further cost—the charts are generally removed from the files and rolled up in the form of bundles, to be finally packed away anyhow in some out-of-the-way hole or corner. There they remain out of sight, and likely enough out of mind as well, until, perhaps, some day a certain record is urgently wanted for reference—maybe at a Board of Trade inquiry. A day or two's exciting search having proved unavailing, the record wanted is considered lost. Although the Board of Trade Regulations provide that certain records relating to the operation of public supply systems must be kept, yet in practice the requirements are often more honoured in the breach than in the observance.

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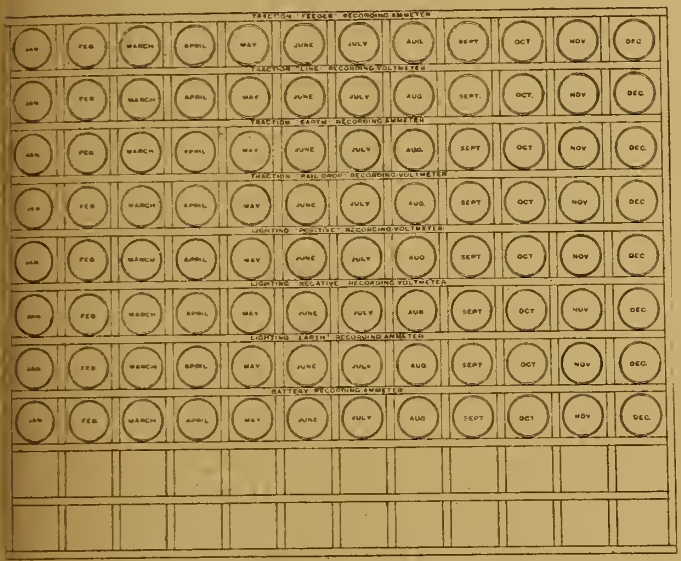
* First published in the TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW, November 15th, 1877.

It seems somewhat strange that most recording instruments for electrical purposes are by no means satisfactory when working under every-day conditions; and it is no exaggeration to say that, in the majority of cases, the inking arrangements give most trouble. An instrument suitable for a widely-varying load, say a recording ammeter for heavy traction load, which will print a true and legible record without constant attention, has yet to be seen by the writer, who speaks from extensive experience. This may seem to be digressing somewhat from the foregoing subject, but, making due allowance for the human element, the more imperfect the record the less chance it stands of ever being permanently filed.

As mentioned before, it is only in the larger stations that anything like system is observed in the filing and storing of records, and here it is usual for the drawing office staff to look after this particular department. But where no drawing office facilities are available, as in the case of most small stations, chaos soon reigns, and it is astonishing what a litter a few months' accumulation of record charts becomes.



Systematic Filing and Storing of Record Charts.

With a view of assisting those who may be thus placed, the writer some time ago devised the arrangement described herewith.

A simple arrangement of shelves is fitted up and pigeon-holed. The size of each compartment should be about 6 in. × 3 in. × 3 in. For containing the record charts cylindrical-shaped papier-maché boxes with well-fitting lids are used. The type of box employed for phonograph records is well suited for the purpose in question, and these can be obtained complete with neat labels, any colour, at very reasonable cost.

The accompanying sketch, which is really self-explanatory, illustrates the device arranged for ten recorders, the two bottom sets being meant for spares for possible future extensions. The writer has taken an example fairly representative of a moderate-sized combined lighting and traction supply station, the recording instruments being as follows:—

Traction "Feeder" Recording-Ammeter.
Traction "Line" Recording-Voltmeter.
Traction "Earth" Recording-Ammeter.
Traction "Rail-Drop" Recording-Voltmeter.
Lighting "Positive" Recording-Voltmeter.
Lighting "Negative" Recording-Voltmeter.
Lighting "Earth" Recording-Ammeter.
Battery Recording-Ammeter.

The usual monthly files are, of course, used in conjunction with the device. At the end of the month, however, the file is stripped, and the record charts, after being secured together in proper sequence of dates by means of one or two substantial fasteners (strong bifurcated pins are very suitable), are transferred to the storing box, correctly labelled, and finally pigeon-holed. The subsequent storing of the records will, in individual cases, be largely governed by local circumstances. It will be seen, however, that the device illustrated is well adapted for extension to accommodate several years' accumulation of record charts, and practically without materially adding to its bulk, except to slightly increase the depth or back to front dimensions.

The arrangement is simplicity itself, and its first cost and subsequent upkeep trifling, and by its means any record can be produced at a moment's notice. It will be fairly obvious that if appearance be a desideratum, the rack can easily be made to match superior surroundings, by the aid of stain and varnish, with perhaps the added dignity of doors, glazed or plain, or some form of collapsible shutter to exclude dust and dirt.

REVIEWS.

Electric Railways Theoretically and Practically Treated. Vol. II. By Sidney W. Ashe, B.S., E.E. London: Archibald Constable & Co. 10s. 6d. net.

This is the second part of a proposed three-volume work on electric railways, and deals particularly with engineering preliminaries and direct-current sub-stations. It is an American production, so that the word "railway" must be understood as including tramways, and particularly the interurban lines which are so characteristic a feature of American electric railway development.

The book is professedly a text-book of the subject rather than a treatise, so that one cannot complain that it is, to a large extent, a compilation from the papers of experts, interspersed with descriptions of standard apparatus and methods of operation, illustrated with such pictures as manufacturers of apparatus are always willing to supply. The result is, on the whole, satisfactory, and the book will be of value to students seeking general knowledge of the subject. The methods described are sound, and the information is fairly up to date.

Chapter I deals with the estimation of profits of a prospective line from a counting of noses in the vicinity. Much more experience is required in the estimation than the simple tale would lead one to suppose, and the results when obtained are usually better forgotten when the line has been built. The chapter should be regarded as furnishing aid to shrewd guessing rather than a complete scientific method.

The two following chapters deal with the determination of the motor capacity; the fourth with schedules and load diagrams; the fifth with power-house and sub-station location. The remaining five chapters give descriptions of sub-stations and their contained apparatus.

The author is, perhaps, rather apt to divagate into byways having but slight connection with the subject in hand. One of the ten chapters, for instance, is devoted to insulating oils, being based on articles published in the *Electrical Club Journal*. So practical a discussion of the subject would adorn a work on transformer design, but appears hardly necessary here.

The book is well printed and illustrated with numerous curves, diagrams, and cuts. Fig. 86, indicating that a rotary should be up-ended in order to sandpaper the brushes, is doubtless merely inserted sideways.

Electricity for Everybody: A Popular Handbook. By R. Borlase Matthews, Wh. Ex. London: The Electrical Press, Ltd. 1909. Price 5s.

This handbook, designed to meet the demand for information of all kinds regarding the uses of electricity, contains an extraordinary mass of data, tables and condensed notes "in infinite variety," being in great part, we believe, based upon the "Canvasser's Handbook," for which the author was recently awarded a valuable prize by the National Electric Light Association of the U.S.A. The contents deal with electric lighting, heating and power, general electrical engineering notes for users of a public supply, and hints to canvassers, each division being further sub-divided into portions relating to residences, "stores," and factories. It is not a book to be read through from cover to cover; it is rather a pocket companion for the commercial engineer or canvasser, furnishing information on, we should think, almost every point that could be raised by a prospective consumer, while to the latter it will serve to show what electricity can do for him, how it does it, why it is better than its rivals, what it costs, and how it should be used.

Naturally the advantages of electricity for lighting, and the best ways to keep the bills low, are early met with, and a model specification is given. The author deprecates references to costs per unit, strongly recommending the canvasser to discuss the total amount of the quarterly bill as a more intelligible basis. Shop lighting and advertising with electric signs are dealt with, and the use of time switches is described; the principles of illumination are clearly explained, with distribution of light curves for various arc lamps (why not for glow lamps ?), and the importance of proper screening and diffusion of light is emphasised. One section is devoted to comparisons between gas and electricity for lighting and heating. The collection of data on ironing, cooking and heating will be especially welcomed, including as it does prices and costs, with other useful particulars.

In dealing with domestic applications of power, the author describes a patent "electric servant" that he has brought out, in the shape of a portable motor with a radius arm, carrying a pulley driven at reduced speed by belt from the motor spindle. The large pulley drives a friction wheel, which can be placed in contact with the driving pulley of any machine that it is desired to drive—the essence of the idea being that one motor may thus be employed to drive any number of handy domestic appliances. This is an ingenious and admirable solution of the difficulty of high cost due to the present practice of fitting every such appliance with a separate motor.

The driving of factories and workshops is the subject of a lengthy section, containing an invaluable collection of data; and the section on engineering notes covers a vast field in small space. "Hints to Canvassers" are given a separate division of the book, and constitute a liberal education in the gentle art of fishing for new business.

Not the least interesting part of the work is the series of illustrations at the end, giving examples of fittings, accessories, installations, signs, lamps, heating and cooking appliances, and power applications of all sorts. We feel that this unique handbook, in the hands of the customer, will do a great deal to broaden his—and her—views as to the possibilities of electricity in connection with his comfort, his business, and his home; in the hands of the canvasser it will be a most potent weapon, guide and support; and, generally, it should exert a material influence upon the development of the electrical industries in this country.

Les Découvertes modernes en Physique. O. Manville, D.es.Sc. A. Hermann et Fils. Price 8 fr.

To many students, and those who desire to have a pretty comprehensive knowledge of the newer discoveries in electricity, together with the mathematical treatment of the subject, this book will prove extremely useful.

The work before us consists of some 450 pages, and is divided into two portions.

The former of these consists of seven chapters, in which are discussed such things as the Discharge of Electricity Through Liquids and Through Gases, Sir J. J. Thomson's Measurements of the Ratio $\frac{e}{m}$, Ionisation of Gases, Rutherford and Sir J. J. Thomson's Experiments on Electrons. The remaining chapters of this portion relate to Radio-activity and Induced Radio-activity, and a final chapter deals with the Electronic Theory of Matter, together with the Zeeman Effect.

The second portion is split up into five chapters, and is wholly theoretical. Here the student will find the mathematical theories of Gaseous and Liquid Conduction Through Gases at Low Pressures, Righi's Theories of Binary Systems, &c. The fourth chapter deals with the Theories of Metals due to Sir J. J. Thomson, Lorenz and P. Drade, as well as the Magnetic Theories of Ewing, Langwin, &c.

The final chapter discusses Maxwell's and Lorenz's theory of light, Voigt's absorption theory, the Zeeman effect and sundry other magneto-optical phenomena.

The work is extremely well provided with references where original papers, or works, are quoted from, and it is very refreshing to notice that in this, the premier branch of physics at the present time, France, Germany, and the rest of the civilised world are mainly interested spectators of the progress made by British scientists.

At present English students have the advantage of treatises on this subject written by the pioneers themselves. Nevertheless, we consider the author has written an excellent and useful book for those who have neither time nor means to consult the original treatises or papers referred to. To many this will form a valuable book of reference.

If we have any fault to find, it is that the figures are very poorly printed, and as in most Continental treatises, the index might well be greatly extended. There are also some 12 pages of notes and errata at the end of the book, which in the third edition should, if possible, be altogether eliminated.

WATER FROM ARTESIAN BORES.

By W. H. BOOTH.

In a communicated article published in the Electrical Review for April 23rd there are certain statements relative to artesian wells that are apt to mislead the reader.

The first of these is to the effect that the supply from boreholes is very unreliable. This is not the case. A borehole having been made, and its yield proved, that yield, if properly stated, may be relied upon to endure. There are high and low water levels in all wells, but the range of fluctuation varies considerably, according to the nature of the stratum. Let the upper chalk with flint be considered. Assume that each flint bed has sufficient voids in it to store 1 in. of rainfall, in conjunction with the adjoining fissures. Then ten such flint layers would store 10 in. of rainfall, and the range of high and low water level would be small. But if the lower chalk be taken into view, it has no beds of flint and few open fissures, and it is also of a more clayey or sticky nature, and a fall of 10 in. of rain absorbed might raise the water level in the wells as much as 80 ft. Recently such an area of country came under my notice, and I found that in the full season some wells were nearly 100 ft. above the drainage point of the chalk stratum, as indicated by the presence of perennial springs at certain of the lower levels. In the ordinary process of well sinking it is usual to dig down to water, and if the digging is done when the water is not at the minimum level, then, when the level does subsequently fall to a minimum, the bottom of the well is dry; I have often walked in such wells and in the lateral headings foolishly driven at a level higher than the minimum.

Thus, while the statements in the article may be correct, they do not convey a correct impression. In boring a well the water level repeatedly changes as the work progresses, rising or falling as each fresh supply vein is pierced. These rises and falls both mean the same thing, namely, a further and more copious yield. If the level rises, it means that the new supply has a natural rest level higher than the supply above it, and is able to overcome it to such an extent that, though the new supply will partially flow away by the fissures of the older supply, yet its volume is enough to raise the general level. If a fall takes place it does but show that the water previously struck is flowing away by fissures out of which more water will flow when the level is reduced by pumping. A borehole, unless lined, will always open up communication between different strata or the various water-bearing beds of the stratum cut through.

A test by pumping, combined with observation of the hydrogeological conditions, will enable a proper estimate to be arrived at of the yield to be expected. But, naturally, water cannot be drawn from the upper part of a cistern when this is half emptied. Yet this is what is often virtually attempted. As though to obviate this difficulty, contractors will sometimes urge very unnecessary depths for boreholes. Not every borehole will yield water, but if it does, the yield will usually be permanent. But in all such work it is most important, as the work proceeds, that notes be made of the first appearance of water, of all the stratigraphical sequences and peculiarities, and of each change of water level. Such observations are sometimes made in a most perfunctory manner, and important geological facts are lost. The greater the reduction of water level by pumping, the more water can there be taken out of a borehole, always provided that the entry of any supply into the hole is below the pumped level. If it be above the pumped level, no further increase can take place. The yield of each source which is lower than the pumped level will vary as $\sqrt{h}$, where h is the amount of lowering of head. This applies also to the yield of a borehold when fed with numerous supplies, all of which would give the same rest level, and very often the yield with reduced levels is greater than the above would indicate, for the lower springs frequently give the lowest rest level, and the yield of the boring, as a whole, usually increases at a higher rate than $\sqrt{h}$.

In a depth of 605 ft., the writer has obtained three entirely different supplies of water from as many different strata. In this particular case about 200 ft. of solid clay came between the second and third water-bearing rocks, and of the three supplies obtained, the lowest water level belonged to the upper rock, and the water from the lower rocks fed the upper rocks, and only became manifest when pumped freely. Boreholes, if properly carried out under expert advice and properly utilised under the same degree of knowledge, ought not necessarily to be so very costly. There are localities where much cannot be hoped from any sort of well, and again in other localities failure is practically out of the question. Every well ought to add to the knowledge of both geology and hydro-geology, but too often the information to be obtained is altogether too unreliable to be of independent utility. Boreholes have frequently been made which were foredoomed to failure. The testing of them is worthless, they are abandoned when they ought to be continued and so played with, often, it is to be feared, from sheer ignorance rather than unworthy motives, that it has been well said, "Truth lies at the bottom of a well; the maker of the well lies at the surface."

The importance of knowing the points where water is struck may be judged from the fact that a well, not pumped below the inflow point, will yield continuously 25 per cent. more water than is usually required if it be pumped, say, 60 per cent. lower than when giving its ordinary yield. It is simply a question of $y \propto \sqrt{h}$, an expression that cannot hold good when h has reached its limit, that is, when no lowering of the well can reduce h, as when the water flows in above the pumped level.

Some wells will bear any amount of lowering of head without injury, as when they are bored in good sound rock. But it is not always good practice to draw down the water level too far. For example, in the case of the chalk where the Thanet sand overlies it, the upper surface of the chalk is often very shaky, and a great reduction of head may cause the Thanet sand to find its way into the borehole; once the well has been strained in this way, it is difficult to remedy it. Fifty feet is a conservative practice as regards lowering the head; 100 ft. is somewhat excessive.

But very many wells yield so copiously that practically no lowering of the water level takes place under the biggest draught of the pump that can be put down the borehole.

The air-lift pump will give many times the yield of the ordinary pump, but when the water is far below surface, the depth of boring is usually much in excess of that required to give the yield, and the power required to work an air lift may be double or treble that necessary to work an ordinary pump.

Still, where water must be had and the hole is small, the air lift may be the only possible pump to fill the contract as to quantity. The air-lift pump is also useful where there is sand in the borehole. Sand is sometimes yielded by boreholes in the chalk, and probably it is almost always due to bad workmanship, including insufficient lining into the chalk, or a lining badly put in so as to permit the escape of the overlying Thanet sand into the borehole. On the whole, it is a good thing that sand should ruin a pump, and it is somewhat of a bad thing that sand can be dealt with by an air-lift pump. Though it is my opinion that the settlement of St. Paul's Cathedral is due to the shrinkage of the London clay, brought about by the fact that the water level under London has been reduced to about the upper surface of the chalk, and therefore does not maintain the London clay moist and swollen—still, it is open to be argued that many years of pumping small quantities of sand from under London have let down the clay.

The natural water level of the chalk under London is, of course, above sea level, for no natural water level can be below sea level. It is only a few years ago that scores of wells in South London, in the locality of Tooting and Mitcham, overflowed some 20 ft. above surface. Hammersmith and Fulham, less recently, were areas wherein the artesian contours were above the surface.

All this is now changed by the multitude of pumped wells, and the water level all over the London basin, or, at least, in the inner area, is going steadily down a few inches annually. But with an artesian well properly constructed, and characterised or classified as to its proper yield by a man who understands the subject, it is quite wrong to say that the supply is unreliable.

The proper yield of a well is not that which can be drawn from it at its high-water level when this is considerably above the low-water level; nor is it what can be drawn from it by a brief pumping test. Again, a prolonged pumping test, such as is often prescribed, is usually a sheer waste. A true estimate of a borehole yield may usually be made in a comparatively short time at a small cost by an engineer who is able to deal with the case in a suitable manner, such manner depending on the conditions of each particular case.

There may be instances of prolonged pumping drying a bore-hole right out. This would imply the existence of a pocket, of an abnormal segregation of a small mass of rock. But such instances are so abnormal as to be practically non-existent. Pockets are, it is true, sometimes declared to have existed, and have been brought into argument to explain the failure of a well which could be much more easily explained otherwise, though, perhaps less creditably.

CENTRAL STATIONS IN TOWNS OF LESS THAN 4,000 INHABITANTS.

A PAPER on this subject was read recently by Mr. James S. Knolson before the National Electric Light Association, of Atlantic City, N.J. It is interesting not only as showing how American practice in this matter differs from ours, but also as indicating certain lines on which English engineers may gain by adopting American ideas.

The author confines his observations to small steam-driven stations, and takes as his standard a station of 100 KW. capacity with two sets. In the first place, he strongly recommends a local company with shares as widely distributed in the neighbourhood as possible, and states that such undertakings rarely owe their inception to outside capital. This, unfortunately, is uncommon in England, and, however desirable it may be, is likely to remain so in the present condition of things electrical. The author pleads strongly for careful restriction of capital outlay, and such simplicity of arrangement as will reduce the amount of skilled labour required to a minimum. His ideal engineer is a sort of working foreman, who takes some of the shifts himself, with one eye on the switchboard and the other on the boiler gauge-glass (though, unfortunately, in the plan given in the paper, this feat is rendered difficult by an intervening wall), the stoker being an inferior sort of person, presumably living on inferior pay. Floor space being unimportant, belt-driven sets are recommended, and a curve is given showing that high-speed simple engines and direct-coupled generators are about 25 per cent. more costly than high-speed simple engines and belt-driven generators. This is very astonishing, and one would very much like to know where this large additional cost comes in. Possibly this is due to using a very high-speed dynamo in the latter case, as the vertical section of the engine-room shows a horizontal engine driving a dynamo on what looks like about a 5 to 1 increase of speed. Evidently a 50-KW. engine running at about 500 R.P.M. is not contemplated in making the comparison. Return-tubular boilers are preferred to water-tube, "for while the water-tube boilers are capable of better economies, the efficiency of a boiler plant rests heavily on the method of firing, and higher costs of water-tube boilers seldom pay for their use in such stations."

With reference to this, we venture to submit that no station is so small but that water-tube boilers, with some form of mechanical stoker capable of burning cheap coal, will pay for themselves over and over again.

For cheapness he also recommends a steel stack, while admitting its more rapid depreciation. An iron stack will probably, in any case, last until it is necessary to replace it by one of greater capacity.

In discussing the necessity of condensing plant, he speaks of the complication involved. While admitting that in most cases such stations will not pay for the cost of surface condensers, it will generally be admitted that jet condensers, costing, probably, for a 100-kw. plant, no more than £250, including pipework, will be worth considering if the annual coal bill is at all considerable and a plentiful supply of water is readily obtainable. In any case, they are best left out for the first few years. His remarks about complication would be better applied to Corliss engines, which he condemns on account of high first cost. Turbines, on the other hand, are favoured, because the exhaust is free from oil, and because of their better "continued efficiency" than simple high-speed engines. As a 50-kw. steam turbine is notoriously a terrible steam-eater, owing to the large amount of unresisted expansion, due to the relatively large clearances that are necessary, this remark rather points to rapid wear in the American high-speed engine.

Turning next to distribution, the author recommends a.c. at 2,300 volts and 60 cycles in very scattered districts, and three-wire distribution at 220 volts across the outers in more compact areas, with step-up transformers for outlying districts. Overhead mains appear to be taken for granted. What a pity we cannot take them for granted in this country! An interesting table of pole costs is given, which we reproduce (Table I). It shows that the average cost per mile in six districts, exclusive of painting and establishment charges, is $426·15, or, with 50 poles per mile, roughly 34s. per pole. Probably £2 to £3 would be nearer the mark in this country for h.t. lines.

TABLE 1.—Pole-Line Costs per Mile for Three-Phase, 2,300 or 6,000-Volt.

No.	Item.	Omaha.	Kansas City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-ft. poles	$275·00	$287·50	$200·00	$200·00	$171·00	$180·00	$218·90
50	Pole hardware	10·00	7·10	16·00	12·50	8·30	7·40	10·25
50	Cross-arms, two-pin ..	17·50	7·25	11·50	15·00	17·00	16·00	14·00
150	Insulators	16·50	6·00	11·20	6·00	6·75	7·00	9·00
	Labour, setting ..	80·00	90·00	200·00	125·00	55·00	100·00	109·00
	Labour, stringing wire	25·00	15·00	40·00	50·00	30·00	40·00	35·00
	Incidentals	25·00	41·00	50·00	30·00	10·00	20·00	30·00
	Total	$449·00	$453·85	$528·70	$438·50	$297·05	$370·40	$426·15

These figures do not include painting, and are exclusive of book-keeping, overhead charges and the like.

We also reproduce a table (Table II) giving comparative costs of street lighting with arc lamps and various-sized metal-filament lamps:—

TABLE II.—Cost of Street Lighting in various units.

Unit.	Arc, magnetite 4-amp.	Tungsten. 40-watt.	60-watt.	100-watt.	200-watt.
No. of units giving street illumination equivalent to one arc ..	1	4	3·21	2·48	1·76
First cost per unit, including brackets, transformers, &c., on a basis of equipment necessary for illumination equivalent to 100 4-amp. magnetite arcs ..	$54·00	$10·96	$12·00	$11·60	$15·70

Operating Cost, Based on 4,000 Hours' Burning per Year.

Unit.	Magnetite 4-amp. arc.	Tungsten. 40-watt.	60-watt.	100-watt.	200-watt.
Maintenance and renewals ..	$6·00	$3·60	$3·80	$4·20	$4·67
Interest, 5 per cent.	2·70	·55	·68	·58	·80
Depreciation, 5 per cent.	2·70	*·49	*·57	*·52	*·73
Current at 2 cents per kw.-hour ..	27·50	4·00	6·00	10·00	20·00
Total per annum	$38·90	$8·64	$11·05	$15·30	$26·20

* Exclusive of cost of lamps.

These figures are exclusive of repairs on overhead equipment, inspection cost, clerical, storeroom costs and the like.

Speaking of upkeep of plant, the author seems to forget that he is dealing with a tiny station with two small boilers, for he recommends the engineer to try experiments "on varying the number of boiler units to suit various portions of the load."

Turning to the question of getting new business, various Yankee methods are suggested, such as "frank talks" in the newspapers and published lists of consumers' average bills, "so that others may see how cheaply their friends receive light." We positively tremble at the thought of such a method in a small English residential district.

Speaking of motor load, 750 units per annum is given as the average demand per h.p. of small motors in five or six towns. In this country the figure for purely industrial towns is about the same. The corresponding figure for a number of towns in England and Scotland, partly industrial and partly residential, was about 400 for 1908.

Ice making and water pumping are mentioned as useful auxiliaries to the supply of electricity, as such loads provide a useful day load which can be applied to suit the convenience of the station. The Americans consume large quantities of ice, but where this has been tried in this country we understand that it has not resulted in a large enough load to be of any very great value in improving the load factor. If, however, the water and electricity works of a small town could be combined, it looks as if the combination would be an extremely economical one. This question of linking some industry involving power with that of electricity supply is one that deserves more attention from the hands of English engineers than it has received in the past. The experiments at Poplar have, we believe, been attended with considerable success, but there are other things besides disinfectants, the manufacture of which require power.

AN ELECTRO-HYDRAULIC BOOSTER.

An interesting adaptation of electricity to the needs of the water supply of a town has recently been completed in Darlington. For some time past, owing to the development of the town, difficulty has been experienced in maintaining sufficient pressure in the high-lying parts around Harrowgate Hill, without creating an unnecessarily high pressure in the remainder of the distributing mains. To overcome this in the past, a stand-pipe has been used adjoining the reservoir over which the water has been pumped. This, however, has involved a considerably increased coal consumption, as, whilst additional head has had to be maintained on the whole of the mains, a small proportion only of the head is used in the higher-lying portions, and to reduce this loss as much as possible, a sufficient supply for this district has only been given during certain hours of the day. Mr. George Winter, the borough surveyor, has evolved a scheme by which not only will ample supply be maintained constantly at Harrowgate Hill, but it will not be necessary to maintain any higher pressure for the town than is called for by its own requirements, and during the night, when the general supply is at a minimum, the reservoir at Harrowgate Hill is filled up, as well as certain tanks in other portions of the town, which are filled only once a day.

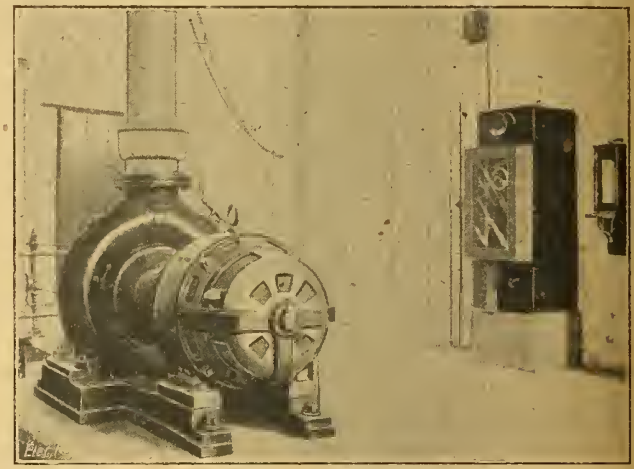


Fig. 1.—Motor-driven Pump and Automatic Switchgear.

A centrifugal pump capable of lifting 120,000 gallons of water per hour against a head of 35 ft. has been provided, the suction of which is connected with the reservoir, and the delivery to a tank capable of holding 60,000 gallons, placed above the pump. The main supply pipe from the pumping station is also carried directly into this tank, together with an overflow into the reservoir.

This pump is coupled directly to a compound-wound motor, having an exceptionally heavy series winding, in order that the quantity of water delivered may be maintained approximately constant with a voltage varying between 430 and 500, as current is supplied from the traction trolley wire at a considerable distance from the generating station. The normal rating of this motor is 38 b.h.p. Provision is made for fine speed adjustments by means of shunt regulation.

A combined automatic main and starting switch, with no-voltage release, is provided, capable of starting up under full load; this switch is of substantial design, with quick step-by-step motion, the time limit between steps being readily adjustable by hand, and is manufactured under Moule's patent.

This starting switch is operated by means of a special pattern of iron-cased quick-make-and-break float contact, operated through a copper rope connected to a float in the tank.

A further provision is made to prevent the motor being started up automatically, should the pump from any cause have lost its priming. A pipe connected with the upper portion of the pump is coupled to a cylinder containing a copper float, which, when up, completes the connection between the solenoid main switch and the tank contact; but if the water falls below a fixed level in the pump the circuit is broken, and the pump cannot be started until reprimed.

This provision is necessary, as the plant is left unattended, and considerable injury could be done if the pump started up without water, though the special winding prevents the motor from running at an excessive speed.

The switchboard, in addition, contains an ammeter, overload circuit breaker and main fuse; the whole is totally enclosed in iron, so that it is impossible to obtain a shock from any portion, although the plant is operated from a traction feeder at approximately 500 volts to earth.

Provision is made by means of a relay, operated from the electricity works through one of the pilot leads, for breaking the whole circuit when required for the purpose of testing leakage current on the traction system, or for other reasons.

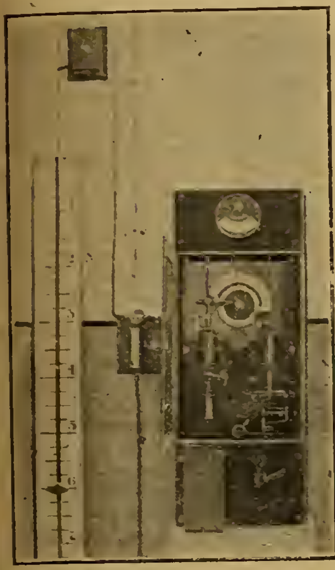
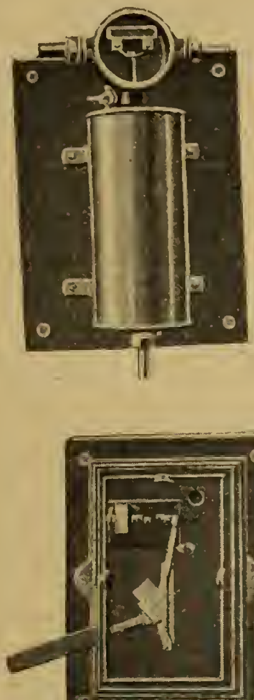


Fig. 2.—View of Automatic Starter and Circuit-Breaker, Hydraulic Relay, and Level Indicator.



Figs 3 and 4.—Hydraulic Relay and Switch.

Heating units are provided inside the motor and switchboard, consuming about 50 watts each, to prevent condensation and leakage on the surfaces of the apparatus.

The pumping plant was supplied and erected by Messrs. Cox-Walkers, Ltd., of Darlington; and the whole of the switchgear, float contacts, automatic switchgear, &c., was designed and manufactured by them to meet the special requirements called for by Mr. J. R. P. Lunn, the borough electrical engineer. The accompanying figures show the general arrangement and some of the details of the installation.

PROCEEDINGS OF INSTITUTIONS.

Steam Turbines.

By Gerald Stoney, M.Inst.C.E.

(*Continued from page* 611.)

(*Abstract of* Cantor Lectures *delivered before the* Society of Arts, *March and April*, 1909.)

The design of condensers has been especially influenced by the introduction of steam turbines. In the old days of reciprocating engines, the condenser giving 25-in. vacuum was quite good enough, but nowadays, on account of the great improvement in economy of steam turbines with higher vacua, it is common to have between 28 in. and 29 in. As a rule, in the case of a condensing plant, the temperature of the cooling water is fixed, and therefore, in order to obtain as low a temperature of the outlet water from the condenser as possible, as large a quantity of cooling water as is practicable should be used. As a fair average, it is generally found that somewhere between 50 and 70 times the steam condensed can be obtained. This means a rise in temperature of the cooling water of about 17° F., as it takes, on an average, about 1,000 B.TH.U. to condense 1 lb. of steam.

When it is remembered that, from about 24 in. to 27 in., each inch of vacuum makes 4 per cent. difference in the steam consumption of a turbine, between 27 in. and 28 in., about 5 per cent., and from 28 in. to 29 in., 6 or 7 per cent., or that approximately 3° F. difference in the temperature of the exhaust means an increase or decrease of about 1 per cent., it is easily understood how important it is to keep the difference between the temperature of the outlet water from the condenser, and the temperature due to the vacuum as small as possible. This difference in good modern condensers, when condensing, say, 12 lb. per sq. ft. per hour, can be kept as low as 5° or 6° F.

The B.TH.U. transmitted per square foot of cooling surface per hour per 1° F. difference of temperature can, in well-constructed condensers, be as high as 1,000 to 1,200. The resistance to the heat passing from the steam to the tubes of the condenser, is affected by the quantity of air in the condenser. If air is present it not only vitiates the vacuum, but also reduces the rate of condensation of the steam by, so to speak, causing a blanket of air to form round the tubes, and thus preventing fresh steam getting to them. The resistance to the transmission of heat in the metal of the tube itself is an exceedingly small figure. The resistance to the passage of heat between the metal of the tubes and the cooling water is apparently one of the principal losses, and varies enormously with the cleanliness of the tube; if there is any slime or dirt or deposit on the inside of the tube, it is found that conduction of heat very rapidly goes down, and therefore, to get the best results, the tubes must be kept clean. It is necessary to have sufficient velocity of flow to make the water mix up as it is travelling along the tubes, and not to have a cold core of water with a hot envelope outside it next the tubes.

It is in connection with the extraction of air thoroughly from the condenser that the greatest improvements have been made of late years, and amongst these, dry air pumps and the Parsons vacuum augmentor are especially prominent. The latter consists simply of a jet of steam drawing the air and vapour from the condenser and delivering it through a small auxiliary condenser to the air pump, and thus, although the air pump may only produce a vacuum of, say, 27 in. or 28 in., there may be a vacuum of 28 in. to 29 in. in the condenser, and in practice this appliance has been found most satisfactory. The effect of using this vacuum augmentor has been in some cases to bring up the conductivity from about 250 or 300 to between 800 and 1,000, or to reduce the loss of temperature from some 26° F. to 5° F., a gain in temperature of, say, 21° F., or 7 per cent. in the consumption of the turbine. The steam jet only uses about 0·6 per cent. of the steam used by the turbine. This vacuum augmentor is applicable not only to surface condensers, but also to jet condensers, with most beneficial results.

One great field for turbines which has only within the last couple of years come into prominence, although it was patented by Mr. Parsons some years ago, is the use of exhaust turbines, that is, turbines taking steam at atmospheric pressure from reciprocating engines or other machinery, and utilising the power contained in it. When it is remembered that there is as much power in steam working from atmospheric pressure down to a 27 in. vacuum, as between 150 lb. down to atmospheric pressure, it is easily seen that the power of an existing non-condensing plant can be more than doubled by the simple application of an exhaust steam turbine and condenser. In cases where cooling water is not available, cooling towers can be fitted, and, of late years, these have been improved so much as to be most efficient pieces of apparatus. Also, in some cases, a further advantage has been obtained in that if the supply of water for feeding the boilers is bad, this bad water can be used in the cooling towers, where it does no harm, and pure condensed water from the turbines can be supplied to the boilers. Such installations are now in use all over the country, and from being absolutely a waste product, exhaust steam has become a most valuable by-product in many works, the exhaust steam being used to drive turbines and dynamos, and the power either used in the works where the exhaust steam is produced or supplied to other consumers of electricity. In many cases the exhaust steam supply is intermittent, such as the exhaust from a winding engine of a colliery where each time the cage goes up or down there is steam from the winding engine, but in the intervals between the winds, there is none. Such intervals, if not too long, can be bridged over by a thermal accumulator. The principle of thermal storage is itself a comparatively old idea in connection with steam boilers, having been proposed by Druitt Halpin in 1891-2, but the best known form of accumulator for use in connection with exhaust steam turbines is that of Prof. Rateau, where a tank containing water has the exhaust steam blown through it so that alternately the exhaust steam is partly condensed, and the water in the tank boils, and thus the supply given to the turbine is constant.

In many cases, however, the stops are two long to be bridged over by any form of thermal accumulator, and in such cases what are called "mixed-pressure" turbines have been introduced in which there is a high-pressure part revolving idly when exhaust steam is used, but when the exhaust steam supply fails, by an automatic arrangement this high-pressure part is supplied with live steam, and thus the turbine continues to be driven. This, also, can be used in conjunction with a thermal accumulator, for such cases as a winding engine where there are short stops only for a portion of the day, and long stops at week-ends or at times when winding is not going on.

It has been found that such mixed-pressure turbines are within 5 per cent. as economical as either a pure turbine for using high-pressure steam alone or a pure turbine for using exhaust steam alone.

Some of the difficulties to be met with in turbo dynamos will be understood if we compare a slow-speed two-pole dynamo of 50 KW. for 300 R.P.M., with a turbo-dynamo of 500 KW., at 3,000 R.P.M., also two-pole. Here we have ten times the speed of revolution, ten times the surface speed, and 100 times the centrifugal force to contend with. The output in kilowatts is proportional to the speed, or ten times, but as the former was for 110 volts, and the latter for 550, we had to have only half the number of segments, so that the voltage per segment is ten times. The frequency of the commutation is five times as great therefore, and the reactance voltage on which the sparking largely depends is 50 times as great; and finally the hysteresis and eddy loss in the armature core will be somewhere about 16 times as much.

It is thus seen that special arrangements will have to be made to meet the very special conditions of a turbo-dynamo. The core loss has to be taken care of by very special ventilating arrangements to enable the heat to be carried off; and centrifugal force is met by employing the best materials and most careful construction. The voltage per segment in the commutator and the reactance voltage, the two principal things which govern commutation, are met with by the provision of either commutating poles or a compensating winding, or a combination of the two. In our experience we have found compensating winding alone most satisfactory, and the adoption of such compensating winding enabled a dynamo to be increased in output from about 200 KW. to 500 KW., and that without any shifting of the brushes such as was formerly necessary.

We have found in our experience, two-pole turbo-dynamos to be much more satisfactory than four-pole, and to cost little more to build, the two-pole proving to be much less liable to flash over than the four-pole; in fact, with our modern two-pole turbo-dynamos such a thing as flashing over is unknown.

For alternators, the type with revolving field magnets has been adopted. The stator is of the usual type of laminated iron, the only noticeable point being that the end windings have to be very firmly stayed. The rotor consists of a steel casting with forged steel pole tips, the coils being separately wound and slipped on in place, after which the pole tips are put on and strong nickel-steel bolts with manganese-bronze keeps are used to counteract the tangential component of the centrifugal force. This rotor may be said to be typical of what is called the "salient pole formation," but there is also what may be called the "barrel" or "drum" type, which was first introduced by Mr. C. E. L. Brown, of Baden, Switzerland, in which the rotor consists of a series of plates with the winding embedded in slots in the outer circumference. It is a moot point which form is best, some having advantages in one way and some in the other, and which will eventually survive depends both on ease and cost of manufacture as well as mechanical and electrical advantages, and up to the present this point has not been settled. As in the case of continuous-current machinery, one object is to get the maximum output at the highest speed possible, and since the materials available limit the length and diameter of rotor, and therefore the available flux and the ampere turns, these again limit in the stator the output which can be obtained with a certain inherent regulation.

A much larger output can be obtained by the adoption of some form of compounding which enables regulation to be made as good as is desired. There are several means of doing this, one which is often used being the "Tirrill" regulator, in which moving contacts regulated by the voltage of supply alter the excitation of the alternator. Another method which we have largely used is what we call a leakage path winding; a small yoke is put across the poles of the exciter round which the main current passes, and when this current increases it chokes back the magnetism, and thus raises the voltage of the exciter.

(*To be continued.*)

The G.B. Electric Tramways in Lincoln.

A MEETING of the ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS was held at the Guildhall, Lincoln, on Saturday, September 25th, when Mr. S. Clegg, M.I.E.E., city electrical engineer, read a paper on the G.B. tramway system and its results in Lincoln. Mr. W. Nisbet Blair, M.Inst.C.E., borough engineer of St. Pancras, president, was in the chair, and there was a large attendance of members. After describing the system, Mr. Clegg said that the Lincoln tramways compared very favourably in their maintenance cost with those on the overhead system, and he gave an analysis of the working costs for the three complete years the system has been in operation, as follows:—

	Pence per car-mile. 1908-9.	Pence per car-mile. 1907-8.	Pence per car-mile. 1906-7.
Traffic expenses	2·10	2·28	2·512
Repairs and maintenance... ...	1·12	1·25	0·913
Management and general expenses	1·00	1·18	1·476
Power expenses	1·38	1·39	1·797
	5·60	6·10	6·698

The average total working costs of 75 other municipalities, taking 1908 figures, were 6·37d. per car-mile run, showing an advantage for Lincoln of 0·77d., which, considering the fact that only 156,190 car-miles were run—the fewest of any municipal system—proved to the author that better results might be looked for with a larger system.

During the whole time the tramways had been running, the current had never been off any part of the line owing to failure of the electrical equipment (apart from the feeders). Apart from unusual snowstorms, a total of only 215 car-miles (or 0·039 per cent. of the total car miles run) had been lost in the three years; of this total, 88 per cent was due to faults on the cars, and 12 per cent. to the melting-out of the main feeder from its socket in the feeder pillar.

Studs which had become alive at Lincoln had always been located as soon as they occurred, without danger to anyone.

The silent running of the cars at Lincoln was remarked on by visitors accustomed to the trolley system.

In times of exceedingly snowy weather the G.B. system was at a slight disadvantage, as compared with the overhead, owing to the fact that it had to make contact not only with the rails, but also with the studs through the snow.

In the discussion, MR. GILBERT WHYATT (Grimsby) asked how the cable was to be half turned round in the conduit as suggested by Mr. Clegg. He took it that the sleeve pieces were somewhat loose, and the problem in his mind was how to get a proper grip of the cable with a loose sleeve piece when it was being moved on 3 in. He also asked what was the difference between London and Lincoln that made the G B. system a success there and apparently a failure in London.

MR. W. WEAVER (London) asked what would be the effect of leaves falling on the studs. At Brighton, when the cars came down a steep hill from the racecourse, the leaves on the track broke the circuit, and there was a narrow escape from a terrible accident.

MR. W. B. FURSER (Kesteven) said he was a near neighbour to Lincoln, and had good opportunities of seeing the work as it was going on. The tramways had operated very successfully from the commencement.

The PRESIDENT remarked that there was generally an objection to the overhead system on æsthetic grounds; but as soon as the overhead system had been established a little time, people forgot that objection. Its one great recommendation was economy in cost of construction. The great expense of the conduit system was due to the laying of pipes and cables underground to a depth of 2 ft. 6 in. He believed the absolute minimum in London was 1 ft. 11 in. Mr. Clegg spoke of the minimum depth in Lincoln as 1 ft. 5 in; that was not a great difference. Even that might mean in thoroughfares such as they had in London, crowded with all kinds of pipes, considerable and costly alterations of pipes which would add enormously to the cost of laying this system of electrical traction. He thought the use of springs in the studs was the weak point of the system. There was no doubt that in narrow streets, and Lincoln had very narrow streets, the obstruction of poles would be a serious matter.

MR. CLEGG, in replying, remarked that the sleeves in order to be threaded on the cable had to be to a certain extent loose, but with cables 100 to 150 ft. long (the distance between the various access boxes) he would not proceed to give the cables a half-turn only to lengthen their life. They had about 4 ft. 6in. at each access box; he would haul up 3 in., and that would give them an increased life of 15 years. That life would be considerably reduced in London. They had started by leaving the cable at the same place and turning it half round; by putting a slight bend on the cables, they could practically turn the cable as they liked. They had done that on one or two occasions with perfect ease. The question why the G.B. system as installed in London did not work satisfactorily at present was *sub judice*, and it would not be advisable to make any remarks upon it. He had not had any experience with leaves on the studs. They had experienced all sorts of obstacles of the nature of leaves on the roads; they had used wet and muddy paper, and had never found anything which would prevent the magnet finding the stud-head. He had been driving the cars himself, when he had been unable to find the studs, but the magnets had always found them. They had had very difficult conditions, but had never found any working conditions which would prevent the studs operating. There was, however, one difficulty which was rather serious; that was the question of ice. Very occasionally there was a fall of rain, followed immediately by a very strong frost; this was liable to produce a thin coating of ice on the top of the studs, which was very difficult to deal with, as ice was a non-conductor. If it happened when the cars were not running, his men had to be got up to go over the track. A heavy fall of snow was also a difficult matter for all systems, the overhead system included. Their case was worse. They had not only to find the rail, but to get contact with the studs. He always had a great admiration for the Lorain system; but in the first place it had a stud which had to be raised slightly above the level of the road, and secondly, it was more costly to install than the G.B. system. Those two points were sufficient to cause them to adopt the G B. system in preference to the Lorain. The G.B. system could claim to be as economical in operating expenses as the overhead system. As the result of their last 12 months' working, they occupied a position very much better than the average overhead system. Taking the 70 municipal systems, they occupied the twentieth position as to cost, and that despite the fact that they were absolutely the smallest system in the country. The question of live studs, which was regarded as the bogey of the system, had turned out to be nothing. They had found it an absolute impossibility, when a stud was at rest, to make it become live. It was only a car passing over and pressing the carbon against the spring which could cause a stud to go wrong. They had found that the making of the stud live had always been detected by the car which caused it. The spring which the President regarded as the weak point of the system had not been so. During the three or four years the system had been working, they had only had 23 live studs due to faulty springs, so he did not think any danger need be apprehended from that source.

Devonport Dockyard Lighting.—We learn that the Admiralty have adopted the "Davy" flame lamp for the lighting of Devonport Dockyard. Messrs. Foote & Milne, Ltd., the contractors for the installation, have recently placed an order for 40 Davy long-burning lamps with MESSRS. FRAMPTON & PAINE, the agents for Arc Lamps, Ltd., in the Eastern, Southern and Western Counties. These lamps, which burn for 36 hours with one trimming, are fitted with a device which prevents the fumes settling on the globe, thus ensuring that the maximum light is obtained during the whole run.

Wilkinson Heaters.—MESSRS. BRAY, MARKHAM AND REISS, LTD., of Walthamstow, inform us that on and after November 1st next, they will only manufacture the Wilkinson heaters, the entire sales being managed by Messrs. F. A. Wilkinson & Partners, Ltd., Harpenden, to whom all inquiries and orders should be sent.

GAS TURBINE RESEARCH.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

Some six years ago in the discussion on Mr. Merz's paper on "Power Station Design," the writer used these words:—"The whole question is going to turn on the boilers, owing to the fact that about 1,000 H.P. is the maximum size that boilers can be made. . . . The space occupied by the boilers and economisers, taking the one station with the other, is about four or five times the space occupied by the engine plant. Now this means a good deal of money, not only in boiler plant but also in buildings, &c., and it is going to turn the whole question in favour of gas. After the present craze for steam turbines has had a run, we shall have a period of gas engines, and eventually *the gas turbine will make its appearance*."

There can be no doubt that we have now fairly entered the gas engine period, for although there has been one notorious failure, the successes are almost as numerous as are the iron and steel works of this country and the Continent. Five years ago the writer was asked to report on the general question of the use of large gas engines for power stations, and he visited many of the leading iron and steel works where gas engines were in use. It was quite remarkable to see the small amount of attention required, and how steadily the engines ran. Their large size was, however, very noticeable, a gas engine of, say, 1,000 H.P. covering nearly twice the area of a slow running steam engine of similar capacity.

The same reasons which brought about the general adoption of quick speeds for steam prime-movers will, sooner or later, cause the present huge slow-running type of gas engine to go out of fashion. The industry badly wants a Willans or a Morcom to lead the way, in large quick-speed gas engines, and so make the link between the present type and the gas turbine, which must follow.

As the field for investigation in gas turbines is so undefined, and the scientific and engineering skill required must be of a high order, the writer thinks it would be well for the engineering trade to combine and have the matter thoroughly investigated by two or three experts who could give undivided attention to it. At present, experiments are being made in a haphazard fashion, without co-ordination, and progress is therefore necessarily slow.

All engineers are interested in the matter, and the initiative for combined action might very well come from the various learned societies. If, for example, the Royal Society, with the Institutions of Civil, Mechanical, Electrical and Mining Engineers, could form a gas-turbine committee and start a fund, the research could be made at an early date. It is probable that the National Physical Laboratory would assist in the physical and chemical experiments, and some of our more progressive firms would, no doubt, bear the cost of drawings, patterns, castings, and the machining and erecting of experimental apparatus.

The matter is practically a national one, because we are dependent on coal for our power, and are now having to compete with countries which have cheap natural water-power. The application of the electric furnace in iron and steel manufacture promises to be revolutionary, and countries without cheap water-power must be on the *qui vive*. Even if the results were mainly negative, the money would be well spent, because it would prevent other investigators going over useless ground.

Regarding the choice of experts, a combined committee made up of members of the contributing societies and firms, under the chairmanship of, say, the Hon. C. A. Parsons, could be depended on to find, say, two or three young engineers having the sound scientific training, as well as engineering skill, necessary for such an investigation.

The idea is not so startlingly novel as some might think, because the famous high-speed electric traction investigation in Germany was financed and carried out by several firms and banks, and the Government, working conjointly. The information obtained was of a most valuable character, although most of it was negative. It was given freely to the world, and Germany thus placed engineers of other countries under a debt of gratitude. If, therefore, the findings of a gas turbine Research Committee were also published, the world would be immensely indebted to this country, and this is the best kind of international courtesy that we can pay.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PHILIPPINE ISLANDS.—The following rates of duty came into force on October 4th of this year. It should be noted that the new tariff provides for the free importation of United States goods if imported *directly* from that country. If imported *indirectly* they are liable to duty in the ordinary way. In addition to the ordinary import duties given below, imported goods are also liable to an "internal revenue tax," which is also levied on similar goods manufactured in the Philippine Islands. This tax is, moreover, levied on goods imported from the United States.

Further details as to this new tariff are contained in a Blue Book just issued by the Board of Trade, and entitled "Philippine Islands—New Customs Tariff." This Blue Book may be purchased at Messrs. Wyman & Sons, Ltd., Fetter Lane, E.C., and the price is 6½d.

Dollar = 4s. 2d. Kg. = 2·204 lb.

Marble in slabs	30 %	ad val.	
Asbestos and manufactures thereof, not otherwise provided for	15 %	„	
Mica and lava and manufactures thereof	25 %	„	
Porcelain, &c., not otherwise provided for ...	25 %	„	
Earthenware not specially provided for:			
Plain...	25 %	„	
Ornamented	40 %	„	
		Dols.	cts.
Wrought-iron and steel: In rails, straight or bent, cross-ties, portable tramways, crossings and similar track sections; switch rails, switches, tongues, frogs, fish-plates and chairs... ...	100 kg.	0	40
Wrought-iron or steel, in pieces, finished:			
Wheels weighing each more than 100 kg., axles, springs, brake-shoes, drawbars, brake-beams, bumpers, couplings, lubricating boxes, and similar articles for railways and tramways ...	100 kg.	0	45
Wheels weighing each 100 kg. or less, axles and springs for vehicles, not otherwise provided for	100 kg.	1	05
Wrought-iron or steel pipes:			
Plain, painted, tarred or galvanised	100 kg.	1	10
Other (except those coated or covered with gold or silver)	100 kg.	1	50
Wrought-iron or steel wire:			
More than 1 mm. in diameter, plain, galvanised or coppered, wire cables and ropes, and barbed wire	10 %	ad val.	
1 mm. or less in diameter, plain, galvanised, or coppered, and wire netting	15 %	„	
Other, including those covered with textiles ...	25 %	„	
Manufactures not otherwise provided for, in which wrought-iron or steel is the component material of chief value:			
Plain, painted, varnished, or japanned, or covered or coated with lead, tin, or zinc ...	15 %	„	
Other (except those covered or coated with gold or silver)...	20 %	„	
Copper or alloys thereof, in bars, pipes, and sheets, or alloys of copper in lumps and ingots, any of the foregoing except of Muntz metal ...	10 %	„	
Copper and alloys thereof, in wire:			
Plain	15 %	„	
Blanched, gilt, or nickelled	25 %	„	
Covered with textiles, not otherwise provided for, or with insulating materials, cables for conducting electricity, and trolley wire ...	10 %	„	
Covered with silk, not otherwise provided for...	25 %	„	
Gauze, cloths, and screenings, in the piece ...	20 %	„	
Manufactures not otherwise provided for, in which wire of copper or its alloys is the component material of chief value (except when covered or coated with gold or silver) ...	25 %	„	
Manufactures not otherwise provided for, in which copper or alloys thereof is the component material of chief value:			
Plain, polished, varnished, painted, tinned or japanned...	20 %	„	
Other (except those covered or coated with gold or silver)	25 %	„	
Machinery and apparatus for weighing, and detached parts therefor, not otherwise provided for...	20 %	„	

Electric and electro technical machinery, apparatus and appliances:	
Dynamos, generators, generating sets, alternators, motors, and similar machinery, not otherwise provided for; transformers and storage batteries, switchboards and switches, arc lamps, telephone and telegraph instruments, fans, buzzers, and annunciators, ammeters, voltmeters, wattmeters, and similar measuring apparatus, dry and wet batteries, and detached parts for any of the foregoing, and articles used exclusively in the installation thereof, insulators, and insulating compounds and materials used exclusively for electrical purposes, carbon, and incandescent bulbs and tubes	10 % ad val.
Cooking and heating apparatus and utensils, chandeliers, desk and table lamps, flatirons, soldering and curling irons, thermo-cauteries and cauterising instruments, surgical, dental and therapeutic appliances, including so-called electric belts, X-ray machines, vibratory apparatus, electro-plating outfits, cigar lighters, other instruments, implements, utensils and articles used in connection with, for, or by the application or production of electro-technical, thermo-electric, galvanic, or galvano-magnetic force, and detached parts for any of the foregoing, not otherwise provided for	20 % „
Engines, steam boilers, pumps, and machinery:	
Of iron, steel, or wood	15 % „
Of other materials; emery cloth	20 % „
Caoutchouc and gutta-percha:	
Crude, and rubber, in sheets, sheeting, or packing, even with cloth or wire insertions, and gaskets and washers	10 % „
Rubber, soft, in articles not otherwise provided for	25 % „
Rubber, hard, in articles not otherwise provided for	30 % „
Submarine telegraph cables	free.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,518. "Improvements in methods of charging and discharging secondary batteries or electric accumulators." A. M. Taylor. October 4th.

22,539. "Improvements in weighing and testing machine electrical indicating means." J. Dobson and H. Pooley & Son, Ltd. October 4th.

22,547. "Propeller to be used for aerial and nautical purposes, and for electrical fans." A. E. Garreau. October 4th.

22,551. "Improvements in and relating to protective devices for alternating-current systems." H. Brazil and H. Cooch. October 4th.

22,552. "Improved time-switch for electric circuits." H. Weller. October 4th. (Complete.)

22,573. "Improvements relating to and in wires, ropes, cables, electric conductors, and the like." G. W. Green. October 4th.

22 580. "Improvements in and relating to telephones and the like." G. R. Webb. October 4th. (Complete.)

22,596. "Improvements in and relating to automatic telephone exchanges" E. Neuhold. (Date applied for under Sec. 91 of the Act, April 7th, 1909, being date of application in Germany.) October 4th. (Complete.)

22,611. "Improvements in systems of electric train lighting." H. Leitner. October 4th.

22,617. "Improvements in electric fire alarms." H. W. Headland and H. W. Headland, jun. October 4th.

22,635. "Improved continuity fitting for electric wiring." A. J. Burfitt. October 5th.

22,640. "System of wireless telephony." A. Burns. October 5th.

22 701. "Improvements in electric cooking and heating tables." H. Gray. October 5th.

22,715. "Improvements in electrodes and in the use thereof in the production of stable electric arcs." J. Y. Johnson (Badische Anilin and Soda Fabrik, Germany) October 5th.

22,723 "Improvements in and relating to current collecting devices for dynamo-electric machines." British Thomson-Houston Co., Ltd. and W. F. Dawson. October 5th.

22,725. "Method and apparatus for collecting mechanical energy in the disturbed waters of seas and lakes by directly obtaining a continuous rapid rotary motion easily convertible into electric energy." E. Bouchard-Praceiq. (Date applied for under Sec. 91 of the Act, April 9th, 1909, being date of application in France.) October 5th. (Complete.)

22,765. "Fool-proof switch wall plug." C. M. Gardner and R. Evans. October 6th.

22,768. "Improvements in or relating to electric arc lamps." E. Christoph and H. Klein October 6th. (Complete.)

22,769. "Improvements in telephone transmitters or microphones." G. A. Nussbaum. October 6th.

22,789. "Improvements in cooling dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) October 6th. (Complete.)

22,791. "Improvements in motor-generators, balancers, boosters, and auto-transformers for direct and alternating currents." A. Mills. October 6th.

22,796. "Improvements in switch stands." C. Raiter. October 6th. (Complete.)

22,802. "Improvements in or relating to starting-appliances for alternating-current electric motors." F. G. Baily. October 6th.

22,806. "Improvements in and relating to starting-switches for electric motors." E. N. Bray and Bray, Markham, & Reiss, Ltd. October 6th.

22,823. "Improvements in electric incandescent lamp fittings." C. Damey. October 6th.

22,827. "Improvements in electric vaporising apparatus." E. Ponszus. (Date applied for under Sec. 91 of the Act, October 7th, 1908, being date of application in Germany.) October 6th. Complete.)

22,866. "Improvements in or relating to electric signalling for railways." G. Carboni and C. Tironi. October 7th. (Complete.)

22,869. "Improvements in or connected with means for the manufacture of bushes or bearings for shafts, axles, electro-motors, dynamos, self-propelled vehicles, and the like." W. G. Hanna and R. W. Hanna. October 7th.

22,878. "Indestructible and unbreakable telegraph insulator." J. Ball and C. F. Reatman. October 7th. (Complete.)

22,896. "Improvements in or relating to electric switches." A. P. Lonnbelg, G. C. Lundbelg and P. A. Lundberg. October 7th. (Complete.)

22,897. "Improvements in electric switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. October 7th. (Complete.)

22,922. "Improvements in electrical energy meters." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, October 8th, 1908, being date of application in Germany.) October 7th. (Complete.)

22,930. "Improved means applicable for use in transmitting and receiving signals by wireless telegraphy or telephony." British Radio-Telegraph and Telephone Co., Ltd., and J. G. Balsillie. October 7th.

22,932. "Circuiting arrangement for working mono and polyphase alternating-current motors." A. Heyland. (Date applied for under Sec. 91 of the Act, October 10th, 1908, being date of application in Germany.) October 7th. (Complete.)

22,946. "Improvements relating to time-indicating devices." A. J. Boult. (Stremberg Electric Manufacturing Co, United States.) (Date applied for under Rule 13, August 12th, 1908. An invention comprised in application No. 16,999, dated August 12th, 1908.) October 7th. (Complete.)

22,988. "Improvements in chains for suspending electric pendants, electric chandeliers and the like." R. J. Simpson. October 8th.

23,029. "Improvements in electric signalling apparatus." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, January 29th, 1909, being date of application in Germany.) October 8th. (Complete.)

23,039. "Improvements in or relating to processes of preserving." A. J. Boult. (Electric Meat Curing Co., United States.) October 8th.

23,040. "Improvements in or relating to an apparatus for causing substances to commingle or separate." A. J. Boult, (Electric Meat Curing Co., United States.) October 8th.

23,042. "Improvements in or connected with reversing mechanisms for dynamos." H. Leitner. October 8th.

23,050. "Improvements in connection with installations of electric incandescent lamps connected in series." E. Booth and N. R. Booth. October 9th.

23,071. "Improvements in electrical table fittings." C. Vaoohan. October 9th.

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Means of Working or Controlling the Motors in Petrol-Electric or Electric Cars. W. A. Stevens. 17,822. August 25th.

Trolley Heads for Electric Traction. F. G. Holmes. 19,482. September 16th.

Process for the Prevention of the Disintegration into fine dust of Electrical Incandescent Refractory Metal Filaments in a Vacuum. Gluhlampenwerk Anker-Ges. 19,847. September 22nd. (Date applied for under International Convention, October 3rd, 1907.)

Ignition Apparatus for Explosion Engines. R. Varley. 19,850. September 22nd.

Dynamo-Electric Machines, A. Beeckel, O. Grünberg, and J. Krukovski and E. Luxembourg. 20,098. September 24th.

Sealing of Cases for Containing Electrical and other Instruments. British Insulated and Helsby Cables, Ltd., and F. A. Bayles. 20,312. September 28th.

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Apparatus for the Electrolytic Production of Sodium and the like. Soc. d Electro-Chimie and R. Hulin. 22,824. October 27th. (Date applied for under International Convention, November 2nd, 1907.)

Apparatus for the Production of Continuous Electrical Oscillations. H. Manders. 23,170. October 30th.

Mechanical Operation of Electric Motor Controllers. Siemens Bros. Dynamo Works and F. O. Thompson. 23,341. November 7th.

Anchoring of Overhead Electric Conductors. F. E. Saunders. 24,701. November 17th.

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Multiple Contact Vibrator for Ignition, Induction and Shocking Coils, Telephone, Telegraph, Electric Bell, and Electro-Magnetic Apparatus. F. J. Clarke. 25,783. November 30th.

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Alternating-Current Meter. Landis & Gyr. 27,283. December 15th.

Electric Voltage Regulators. A. A. Tirrill. 28,190. December 24th. (Date applied for under International Convention, April 27th, 1908.)

1909.

Electrolysis of Aqueous Saline Solutions. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) Rights under Sec. 91 of the Patents, &c., Act, 1907, not granted. 605. January 9th.

Means for Directly Converting an Ordinary Electric Lampholder into a Switch Lampholder. E. B. Wright. 3,637. February 15th.

Method of and Means for Protecting Metallic Articles Embedded in the Ground from Stray Earth Currents. H. Geppert. 4,353. February 22nd.

Starting Devices for Alternating-Current Induction Motors. M. Kallmann. 6,957. March 23rd. (Date applied for under International Convention, March 27th, 1908.)

Electric Ignition Apparatus for Internal Combustion Engines. R. F. Hall. 11,223. May 12th.

Magneto-Electric Apparatus for Firing Electric Igniters. W. E. Lake, (Fabrik Elektrischer Zundor Ges.) 14,126. June 16th.

Primary Batteries. W. A. F. Bleeck. 15,191. June 29th.

THE
ELECTRICAL REVIEW.

Vol. LXV. OCTOBER 29, 1909. No. 1,666

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICES:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. - Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E C.

THE STATUS QUESTION.

THE problem of raising the status of the engineering profession, which has been kept so prominently before the eyes of engineers during recent years, is in no danger of falling into oblivion. Only the other day a paper on this subject was read before the Society of Engineers, by Mr. G. Allan Thomas, who gained the first of five annual prizes offered by the secretary of that society, Mr. A. S. E. Ackermann, with a view to promoting reform and hastening the recognition of the profession as being on an equality with the older professions of law and medicine. The author advocates co-operative action on the part of the three leading engineering institutions for the purposes of restricting the title of "engineer" to those who are duly qualified by training and experience to act as such, and of obtaining statutory powers similar to those possessed by the governing bodies of the sister professions—a proposal very much on the lines that we put forward some months ago.

Mr. Thomas would appoint the "Central Organising Body," or, as we should prefer to call it, the Engineering Council, from the Institutions of Civil, Mechanical and Electrical Engineers only, but it must be admitted that these by no means include within their scope the whole of the branches of engineering, and in this respect the profession is at a serious disadvantage compared with the legal and medical professions; the functions of an "engineer" cover a very wide field, from sewerage and waterworks to railway construction and power supply, from shipbuilding to telegraphy, and it is clear that the task of reconciling and marshalling in line the diverse forces of these heterogeneous and incoherent interests will be a gigantic one. Nevertheless, the need is pressing, and that there is a powerful and growing current of opinion in this direction, not only here, but also abroad, is certain.

As things are, anyone can call himself an engineer, without incurring the least risk of exposure or punishment if he is not possessed of adequate qualifications; provided one can secure commissions, there is no difficulty in obtaining the services of skilled assistants to carry them out, for qualified men in subordinate positions are only too plentiful. The man with a talent for commercial organisation, therefore, may succeed, while the man of high scientific and professional attainments is left out in the cold. Instances will readily occur to the mind of anyone familiar with engineering circles. Unfortunately, important works are not seldom placed in the hands of men who have neither the ability to carry them out successfully, nor the acumen to surround themselves with a competent staff, and the result is disaster, for which, however, the "engineer" is not legally responsible. Much public money has thus been wasted, and unmerited discredit cast upon the whole profession.

Another unfortunate result of the present state of things is that even the most highly-qualified engineer, duly appointed to a position of high responsibility, is often denied the respect which is his due. When one calls in the advice of a doctor or a lawyer, one feels that it must be followed, even if it run counter to one's own views or desires; but when an engineer is consulted, his opinion does not carry equal weight, and his authority is not unquestioned. Nothing is more remarkable than the manner in which non-technical officials, who would not dream of pronouncing upon a point of law or medicine, show no hesitation in expressing their views upon engineering matters, and overriding the opinions of competent engineers. This phase of the subject is, perhaps, most strongly marked in the case of the public services, such as the Post Office and other Governmental departments and—as electrical engineers will readily agree—in municipal undertakings.

It has been argued that the Institution of Civil Engineers, by the wide scope of its articles, embraces all branches of engineering, and is in itself qualified to provide the necessary stamp of merit. It cannot be denied that this, the premier Institution, has led the way, by requiring candidates for membership to prove themselves duly qualified by examination and otherwise, towards the attainment of a high standard of scientific training, experience, and general education and culture; and it has urged upon its members the desirability of adhering to the recognised code of etiquette. But we do not think that, as at present constituted and governed, the Institution of Civil Engineers can be accepted either as fully representative of engineering or as a model organisation. Affiliation of the other important bodies to the Institution of Civil Engineers would go far towards removing the former objection, but cannot be suggested unless they also agree to institute due trial and strict examination into the qualifications and experience of their new members, and there will still remain the difficult question of the status of those who have already been admitted to membership. It is doubtful, too, whether the younger institutions would be prepared or could be induced to part with any fraction of their independence, in view of their great size and importance, and, possibly, some reluctance to admit the superior standing of the elder body.

On the other hand, the Institution of Civil Engineers has always exhibited a somewhat haughty temperament and has held itself aloof from all proposals towards co-operation, though it has offered generous hospitality to its juniors. Even when proposals for reform and progress have emanated from within its own ranks it has usually turned a deaf ear to them. The most recent attempt was that of April last, when an influential committee submitted to the Council the results of a plebiscite of the members, proving the existence of a strong feeling in favour of reform. Yet the Council merely acknowledged without comment the receipt of the letter conveying the result of the inquiry. Its attitude, as expressed in the report to the last annual general meeting, is that of leaving to the public the recognition of the professional status of members of the Institution, and it deprecates any attempt to regulate the acts of engineers who do not belong to it. A code of professional conduct was submitted to the meeting, but the adoption of a scale of fees was regarded as impracticable.

It will be seen that the Council, at any rate, is disposed to withdraw within its shell, and to do nothing. Yet, surely, if the claim of the Institution to be the head of the engineering profession is to be allowed, this attitude is an impossible one. The call for reform is insistent, and cannot be denied. If the Civil Engineers will not move, action must come from other quarters—and any such proceeding will necessarily detract from the high standing of the parent body.

SUCTION GAS AS A POWER FOR PIONEERS.

We are by no means anxious to stir up the embers of the fierce fires of controversy which have raged in times past regarding the use and abuse of the suction-gas plant. Whatever its merits and demerits, they are by now patent to all observers, so far as conditions in this country are concerned, owing to the fact that the erstwhile "revolution in power" has now settled down to an ordinary everyday existence. The object of these notes is to point out that, whatever may be the decision of engineers as regards the usefulness of the suction-gas plant in Great Britain, it does not follow that the power problem of the world is solved.

We are led to these remarks by an extract we have received, through the courtesy of an Australian correspondent, from the pages of *The Lone Hand*. This magazine, which is of a character calculated to appeal to a large class of general readers in the Antipodes, contains in its September issue an article by C. A. Jeffries, entitled "The Suction Gas Fiasco." The interesting point to us is not so much the graphic recital of the early English failures, or the able and lucid summary of the engineering pros and cons of the question, as the assertion with which the article concludes. This reads as follows:—"To the knowledge of the writer, three Sydney firms, four Melbourne houses, and one Brisbane manufactory have installed suction or producer gas plants, found them wanting, and replaced them, or are in the act of doing so, with either electric power or gas from the civic authorities or gas companies. So, with these experiences of suction and producer gas, Australian manufacturers will do well to keep clear of what on paper can be made to look a very alluring proposition." The sting of this article assuredly lies in its tail.

Now there is no doubt in the minds of most engineers that, given on the one hand an adequate system of centralised power at average rates, and on the other an independent suction gas plant with its possibilities of breakdown, the manufacturer who chooses the latter must seek protection behind the Scriptural injunction which deters us from calling our brother "Fool." But what about the pioneer of civilisation who has established a factory several hundred miles up country, where the municipal authority, if there were one, would rather set its Sanitary Department to chase the mobile mosquito than inaugurate an Electric Lighting and Power Committee? There are many thousands of industrial concerns, all vital to the world's progress, situated in such a position that only a slender line of rails provides them with the necessaries of life, and with an outlet for their finished product. Freight is heavy, labour is cheap, and the plant which will give them the most power out of a pound of anthracite, independent of any question of depreciation, steadiness of running, labour charges, and other complexities which enter into the short-radius fight at home, will win the day. In such locations suction gas plants have surely a sphere.

Again, in many pioneering power plants of this nature the question of transport into place is a serious one. When one hears of boats destined for the Upper Nyanza being completely built and fitted at home, taken apart, numbered, and sectionalised so that each piece can be carried between two natives for many miles through rough country, one realises the difficulty of engineering operations in the lone lands of the world. The suction gas producer plant is light, portable, and capable of sub-division. It is not difficult to put together with comparatively unskilled labour, and when in place it is not subjected to severe internal pressures testing the excellence of the work. The gas engine itself is a comparatively small and portable affair. No expensive foundations are necessary, so that the plant can be put up with comparatively little precaution on soft ground, and, granted the supply of suitable fuel, there is very little doubt as to its superiority to a cranky old steam engine and a superannuated loco-type boiler. Wanderers in the backwoods will bear us out when we say that the choice of firms or individuals of small capital operating in such places does not usually lie between a high-priced modern steam plant and a low-priced but capricious gas plant, but rather between the latter and an absolutely cranky, vicious, but dirt-cheap second-hand combination of alleged steam engine and boiler. Under the circumstances the gas plant scores.

The matter is of great interest to electrical engineers, and is therefore discussed in these columns. The sale of electrical plant, from a dynamo to a metal-filament lamp, depends upon the presence in the first instance of mechanical power; water power is not often available in sufficient quantity or steadiness. Wind power is used considerably for pumping water, &c., but the driving of dynamos at a steady speed by this means would make even a Salt Lake City Mormon "admire." The suction-gas plant, unless the above remarks can be contradicted, comes next on the list of practical accessibility and efficiency, and we therefore suggest consideration of its merits from an entirely new point of view by electrical exporters when the question of power for pioneers arises.

The Imperial Press Conference.

At the Imperial Conference held in June last, a Cable Sub-committee was formed of leading representatives of the Press of Great Britain and Greater Britain, to open negotiations with cable companies for Press rate reductions. The result was an agreement by the Government-owned Pacific Cable Board to reduce their Press rate to Australia and New Zealand from 1s. a word to 9d. a word, and this was closely followed by reductions of about 25 per cent. on the Eastern Telegraph Co.'s lines to India, Australia, New Zealand and South Africa, practically falling into line with the Pacific Cable reductions. There has been submitted for the approval of the Board of Trade the memorandum and articles of a new organisation, registered in the name of the "Empire Press Union," with which the Cable Sub-committee will be merged. A secretary has been appointed, and Mr. Harry E. Brittain, the popular hon. secretary of the Conference, will act in the same capacity, and help in the organisation of the permanent body.

Dominions and over-sea States will form their own committees and enrol members, and every newspaper of the Empire will be eligible, and may nominate one member.

The object of the Empire Press Union is to carry on the work begun by the Conference, and it now remains to be seen what will be the result of its endeavours to obtain for the newspapers throughout the Empire a better and fuller news service. During the Conference the Canadian section seemed desirous of obtaining lower rates between this country and Canada, and of having news of purely British origin and flavour, and went so far as to suggest the laying of a cable to provide for its realisation if the Atlantic cable companies did not reduce their rates.

"Wireless" was to be a valuable lever to reduce charges across the Atlantic, but so far, notwithstanding various protestations and Mr. Marconi's statement at a meeting of the Conference, and the pious hope, if not belief, of others at the Conference, we have not yet been favoured with a demonstration that would lead to the belief that it is possible to rely on this system of communication, year in and year out, for continuous working at any speed for from 12 to 24 hours daily, between the United Kingdom and Canada. This must have been more or less in the minds of members of the Conference towards the finish, as another plan—viz., that of laying a cable to Canada at their own cost, or preferably that of the Government—was freely mentioned.

It will, therefore, be interesting to note the next step taken, because, if the Atlantic companies remain obdurate, there will be no other plan left but cable laying and working. Will the Government or the Committee rise to this, as nothing material has yet been gained in the reduction of rates on Government lines and the consequent meeting of them on competing lines? The rate of 9d. is probably divided up as follows: 5d. to the Atlantic and land-line companies, and 4d. to the Government lines beyond Canada; and the Government are apparently not doing much more in the way of cheap rates than the companies.

MODERN TENDENCIES IN STEAM TURBINE DESIGN.

By A. P. CHALKLEY, B.Sc.

Practically no radical alteration in the design of steam turbines has taken place in the last five years, and each manufacturer has continued more or less on the same lines as previously, making various improvements in detail but no change in principle. In the last 12 months, however, there have been signs of great activity among even the most conservative of turbine builders, who in each particular case seem to have been roused to a sense of the possibilities of advancement, and to a realisation that types of turbines other than their own may possess advantages so considerable as to lead to their general adoption, unless further improvements are effected in the design of the original type.

That the question is becoming one of importance is evidenced by the fact that the two most prominent firms engaged in the manufacture of Parsons turbines in this country are now both working upon designs embodying great modifications from the usual type, and one of these firms has already placed a new machine on the market. There is, further, the ominous news that the British Admiralty, which has hitherto plumped solidly for the Parsons turbine, has recently ordered three destroyers to be equipped with Curtis turbines, while one will probably be engined with a type manufactured by the Parsons firm, in which the impulse and reaction principles are combined in a somewhat original manner.

Keen observation is not necessary to see that neither the Parsons nor the Curtis turbine (and all others may be considered for the moment as offshoots of these two) is the ideal machine which can be expected to maintain its sway for any length of time. The former has gained such a foothold in this country that to speak of it as anything but perfect seems to be almost a heresy. But it has its weak points, and the evolution of the turbine can only be carried out by recognising them and not by neglecting them while another type is brought forward elsewhere to capture the none too abundant trade.

The chief weakness of the Parsons machine lies in the high-pressure end. The steam after passing through the double beat valve has a pressure of, say, 100 lb. per sq. in. when it enters the first row of guide blades, and hence its specific volume is low and also its actual volume. This necessitates that the annular space between the spindle and the cylinder, whose sectional area is rather more than the circumference of the spindle multiplied by the blade height, should be small. The spindle diameter cannot be reduced below a certain limit for several reasons, the chief being that the resultant velocity of the steam is dependent on it, so that the only remedy is to have short blades. This causes two troubles. The clearance between the cylinder blades and the spindle and between the spindle blades and the cylinder can never be less than 0·02 in., and even with this clearance the danger of stripping, especially with superheated steam, is quite serious. If the blades are only $\frac{1}{2}$ in. high, as is frequently the case for a 500 or 750-KW. turbine, the area of the leakage path through which steam can pass without doing any work is more than 4 per cent. of the whole steam inlet area—that is to say, nearly 4 per cent. of the available power in the steam may be wasted. Of course, it is hardly fair to say that the whole of this is irretrievably lost, as it is more than probable that some of its energy is returned in the next stage; but, in any case, it does not do its work in the most efficient manner.

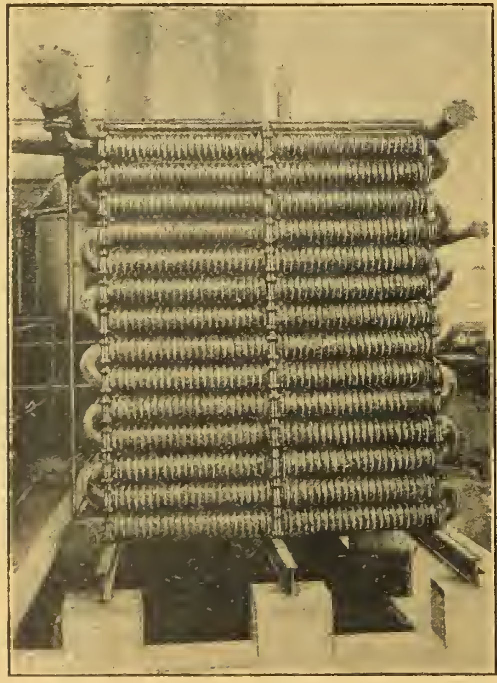


FIG. 1.—END VIEW.

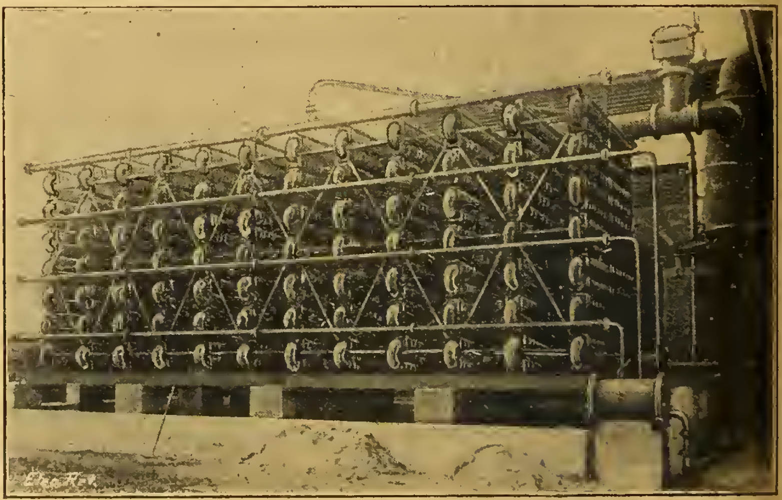


FIG. 2.—SIDE VIEW.

EVAPORATIVE CONDENSERS AT BRIDLINGTON (see opposite page).

At the low-pressure end the case is different, particularly in the third and last expansion. The clearances need not be very much greater—at any rate, not more than 0·03 to 0·035 in. for the same machine (500 to 750 KW.)—while the blades would be from about $3\frac{1}{2}$ in. in the first row to 6 in. in the last row of the final expansion. The loss in efficiency by leakage is, therefore, practically negligible, and the danger of stripping is much diminished—first, from the reason that the temperature is much less, and, secondly, because the clearances are greater. In fact, the low-pressure end of a Parsons turbine—that is, from the point where the steam is at atmospheric pressure to the exhaust, is about as ideal a machine from a theoretical and practical point of view as could well be expected; and this is proved by the splendid results obtained by Parsons exhaust steam turbines, both as regards reliability of running and lowness of steam consumption.

The Curtis turbine, on the other hand, suffers from defects which do not exist in the Parsons type, but possesses advantages at the high pressure end, which are of enormous value. The first set of nozzles through which the steam passes do not extend round the whole of the periphery at the inlet end, and are usually only about one quarter of the area of the annular space between the wheels and the cylinder, which can, therefore, be much larger than in the Parsons machine. On expanding through the nozzles the steam, of course, drops its pressure very much more than in the first row of guide blades in the reaction turbine, and the volume is consequently large, permitting the use of long blades, which, for the machine previously mentioned, would be perhaps $1\frac{1}{4}$ to $1\frac{1}{2}$ in. high, instead of $\frac{1}{2}$ in. Furthermore, the full steam pressure comes on no part of the turbine casing except the steam chest, and the temperature throughout is correspondingly lower, even with the use of superheat, so that the liability of the cylinder to distortion is greatly minimised.

The only part of a Curtis turbine where leakage of steam is probable is between the spindle and the fixed diaphragms which extend down to it, and it is here that this turbine is at a disadvantage. The clearance has to be necessarily small, and if seizure takes place, the effect is far more serious than the stripping of blades in the reaction turbine, for the reason that the spindle is usually bent when such an accident occurs. Also, while in the latter case the blades may easily touch the cylinder casing or the spindle without being stripped, it is more than probable that the slightest contact in the Curtis turbine will cause the maximum disaster. This danger is greater as the wheels become larger and heavier, that is to say, as the low pressure end is approached; and in view of this, the Fore River Shipbuilding Co., of Quincy, U.S.A., the constructors of practically all the Curtis machinery for the United States Navy, have recently made a great alteration in the design of their turbines. They have now adopted 14 stages instead of seven, which has hitherto been universal in marine work, and the last eight stages are on one drum, thus transferring the leakage space to a similar position to that in the Parsons turbine—between the drum and the interior of the diaphragms—and adding considerably to its reliability.

Summarising the above facts, the result which *must* finally be brought about is the combination of the two systems in the points where they show their greatest efficiency. The deduction is obvious—so obvious that one might wonder why it had never been put into practice, if the difficulties of construction and the high cost of experimenting in these competitive times were not realised. A turbine in which the high-pressure end is of the Curtis type (in principle), and the low-pressure end of the Parsons type, seems to contain all the elements necessary for the greatest success. The exact meaning of high-pressure and low-pressure ends must be determined by experiment, but as a rough estimate it may be said that the machine should be of the Curtis type from the stop-valve pressure to atmospheric pressure, and of the reaction type down to exhaust pressure; that is, so that the work accomplished in the two portions should be approximately the same. There is but little doubt that a turbine built on these lines would far exceed in efficiency and reliability all the others at present in existence, and it is indeed satisfactory to learn that the pioneer in steam turbine manufacture in this country is now engaged in experimenting with such a machine, and a few years hence we may expect to see its general adoption.

EVAPORATIVE CONDENSERS.

In view of the article on this subject contributed by Mr. E. K. Scott in our issue of September 24th, Mr. A. J. Beckett, borough electrical engineer, Bridlington, has kindly forwarded the following particulars of his plant:—

The condenser (figs. 1 and 2, p. 684) consists of 12 coils of Ledward's corrugated pipes arranged in one group connected together by a common exhaust main at the top and a vapour pipe at the bottom. At three intermediate points the water is drained away from the coils and led through horizontal pipes to one end of the condenser, where it passes through a sealing chamber, which is connected to the wet pump. Each drainage section is controlled by a valve, so that the hot well temperature may be varied as desired, and a higher temperature obtained than that corresponding to the vacuum.

The air pumps are of the Edwards three-throw type motor driven, 10 in. diameter × 10 in. stroke with a separate rotary wet pump.

The air pumps and the circulating pump, which is also motor-driven, also the switchboard for the three motors, are installed in a section of the boiler house.

The whole of the condensed steam passes from the wet pump to the gauge tank of a Lea recorder. This tank is placed close to the hot well from which the feed pumps draw, while the recorder proper is fixed in the engine room. A pipe is connected between the tank and the recorder to maintain the same level throughout, and by this means an exact record is kept of the steam consumption.

The plant is installed for dealing with a maximum load of 500 KW., the power absorbed by the air pump is 4 KW., and by the circulating pump 2 KW. The low power consumption is due to the fact that the amount of water circulated over the condenser and the height to which it is lifted (15 ft.) are extremely low.

Coal tests have been carried out both condensing and non-condensing under precisely similar conditions of load, and a saving of 26·7 per cent. has been obtained. In addition to this saving there is also a large saving in water, which from the town's supply costs 9d. per 1,000 gallons.

Coal Test, July 27th, 1909. Non-Condensing.

Time.	Machine reading.		Units.		Lb. of coal.	Lb. per unit.	—	Load in KW.
3–4	2,592	2,676		84	560	6·6	3	
4–5	2,676	2,761		85	784	9·2	4	74 5
5–6	2,761	2,837		76	672	8·8	5	72 0
6–7	2,837	2,907		70	672	9 6	6	85 8
7–8	2,997 655,627	2,976 655,640	69 13		1,008	12·2	7 8	81·9 131·6
8–9	2,976 655,640	2,979 655,815	3 175	178	1,456	8·1	9 10	269·5 165 7
9–10	655,815 2,979	656,008 3,027	193 48	241	2,016	8·3	11 12	84 6 72·0
10–11	656,008 3,027	656,116 3,037	108 10	118	1,288	10 9		
11	3,037	3,095		58	616	10 6		
				992	9,072	9 15		

Coal Test, Condensing. Monday, July 26th, 1909.

Time.	Machine reading.		Units generated.		Lb. of coal.	Lb. per unit.
3–4	71,573	71,669		96	448	4 6
4–5	71,669	71,769		100	504	5·0
5–6	71,769	71,843		74	560	7·5
6–7	71 843	71,917		74	672	9 0
7–8	71,917	72,002		85	616	7·25
8–9	72,002	72,035		33		
	655,178 2,457	655,295 2,466	117 9	159	1,390	8 7
9–10	655,295 2,466	655,472 2,524	177 58	235	1,344	5·7
10–11	655,472 2,524	655,609 2,527	137 3	140	896	6·4
11–11.45	655,609 2,527	655,627 2,572	18 45	63	448	7·1
Total ...	—	—		1,026	6,878	6·7 26·7 % saving

Pence per unit, ·3148d.

Coal used, smudge, 8s. 10d., hand fired, Crosthwaite fire bars; barometer, 29; vacuum, highest, 27; lowest, 24½; coal saving shown on tests, 26·7 per cent.

New Condensing Plant Results.

Contract price	£1,600
Interest and principal on £1,600 at 7 per cent. ...	£112
Coal 1,640 tons at present price 8s. 10d.	£724
Saving shown on test	26·7%
26 7 on £724	£193
Interest and principal	£112
Coal saving	£193

Net gain £81, after paying interest and principal.

CORRESPONDENCE.

Letters received by us after 5 P.M. on **Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coefficient of Self-Induction.

Your reviewer must again claim your indulgence in order to reply to the letter of Messrs. Cramp and Smith, published in your last issue. They accuse him of reading a meaning into their words which they had not intended. All that he did was to quote *seven* consecutive lines from one of their letters, and two from another, and propound to your readers the riddle of reconciling the statements contained in them. If this be reading a false meaning into their words, then he apologises. Messrs. Cramp and Smith may have perfectly clear notions in their own minds of what they mean, but outsiders can only judge by what they have written.

They admit that "in a strict academic sense it is, of course, true" that Maxwell's coefficient cannot be used in a vector equation at all. Yet "they cannot agree with this statement," because "if logically followed it would effectively destroy every ordinary alternating-current calculation!" In your reviewer's opinion this is sorry stuff. It sounds as if they said that the gods are false, yet we cannot get on without them. Surely it is unnecessary for scientists to assume such a humiliating attitude.

"By substituting for irregular waves their equivalent sine waves." The assumption is made here that there is such a thing as an equivalent sine wave. Your reviewer thinks that this idea was exploded some years ago.

"All this follows from, and is exemplified in, the work of Steinmetz, Thompson and many others." It is useless for the authors to quote the authority of these high priests, unless they give chapter and verse. They might as well summon Aristotle and Lucretius to their aid. They also quote the second volume of Dr. Russell's "Treatise on Alternating Currents," apparently not so much for the purpose of confuting your reviewer, but rather to point out the superior merits of their own volume.

They tell him that he will find in this volume under the equations for the transformer "an expression for Maxwell's coefficient in terms of the reluctance of an air circuit. Dr. Russell further points out that, to an iron circuit with constant permeability, these equations are applicable; and in subsequent calculations not only does he assume the permeability as constant, but he also attempts to justify the neglect of iron losses; of which neglect at least *we* are not guilty."

Your reviewer has looked up the references in the above quotation, and is surprised to find that they are hopelessly inaccurate. Dr. Russell does not give an expression for Maxwell's coefficient in terms of the reluctance of an air circuit. When discussing the iron circuit transformer, he neither assumes that the core has constant permeability, nor does he neglect the iron losses.

In conclusion, it is well to remind electricians that self-inductance depends not only on the number of turns, and the geometrical shape of a coil, but also on the thickness of the wire. If this wire be infinitely thin, then the inductance is infinitely great whatever may be the shape of the coil. If there is iron in the neighbourhood of the coil, the notion that the flux is proportional to the current is one which will appeal only to the simple ones of this world. To assume that this quantity can be represented by a complex variable is a leap in the dark. If we make such suppositions we can deduce from them certain formulæ which may, or peradventure may not, represent approximately what happens in practice. As it is absolutely impossible to calculate, even roughly, the magnitude of the errors introduced by these assumptions, the whole performance must remain a botching piece of work.

If there is no self-inductance when iron is present, then how can we make our calculations? It is certainly more difficult in most cases, but in a few cases it can be done quite easily. For example, we can prove easily that the magnetising turns of a constant-potential transformer are very approximately constant. We can even discuss the effects of wave shape on the voltage drop in the secondary. In this connection Ampere's and Faraday's laws are invaluable. Unfortunately no one has yet explained in a rational manner how hysteresis can be accurately taken into account in our equations. Further research in this direction is badly wanted.

It is of importance that the youthful engineer should know where the quagmires are in the grounds on which he intends some day to build. If he is ignorant of their existence, is there not a serious risk that he may erect a noble superstructure on one of them, which when the rains come, and the winds blow, will gradually sink from sight, and he will see the labour of the best years of his life pass away like a dream. Would he not then have reason to blame his teachers? Instead of warning him of the treacherous quagmires, they lure him on to them by showing that they can support light structures. Some of these seem to have drifted on to firm foundations mainly by good luck, others are at the mercy of every breeze. Is it not the duty of every teacher to purge the eyesight of his pupils with "euphrasy and rue," so that they may be able to examine carefully the foundations on which they have to build?

Your Reviewer.

Finance and Industry.

Being the inventor of a new wiring system, and after having a four months' hard struggle to raise working capital, I have read your leading article in last week's issue with the greatest interest. Every word I can personally confirm and, as far as this country is concerned, I may say that the taking out of a patent is simply child's work in comparison with the difficulty in getting the necessary working capital to put the invention on the market.

At the present time one would surely think the greatest need of the electrical industry is a cheap, simple and reliable wiring system. And, yet, what are the facts? I wrote to nearly three-hundred directors of electrical supply companies pointing out that I had invented and perfected such a system and asking their co-operation in placing it on the market. Eagerly I awaited their replies, for these were the very people who would be most interested in such a thing as a help in securing better financial results for their concerns. To my disappointment I had but one reply, and this simply stated the writer regretted he could not help me. Not one thought it worth their while to investigate matters, and yet people wonder why the Germans and Americans are getting ahead of us.

Having failed to secure the financial help of the directors, I next approached a well-known manufacturing and supply concern, whose name is a household word in the electrical industry. This firm simply acknowledged my letter, and stated the matter would have further consideration. After waiting for some time, I decided to call personally and investigate matters. As the gentleman I wanted to see was engaged at the moment, I had a conversation with the manager of the showroom, and I explained my new wiring system to him by means of actual models. He examined them carefully, and was quite enthusiastic in praise of the whole thing. Just then the gentleman I wanted to see came along, and the following took place:—"Oh, Mr. Martyn, we are writing to you to-day to say your new wiring invention does not interest us." The manager of the showroom: "Oh, Mr. So-and-So, have you seen this system?" "No; what is it?" Further comment is needless. And yet a shareholder friend of mine wonders why this firm is doing so badly.

I am now in communication with some city people, but it is difficult to say if I shall be successful in raising the necessary working capital, and I am determined the invention shall not be strangled by company promoters. The system is so simple that any village mechanic could erect it, so reliable that it is safer than any method now in use, and its cost should be about half in comparison with present standards. It has been most favourably reported upon by well-known consulting engineers, central station engineers and even by yourselves (see page 216 of the Electrical Review, August 6th, 1909); and for the want of working capital I am beginning to doubt more and more every day if I shall succeed in getting it on the market in this country, and for this reason an invention which is undoubtedly of the greatest benefit to the electrical industry must stand on one side.

Sarsfield W. Martyn, A.M.I.E.E., A.M.I.Mech.E.

London, N.W., *October 19th*, 1909.

British-made Magnetos.

There recently appeared in your columns a letter calling attention to the fact that the large majority of British motor-cars are fitted with foreign magnetos. Your correspondent drew some conclusions rather to the detriment of British electrical manufacturers, and finally asked why it was that no British firm could turn out a magneto to compete with the foreign machine. He concluded by saying that the car manufacturers are only too anxious to secure a reliable British magneto. May we offer some observations, as the result of our experience?

We have been manufacturing ignition apparatus for motor-cars almost since the beginning of the motor industry, and have equipped thousands of cars, and can claim, we think, to be fairly experienced in ignition requirements.

About four years ago we turned our attention to magnetos, and spent some thousands of pounds in experimenting, until finally we brought our machine to perfection. Our magneto gives dual ignition and switch starting from the dash, and is considered in many respects in advance of any other magneto. In price also, our magneto will compare very favourably with all the leading foreign makes.

We have spent large sums in advertising, and as a result we are selling a large number of machines. The magnetos we have supplied are giving every satisfaction, and in every way it would seem as though the British magneto problem were solved.

So far, so good; but when we approached the car manufacturers our difficulties commenced.

Your correspondent said that the motor-car makers would rather use a British magneto if they could. We wish this were so, for we have found nothing but obstacles placed in our way up to the present. In some cases the car manufacturers are willing to test the magneto, and are even quite flattering in their reports, but this is as far as they will go.

It appears that makers have even signed agreements with oreign magneto firms undertaking to supply no other nagneto than their own unless the buyer of the car definitely pecifies another make. In fact, we have this morning eceived a letter from a well-known car maker in precisely hese terms. The British magneto manufacturer is thus on he horns of a dilemma, and he must, perforce, appeal to the public.

If the public will specify British magnetos for their new cars for next season, the car manufacturers will be unable to refuse to supply them. The matter really rests in the hands of the public, and it is entirely at their option to encourage or discourage the home manufacturer of electric magneto equipment.

Jno. C. Fuller & Son.

London, E., *October 20th*, 1909.

The Relative Costs of Electricity and Gas.

For the purpose of comparing the relative costs of lighting by electricity and gas, I understand that some Government officials assumed 8 units equivalent to 1,000 ft. of gas.

Would you please state what price of gas is equivalent to electric light (100 volts) at 6d. per unit with Osram lamps.

Can you give such standards of comparison as used by the Postmaster-General, any Government department, or big Corporations?

A. B. C.

[This, as has often been pointed out, is a fallacious mode of comparison. It is like comparing an electric oven with a kitchen range on the single and inadequate basis of cost of fuel. There is no direct comparison of any value on such a restricted basis. The cost of electricity under the conditions stated, would be about the same as that of the gas required to give the same number of candle-hours, at 3s. per thousand cubic feet, but the cost of running an establishment lighted with electricity has repeatedly been proved less than that of one lighted with gas.—Eds. E.R.]

Publication of Prospective Business.

I think it would be interesting to hear the views of your readers on the publication of prospective business. My own idea is that it is hardly less than a curse to manufacturers, their representatives and purchasers alike. What happens is that a paragraph appears in the papers to the effect that the T.C. of Timbuctoo had before them a report by the engineer, Mr. Smyth-Jones, *re* extensions. Thereupon every manufacturer who is any good bombards Mr. Smyth-Jones with circulars, and hosts of representatives call upon him. Ultimately the matter is either shelved or tenders are called for, and there is the same old fight for the contract at an unremunerative figure. The net result in any case is that the manufacturer and his representative have wasted time, trouble and money, the engineer has been bothered, and nobody is any better off than if the job had never been mentioned till tenders were invited.

J. S.

Contractor, Supply House, and Manufacturer.

Do you not think that it is about time the contractor, the supply house, and the manufacturer understood exactly their respective positions in the electrical world? Every week there appear letters in the electrical papers calling attention to either one or the other of these people cutting one another's throats and tumbling over each other in the effort to secure business.

Only this week I notice that one of the largest electrical machinery manufacturers in the country has accepted a paltry wiring job, but has placed the carrying out of the work in the hands of a contractor. (Observe the kindness in cutting a man's throat and then giving him a piece of sticking plaster to patch it up again.)

And what do you think of the lamp manufacturer who, instead of openly giving better terms to the consumer, sneakingly offers him lamps at 14 to the dozen?

Surely it is about time that something was done to put this thing down, and the sooner it is done the better it will be for all concerned.

Supply or Contract (not both).

A Question on Load Factor.

Will some one kindly inform me whether I should be correct in including the capacity of the battery in determining the load factor of a tramway station, and, if so, how this should be determined?

The plant consists of two 100-KW. generators and a battery of 980 ampere-hours capacity. The machines run about 14 hours a day, the load being commenced and finished on the battery.

I feel inclined to ignore the battery, take the station capacity as 200 KW., and reckon on a 14-hour day.

Ratio.

The Publication of Salaries.

It has often been a matter of wonder to me why you publish particulars of salaries. Of what possible interest to anyone can it be to read, as those who run may do this week, of the appointment of a gentleman at 30s. per week? Moreover, there are the recipients themselves to consider. I should think the feelings of any engineer would at any rate be mixed when reading in the paper that his salary had been increased from £200 to £210 per annum, which seems to be about the usual extent of Corporation generosity.

J. S.

Unemployment.

I have been much interested in the correspondence on unemployment and combination in your last few issues. The question is one that vitally affects the workers, whether they style themselves electricians, electrical fitters, or wiremen, but I cannot let the letter of "Unity is Strength" pass without comment. He says: "Most people are aware there is already an Electrical Trades Union, but the bulk of their members are wiremen;" so far 'tis true, but he goes on to say: "They do not make any provision for other branches, and even if they do, all candidates accepted are classed as wiremen, that being their main object." This is simply rubbish; the men accepted in the Electrical Trades Union are classed according to their trade, the same as they are in any other trade union. Again, "what we want to do is to organise electricians, men who have served a specified time at the trade, and can do wiring, and are capable of taking charge of plant, and doing running repairs." This is exactly what the Electrical Trades Union has been trying to do for some years, and the "bulk of their members" have exactly these qualifications.

The fact of the matter is, the term wireman has been as much abused as the term electrician.

A man or a youth who has been about a fortnight carboning arc lamps (and cleaning windows) in a draper's shop, becomes at once an "electrician," but after following various phases of employment and half ruining a few contractors who have eccentric ideas of cheapness, he may become a species of wireman, but, fortunately, there are other types of wiremen. There is the man who has served a genuine apprenticeship and is able to lay down an electrical plant, including motors, switchboards, wiring, telephone, bells, lifts and all the many electrical appliances now so common to a modern works, ship, or block of offices. This is the real wireman, and with all due respect to other grades, he is one of the most important units in the electrical industry.

To those "electricians" in charge, shift engineers, substation attendants, and others who may feel they are above the ordinary trade union, let me point out that by combination in the Electrical Trade Union many others in addition to armature winders and wiremen have been enabled to establish a reasonable rate of wage, that we have an efficient organisation ready to hand, that we desire to see all grades of competent electrical workers combined, and if these men are really anxious to see better conditions prevail, they will not endeavour to form a multiplicity of sectional organisations which will only lead to chaos, but will join the organisation which was formed, and is maintained, by electrical tradesmen for the betterment of the electrical trade. By so doing, "Unity is Strength," and others who have written on the subject, will be carrying out their own ideas to their logical conclusion.

In furtherance of these objects, I will be pleased to correspond and give further information to any who will write to me direct.

J. Rowan,
General Secretary, *E.T.U.*

Manchester, *October 20th*, 1909.

If my first letter starts a society of the genuine brand of electricians demanding a living wage and keeping up the prestige of our trade, I shall not only be rewarded, but delighted; this is the only means of extracting the wheat from the chaff.

The great complaint and growing evil is that the electrical market is flooded with inexperienced men, whilst the good brand are shut out.

In these days of combines and federations of masters fighting the right with their might, it is incumbent to keep up a defence (not defiance); therefore, I am rather afraid of new-born societies, because their weakness is a loophole for cowardly attack. My reference to the A.S.E. electrical section was owing to its long and tried establishment and powerful representation in the House of Commons on burning complaints and trade injustice and tyranny.

We often hear of the tyranny of Trade Unionists in shops in not giving a royal welcome to men with a keen relish for plums fought for and dearly bought by others. We shall always find plenty of passengers willing to travel without paying their fare. Bad as the boycotting is, this is nothing to the tyranny of masters if we stand alone.

In some cases men offer their services merely for the experience, whilst their board and clothes are found or drawn from the bottomless pit of unearned increment. What chance has the poor boy with brains, and no cash, or rich parents to lean on for supplies?

As magnetism and electricity are twin sisters, so are theory and practice. Practice is the proof of the pudding, and men with merits and ability should have a clear road to elevation, and poverty should never be a hindrance.

Wm. Podmore.

Sheerness-on-Sea.

Train Lighting.

Will any reader please give information on the following points relative to train lighting by electricity?—

1. Name of firm, making and pushing the "Moskowitz" system, or any railway on which it is in use, results, &c.
2. Any railway using the Leitner-Lucas system.
3. Any railway on the Continent (or elsewhere) actually using a turbo-generator set on the engine for main lighting, with data, or where the same can be obtained.

Railway.

"STERLING" CENTRAL-BATTERY AUTOMATIC INTERCOMMUNICATION TELEPHONES.

The march of progress in electrical science, which is constantly bringing into view new and surprising developments in almost all branches of the industry—so that what was novel five years ago has become a "back number" to-day—is as steady and continuous in telephonic matters as in any other department of electrical activity. But the great advances that have been made in telephony are probably less fully appreciated by the bulk of the electrical profession than those in more familiar subjects, principally because there is so little in common between telephony and the heavier branches of electrical engineering. Telephone engineers, like telegraph engineers, are, above all things, specialists; and their work, except in respect of its fundamental principles, is to a great extent a sealed book to the average electrical engineer. Nevertheless it is a most interesting subject, well worthy of study and presenting many remarkable examples of mechanical ingenuity and patient evolution.

Sometimes, as recently in the lighting industry, revolution is a more appropriate word. The introduction of the central-battery system into exchange communication, for example, whereby innumerable isolated primary batteries at subscribers' stations were replaced by one big storage battery at the exchange, practically effected a revolution in this class of work. The adoption of the system in connection with the allied function of intercommunication between the different offices or departments in a single building has been somewhat delayed, doubtless on account of the difficulties inherent in this special problem; it must be borne in mind that in this case no staff of experts is at hand to remedy defects, and therefore no defects must be allowed to arise; moreover, there are no switchboard operators to put the different stations in communication with one another; each user is his own operator. There are also technical and commercial difficulties to be overcome.

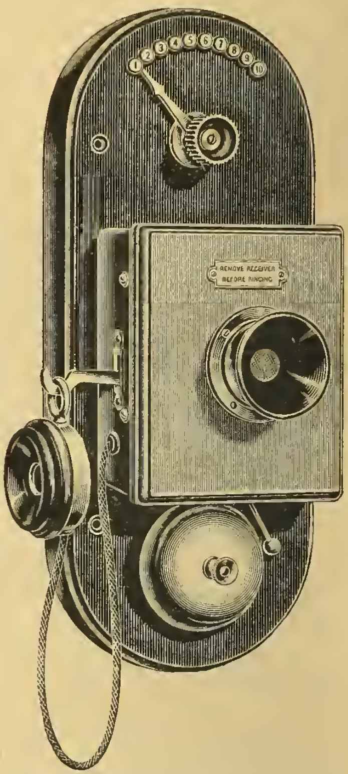


Fig. 1.—Automatic Intercommunication Battery Ringing Telephone, with Radial Switch, Wall Type.

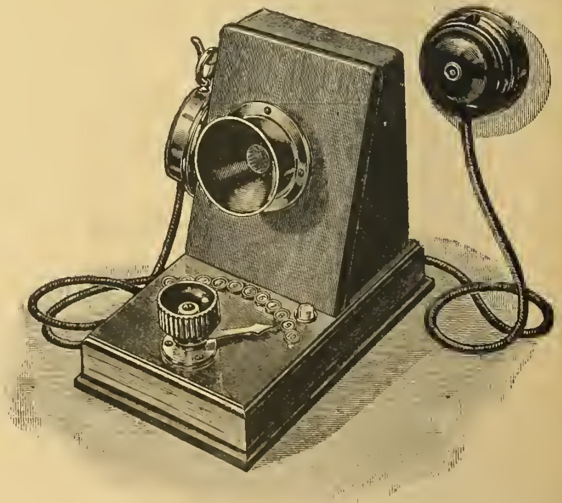
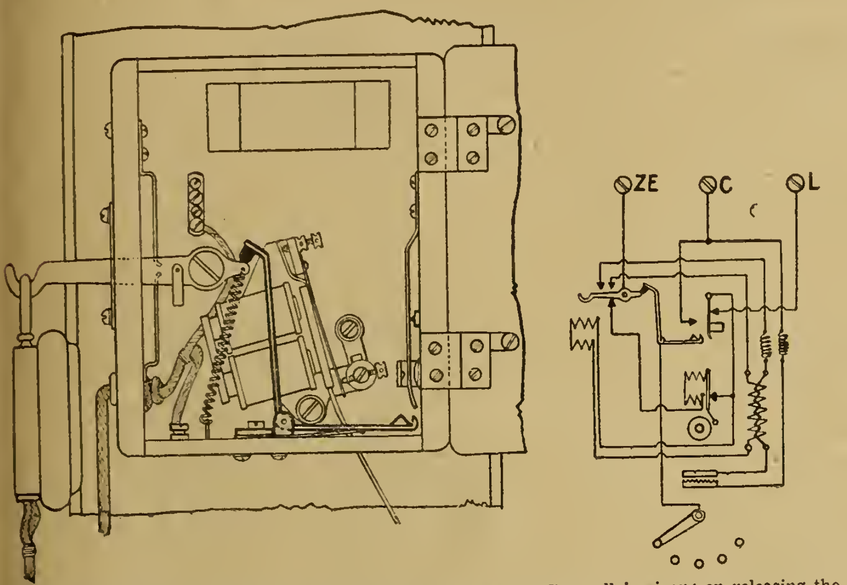


Fig. 2.—Automatic Intercommunication Battery Ringing Telephone, with Radial Switch, Table Pattern.

A solution of the problem has been attained, however, and is embodied in the new system of "automatic intercommunication telephones" which has recently been put on the market by the Sterling Telephone and Electric Co., Ltd. In this system only one central battery is employed, and a great economy is thus effected; for example, in an installation comprising 10 stations, 20 microphone cells are dispensed with, their place being taken by one battery of six cells, which serves for both ringing and speaking. This improvement has been extended to all the company's intercommunication telephone equipments, except those in which magnetos are used. Fig. 1 shows one of the wall instruments, and fig. 2 a table set, of the radial-switch type, employed in this system. An important feature of these is the ingenious patented device employed by the Sterling Co., to effect self-replacement—the "automatic" feature. What this device accomplished was briefly explained in our issue of May 28th. We are now permitted to show *how* it is done.

The object of the device is to restore the connection between the receiver and the home line automatically after another station has been called up; so that, no matter what stud the selector switch arm is left on, the station, when not in use, is always in readiness to receive a call. In the ordinary way, to effect this purpose, it has been necessary to fit a separate movement for each line at each instrument, but, with this device, one lever fulfils the whole of the requirements. To answer a call, the user has merely to raise the receiver and listen, his selector switch being out of the circuit altogether. To originate a call, the user places the selector switch on the desired contact, raises the receiver, and rings, the act of ringing disconnecting the home line and connecting the receiver to the line selector switch. The replacement of the receiver on the hook when the conversation closes again actuates the lever, connecting the receiver to the home line and disconnecting the selector switch. Besides effecting these operations, the device, by disconnecting one line, reduces the capacity of the circuit and thus minimises cross-talk. This is made clear by the diagram, fig. 3, which with the footnote is self-explanatory.



By raising the receiver and pressing the bell-push (on the right hand) a call is given; on releasing the push, the bent lever retains the receiver in connection with the selector switch, but when the receiver is hung up, the bell-push is released by the bent lever and the home-line connection is restored.

FIG. 3.—INTERIOR OF "AUTOMATIC" TELEPHONE, AND DIAGRAM OF CONNECTIONS.

It should be added that the illustrations given only represent two out of many patterns of the radial-switch type; and fig. 4 shows one of the multiple-lever instruments, arranged for central-battery working, in which the ordinary separate self-restoring movements are employed.

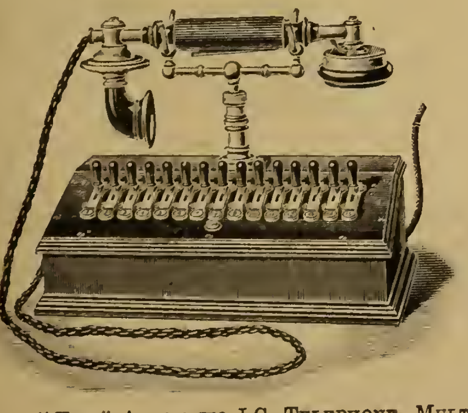


FIG. 4.—"EBA" AUTOMATIC I.C. TELEPHONE, MULTIPLE-LEVER TYPE.

If one puts all one's eggs in one basket, it is advisable to "watch that basket;" the Sterling Co., while putting all its cells into one battery, has endeavoured to render the task of watching the battery a sinecure, and to this end has investigated the battery question very closely. We were interested to learn during a recent visit to the company's showroom, that the result had been the adoption of a "wet" cell, doubtless on account of the lower resistance and greater reliability of this type. The pattern selected is entirely new—the two-quart "Invicta" sack type, illustrated in fig. 5. In this cell, it will be noticed, the zinc, a split cylinder of large size, rests upon four inward projections of the glass jar, and is guided at the top by similar projections; connection is made with it by means of a leaden strip, with a screw terminal at the free end. A glass cover is provided, with a central hole for the carbon rod, and a slot through which the lead strip passes. A recess in the bottom of the jar receives the lower end of the carbon rod, round which is the "sack" containing the depolariser; the rod fits freely in the sockets, and carries a terminal at the upper end. The whole is of sound mechanical design; the jar is exceptionally deep (11 in.), and creeping is abolished. Six of these are required to form the central battery for an installation of 10 or 15 stations.

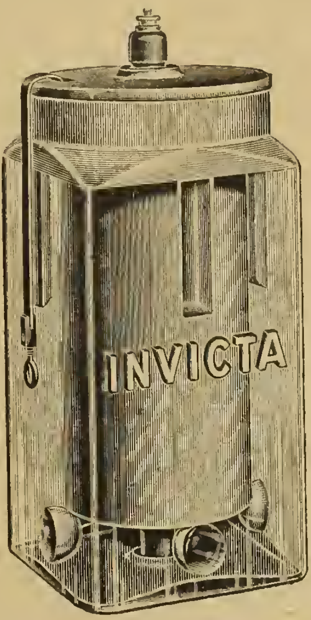


FIG. 5.—"INVICTA" SACK CELL.

The advantage of getting rid of a large number of scattered batteries is self-evident; at the same time the difficulty of finding convenient places to put them in, and the unsightliness of the necessary connections, are obviated when the central-battery system is employed. We have no doubt that the improvement will meet with the approval of the user, and that the enterprise of the makers will be duly rewarded. We may add that the company's works at Dagenham (Essex) have commenced the manufacture of telephones and allied apparatus.

DIFFERENCES BETWEEN ENGLISH AND AMERICAN PRACTICE.*

By J. S. CONOVER.

Many engineers and manufacturers have often wondered why there seemed to be so little demand in England for articles which are sold in this country in large quantities. This condition is largely due to certain differences in engineering practice, and the following explanation of some of these differences may be of interest to the readers of the *Review.*

The early progress in the electrical lighting field in England was greatly impeded by the strict regulations imposed by the Government, which made the cost of producing and distributing electricity so high as to be almost prohibitive. In the early nineties these regulations were materially modified, and the electric lighting industry began to advance with considerable rapidity. One important regulation remained and is still in force, which in itself is sufficient to account for many of the differences in lighting practice between this country and England. Under this regulation practically all electric lighting wires in cities and towns, large and small, have to be placed underground. This requirement has been one of the principal factors in limiting the use of electricity for lighting purposes to cities or towns of about 20,000 inhabitants or more, as smaller towns cannot often afford the expense of an underground cable system. In the large cities in this country underground cables are generally used, so that the difference in practice is much less marked than in the case of smaller cities and towns in which overhead cables are mostly used, except, perhaps, on a few of the principal streets.

Another fact which has undoubtedly had a considerable influence upon the use of electricity for lighting purposes in small towns is that, in England, most of the towns were provided with a gas plant and distributing system before the advent of electricity into the lighting field. In this country such was not the case, as many of the towns of between 5,000 and 10,000 inhabitants have only come into existence within the last 10 or 15 years, and electricity has had the same chance with gas of being first in the field. In this country over 60 per cent. of the central stations generating and distributing electricity for lighting purposes are in towns of less than 5,000 inhabitants.

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* Abstract of an article in the *General Electric Review*, U.S.A.

A large majority of the electric lighting plants in England are owned by the municipalities, which also own the street railway systems. In the smaller towns in which only one generating station is required, it is economy to combine the lighting and railway stations in one. It is also economical and convenient to have the generators so designed that they can be used for either class of service. This has led to a demand—which is practically unknown in this country—for direct-current generators which will give about 460-480 volts as shunt machines, and which are provided with a series field so that they will give 500·550 volts when operated as compound-wound machines.

The system of street lighting generally used in England is the series multiple; that is, two lamps in series on 220-240 volts, or four in series on 440-480 volts; or the straight multiple. Series arc and incandescent systems are practically unknown.

The comparatively small amount of alternating-current distribution naturally limits the demand for lighting transformers, and even this demand is different from that in this country. The underground cables necessitate the grouping of transformers and the use of larger sizes, so that the demand for transformers of under 20 kw. is very small. All lighting transformers have to be provided with ground shields, a requirement which prevents transformers of standard American construction from being used.

A very marked difference exists in the demand for meters, apart from that due to the difference in the relative proportion of alternating and direct-current distribution. In this country practically all house-service meters are wattmeters; in England nearly all direct-current house-service meters are ampere-hour meters.

Until recently the principal differences in incandescent lamps have been in the voltage and the type of base. The English demand has been primarily for voltages between 220 and 240, and the bayonet type of base.

The demand for lighting apparatus in this country and in England differs in amount as much as in character, if not more. By 1902 or 1903 most of the cities and towns in England that could support an electric lighting plant, had one. The growth of cities and towns there is very slow compared with that in this country, and very high buildings are not replacing those of moderate height; so that after the more thickly settled portions of a city or town have been supplied, the yearly demand due to expansion is relatively small. In this country the erection of very high buildings in place of those of four or five stories creates an ever and rapidly increasing demand in a given area. Furthermore, the use of electricity in England is limited more to the real need for light, and does not extend to any considerable extent into the realm of advertising. The central portion of London is fairly well lighted, from the standpoint of convenience and safety, but it is dark as compared with New York, due to the lack of brilliant advertising displays. The yearly increase in the load of the New York Edison Co. is, I believe, about 20 to 25 per cent., while the yearly increase in the total lighting load in London is not more than 5 or 10 per cent. The total yearly sale of incandescent lamps in this country at the present time is estimated to be about 60,000,000, whereas in England, with a population approximately one-half as great, the total yearly sale probably does not exceed 15.000,000.

In the railway field there are fewer marked differences between the practices of the two countries, although a number of quite important ones is to be noted. The most important, perhaps, is that of speed. In England the maximum speed for street railway cars allowed by the municipal regulations (which are generally enforced) is about 12 miles per hour. In this country, while there are regulations in most cities, they are not strictly enforced, and the average maximum speed in cities and towns is about 25 miles an hour.

To the writer's knowledge, no interurban roads using the public highways have been built in England. Whether any attempts to promote such roads have been made is also unknown to the writer, but it is pretty certain that speeds of from 40 to 50 miles per hour, which are common in this country on the public highway, would not be permitted in England, and the authorised speeds would probably be so low as to make the service unattractive and the undertaking unprofitable.

Another regulation which tends to limit the extension of electric roads into the more thinly populated districts, is that the drop in voltage in the return circuit shall not exceed seven volts. This regulation has made the use of track boosters quite common, and even with these boosters the cost of return cables becomes a serious item on lines extending into the suburbs. The limits set for speed and for drop in voltage in the return circuit have had the effect of confining the field of the electric railway to the fairly thickly settled portions of good-sized towns.

A fact which ought not to be overlooked in this connection is that the average English working man's wages give him a very narrow margin above his bare living expenses, and he will walk a considerable distance rather than pay a car fare. This fact alone would make a failure of a street railway in an English town of a size sufficient to support a good paying road in this country.

The type of street car generally used in England differs from that used in this country, in that it is of the double-deck type with seats on top. The low speed employed makes this type of car possible, and as the regulations limit the number of passengers carried to the seating capacity, this can be almost doubled without much expense or additional weight.

The usual practice in England is to string the trolley wires on the side of instead of over the middle of the track. This is done to minimise the length of brackets and to permit their use wherever possible, as they are considered more sightly than span wires. This type of overhead construction necessitates the use of a trolley with a swivel head, which design is practically unknown in this country; furthermore, the double-deck car requires a special type of trolley base to prevent the trolley pole from interfering with the passengers. There is, therefore, practically no demand in England for trolleys of the types which are standard in this country.

The low speeds do not necessitate motors of as great capacity as those generally used in this country, and lower armature speeds are required. This latter requirement led first to the design of special low-speed armatures to fit frames of standard American type, but lately it has resulted in the design of special motors for the English conditions. The low speeds also make it feasible to use electric brakes, which have never been employed to any extent in this country, and which necessitate a different type of controller from that generally used here.

In the field of heavy traction the English practice has adhered more closely to ours.

In the industrial field the difference between English and American practice is, perhaps, more one of degree than of character.

Competition in most lines of manufacture is very keen, and profits are generally smaller than in this country. Stockholders are very insistent upon the payment of regular dividends, and as the directors of joint-stock companies are personally liable for the payment of dividends which have not been earned, they are very careful to satisfy themselves that such have been earned before authorising their payment. The natural result of these conditions is a tendency to minimise the amount allowed each year for depreciation, and as the initial plants are generally of a very substantial character, rates of depreciation which would not be considered sufficiently high in this country are considered satisfactory in England.

Many manufacturing firms in England are just about able to pay a dividend, after making the usual provisions for depreciation.

The difference in conditions between the two countries extends even into the field of renewal parts. A characteristic of the English is their ability to make things last a long time and continue to give good service. This is due, in some measure at least, to the fact that they usually have an ample equipment for the requirements of the service and are able to give it systematic inspection and care.

The English market can be classed as a very restricted one as compared with our market. A restricted market must have an effect upon those who are supplying it, and the natural result is relatively small production and a limited stock. This is just what one finds in England in nearly every branch of business. It is quite clear that a manufacturer who has a small production and carries only a very limited stock cannot afford to install the same sort of equipment as the manufacturer who has a large production and carries a large stock. The English manufacturer must then get along with the minimum equipment, and have that equipment as flexible as possible.

The necessity for minimising his equipment has forced the English manufacturer to make the best use of what he has, and in doing this he often shows great skill. In going through one of the large shipyards on the Tyne, near Newcastle, I remember being very much impressed by finding in the middle of an old and badly-lighted shop with a very poor equipment of tools, a thoroughly modern 5,000-h.p. triple-expansion marine engine in process of construction, the height of which was so great that a hole had been made in the roof to permit of its erection. The average American manufacturer would not undertake to build saw-mill engines in such a shop and with such an equipment, and yet I doubt if the best equipped shop in America could produce an individual engine of equivalent size and type, of better quality or at a lower cost. If a number of duplicates were required, the English shop would, of course, be at a great disadvantage; but in England a number of duplicates are seldom required, and the manufacturers' facilities are fairly well suited to the character of the demand.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Veritys' Installation Manufactures.

We understand that since the issue of "Verity in Three Volumes," Messrs. Veritys, Ltd., of 31, King Street, Covent Garden, London, W.C., have been so constantly asked by their customers for particulars and prices of small plants suitable for up-country electrical installations in bungalows and on tea and rubber plantations, that they have published a pamphlet, X108, giving the details generally desired, and a copy of this is before us as we write. It shows direct-coupled petrol or paraffin engines and dynamos, and all other parts going to make up an installation. The plants are well past the experimental stage, for Messrs. Veritys have quite a number of them running here in England, and already several abroad. It is claimed that they are so simple that the average gardener or groom can easily look after them, and owing to their small weight they can readily be moved to fresh quarters when desired. They consist of a high-speed vertical petrol or paraffin engine coupled, as shown in the illustration, fig. 1, to an "Aston" dynamo; the pamphlet also gives particulars and prices of accumulators, ceiling fans, fittings and other sundries which are generally required in connection with such installations, and to simplify matters for non-technical buyers there is given on the back page a complete estimate for an average installation.

To meet the requirements of the increasing number of alternating current electricity supply systems abroad, Messrs. Veritys have for the last 18 months been preparing alternating-current ceiling fans, such as would be suitable for use in the tropics; this new fan, the "Rangoon," is now ready, and after tests extending over several months, it is claimed to be as great a success as their 1909 D.C. ceiling fan. A point about this fan, and one which friends from abroad have accentuated, is its silent running. The fan is English made, and is shown in fig. 2. These ceiling fans are stove-enamelled, and consequently are readily kept clean with a damp cloth, an improvement on ordinary painted fans. The fan can be fitted with two, three or four blades, which are set up at a large angle and pitch, and therefore give a most excellent breeze, even when running slowly.

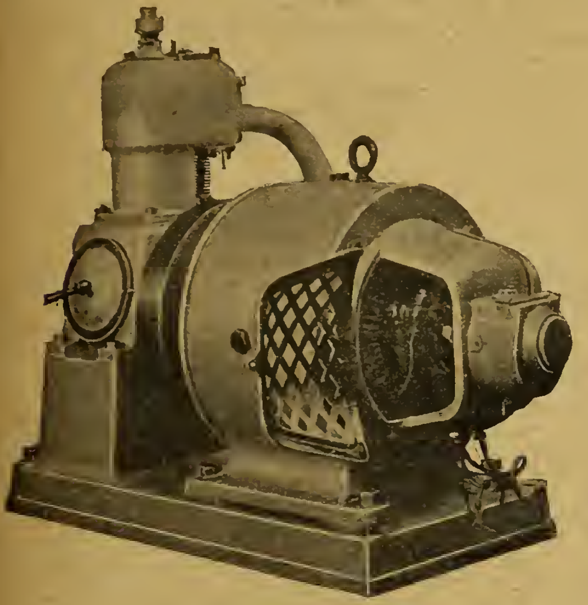

Fig 1.—Veritys' Small Electric Lighting Sets for Bungalows and Up-Country Stations.

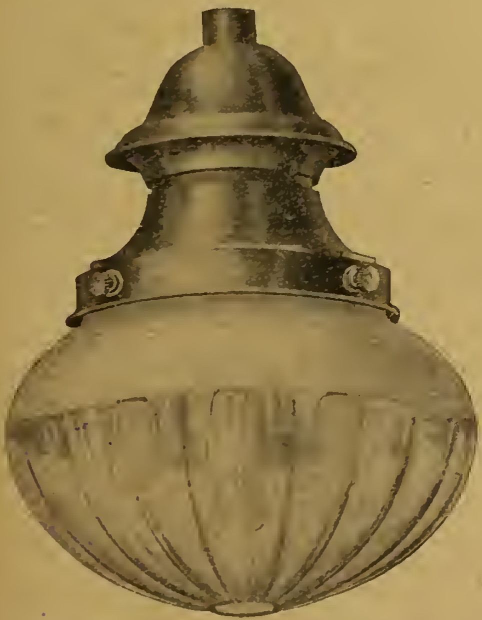

Fig. 3.—Veritys' New "Radiant" Lantern for Aston Metalamps.

Another item for which a large sale abroad is expected is the firm's new "Radiant" lantern, which has been brought out to meet the demand for a lantern having all the advantages of an enclosed arc lamp as to brilliancy of illumination, but requiring no daily or weekly trimming. The efficiency of these lanterns when fitted with "Aston Metalamps," is stated to be very high, and by their use they will give as much as 400 C.P. The lamp is understood to be an effective and economical lantern for shop and street lighting. It is fitted with specially fluted globe with self-contained opal reflector, so that the light is well diffused, and it has been found to be a very popular way of lighting small shops.

Ferranti High-Tension Ironclad Mining Switchgear.

Messrs. Ferranti, Ltd., of Hollinwood, have recently placed on the market a new design of high-tension ironclad switchgear to meet the demand for absolutely safe, simple and fool-proof switchboards for use in collieries, mines, factories, and other works receiving high-tension supply from a central station. The design, as shown in fig. 4, is simple and inexpensive. The bus-bars are contained within a separate chamber situated at the back top corner. This compartment is normally kept locked while the bars are alive, but access can be obtained to it by unlocking doors at the back (when the gear is erected clear of any walls) or from above (when erected to butt up against a back wall).

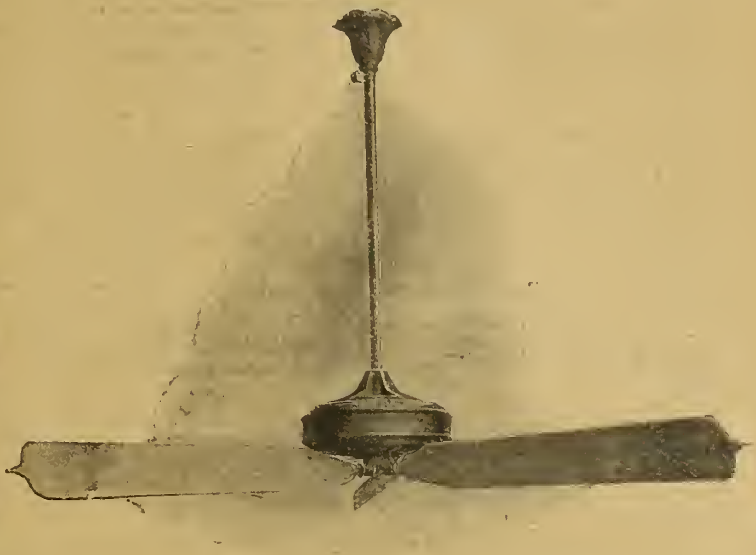

Fig. 2.—Veritys' "Rangoon" Ceiling Fan for Alternating Current.

The equipment of the feeder cubicles usually consists of cable receiver, two isolating switches, automatic oil switch, ammeter and current transformers; the transformer panels require only one isolating switch.

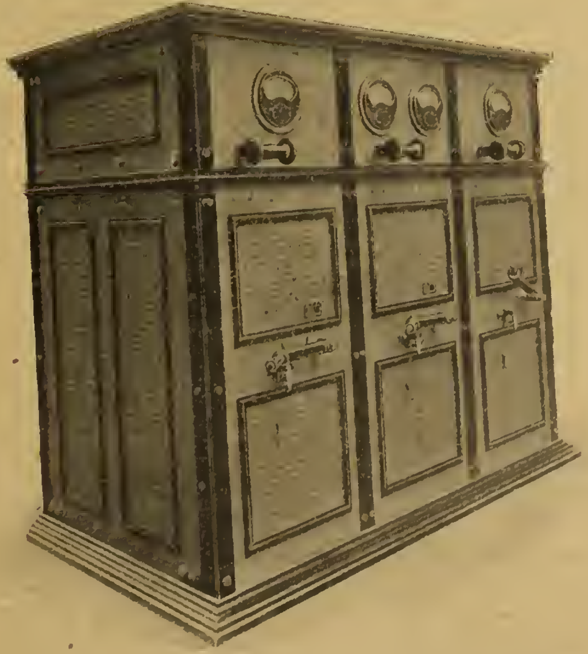

Fig. 4.—Ferranti High-Tension Ironclad Mining Switchgear.

The gear is primarily arranged to receive the minimum necessary apparatus as above enumerated, with perhaps the addition of a voltmeter or other device to indicate when the feeder or bus-bars are alive. It is, however, very flexible, and can be arranged to accommodate additional transformers where wattmeters, relays, power-factor indicators, Merz-Price protection or other refinements are specified.

When required, the interlocking can be very completely effected. The isolating switch (in the case of the feeder cubicle both are coupled together) is interlocked with the main switch, so that it cannot be opened or closed unless the main switch is open. The isolating switch may further be interlocked with the front panel, so that the latter cannot be removed unless the isolating switch is in the open position, and, finally, the panel closing the cubicle at the back is provided with an indicator showing whether the isolating switch of the corresponding cubicle is open or closed. Thus the apparatus in each cubicle can be examined with perfect safety and without interrupting the supply.

In the design of this gear special attention has been paid to the position and method of fixing the cable receiver so as to enable the feeder cables to be easily coupled up; all connections are of the simplest and most straightforward character, and the main switches are arranged for ready withdrawal for examination or otherwise. These switches are of the free-handle type, with indicators showing whether they are open or closed, and they can be arranged for operation on overload with or without time-limit devices, reverse power, or in accordance with the Merz-Price system.

The gear is built upon the unit system, and can be extended indefinitely in either direction, each panel being self-contained and separated from the adjoining ones. It is very suitable for use under temporary conditions, as it can be erected, dismantled, transported and re-erected, when required, in the minimum of time.

A Handy Refrigerating Plant.

Some time ago a well-known engineer—Colonel Crompton, we believe—referred, at a meeting of the Institution of Electrical Engineers, to the great field which existed in hot countries like India, for means of producing "artificial cold," and there is no doubt that the small refrigerating plant when electrically driven is a most compact and convenient appliance for this purpose. Last week we referred briefly to the electrically-driven refrigerating plant shown by Messrs. Worssam & Son, of Wenlock Road, City Road, N., at the East London Electrical Exhibition, consisting of one of the firm's "country house and hotel" installations.

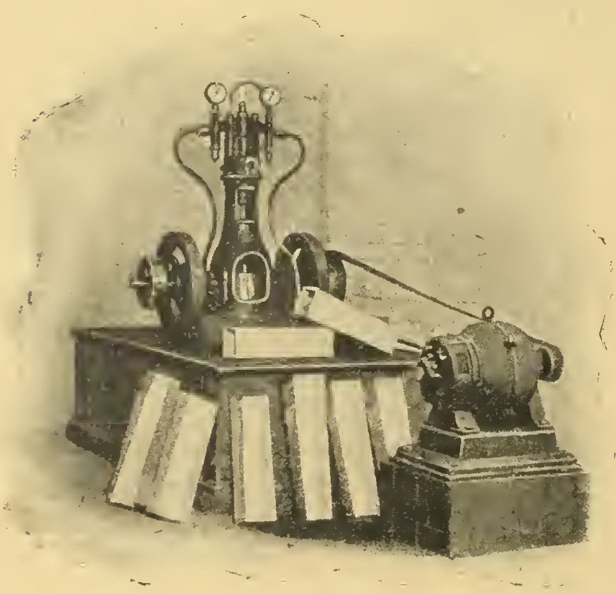

Fig. 5.—Self-contained Electrically-driven Ice-making Plant.

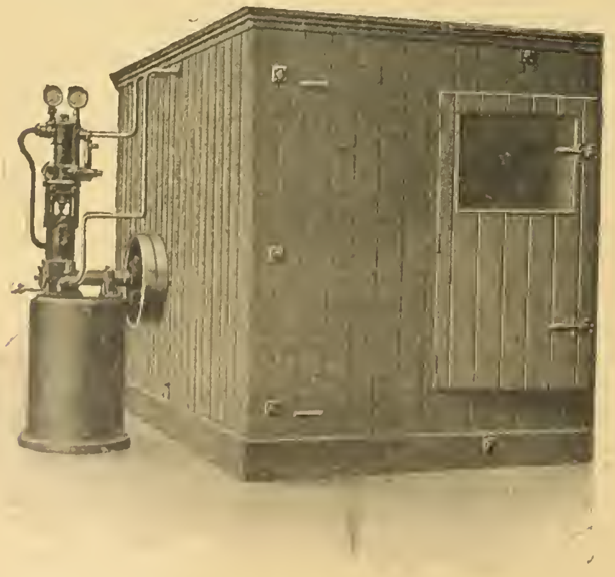

Fig. 6.—Cold Storage with "Zero" Compressor.

In this the cold air chamber is provided with the necessary hooks and shelves for the reception of perishable goods, the low temperature being obtained by means of cold brine, which is carried in a tank suitable for storage, so as to obviate the necessity of continuous running and allow of the plant being shut down over a week end.

The brine tank forms an internal partition of the store, and contains the cooler coil in connection with one of the firm's "Zero" compressors, driven by a small electric motor.

The brine tank is protected by wooden screens with hinged doors at top and bottom, which provide for temperature regulation without it being necessary to enter the store.

The "Zero" machine is of the enclosed type, with the working parts running in oil; the compressor piston is fitted with metallic packing rings, and no cup leathers are used. The compressor is single acting, and the gland is only subjected to the low pressure of the suction gas.

In addition to cooling the store, blocks of ice for table use can be produced in moulds inserted in the brine tank from above the store.

The cost of mechanical refrigerating plant suitable for private house purposes, usually ranges from £85 to about £140, being dependent on such factors as size and storage accommodation. Messrs. Worssam make a compact little ice-making plant, in which the compressor and ice-making tank are entirely self-contained and driven by a small motor energised from accumulators. This plant is illustrated in fig. 5.

The firm are makers of both carbonic acid and ammonia compression plants, and recommend the former for small stores, owing to the odourless and harmless nature of the CO_2 used, and its cheapness.

Cooling is effected either by direct expansion, air circulation, or brine circulation, each system having its particular application.

Low-Voltage Batteries for Metallic-Filament Lamps.

The Chloride Electrical Storage Co., Ltd., of 39, Victoria Street, London, S.W., are making a speciality of low-voltage batteries of moderate capacity for use with the various kinds of metallic-filament lamps which are producing a silent revolution in the electric lighting industry. With these new lamps the size of the generating plant necessary for a given number of lights is so considerably reduced, that the cost of an installation need no longer be a bar to business, with the result that a very large number of small batteries of "Chloride Accumulators" are being erected all over the world for low-voltage plants. These batteries embody the Chloride Co.'s standard practice, the plates being suspended from the edges of the glass boxes, and are fitted throughout with their well-known wood diaphragm separators, which reduce the attention required by the battery to a minimum. The company issue a leaflet giving dimensioned particulars of the space occupied by these small batteries according to the method of arrangement, and information regarding charge and discharge rates. These leaflets should be of particular service to readers in India and the Colonies.

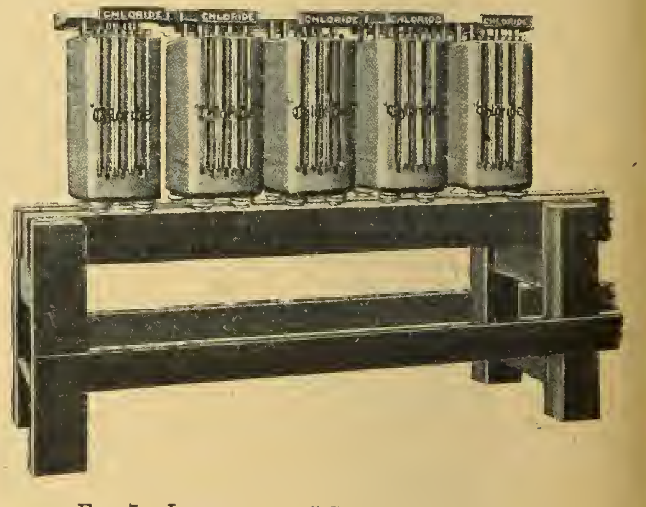

Fig. 7.—Low-voltage "Chloride" Battery.

"Dura" Dry Cells.

Messrs. Siemens Bros. & Co., Ltd., of Caxton House, S.W., have brought out a dry cell specially adapted for export and for use in hot climates, called the "Dura" cell. All dry cells are more or less alike externally, but the peculiarity of the Dura cell is that it is really "dry"; the cell is issued with the exciting agent in an absolutely dry condition, so that there is no possibility of deterioration during transport or storage. The cell is rendered active by adding pure water to the contents, by way of a charging tube; it is then ready for use in the ordinary way. The cell is fitted with the usual brass terminal and wire connection, but can be supplied with two locking terminals if desired.

A somewhat similar cell, in respect of portability and freedom from deterioration, is the Siemens "Transport" cell. In this case the excitant is fluid, but cannot escape, the filling tube being provided with a water-tight screw-down cap. When the cell is not wanted for a time, the exciting fluid can be poured off and the cell rinsed out, after which it can be stored for any length of time, in any climate, being recharged with solution only when it is required for use. As the internal resistance is low, these cells can be used for ignition purposes, for lighting small glow lamps for short periods, &c.

LEGAL.

Metallic-Filament Lamps.

The Welsbach Incandescent Gas Light Co. Summoned.

Before Mr. Bros, at Clerkenwell Police Court on Saturday, the Welsbach Incandescent Gas Light Co., Ltd., were summoned at the instance of the Wolfram (Tungsten) Metal-Filament Lamps, Ltd., and the General Electric Co., Ltd., the alleged offences being applying a false trade description to goods (lamps) which they had in their possession, and which they sold under the name of "Welsbach Aur" lamps. There were also summonses against Mr. Lawrence Fletcher, managing director of the defendant company, for having caused false descriptions to be made concerning those lamps.

Mr. Rufus Isaacs, K.C., Mr. H. A. Colefax and Mr. E. Lunge represented the plaintiffs, and Mr. A. Walter, K.C., and Mr. A. H. Bodkin appeared for the defendants.

At the outset it was stated by Mr. Walter that they would elect to have the case tried by a jury. The summonses against Mr. Fletcher were adjourned until the summonses against the company were disposed of.

Mr. Rufus Isaacs, in opening the case, said the summonses were issued under the Merchandise Marks Act of 1887. The Welsbach Incandescent Gas Light Co. was incorporated for the purpose of dealing with the inventions of Baron Auer von Welsbach, a famous inventor in relation to lighting plant, and the inventor of what was commonly known as the incandescent gas mantle. The connection of the company, however, with Baron Welsbach was entirely in relation to gas lighting, and had nothing to do with electric lighting. A German company known in this country as the Aur Co. had acquired Baron Welsbach's inventions in Germany in relation to gas lighting, and subsequently acquired the invention in relation to metal filaments for electric lamps. That was a lamp in which the metal filament was distinguished from the carbon filament, which had hitherto, but not entirely, practically ruled the market. The metal filament was made of a rare metal called osmium, and the lamp was designated the osmium lamp. Apparently, inventors had been devoting a considerable amount of attention to finding some means of making this metal filament which would be commercially developed, but Baron Welsbach had succeeded in inventing this lamp, which was never in any way, whether as an invention or as a manufacture, acquired by the Welsbach Incandescent Gas Light Co. The Aur Co. had appointed the General Electric Co., Ltd., their exclusive agents for the sale of this lamp in this country. After a little time there was a further invention which was of great practical and commercial utility, and which consisted, among other things, of using for the metal filament a metal which was known as "wolfram" or "tungsten." That appeared to be a cheaper and a commoner kind of metal, with the result that it became at once a very useful and a very popular mode of making metallic-filament lamps. The Osram lamp was made of this "wolfram" or "tungsten," and was made under the invention of the German company known as the Aur Co., which introduced the Osram lamp into this country. The Aur Co. was therefore the pioneer and the introducer to this country of the metal filament made of "tungsten." The General Electric Co. was also appointed the exclusive agents in this country for the sale of these Osram lamps, and subsequently, under the Patent Act, a factory was established in this country by a company known as the Wolfram (Tungsten) Metal-Filament Lamps, Ltd., consisting of a number of persons associated with the General Electric Co. and the German company known as the Aur Co. That had become an immensely valuable business, and there had been a large demand for those Osram lamps, which were known as metal-filament lamps. On September 22nd last a full-page advertisement appeared in the *Daily Telegraph*, which was subsequently repeated in other well-known daily newspapers with a picture of a lamp bearing the words "Welsbach," "Aur," and "Remember that the electric metallic-filament lamp was invented by Baron Welsbach, and see that the trade mark 'Aur' appears on every lamp." There was also an offer to supply the lamps in exchange for other lamps, and only charge the difference in the cost of the customer's electric lighting for the quarter ending December, 1909, compared with the corresponding quarter last year. At the foot of the advertisement was the name of the Welsbach Gas Lighting Co., Welsbach House, Gray's Inn Road. Those statements, submitted Mr. Isaacs, in conjunction with the picture, were calculated to lead persons to believe that the lamp which the defendant company was thus offering, was a lamp which had been either invented or manufactured by Baron Welsbach, whereas that was not true. Subsequently a Mr. Hale went to the Welsbach Co.'s premises in Gray's Inn Road, and saw a young lady who was in attendance upon customers. Having read the advertisement, he asked for the lamps as advertised, and asked whether they were the Welsbach lamps, and the young lady answered "Yes." Afterwards he saw a salesman and asked the same question, and received the same reply. Mr. Hale thereupon bought two lamps for 5s. 5d. Later he went and purchased 18 more lamps, and received an invoice upon which the lamps were described as "Baron von Welsbach lamps." Having dealt in detail with the sections of the Act under which he contended the defendants had made themselves liable, Mr. Rufus Isaacs said that was as far as they proposed to go that day. There would be only one formal witness, and then they would ask for an adjournment.

A clerk from the office of the Registrar of Joint Stock Companies was called, and proved the registration of the defendant company.

Mr. Walton intimated that there would be a good deal of technical evidence, and he was going to submit that no case had been made out.

Mr. Isaacs remarked that it would be better to hear the evidence first.

The hearing was adjourned.

Blackpool Tramroad Co. *v.* Fleetwood Urban District Council.

The Blackpool and Fleetwood Tramroad Co. were the appellants and the Fleetwood Urban District Council were the respondents in an appeal heard at the Preston Quarter Sessions on Thursday last week. The question at issue was whether a length of tramway rated at £467 should be treated as a tramway and rated as a railway at one-quarter of the full rateable value.

According to Mr. Sutton, who appeared for the respondents, two distinctive things were authorised under the private Acts of Parliament of the Blackpool and Fleetwood Tramroad Co. One was a tramroad 6 miles 5 fur. in length, and the other a tramway a little over 5 fur. long in Fleetwood. In a previous case of the appellants, the House of Lords directed that so far as their line was a tramroad, the company was entitled to exemption, and ought only to be rated to one-quarter of the full rateable value. That had been done, and the rate of £2,232, which had been previously laid upon the company, was divided, thus leaving the "tramroad" rated at one-quarter, but the tramway at the full rateable value of £467.

Against the latter assessment the appeal was laid. The appellants held that although it was a tramway they were entitled to the exemption given to railways.

For the respondents, Mr. Sutton submitted that a tramway was not a railway, the test being what it would be described in ordinary language. The rails did not project above the road and were laid in the public streets, whereas in a railway the rails were raised above the ground and on private property. He contended that if the Court decided that the Fleetwood Co. was entitled to an exemption, every tramway in the country could be treated as a railway.

Mr. Worsley Taylor, K.C., said if he decided in this case that the tramway was a railway, and the decision was upheld by the House of Lords, the result would be to turn over three-quarters of the rating of the tramways belonging to public authorities.

"Tramroad" and "tramway," contended Mr. Hodgson, for the appellants, meant practically the same thing. In the present undertaking they had through booking, and the same carriages ran from one end of the undertaking to the other.

The Bench reserved judgment, and Mr. Worsley Taylor intimated that his decision would be given on November 29th.

Sequel to Fife Pit Explosion.

Sheriff Shennan, Kirkcaldy, has given judgment for £350 as damages, with the expenses, in the case of the pit repairer who sued the Fife Coal Co. for injuries sustained in an explosion of inflammable gas in the Mary Pit, Lochore. The explosion, it was alleged, was due to a spark from a motor used in connection with an electric fan for ventilating the pit.

Holmes *v.* Associated Newspapers, Ltd.

(*Concluded from page* 653.)

Called for the defence, Mr. James Swinburne said he had made a particular study of electricity, and had considered the documents in the case, including the plaintiff's specification, also what the defendants said had gone before, and the defendants' machine. Various appliances had been in use, or tried, for printing machinery, and amongst others was that known as the Ward-Leonard system. As an electrician, he could not see that there were any advantages set forth in the plaintiff's specification other than those which followed from the use of two motors as distinct from one motor. Having described the defendants' arrangement, witness said he had not found, reading through the plaintiff's specification, anything which to him, as an engineer or an electrician, would give him any idea that he had in mind the wish to avoid the gentle reversal of pressure of the teeth in such an arrangement as described by Mr. Dugald Clerk. There was nothing stated about it at all. There was no invention in an electrician or mechanician coupling his machines in series.

Supposing that prior to 1898 electrical driving was perfectly well known, in your opinion would there have been in 1898 any invention in merely driving that machine by the motors instead of by two sets of pulleys?—None at all. There would have been no invention in 1881.

His Lordship: Supposing that the printing press had never been driven by electricity before, and somebody made a machine which worked satisfactorily—which substituted motors for the pulleys and belts—that would require originality, would it not?—No, my lord; because it was directly understood, since there have been electric motors, that an electric motor can in every case take the place of a belt with advantage.

Referring to claim 4 of the plaintiff's specification, Witness said that every specific thing claimed there was *per se* old.

Cross-examined by Mr. Walter: In 1898 a system by which you could use a high-speed motor for the purposes of slow driving was an advantage, chiefly, not because of efficiency, but because of the price. Slow-speed motors were not only more expensive to make, but they were more wasteful in current. The only system he found in the whole of the plaintiff's specification was a system of coupling electric motors plus controlling adjuncts.

Prof. Chas. Vernon Boys gave evidence, generally bearing out the evidence of the last witness.

In summing up the case for the defence, Mr. Astbury said his contention was that everything in the plaintiff's invention was to be found in the earlier American specifications. In both you had all the parts which the switchboard was to operate, and when you did operate them you got all the same results in both.

Mr. Justice Neville asked how, in the American machine, the current was cut off in the small motor?

Mr. Astbury said that it was cut off by a plunger falling down beyond a certain contact, but not until the big motor had overlapped the smaller. The only difference between the American system and the plaintiff's, he submitted, was that in one the two starting-buttons were side by side, and in the other, one was on top of the other. All that the plaintiff had done, he contended, was to take two sides of a switchboard and put them together in a way that required no invention at all. He submitted that the whole of the plaintiff's patent was bad, and, in respect of the only one part that might be the subject matter of a patent, the defendants did not infringe.

Mr. Kerley, following on the same side, submitted that what the plaintiff claimed that his patent would do had been done long before. If the plaintiff had been the first to apply it to electric motors in place of the old belt-drive, there might have been some subject matter for invention; but the principle had been applied to electric motors in the American invention.

Mr. Walter, replying on the whole case, submitted that the defendants had only been able to show similarity between the patent sued upon and prior inventions, by taking the principle only and leaving out all the adjuncts. One feature of the plaintiff's invention was that the starting motor worked with a very small current; that enabled the invention to be worked commercially.

At the conclusion of the arguments, his Lordship reserved judgment.

In giving judgment on Tuesday, his Lordship said that mechanism in which auxiliary driving power was used in connection with the main driving power or mechanism arranged in such a way that the main driving power overtook and then cut out the auxiliary power, was well known. Such a device was used in barring and turning engines, and in the case of printing presses driven by hand and pulley. In the latter case the device was used for, *inter alia*, the purpose of getting a smooth drive from the start, avoiding jerks which were apt to break the paper in the printing press. In such cases, the shaft turned by the small pulley was geared sometimes to the shaft of the main pulley and sometimes to the shaft of the printing press, or, as Mr. Clark put it, sometimes in mechanical series and sometimes in mechanical parallel. "For the sake of brevity, I will adopt these expressions. In the *Western Electrician* and in the *Electrical Engineer* was published before the date of the plaintiff's patent a description of an American motor-driven printing press. In that case two motors were used, main and auxiliary geared to the press in parallel and not in series, the auxiliary motor being used for making ready, and as I read the description for starting the engine, the two motors were so arranged that upon the main motor being started it overtook and, by releasing a clutch, cut out the auxiliary motor. The two motors were operated by separate electrical controls. In my opinion, the only noticeable differences between the mechanism so described and that of the plaintiff's are, first, that in the American machine the motors are geared in parallel, while the plaintiff's are in series, and, secondly, there is a different method of control. A good deal turns upon the question whether the difference between motors geared in parallel and in series is material. The plaintiff's evidence is to the effect that it is. It is alleged that if in parallel back-lash would be occasioned, at the moment when the main motor took up the driving from the auxiliary motor, to the risk of the web. I come to the conclusion on the evidence that no appreciable back-lash could be caused in the American machine, and that the arrangement of the motors in parallel or in series is not a matter of mechanical importance, but rather a matter of convenience having regard to the amount and position of floor space. Upon these findings the question arises whether Claim 1 in the plaintiff's specification is a good claim. As I read Claim 1, it is not confined to the use of an auxiliary motor in addition to, and driving by, power gear through the shaft of a main motor for the purposes mentioned in the claim in connection with the plaintiff's controlling device alone, but in connection with any suitable electrical device for operating the motors. It appears to me that the claim thus construed covers the use of the motors as described in the published description of the American machine in every particular except the arrangement of the motors in parallel. I have already stated my conclusion that this distinction is immaterial, and I think, therefore, that Claim 1 claims the use of mechanism, the use of which for the same purpose had been already publicly described in this country before the date of the plaintiff's patent. It follows, in my opinion, that the plaintiff's patent is bad, and that his action for infringement fails, and must be dismissed with costs."

Mr. Astbury, K.C.: With regard to the particulars of breaches, I ask your Lordship to certify that they were reasonable and proper.

Mr. Walter, K.C., said a large number of papers had been put forward, but no doubt he and his learned friend could agree what should be included.

His Lordship granted the usual certificate.

Francis & Co., Ltd., *v.* West Ham Corporation.

Mr. Justice Coleridge and a Common Jury were occupied during the greater part of two days in hearing an action brought by Francis & Co., Ltd., against the Mayor of West Ham in regard to the liability of the West Ham Corporation for an accident to a workman through coming into contact with a live wire connected with the electric tramway service.

Francis & Co., who are blind manufacturers, of 64, Gray's Inn Road, claimed indemnity against the sum of £178 12s. 2d. received from the plaintiffs by the widow of a workman under the Workmen's Compensation Act for the death of her husband, which, it was alleged, had been occasioned by the negligence of the defendants. There was also a claim for indemnity against the cost of the action in which the award was made.

In July, 1908, the plaintiffs were employed by the defendants to execute certain repairs to the tramway-shed blinds at the defendants' depôt in Greengate Street, Plaistow. It was the duty of the deceased workman to place in position a revolving shutter over one of the doors through which the electric cars entered the shed, and owing, it was said, to the negligence of the defendants' servants, the man came in contact with a live wire, and received a shock which knocked him off the scaffold upon which he was standing, and his injuries were such that he died on the following day. Arbitration proceedings were taken under the Workmen's Compensation Act, and the plaintiffs, who were the man's employers, were called upon to pay compensation to the widow, for which they claimed they were entitled to be indemnified by the Corporation of West Ham, as the owners of the tramways. The defence was that the deceased workman at the time of the accident was under the control and direction of a foreman in the plaintiffs' employ, who had been warned of the existence of the live wire and its dangerous proximity to the work which was being done.

Mr. Ashton, K.C., was for the plaintiffs, and Mr. Macall, K.C., for the defence.

The jury returned a verdict for the plaintiffs, and judgment was entered accordingly.

SOME NOTES ON THE MANAGEMENT OF AN ELECTRICAL SHOWROOM.

By DELTA.

With the increase in the use of electrical energy for domestic and other purposes during recent years, there has been correspondingly increased competition with rival systems of illumination. Electrical engineers have found it necessary to include in their organisation a complete and self-contained staff, whose duty it is to disseminate information concerning the advantages attaching to the use of electrical energy. This publicity department is now an important factor in all electricity undertakings, and is presided over by an official trained and fitted for his position. The general methods of publicity campaigns are now well understood. Much has been written on the subject, and it has received the attention of all engineers supplying electricity for domestic purposes. The principles of this important department can now be said to be well established on rational lines, and fairly standard general methods are in operation. In the case of the various sub-departments of the publicity section, it cannot be said that at present there exists that uniformity of practice which indicates a thorough understanding of the subject. The sub-sections forming together, as they do, the whole department, must have given them just as careful study as the broad principles of publicity work, if efficiency is to be ultimately attained. Especially does there appear to exist some lack of understanding, or at any rate, uniformity of idea, as to the precise lines on which the electrical showroom should be run. This state of affairs is, to say the least, undesirable, for the showroom, both in point of view of capital expenditure, and also in cost of working, is the most expensive part of a publicity department. The function of a showroom being in the first place educational, it is important that the very ample means to this end at the disposal of the publicity manager should be used effectively. Lack of attention to the details of this section of the publicity department will not only, in the natural order of things, decrease its utility, but lead to the undesirable result that the existence and cost of working of it, are not justified by the benefits accruing to the whole undertaking.

The size of the showroom will, of course, be decided within fairly close limits by the amount of capital at the disposal of the undertaking in question. It is important that these premises should not be too large. It is far better to have a small establishment, and spend the money saved on the internal decoration, than to have large premises poorly and barely equipped. The size should be carefully restricted to that which can be adequately or even extravagantly fitted. The showroom will, in the majority of cases, be in connection with the office of the publicity department, and it is of the highest importance that however small the undertaking may be, if it boast a publicity manager, this official should be provided with a private office in which he can interview prospective consumers. A far better effect will be obtained than by a semi-private talk in the showroom, where possibly other people may be. At least one assistant will be necessary in this department, and again, on however modest lines this department is run, the selection of this person should have adequate care. It is not sufficient to have merely an intelligent clerk, or an enterprising shop assistant in this capacity. The man chosen should be thoroughly well acquainted with the class of work with which he has to deal, and should be competent to answer all ordinary questions that may be put to him. Many may be inclined to regard the foregoing statements as superfluous, by reason of their being so obvious, but the writer can assure such persons that he knows of more than one case in which the assistant in charge, for the time being, of a showroom in connection with an important electricity undertaking, was unable to answer the simplest questions having reference to the business. The choosing of all the assistants in this department requires great care, and the salaries should be such that reasonable knowledge of the subject may be expected.

The actual arrangement of the showroom stock will depend, in a large degree, on the particular taste of the publicity manager. Variety should be aimed at in the selection of the fittings to be exhibited, and one particular type should not, as a rule, be unduly multiplied. The great number of lacquered brass fittings to be found in many showrooms does not secure that variety which should be found in an establishment of this kind. It should be borne in mind that wrought-iron and oxidised copper fittings do not cost a great deal more than lacquered brass and are preferred by many people, and for this reason they need not be treated altogether as a side line. A glance at many showrooms also seems to indicate that the general public have a predilection for fittings of the pendant variety, those of the bracket and ceiling type being, in comparison with the others, few in number. The arrangement of the windows should be according to some well thought out plan, and should be changed at regular intervals of time. A showroom that has precisely the same appearance from week to week will soon cease to attract attention, and become "stale." It is advisable to arrange with the contractors who supply the fittings for the showroom, to have these changed from time to time, in order that the appearance of the showroom may be continually altering. This should especially be done in the case of electrical heating devices, as these are many in number, and the purchase of even a moderately representative selection would entail great expense, while if an arrangement is made with the fittings manufacturer the latest types can be continually exhibited.

A question of considerable importance arises at this stage, as to the sale of fittings in the showroom. There are generally two courses open to the publicity manager. In the first place, the showroom can be treated as such literally, and the establishment used merely for the exhibition of those fittings which are likely to find most acceptance among the inhabitants of the neighbourhood, or on the other hand, the department may be regarded in a more strictly commercial sense, and the sale of fittings undertaken. Which of the two courses is adopted will depend, to a large extent, on local conditions, especially on the size of the electricity undertaking. If fittings are sold at the showroom the amount of clerical work necessarily entailed will be considerable, and the trouble ensuing in the frequent case of the publicity department not being adjacent or near to the offices of the department, will by no means be negligible. On the other hand, it will be of inestimable value, in the case of many consumers, to be able to do this kind of business on the spot without the intervention of the manufacturer or local electrician. However, as a general rule, the sale of fittings should not be undertaken in connection with the showroom of an electricity undertaking, except in special circumstances, or in the case of the publicity department being at all extensive. Care should, however, be taken that information as to cost, &c., of any fitting exhibited in the showroom can be at once turned up in the maker's catalogue. It is not sufficient for the assistant merely to give the price, but the person interested should have an opportunity of inspecting illustrations of fittings of similar design. In the case of fittings being sold at the showrooms, the details of such practice fall naturally under the head of business methods, and with such details the writer does not purpose dealing.

The methods of dealing with the various persons who from time to time visit the showroom, call for some comment. The system employed by many publicity managers of having every call recorded is in principle admirable, but the practice which is the result of this system, of the assistant making strenuous endeavours to discover the names and addresses of strangers, when they may not care to disclose them, is of questionable expediency. It should be remembered that the function of the publicity department is to educate the general public to realise the advantages of electric light, and not to persuade them to adopt a particular system of illumination against their will. The showroom seeks to carry out this education in the simplest manner possible by placing before the public actual examples of the superior method. Obviously, a system that has the effect of keeping people away from the showroom is inimical to the interests of the publicity department. The knowledge that he will be bullied by an assistant into leaving his name and address, will often keep a prospective consumer away from the showroom, and cause him to continue to use whatever system of illumination he then has in his house. For this reason the general public should be invited to visit the showroom, and undue efforts should not be made to obtain the names of those so doing, while it is pointed out that such information is requested, and will be gladly received. If this information is supplied, the person in question can, of course, be called upon and carefully looked after in the orthodox fashion until the application form is signed. While bearing in mind the fact that the showroom does not exist for the gratifying of idle curiosity, it should never be forgotten that no custom or rule should be suffered to remain in force that has the effect of keeping the undecided person away.

To say that a showroom should be adequately lighted is to express a platitude, and no publicity manager would be guilty of neglect in this particular. It is, however, possible to be needlessly or even harmfully extravagant in the illumination of these premises. The general public are quite well aware that an excessive degree of illumination can be obtained by the use of any illuminant, provided sufficient money is spent for the purpose. An enormous blaze of light is not a *prima facie* argument in favour of electric light, and is very costly to the department. The superfluity of illumination should also be avoided in view of the fact that this will hinder the display of various fittings, and will also make the premises uncomfortable.

This important department of the modern electricity supply undertaking calls for great and detailed care in its management. There is no reason why it should not be run on lines of thorough efficiency, it being borne in mind that the existence of no department is justified if the result of a long period of working is a loss to the undertaking. Of course, it is impossible to adequately estimate the efficiency of such a department, for many circumstances, out of the control of the publicity section, may hinder an otherwise willing consumer from being connected. The cost of working the showroom should be as rigorously studied as in the case of the generating station, for unprofitable extravagance and waste can easily occur. Above all, the showroom should be up to date, and any new electrical device on the market should be exhibited as soon as possible. Progress and economy are two cardinal maxims in modern business methods, and in no commercial enterprise will the observance of these contribute more directly to efficiency than in the case of the electrical showroom.

BUSINESS NOTES.

Consular Notes.—Turkey.—The British Consul at Salonica reports that the electric tramway in that town, which began running in June, 1908, has survived several attacks of the strike epidemic, and now has no competitor in the shape of passenger steamboats, all except one having returned to Constantinople. In 1909 a few additional tramcars will be imported. Something is at last being done by the municipality to improve the lighting of Salonica. The electricity will be supplied by the dynamos which drive the electric cars. The wires will be carried overhead, and for this purpose 211 tapering trellis-pattern standards of Belgian iron of an average weight of 1,760 lb. are to be used. Private consumers still seem to be deterred by the tariff—70 c. per unit—though this compares favourably with European rates; and the Consul has been assured it is to be the maximum rate. So far three theatres and a big flour mill are the only instances of private electric installations. Three of the four main arteries of Salonica will shortly be lighted by electricity, as well as one or more of the principal cafés. The telephone is in use in the Custom House, the offices of the Provincial Government and the Inspectorate-General, and the police-stations are also linked up by telephone. The instruments are being imported chiefly from Germany.

The British Consul at Smyrna reports that application has been made to the Government for the concession for the right of exploiting electric lighting and traction in Smyrna and suburbs. In this connection the Consul calls attention to the Official Programme of public works, issued by the Imperial Ottoman Ministry of Public Works, which deals with this amongst other projects. The book (printed in French) may be consulted at the offices of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. That British merchants and manufacturers, and even financial houses, are taking a more active interest in the trade of Turkey is evidenced by the Press reports and by the increased number of inquiries reaching the Consulate-General. Most of these inquiries are for names of local dealers in the special article or articles in which the home merchant or manufacturer is interested, or for those of suitable agents. Suitable answers are duly supplied to these inquiries, but it may not be amiss to observe that in most cases the information sought for is already in the possession of the Commercial Intelligence Branch of the Board of Trade, a direct or first application to which would very often mean a saving of time to the inquirers. The recently established British Chamber of Commerce in Smyrna ought to prove of additional service to British merchants and manufacturers disposed to extend their businesses in Smyrna.

A Tantalum Smoker.—A smoking concert was held at the Crown and Castle Hotel, Dalston, N.E., on Friday last. Mr. A. D. Hunter was in the chair, and a number of visitors were present, including Mr. S. Green (St. James' and Pall Mall Co.), Messrs. R. E. Pooley and Clifford Austin, Mr. H. E. Harrison (Great Northern and City Railway), and Mr. Lidgey (of Messrs. Siemens Bros., Cardiff branch). The programme was provided chiefly by the joint staffs of Messrs. Siemens Bros.

Exhibition Awards.—THE COWPER-COLES ENGINEERING CO., LTD., have been awarded by the juries for the different sections of the Imperial International Exhibition a Diploma for Grand Prize in connection with their metallurgical and electrochemical exhibits, and a Diploma for Gold Medal for Mechanical Engineering; also a Diploma of Honour for Applied Chemistry.

Bankruptcy Proceedings.—The affairs of LAING, WHARTON & CUNNINGTON, electrical engineers and contractors, 7, Great Newport Street, St. Martin's Lane, W.C., were again before Mr. Registrar Giffard at the London Bankruptcy Court on Wednesday last week. It will be remembered that, in the preceding week, Harry Pigott Allison, a member of the firm, was granted an order of discharge, subject to a judgment for £200 being entered against him. Mr. Hansell, for the debtor, now asked that the £200 should only become payable from any surplus income above £400 a year, on the ground that his client could not properly earn his living under that amount owing to the character of the business in which he was engaged. Mr. W. P. Bowyer, assistant Official Receiver, suggested that £350 per annum was amply sufficient for the debtor's expenditure, and that anything beyond that amount ought to be handed over to Mr. Alfred Page, the trustee under the bankruptcy, to be placed against the amount of the judgment. Mr. Hansell agreed to the amended sum, and said his client would file an account of his income every six months, until the judgment had been satisfied. The order of the previous Wednesday was amended on those terms.

E. A. BRANDON, electrical and mechanical agent and factor, trading as E. A. Brandon & Co. at 33, Devonshire Chambers, Bishopsgate Street Without, E.C.—The public examination of this debtor was to have been held on Wednesday last week. The statement of affairs showed total liabilities £2,107, of which £1,137 was expected to rank against assets valued at £8 1s. 8d., after deducting £14 16s. 6d. for payment of the preferential claims. The case was not reached at the rising of the Court, and the hearing was adjourned until November 10th.

S. E. SMITH, electrical engineer, Lincoln.—A receiving order was made on October 19th on a creditor's petition. First meeting and public examination, November 4th, at Lincoln.

ERIC EATON, electrical engineer, Ashton-under-Lyne.—First meeting, October 30th; public examination, November 18th—the former at Manchester, the latter at Ashton-under-Lyne.

ERNEST GOODMAN, electrical engineer, Coventry.—A receiving order was made on October 22nd, on debtor's own petition.

Trade Announcement.—MR. GEORGE ELLISON has just completed extensions to his works at Warstone Lane, Birmingham, which have been made owing to increased business.

South African Order.—MESSRS. ANDRE CITRÖEN AND CO., of 19-21, Queen Victoria Street, have just received a £3,000 order for their machine-cut double helical gears in connection with South African hoists.

Stirling Boilers.—The following are among the orders that have lately been received by the STIRLING BOILER CO., LTD.:—

Two Stirling boilers for the Indian State Railways (Oudh & Rohilkund Railway).
Boiler for Copenhagen Tramways.
Boiler, chain grate stokers and superheater for the Newcastle and District Electric Lighting Co.
Boiler, superheater and chain grate stoker for the Borough of Partick.
Two boilers and superheaters for Fulham Electricity Works.
The foregoing are all repeat orders.
Order for boiler, superheater, and chain grate stoker for Ashton-under-Lyne Electricity Works.
Order for boiler fired with waste gases from destructor for the General Post Office, Mount Pleasant.

Besides the above, orders for many large boilers for important paper works, chemical works, cotton mills, oil works, sugar refineries and other general manufactories are in hand.

Renovation of Glow Lamps in Germany.—The attention of the Imperial Chancellor was recently drawn to the opinion, as expressed in newspaper advertisements, that glow lamps can be placed on the market, without payment of the lamp tax, which have been reconstructed either by the insertion of new filaments or by the cleaning of the blackened bulbs, followed by re-exhausting of the lamps, the contention being that these operations do not represent manufacture within the meaning of the law in regard to the taxation of illuminating articles. As the Prussian Minister has just informed the chief revenue authorities, this view of the question is based neither upon the law nor upon the technical conditions. Both lamps whose filaments have been burnt through and those which have become blackened, are technically designated as used. If they are again made capable of service, this is regarded as equal to the manufacture of new lamps, and these lamps are to be taxed as new lamps as soon as they are removed from the rooms of the establishment in which the construction or the reconstruction has taken place. In addition to this, lamps which become unserviceable before use, perhaps during dispatch, or shortly after being placed in use, cannot be put on the market after reconstruction without being subject to taxation, as compensation for the tax in the form of a lump sum to manufacturers is provided for in the case of lamps which become unserviceable in this way.

Book Notices.—*Elektrische Uhren.* By Dr. A. Tobleu and J. Zacharias. Second revised edition. Vienna: A. Hartleben. Price M 3.—This book was originally published some years ago, but has now been practically re-written, as the subject of electric time service has advanced more than most other branches of electric work, more especially in connection with the maintenance of public clocks. After a short historical introduction, the writer proceeds to a detailed description of the various electric devices employed in connection with clocks. Chapter I deals with driving mechanisms (electrically influenced pendulums, electric winding devices, &c.) and with contact-making devices. Chapter II describes the electric distribution of time to the various parts of a town, district or country. In Chapter III electric chronographs, time-registering devices and other scientific instruments are described, and in Chapter IV a useful descriptive catalogue of the various patents taken out in connection with electric clockwork between 1877 and 1909 is given. This list is divided into seven groups: (1) Self-contained electric clocks and clock installations; (2) electric clocks controlled from a distance; (3) circuit arrangements for electric clocks; (4) devices for setting the hands of electric clocks; (5) regulation devices; (6) electric striking mechanisms; and (7) electric winding and contact-making devices. The book is comprehensive and fairly up to date, although a good deal of obsolete material has been retained from the older edition. The treatment will appeal more to those engaged in the work than to students, as there is much more detailed description of actual constructions than critical comparison of typical arrangements.

Fowler's Mechanics' and Machinists' Pocket Book and Diary, 1910. By W. H. Fowler, Wh. Sc. Manchester: Scientific Publishing Co. Price 6d. net.—This is the second edition, and has been considerably extended in scope and contents; it contains a great store of information for machinists, and strikingly illustrates the great changes which have taken place in workshop practice during the last 20 years. Numerous tables and data are included, and the book will no doubt be as popular as the other handbooks emanating from the same source.

Arithmetic of Electrical Measurements. By W. R. P. Hobbs. Thirteenth edition. London: T. Murby & Co. 1909. Price 1s.—

In this book a large number of problems are given which involve the application of Ohm's law, Lenz's law, and other fundamental principles of electric technology—some of them being derived from City and Guilds examination papers. Numerous examples are fully worked out, and brief explanations of the governing conditions are included. The book should be useful to students as affording practice in such calculations. Answers are appended to the questions.

Standard Dimensions for the Threads of Sparking Plugs. Engineering Standards Committee (Report No. 45). London: Crosby Lockwood. Price 2s. 6d. net.—The Committee's investigations have shown that the general practice in making sparking plugs is to employ a thread similar to that originated by Messrs. De Dion-Bouton, having 17 threads to the inch (corresponding to a pitch of 1·5 mm.). This thread is so extensively used in this country for sparking plugs that considerable difficulty would be experienced by manufacturers in adopting any other standard, and it has therefore been adopted by the Committee. The Report gives the dimensions of the thread on the plug itself, the tap for cutting the thread to receive it and the gauges for both the plug and the female thread. It is the Committee's intention to hold a conference in the near future with the automobile societies in order to draw up an alternative standard of larger diameter, which will permit of a more satisfactory design for the sparking plug.

Everybody's Story Magazine, November.—This is the first issue of a new 4½d. magazine, issued by the Religious Tract Society, for which there has been a very large demand already, and the machines are still running. It contains a number of complete short stories, forming very readable fiction for the railway traveller or for our voteless folk at home.

British Standard Specification for Ammeters and Voltmeters.—The Engineering Standards Committee (Report No. 49). London: Crosby Lockwood. Price 2s. 6d. net.—In this specification, instruments are classified as sub-standards, first grade and second grade instruments, according to their accuracy. The second-grade instrument, having a not very high order of accuracy, is suitable for workshops and similar places where accuracy is not of vital importance. The Committee make certain definite recommendations for the construction of instruments, and standard scale readings for ammeters and voltmeters have been adopted, reducing the number of scales which have to be kept in stock. The drop in pressure on the shunt has been standardised, in order to obtain interchangeability; its value is different to the German standard. The transformation ratio of a pressure transformer has been fixed, as well as the current in the secondary circuit of a series transformer. The Committee intends dealing in a separate report with standards for instrument transformers, resistances and separate shunts. The question of accuracy has necessitated a great deal of investigation and prolonged discussion, on account of the inherent differences in the various types of instruments, as well as the degree of accuracy attainable under practicable working conditions. The difficulty of expressing in a simple manner the permissible limits of error when these had been decided upon gave the Committee a considerable amount of preliminary work before a useful result was attained, and we are assured that the figures for the accuracy are based on actual "test records" supplied for the use of the members.

Examination Questions in Electrical Engineering. By a Certificated Teacher. London: S. Rentell & Co. Price 1s. net.—This little book gives the questions set by the City and Guilds Institute at its examinations in the title subject since 1900, with answers where these are numerical; complete answers and illustrated solutions are given for the questions set in 1908. In spite of the possible suggestion that books of this kind aid "cramming," there is no doubt that they are of great assistance to both student and teacher: to the former by enabling him to test and exercise the knowledge that he has acquired, and to the latter by providing him with a store of suitable questions for home work. Many students of considerable ability undoubtedly fail to convey to the examiner a due sense of their attainments simply because they have not acquired the knack of answering examination questions in the most efficient way; these will find the fully worked examples most helpful, and we understand that in future issues of the book full solutions will be appended to all new questions. So far as we have tested the solutions they are correct, and the book is well printed.

"Electrical Engineering." By C. P. Steinmetz. New York: McGraw-Hill Book Co. 1909. Price $4.00 net.

"Radiation, Light and Illumination." By C. P. Steinmetz. New York: McGraw-Hill Book Co. 1909. Price $3.00 net.

Effect of Strike in Sweden. — According to the Swedish industrial journal, *Norden,* a striking example of the disastrous effect of the great strike on the Swedish industry is found in the statement of the proprietor of the Scandinavian manufactory of incandescent electric lamps at Nyköping, that his firm lost a contract for the delivery of 300,000 incandescent lamps to a German firm. Owing to the new Bill introducing a tax on electric light in Germany, it was in the interest of the manufacturers and the wholesale, as well as retail, trade to supply their customers, or all consumers of electric light, with as many lamps as possible before October 1st. His firm thus received an order for 300,000 lamps, but the strike commenced, unfortunately, and the result was that only 20,000 lamps were delivered.

Electrical Smelting.—The Swedish Iron Commission, appointed by the Government, a short time ago appointed a Committee with the object of going into the question whether the Commission ought to provide the necessary capital for carrying on experiments on the electrical smelting of iron ore, not only for the purpose of attaining a practical solution of the problem, but partly, and perhaps chiefly, with the view of being able to make practical demonstrations of the processes and furnaces before iron masters and other representatives of the iron industry, so as to call their attention to the advantages of the electrical process. It is estimated that a sum of 250,000 kr. (£13,833) is required in order to build the plant and to carry on the experiments long enough to ascertain the economical results.

Charge of Stealing Lamps.—At St. Helens on October 20th, Frank Hammond, *alias* Dr. Kerr, George Frank Blease, F. Taylor, &c., was charged with stealing 40 electric lamps from the London and North-Western Railway Station. Accused had been employed at the New Brighton Tower as an electrician, and he obtained the lamps by representing that he had been sent for them by the Rev. Father Proctor, to whom they had been consigned. He then sold 29 of the lamps to a Warrington tradesman by stating that they were a bankrupt stock. Prisoner was sentenced to six months' hard labour. At Warrington, on the previous day, Hammond was sentenced to three months' hard labour for stealing, by means of a trick, six electric globes, value 18s., the property of Mr. H. Bibby, 13, Arpley Street, and obtaining by similar means two electric globes, value 6s, from Mr. T. Daintith, 121, Bridge Street.

Catalogues and Lists.—The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—Twenty-four-page illustrated catalogue (No. F79), in which they set out very fully particulars of their "Eclipse" electric heaters. Special attention is devoted to the convector patterns, and some very acceptable designs are shown for different classes of buildings. Circular patterns, electric car and train heaters, wall and cylindrical type heaters, factory heaters, &c., are represented, catalogue numbers, code-words, prices and sizes being given. A small section of the catalogue is devoted to glow lamp radiators. Two small folders have also been received, one relating to these heaters, giving sizes, prices, &c., the other giving prices, &c., of the "E.O.A." metal-filament lamps. Contractors who apply to the firm expressing the wish can have a quantity of these folders with their own name and address printed thereon.

The Electrical Trades Supply, Ltd., Britannia Works, Great Charles Street, Birmingham.—Twenty-four-page catalogue, in which they set out numerous illustrations, with prices, &c., of a variety of E.T.S. porcelain and stoneware insulators and cleats, ironwork for insulators, tools for line construction and general electrician's service, also various sundries.

The Sunbeam Lamp Co., Ltd., Park Road, Gateshead.—From this company we have received a number of publicity novelties, postcards and other things setting forth the claims of the Sunbeam metal lamps, which "give the best light in the world," and "save 14s. in the £ on your lighting bill." A neat hanging show-card effectively represents the bowels of the earth brilliantly lighted by one of these 220-volt lamps—the candle-power is not stated. Copies of all this advertising matter are being distributed broadcast amongst the trade.

The General Electric Co., Ltd., of Queen Victoria Street, E.C., seems to have a never-ending variety of novelties in its Wonder Box of Publicity. The saving in one's lighting bill and the additional flood of light when using Osram lamps, as compared to when one used carbon-filament lamps, is easily seen by operating the cardboard switch on the card just received.

Messrs. Baxendale & Co., Miller Street, Manchester.—68-page catalogue detailing, with an abundance of illustrations, their various telephones and telephonic manufactures, fire alarm apparatus, wires and cables, batteries, insulators, &c. A number of pages are occupied with clear diagrams of connections.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—The plaster bust of "Mephistopheles" with which this firm have long made the "Efesca" metal-filament lamp familiar to electrical men and consumers, has in the publicity efforts of the makers taken upon itself a cardboard cut-out form. This cut-out is designed to carry suspended from the Mephistophelian hand an actual lamp, and it is for counter or shop-window display. Being less expensive to produce than the plaster busts, the new device can be distributed more freely, and Messrs. Falk, Stadelmann are prepared to supply one or more to any electrical contractor or dealer who will communicate with them. They are not discontinuing the use of the plaster cast, which they supply to their more regular "Efesca" lamp customers.

Messrs. S. W. Martyn & Co., 11, Pratt Street, Camden Town, N.W.—Two pocket lists; one entitled "What a Nice Car!" particularising regarding the firm's motor-car business; the other, entitled "An Imitation," drawing attention to their electric lighting, heating and cooking and other installation work.

Mr. George Ellison, Birmingham.—Illustrated and priced leaflets; No. 102, describing oil-immersed three-phase rotor-starters; No. 221, detailing their oil-break circuit-breakers; also an attractive date-card for November.

The Cable Accessories Co., Ltd., Britannia Street Works, Tividale, Staffs.—Illustrated list of 16 pages giving particulars of their electric light cast-iron water-tight fittings, &c., for collieries, factories, mills, street and general lighting. Hand lamps, cluster light fittings, arc-lamp winches and other tackle, fuse boxes and sundries, are noted.

Messrs. Mirrlees Watson Co., Ltd., Scotland Street, Glasgow. —A number of new publications have just been issued. The chief is a 20-page finely illustrated catalogue of independent condensing plant, the relative merits of the three following types being dealt with; surface condensing (counter-current or contra-flow); jet condensing (elevated self-draining counter-current type); jet condensing (low level counter-current type). Photographs and line drawings are included of a number of installations that have been put into different works, electrical and other. The other publications are devoted to the following subjects: Condensing plant for rolling-mill engines at the steel works of Messrs. David Colville & Sons, Ltd., at Motherwell; surface condensing installation at Leeds Corporation electric lighting station; utilisation of exhaust steam on the Rateau system; tabulated list of independent condensing plants installed by the firm; two surface condensing installations at Pretoria, S. Africa, and at Meerut electric power station, in India; jet condensing plant at a Scottish Co-operative Works; condensing plant for blowing engines at the Workington works of the Moss Bay Hematite Iron and Steel Co., Ltd.; surface condensing installations supplied to the Lancashire Electric Power Co. and the Yorkshire Electric Power Co.; and the Mirrlees-Edwards air pump. All of these pamphlets are of uniform size, and are executed in very good style on art paper.

Messrs. H. G. Mayer & Co., 67, Aldersgate Street, London, E.C.—New price list of "Plania" carbons for open, enclosed and flame arc lamps.

LIGHTING and POWER NOTES.

Bath.—The Electric Lighting Committee is desirous of extending the area of supply to within a radius of 3 miles from the Guildhall, and it is intended to interview the representatives of the Somerset Power Co. respecting the cession of its powers.

Bedford.—The T.C. has received from the L.G.B. sanction to a loan of £630 for street lighting by electricity.

Berkhamsted.—The U.D.C. has executed an agreement with the Chesham E.L. and Power Co.

Bradford.—At a recent meeting of the City Council, the annual report of the city electrical engineer was adopted. This points out that it is hoped to have the first turbine extension running in a few weeks, and the second a month later. The beneficial effect of reductions made two years ago in the rates for power and heating, and of the special terms offered to consumers taking a bulk supply, is now being felt, the units supplied to consumers affected by these rates having risen from 2,697,381 during the year ended June 30th, 1907, to 5,039,274 in the year ended June 30th last. Both hired and purchased motors are on the increase, whereas, previously there had been a falling off. Some fear is expressed as to the immediate future as regards lighting revenue, owing to the universal adoption of metallic-filament lamps; the units sold for lighting during the past half-year are less than those sold during the half-years ending June 30th, 1907-8. The total number of consumers has increased from 2,313 to 2,457. Considerable economies in production are expected when the turbine plant is in service, and also as a result of advantageous coal contracts.

Brighton.—The borough electrical engineer is recommending the purchase of a fifth turbo-alternator for the Southwick generating station, owing to the increasing demand for electricity.

Bushey.—Watford U.D.C. is taking steps to ascertain the probable number of consumers for E.L. in the area of the Bushey U.D.C. If the demand warrants it Watford will, with the consent of Bushey U.D.C., apply for a prov. order.

Canada.—The parish of Pointe aux Trembles, says the *Canadian Engineer*, has awarded to the Saraquay Electric and Water Co. an exclusive franchise for electric light and power over a territory of 35 square miles on the Island of Montreal. A correspondent states that the company is about to install an electrically-driven water-works pump with a capacity of 1½ million gallons per day, also six 250-kw. 11,000-volt transformers. A contract for a 500-kw. steam turbo-generator has been placed with the Canadian General Electric Co.

Continental Notes.—Sweden.—A meeting was recently held at Stockholm at which some of the most prominent and well-known landowners and representatives of industrial circles were present, when it was decided to form an association under the name of the Swedish Water-power Association. The object of this association is to form a central body, which will be able to further the joint interests of the owners of the waterfalls. As the development of the electrical industry in connection with the waterfalls makes new legislation for the regulation of the rivers and the waterfalls absolutely necessary, the Association will be able to represent and to protect the interests of the owners in a way that will carry great weight, when the new law is drawn up. It is further intended to assist the members with information and advice, and to make the waterfalls and everything connected therewith a matter of special study. In Norway invitations to attend a meeting in order to discuss the formation of a similar association have been sent out by men interested in the matter.

The Hellefors Ironworks Company has just placed with the New United Electric Company the orders for the entire electric equipment of the just completed extension of its works. It comprises five large three-phase generators, and transformer station complete with the necessary apparatus. The grinding sheds will be driven by the biggest electric motor so far used in Sweden—an asynchronous three-phase motor of 2,700 h.p. at 210 r.p.m. For driving the accessory machinery of the grinding sheds, there will also be installed a similar motor of 400 h.p.

Switzerland.—The Electricitäts Genossenschaft is the name of a new concern which has lately been organised at Sins (Meienburg) to establish a central station in the town for the supply of electrical energy for lighting and power purposes.

Belgium.—La Société des Forges et Laminoirs de Baume has decided on the establishment of a large new electric power plant, at an estimated cost of £14,000, for the driving of the rolling mills at its works.

Crompton.—The U.D.C. has decided that whenever there is a specific application for electricity, Oldham T.C. shall be allowed to supply it, subject to the Council's future interests being safeguarded.

Falkirk.—A note in our issue of October 8th under this heading, dealing with the Corporation electricity undertaking, made it appear that after paying interest, &c., there was a clear profit for the year of £953. We have since received an abstract of the accounts of the T.C., and find that after paying interest a balance of £999 remained, but after meeting sinking fund, bad debts, taxes, &c., there was a deficiency of £316—this sum, however, including £227, the cost of procuring the provisional order, which had appeared in the capital account.

Frodingham.—The U.D.C. has decided to apply for a prov. order for E.L. The Council has already arranged to light the streets by electricity.

Fleetwood.—The U.D.C. has decided to pay its clerk the sum of 50 guineas for extra work—legal and Parliamentary—done by him in connection with the acquisition of the electricity undertaking, the said amount to be included in the next loan.

Llanelly.—An electrical plant is being installed at the Morfa Tinplate Works for providing power in the cold-rolling department. This is a new departure in the neighbourhood.

London.—Stepney.—The new generating station of the Borough Council, situated at Blyth's Wharf, Limehouse, was opened by the Mayor on Wednesday afternoon last. The new plant will have many advantages over the original station at Osborn Street, not the least being sea-borne coal and ample condensing water, whereas at Osborn Street the plant is necessarily non-condensing and all fuel carted. The buildings are of steel and concrete—provision being made at one end for extending them. The boiler house contains an initial installation of three water-tube boilers, and space remains for four more. One boiler of 22,000 lb. per hour capacity is fitted with Underfeed stokers and forced draught, and the two smaller ones with chain grates and induced draught. The bunkers will accommodate 1,000 tons of fuel, which will eventually be handled mechanically over the river wharf. Steam is supplied to one 2,000-k.v.a. Willans-Parsons turbo-alternator and one 1,000-kw. Parsons turbine with two generators in tandem, this plant being similar to one installed at Osborn Street, which is to be removed to the new building shortly. Both turbines are equipped with contraflo condensers and air pumps, the circulating water being obtained from two river wells equipped with Rees-roturbo circulating pumps and piping arranged on the Bowden patent system, as described by us in connection with the South Metropolitan Electric Light and Power Co.'s station at Greenwich (see Electrical Review, August 2nd, 1907). The larger turbine unit generates three-phase current at 6,600 volts, and in the case of the smaller machine, the output is transformed up to this pressure, the machines being controlled by e.h.t. switchgear of the Reyrolle ironclad type installed in a gallery. Similar switchgear is provided at Osborn Street, where motor-converters are installed to convert and transform the h.t. a.c. supply to direct current at normal pressure; the Merz-Price patent system of control is installed in connection with the e.h.t. switchgear. The l.t. boards are of Messrs. Crompton's make. The total length of mains now laid in Stepney amounts to 150 miles; the borough has a river frontage of 2½ miles, almost the whole of which is lined with large warehouses, &c., and it is anticipated that these will take a large supply in the near future. The electrical and mechanical equipment has been installed to the design, and under the supervision of, the borough electrical engineer, Mr. Wm. C. P. Tapper.

City.—At the last meeting of the City Corporation, the Streets Committee brought up a report relative to the notice (already mentioned in this paper) of the County of London Electric Supply Co., of its intention to commence the laying of electric mains in various important streets. It was agreed to give notice that the proposed works were disapproved of. An application was received by the City of London Electric Light Co. for permission to lay mains in King William Street, Lombard Street and Creechurch Lane. The required permission was granted subject to the works in King William Street and Lombard Street being commenced after six o'clock on a Saturday evening and continued continuously during Sunday. If not then completed, the trenches are to be filled, and operations are to be resumed on the following evening. The Streets Committee is to arrange for some further experimental lighting in the thoroughfares, as suggested in the report on the recent inspection of various systems of public lighting on the Continent.

Hampstead.—The recent electrical exhibition was visited by 12,000 persons.

Hammersmith.—A referee having been appointed by the B. of T. to inquire into the complaints as to the condition of the London United Tramway tracks, the Council's solicitors have been instructed to retain counsel and obtain expert engineering assistance. The authorities of the Shepherd Bush Exhibition wrote to the Council expressing a desire to enter into a contract for the supply of three-phase current for the remainder (four years) of the contract period. The Council communicated with the

Kensington and Notting Hill Electric Lighting Companies, from whom it purchased the current, with the result that the companies, with the exception of a few minor modifications, to which the Exhibition authorities are willing to agree, are prepared to enter into a contract to give the supply required upon the same terms as those under which the present supplementary three-phase supply is given. The Electricity Committee directed the attention of the Works Committee to an experiment which had been tried in the lighting of the Grove by substituting for one of the existing arc lamps a 400-C.P. "Osram," with clear glass globe. The annual cost to the electricity undertaking for lighting the Grove by arc lighting, is £138, compared with £92 18s. 6d. for the incandescent lighting, and the cost of the conversion is estimated at £20 11s. 4d. Having regard to the saving to be effected, and the increased lighting efficiency to be gained, the system of lighting the Grove is to be converted as suggested.

The East London Electrical Exhibition, to which we referred last week, closes to-morrow; we understand that it has resulted in good business in electric plant, motors, &c.

The Finsbury librarian reported at the meeting of the Council on October 21st that the introduction of Osram lamps at the Central Library in May last had caused a saving in the cost of current amounting to £14. Taking into consideration that the period covered was the lightest portion of the year, it was not too much to believe that when there was a complete installation of Osram lamps at the Central Library and branches, the saving in the cost of current would be at least £80 per annum.

Some details of the new Post Office power station on the Surrey side of the Thames at Blackfriars were contained in a recent issue of the *Times*. The new plant will supersede three existing installations; it is housed in a brick and steel structure, and will include, in the first instance, three Willans-Dick, Kerr turbo-alternators, one of 500-KW. and two 1,000-KW. capacity. The plant is to operate on 17 lb. steam per kilowatt-hour (presumably at full load), and will generate at 6,600 volts pressure. A small Willans steam dynamo and a B.T.-H. motor-generator are provided for excitation. The main switchgear is of Westinghouse type, and other adjuncts are a 20-ton three-motor traveller in the engine room and coal-handling and conveying plant by Babcock & Wilcox. Seven Stirling boilers are installed, three of the land type, each of 20,000 lb. per hour capacity, and four of the marine type, each of 17,750 lb. per hour capacity. The fuel will be bituminous slack, which will be burnt in chain grate stokers. Duplicate cables couple the plant with sub-stations in the main Post Office buildings, where the supply will be transformed down to 440, 220 and 110 volts for general use. The 40 miles of pneumatic tubes radiating from St. Martins-le-Grand require some 500 H.P. for their operation, and the numerous lifts, conveyors, and other applications in addition to lighting will ensure a good load for the new plant.

Macclesfield.—It is understood that the B. of T. has intimated to the T.C. that it proposes to revoke the E.L. order, and in consequence the General Purposes Committee, which has discussed the matter *in camera*, has recommended the Council to empower the Gas Committee to prepare plans and estimates for the supply of electricity within the borough.

Methley.—The U.D.C. has granted permission for the Yorkshire Electric Power Co. to pass through the district with overhead lines for the purpose of supplying energy to the Castleford district.

Rawtenstall.—The Globe Spinning and Manufacturing Co., Ltd., has applied to the T.C. for a supply of 1,500 H.P. for driving the works.

Rotherham.—The T.C. has decided to apply by a Parliamentary Bill for power to supply electricity in the Tinsley district, to lay a feeder and distributing main in the Broom district, and to borrow £5,000 for small extensions of mains and additional services.

A Scottish Deputation. — Representatives of the Glasgow, Edinburgh and Partick Corporations interviewed Mr. Tennant, of the B. of T., on October 20th, with regard to the Electric Lighting Acts Amendment Bill. A new clause safeguarding the rights of public bodies supplying electricity was discussed, but another conference will be held before the proposed amendment to the Bill takes final shape.

Sheffield.—An Electrical Exhibition, arranged by the Electric Supply Department, was opened on the 14th inst. It is essentially a domestic electrical exhibition, and no pains have been spared to get together a thoroughly representative display of every useful electrical appliance for the home. A large selection of ovens are on view under actual working conditions; ironing by electricity proceeds all day long, and the Therol water heater and Fuller geyser attract a good deal of attention. Among other items are a vacuum cleaner, also useful novelties in the form of hair dryers, vibrators, sterilisers, bed-warmers, coffee pots, kettles, &c. A portion of the premises has been arranged as a dining room, and is a source of admiration to visitors. The table is covered with an electric cloth, and is decorated with some handsome examples of candelabra and glassware.

The E L. Committee has accepted the offer of the Windermere and District Electricity Supply Co , Ltd., for the purchase of six 75-KW., six 1½-KW., four 3-KW., and two 6-KW. second-hand transformers for £41 5s. The general manager has been authorised to sell to this company second-hand transformers to the further value of £100 during the next 12 months.

Swansea.—The Streets Committee has resolved that whenever electric cables are available for lighting, the borough surveyor and the electrical engineer are to confer with a view to the substitution of electric for gas lamps. Four electric arc lamps are to be put up in Eaton Road, Brynhfryd, at an annual cost of £12 10s. per lamp.

Walthamstow.—The L.G.B. has sanctioned the borrowing of £1,100 for feeder cables for interconnecting the Higham Hill and Blackhorse Lane feeders.

Whitchurch (Salop).— The U.D.C., which has unsuccessfully negotiated for the purchase of the gas undertaking, and for the reduction of the public lighting account (about £400 per annum), has decided to consider the question of an electrical installation.

Willesden.—The Electricity Committee reports that the chairman of the Committee, with the clerk, the electrical engineer, and Mr. J. F. C. Snell (consulting engineer), interviewed Mr. James Devonshire and Mr. T. E. Ruthven Murray, managing director and electrical engineer, respectively, to the North Metropolitan Power Co., with reference to the terms under which the Council is to receive a bulk supply from February, 1911. All matters had previously been settled, except as to metering the maximum demand. As a result of the interview, it was arranged that the "maximum demand" of the supply to the Council in each quarter shall be the maximum sum of the simultaneous readings of both the alternating and the continuous current supplied by the company to the Council occurring during such quarter, as recorded by the average readings of two appropriate indicators, one to be provided and kept in repair at the expense of the company, and the other at the expense of the Council. In regard to a letter requesting the Council to join and financially support an Association which had been formed for the purpose of giving publicity to electricity undertakings, the electrical engineer was instructed to report as to the best means to advertise the undertaking of the Council. The annual report for the year ended March 31st last, shows a gross profit of £8,594, and a net profit of £320.

Worthing.—In connection with the laying of additional feeder cables, the Electricity Committee of the T.C. proposes, with the consent of the Highways Committee, to place the fuses used for sectionising the feeding districts in pillars to be erected on the footway, instead of in chambers under the footway, as has been the practice in the past.

TRAMWAY and RAILWAY NOTES.

Accrington.—The question of the through running of the electric cars between Accrington and the Rossendale Valley, which has caused a dispute between the Rawtenstall Corporation on the one hand and the Haslingden and Accrington Corporations on the other, has been amicably settled by committees of the various corporations, and it is expected that the cars will run through in a few days.

Bacup.—The Rawtenstall Town Council has adopted a resolution of the Electricity and Tramways Committee to supply any electricity which the Bacup Corporation may require for the purposes of the proposed extension of the Rochdale tramways from Shawforth to the centre of Bacup. The resolution was passed in response to a letter from the town clerk of Bacup to the town clerk of Rawtenstall, intimating that in the event of the tramways becoming an accomplished fact, the Rochdale Corporation would require a supply of current to work the service from the terminus at Bacup to Shawforth—just over 2 miles. Rawtenstall's price for the current is 1½d. per unit.

Belfast.—At a recent meeting of the Tramways and Electrical Committee, a deputation was present to urge on the Committee the desirability of having the tramways extended up the Oldpark Road for the accommodation of the residents. The manager, Mr. Nance, was directed to report on this, and also upon the proposed extensions on the Ligoneil and Donegall Roads. The question of removing the centre poles at certain points was adjourned until the next meeting.

Bradford.—At a meeting of the Finance Committee of the Corporation held on the 21st inst., it was reported that the Tramways Committee had decided to recommend that dogs should be allowed on the top deck of tramcars at ordinary fares, the conductor to be given power to discriminate between dogs suitable for passengers, and dogs likely to cause annoyance to other passengers. We understand that the subject of lady passengers being allowed to carry teddy-bears was not discussed.

Brighton.—The Tramways Committee is urging that the B. of T. should obtain powers to issue licences to local authorities for the working of rail-less trolley cars.

Bury.—A letter has been received by the Tramways Committee of the Corporation from the Association of Tramway and Vehicle Workers, in which it complains that sufficient time is not allowed in which to make the journey on a number of sections, and expressing the opinion that the speed at which cars often travel is dangerous. Consideration of the subject has been deferred for a month to enable the manager to prepare a report.

Cardiff.—Early on Sunday last 300 tramway employés met Mr. Arthur Ellis to discuss the alleged hardships attendant on the recently introduced 54 hours week. Ultimately it was agreed that the men should devise a scheme which will be submitted to Mr. Ellis for consideration.

Continental Notes.—Bavaria.—Herr von Frauendorfer, Bavarian Minister of Railways, has just been interviewed on the subject of electric railway working and the utilisation of water-power in the kingdom. As to the question whether military reasons place certain limits upon the working of main lines by electricity, the Minister is reported to have remarked that the subject was not yet ripe for decision. The military authorities had declared themselves in agreement that electrical working should first of all be established on lines of less military importance, and the experience gained on the lines after a few years would determine the future solution of the problem. The water-power presumably intended for the purpose (the Walchensee, &c.) had already been designated by the authorities. With regard to the suggested use of Bavarian water-powers for industrial purposes, the Minister expressed a warning against an over-estimation of the value of such powers. It was not sufficient to have cheap water-power alone. It was necessary to have easy facilities for obtaining raw materials and for forwarding manufactures and also to possess good conditions of labour. Referring to the competitive schemes received in connection with the Walchensee water-power project, the Minister observed that naturally it could not be stated beforehand which plan would be carried out, although probably a combination of the features contained in the various proposals would be made. The authors of the competitive schemes included first rank firms in Germany and Switzerland on the one hand, and representatives of technical science on the other. But not a single project put the water-power of the Walchensee at 100,000 h.p. as estimated by Major Donat, the proposals ranging from 50,000 to 60,000 h.p.

Germany.—It is just over two years since the A.E G. brought forward a scheme for the construction of a new underground and high-level electric railway in Berlin, and the Municipal Highways Committee has just given approval to the project in principle. The Committee has decided that in every respect the underground railway is to be preferred to the proposal for a suspended electric railway. As projected by the company, the railway would begin as an elevated line at the junction of Christiania and Schweden Strasse, and proceed to the Humholdthain, where it would descend underground by means of a decline. The railway would then continue as an underground line under the Brunner Strasse to the Waisenbrucke, pass under the Spree and subsequently rise into a high-level line and finally terminate at Hermannplatz, Rixdorf. It is estimated that the cost of construction would amount to £4,400,000.

Sweden.—As a result of the fresh inquiries which the electrical department of the Swedish State Railways has made with regard to the cost of electrifying the border railway (the line by which Lapland iron-ore is carried to the Port of Narvik, in Norway), a new programme has been drafted, on the basis of which two tenders have been procured. One of these is from the Swedish General Electric Co., of Västeräs, associated with the firm of Siemens-Schuckert, of Berlin; the other is from the A.E.G., through the Swedish Share Emission Co. The amount of the tender is in each case kept secret. Tenders were also invited from the United Electric Co., but declined, as the latter are connected with sub-contractors of the first-named company.

Italy.—The Società Imprese Elettrice Piacentine is to construct and work five sections of electric tramways in the town of Piacenza.

The commune of Galluzzo, in the province of Florence, has been authorised to construct an electric tramway from Tavarnuzze to Impruneta, starting from a junction with the existing Chianti line near the station of Tavarnuzze. Energy will be provided from the central station at Varlungo.

Liverpool.—The City Council at the next meeting will consider the following recommendation of the Tramways Committee: "That an application be made to the Board of Trade, under Sec. 20 of the Tramways Act, 1870, for their sanction to the borrowing of the sum of £10,000 for the provision of additional cars, and that the amount which may be sanctioned by the Board be placed at the disposal of the Tramways and Electric Power and Lighting Committee."

Newcastle-on-Tyne.—A report has just been issued by the general manager of the Corporation tramways on the present condition of the undertaking. In the course of it he reviews the history of the concern, and then goes on to refer to the late engineers' strike, and the severe depression which followed. Many concessions, he says, were granted just prior to the strike, and it was, therefore, impossible to make a fair comparison with the year's working prior to the concessions being granted. This was decidedly unfortunate, as, if a fair comparison could have been made, it would have been of very considerable value in deciding how far the concessions had affected the undertaking. Every endeavour was being made to curtail the expense of car maintenance, consistent with the safety of the travelling public, and the well-being of the cars themselves. The system had always been heavily handicapped owing to the variety of cars. There were far too many cars of the eight-wheeled type, and not enough of the four-wheeled top-covered type. The Tramways Committee might take it as an accepted fact that the life of the large cars was very limited, owing to their bad design, and, therefore, it would become necessary sooner or later to replace those cars. He recommended that a start should be made as soon as convenient with building a better kind of car to replace them. Seeing that it was the desire of the Committee to reduce their operative expenses, Mr. Hatton points out that the maintenance of the permanent way must be placed under his control. When he was appointed by the City Council the appointment stated that he was to undertake the complete control and management of the system. He had not that control when another department had control over an expenditure of some £8,000 per annum. In the course of a reference to ½d. fares, he says one could not ignore that class of person who was always clamouring for ½d. fares. There was a section of the public who would be perfectly satisfied if they could have the same fares and stages as in Glasgow—half-mile stages for ½d., and four ½-mile stages for 1d.—but there no difference was made between workmen's fares and ordinary fares. The above conditions in Newcastle would, undoubtedly, benefit the 1d. passenger, but a workman who now travelled on the Newcastle system 1½ miles for a ½d. coupon ticket, would then be reduced to half a mile for a ½d., and the workman who could now travel close upon four miles for a 1d., would only be able to travel two miles for a 1d. under the Glasgow system. It was probable that such an alteration would raise more opponents than it found supporters. No doubt the reply would then be, "let us retain our present system of workmen's fares and stages, and give us in addition a system of fares and stages as are in use in Glasgow." The undertaking would then have to be supported out of the rates in a similar manner to the other great departments of the Corporation, *i e.*, there would have to be a rate levied to produce the necessary funds to carry on the tramway system. Mr. Hatton maintains that the tramway system is in great need of an average fare greater than a 1d. It was essential that some alteration should be made in the workmen's fares. For cheapness the workmen's ½d. fare in Newcastle had no equal in the provinces. Further, there must be an alteration in the present coupon system. He makes certain recommendations, including the following:—

Every car throughout the day shall run at a penny minimum fare except for school children. This is the same condition as at present.

On every car run before 7 a.m. the conductor shall issue a return ticket value 1½d. to cover the return journey over any 1d. section. This is an increase upon the present ½d. workman's fare.

That the conductors shall be empowered to issue (or withhold) these return tickets only to men dressed as artisans, or who, to all appearances, are of that class.

Failing the adoption of those modifications, Mr. Hatton suggests that the Committee should adopt a system which is in use in some towns:—That up to 7 o'clock in the morning a universal penny workmen's fare shall be charged, and to those who desire the same a return ticket for 2d. shall be issued allowing for the return journey at any time of the day. That system had many advantages compared to any other, and it treated all workpeople alike. The last-named system appealed to him as the best suited for the city and the least expensive to work. Dealing with ordinary fares the manager states that what the system required was an average fare of something greater than a penny. He suggests a revision of stages with alteration of fares, but the whole route would remain the same in each case as at present, that was 1½d., but to encourage the long-distance traveller he proposed that anywhere in the 1½d. section a return ticket covering the whole route should be issued for the fare of 2½d. It was undesirable to revert to the old fares and fare stages. In conclusion, Mr. Hatton says:—"The course that I should adopt if the undertaking belonged to me is to reduce the working expenses to a minimum by further cutting down the expenditure, and await developments. With improved times, and then—and then only—if matters do not improve to the satisfaction of the Committee, the Committee and the whole of the ratepayers in the city will know that there is only one alternative—*i e*, to increase the fares, but not necessarily by falling back on the old fares and fare stages and conditions, as even that altered condition of affairs may not yield that amount of money that it is necessary to set aside annually for renewals and depreciation."

At midnight on Saturday last the Newcastle and District Tramway Workers' Union held a largely attended meeting to discuss the action of the tramways department in connection with the re-organisation of working which is being carried out. Ultimately resolutions were carried protesting against the methods of the management in evading consideration of grievances, and in regard to the Tramways Committee's action respecting the car cleaners.

Rawtenstall.—The T.C. on Thursday passed a resolution agreeing to the through running of cars between Bacup and Accrington upon certain conditions for 12 months. A sub-committee has been appointed to deal with additional stopping places between Lockgate and Bacup.

Rotherham.—The T.C. has decided to apply in a Parliamentary Bill for power to run rail-less cars in the Wickersley, Bramley, Maltby, Tickhill, Whiston, Aston, Swallownest, Aughton, Brinsworth, Tinsley, Catcliffe, Treeton, Laughton, Brampton, Dinnington and Thorpe Hesley districts.

West Ham.—In conjunction with East Ham and Leyton, arrangements have been made with the L.C.C. for tramway through-running between Aldgate and Ilford Broadway, and Aldgate and the Green Man, Leytonstone. The basis arrived at was an equal earning value for the whole of the lines, the route between Stratford and Aldgate being provided with a doubled service, as compared with the other lines, as at present.

TELEGRAPH and TELEPHONE NOTES.

Cable Cut.—It is reported that the cable of the Ministry of Marine along the Finnish coasts has been cut between Lachta and Mugenport, and 300 metres of it have been carried away.

Cable Repaired.—Cheiksaid-Perim, October 10th, 1909.

Ceremony by Cable.—The daily Press during last week contained much matter in reference to the opening of (or giving the signal to open) the doors of the new Tuberculosis Institute, from West Dean Park, Chichester, to Belmont Park, Montreal, by the King. The lines were cleared in the usual manner, and the point connected with the ceremony which calls for special notice is the vast improvement in automatic relays brought about during the last few years. Nearly forty years ago one of our contributors took part at the other end when His Majesty (then the Prince of Wales) was present at the residence of Mr. Pender, at 18, Arlington Street, at an inaugural fête to celebrate the opening of direct submarine telegraphic communication with India. It was even so early in the history of the invention of using a wire to direct and control electric impulses, that through submarine cables for vast distances and with numerous manual transmissions—far greater than the transmission across the Atlantic—messages were passed along a clear course from His Royal Highness to H.E. the Viceroy of India, containing 57 words, and a reply was written and received in London in 11 minutes. Sir Bartle Frere also dispatched a message to the Governor of Bombay, containing 19 words, and the acknowledgment was received in London in 4 minutes 50 seconds. The interest of the world was at that period centred in the question how quickly it was possible to get a message from the United Kingdom to India and back, and this was actually accomplished in 4 minutes 22 seconds, and from Malta to Bombay and back in 1¼ minutes, over six independent circuits, one after the other, by hand, or there and back, 12 transmissions.

Emden-Teneriffe Cable.—The *Elektrotechnische Zeitschrift* of October 7th contains interesting particulars of the German cable to South America. On August 26th last the Emden-Teneriffe section was opened to international traffic. Our contemporary states that this cable is owned by the Deutsche-Sudamerikanische Telegraphengesellschaft, of Cologne, who laid it at the request of the Imperial Postal Department, and is to form part of a system of cables connecting the German West African Colonies and South America with the German Empire. The *Zeitschrift* emphasises the fact that the German system at present ends at Vigo. It is not yet known if the Teneriffe-Pernambuco section is to be laid direct or *via* Monrovia, but it is considered that the extra cost of this deviation will be more than counterbalanced by the connecting-up of the West African Colonies over German cables. The section already laid was manufactured by the North German Cable Works at Nordenham, and the cable steamer *Stephan*, from June 15th to 26th, laid 676 N.M. of cable to the mouth of the Canal, and between July 25th and September 2nd, the remainder of the cable to Teneriffe—1,431 N.M. The short cable between Borkum and Emden worked in conjunction with the system is owned by the German Government, and was already laid last year.

The cable has one conductor:—

Shore End and Intermediate core, 600 lb. copper/340 G.P.
Deep Sea type core, 500 lb. copper/315 G.P.

The conductor of the Shore End and Intermediate is a single wire of 3 mm. surrounded by 12 wires of 1 mm. diameter. The conductor of the Deep Sea is also a single wire of 2·73 mm., surrounded by 12 wires, 0·91 mm. in diameter, C.B. 2,017ω, or about 2·42ω per N.M. at 75° F.; capacity 445 mfd., or ·4200 mfd. per N.M.

The core was subjected to a pressure of 600 atmospheres.

The dielectric resistance is not less than 400 megohms per N.M. The outer covering of the cable varies according to type. The core of the shore end and intermediate types is brass taped.

The telegraph authorities at Emden work the German end of the cable, while the station at Teneriffe is in the building of the Spanish Government telegraphs at Santa Cruz, but the cable is worked by the company's employés.

The land cable between Borkum and Emden has two conductors of the same size as the intermediate cable, one being used as an earth connection.

The capital of the company is at present 11,800,000 Mark, of which 4,000,000 Mark is in shares, and 7,800,000 Mark in 4½ per cent. debentures.

Long-Distance Telephony.—According to the Italian newspapers, the work of establishing a telephone connection between Italy and Germany will be completed within a brief period. The line proceeds from Milan and follows the St. Gothard railway, terminating at Frankfort-on-Main. The charges for utilising the telephone between the two cities have already been fixed by the two States interested. It is said that Switzerland, which has not participated in the connection, will receive compensation from both Germany and Italy.

Newfoundland Cable.—The *Telegraph Age* states that the authorities have stopped the laying of the Commercial Cable Co.'s underground conductors through the streets of St. John's to the company's city office, so that the operating staff has had to be housed in the cable hut, on a most desolate seashore. The contract with the Government having been repudiated, the company is liable to pay an annual tax of $8,000, besides a rent of $2,000 a year demanded by the city of St. John's for the right to carry the telegraph line into the city. For the last two months the company has been doing a through-traffic business between London and New York, having no connection with Newfoundland business.

Rose's Universal Code Economiser.—Invented by Sydney A. M. Rose, A.M.I.E.E. London: Sidgwick and Jackson, Ltd. Price 10s. 6d.—This system, in the words of the author, is the outcome of much thought, and was devised to overcome vexatious errors, entailing much delay, from which he has greatly suffered; the economiser is intended to provide for the use of any number from 0 to 159,999 as a pronounceable code word of seven letters, each word being quite distinct from any other of the remainder of the 160,000 words in Section "C." In addition to the foregoing, any sum of money ranging in halfpenny stages up to £6,666 13s. 3½d., or its equivalent in dollars and cents, can be transmitted in one word in Section "F," or any sum from one halfpenny or cent up to £3,199,999 19s. 11½d., or $15,359,999.99 c. in Section "G." A key table is given in which numbers from 1 to 19 are represented by consonants B, C, D, F, G, H, J, K, L, M, N, P, R, S, T, V, W, X, Y, Z, and the vowel "U" is inserted between each two letters representing numbers, to separate one from the other. A fixed divisor of 20 is agreed upon to reduce a series of figures to numbers within the scope of the key table, and letters thus selected are formed into code words with the vowel "U" inserted as above stated. This vowel is looked upon as a check upon any irregularity or mutilation of a word by the telegraph system, but we do not follow Mr. Rose in this claim, as bad spacing, the only class of fault which he contemplates, is not the only reason for errors; if a dot or dash be dropped, the check of the "U" will not serve at all. Much complaint has been made by telegraph companies and administrations of the nature of words used by the public, and we hardly think combinations such as BUBUBUBUBUB, ZUKUVUVUX, LUSUGUFUPUC will serve the cause of accuracy; in the rush and scurry of getting the message off, an operator might be confused. Mr. Rose may have a partial check, but it would seem by the above three words that 14 of the letters are wasted to secure this advantage, and the system of the divisor 20 is to this extent neutralised. Two of the words quoted contain more than 10 letters each, and would be chargeable as two. The dividing or multiplying by 20 as many as five times, also seems a cumbrous task, and errors in calculations may be made. Delays or serious consequences caused by errors in telegrams in proportion to the large number handled are very small, and if greater attention were paid to the formation of code words, it may be reasonably advanced that greater accuracy would follow.

Rowland Telegraph System.—Explaining the reason for its abandonment of the Rowland printing telegraph system, the Postal Telegraph Cable Co, New York, states in the *Telegraph Age* that excellent results have been obtained with the system, which has been in use for about two years on six of the company's circuits, three being operated octoplex, two quadruplex and one duplex. The octoplex circuits had each a carrying capacity of 2,000 to 2,500 telegrams of 30 words each per day, and the other circuits in proportion, while on emergency this traffic could be increased by 50 per cent. But it was not found possible to maintain the apparatus in working order, it being subject to more or less frequent interruption, and it could not be used upon wires with which the attendants were not familiar. The company having determined to prevent every avoidable delay to telegrams, found it necessary to stop using the printer, the use of which was always regarded as experimental. Improvements may be effected in the apparatus, and it is quite possible that further experiments will then be made.

Wireless Telegraphy.—Experiments with the portable outfits made by the Telefunken Co., for the German Army, have shown that with them communication can be maintained between Berlin and Vienna, a distance of 1,550 km., or 963 miles.

An Admiralty station is to be erected at Wick.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Melbourne.—Telegraph and telephone material, for the P.M.G. See "Official Notices" to-day.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Bradford.—November 13th. General stores for the Tramways Department for a year (returnable deposit of £1 1s.). Tramway Offices, 7, Hall Ings, Bradford.

Canada.—Montreal.—Tenders are being called by the Saraguay Electric and Water Co. for turbo-generators of 2,000 kw. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4, Phillips Place.

Ottawa.—November 25th. Tenders are invited for the packing of material and supplies for points along the Yukon telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911 and 1912. Forms of tender and specification may be obtained and form of contract seen on application to Mr. J. T. Phelan, Superintendent of Government Telegraphs, Vancouver, B.C.; Mr. William Henderson, District Superintendent Government Telegraphs, Victoria, B.C.; and from the Government Telegraph Agents at Ashcroft, B.C.; Quesnelle, B.C.; Hazelton, B.C.; and Telegraph Creek, B.C. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.—*Canadian Engineer.*

Eastbourne.—Tenders are to be invited for a condensing plant, similar to the one now in use at the generating station. The estimated cost is £1,835.

Epsom.—November 2nd. Eight d.c. long-burning flame arc lamps for the U.D.C. See "Official Notices" October 22nd.

India.—Lucknow.—December 31st. The Lucknow Municipal Board is prepared to consider proposals for the grant of a concession for the supply of electrical energy, coal or oil gas, within the municipal limits of Lucknow, for house and street lighting and other domestic or manufacturing purposes. Particulars of area of supply, &c., can be obtained on application to the Secretary of the Board. Tenders will be received up to December 31st, 1909. R. Hobart, I.C.S., Chairman Municipal Board, Lucknow, India.

Italy.—November 3rd. The Italian State Railway authorities in Rome are inviting tenders for the supply of four electric motors for the railway workshops in Rome.

London.—L.C.C.—November 1st. Brass and other castings and fittings, lamp glasses, carbons, insulating materials, cables and lamps, for the L.C.C. See "Official Notices" October 22nd.

London.—November 3rd. Electric lighting installation at the Buxton Street Elementary School, Whitechapel. See "Official Notices" October 22nd.

Sherburn (Co. Durham).—November 6th. Electric light installation for the main portion of the parish, for the P.C. A. Stanley, clerk, Leamside, Fence Houses.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Warrington.—November 2nd. Arc lamp lowering gear for the Corporation Electricity Department. See "Official Notices" October 22nd.

CLOSED.

Aberdeen.—The Public Health Committee has accepted the tender of Messrs. J. Blaikie & Sons, at £610, for the electric light installation at the City Hospital.

Brumby and Frodingham.—The U.D.C. has accepted the tender of Messrs. Reid, Ferens & Co., of Newcastle-on-Tyne, for electric light standards, &c., for the streets, at £278.

Canada.—Quebec.—According to the *Canadian Engineer*, the Verdun Municipality has awarded the following contracts:—

Two engines for electric installation.—Belliss & Morcom, Birmingham, England; agents, Messrs. Laurie & Lamb, Montreal; $9,500.

Two 235-k.v.a., three-phase, engine-type generators, with direct-connected exciters and complete switchboards.—The Canadian Westinghouse Co., $7,532.

Mr. Charles Brandeis, of Montreal, was consulting engineer.

Dundee.—Messrs. A. Westwood & Son have secured the contract for the electric lighting of the Corporation branch reading room, at £110.

Fleetwood.—The tender of the Klein Engineering Co. for the erection of a cooling tower at the electricity works has been accepted by the D.C., at £280.

Glasgow.—A Committee of the T.C. has recommended or acceptance the offer of Fairlie & Paxton for collector brushes.

Haslingden.—The Chloride Electrical Storage Co., Ltd., ave secured the contract for a 500-volt battery, a Highfield ooster and switchboard for the tramways.

Hertfordshire.—The County Council has accepted the tender of Rogers & Gowlett, Ltd., at £138, for substituting metallic-filament lamps for carbon lamps in five schools, requiring approximately 800 lamps.

India.—The Globe Electric Co., Ltd., have secured the contract for a large number of their latest pattern, 1909, long-burning "Globe-Santoni Standard" flame lamp, for the Bengal-Nagpur Railway. The contract includes the whole of the insulators, brackets and wiring sundries for the installation.

La Plata.—The Chloride Electrical Storage Co., Ltd., are supplying an Entz booster and switchboard in connection with the lighting and tramway circuits.

London.—L.C.C.—During the summer recess the Highways Committee received tenders for supplying and laying 440,000 stoneware ducts in connection with the electrification of further portions of the tramways. The following is a list:—

(1) Supply of Stoneware Ducts.

	Rate for 1,000 ducts.	Quantity.	Amount of tender (including £100 for extra works).
Stanley Bros., Ltd. (accepted)	£9 0 0	440,000	£4,060 (less 2½ % cash)
Sutton & Co.	9 17 3	222,000	2,270
H. R. Mansfield	10 4 11	100,000	1,125 (less 2½ %)
Hosea Tugby & Co., Ltd.	10 4 11	250,000	2,661 „
Ensor & Co., Ltd.	10 5 0	440,000	4,610 „
Robinson & Dowler	11 0 0	100,000	1,200
Doulton & Co., Ltd.	12 0 0	100,000	1,300 „
R. W. Blackwell & Co., Ltd.	13 13 6	440,000	6,117
Joseph Place & Sons, Ltd. (not to specification)	15 0 0	100,000	1,600

Estimate of chief officer of tramways, £4,800.

(2) Laying of Stoneware Ducts.

Reid Bros.	(accepted)	£26,622
Westminster Construction Co., Ltd.		26,886
Bower Bros.		31,307
Dick, Kerr & Co., Ltd.		31,497
John Mowlem & Co., Ltd.		32,501
Callender's Cable and Construction Co., Ltd.		33,209
Robert W. Blackwell & Co., Ltd.		34,055
R. C. Brebner & Co.		50,548

Estimate of chief officer of tramways, £29,750. Messrs. Reid Bros. will sublet certain portions of the work.

During the recess tenders were also received for high and low-tension switchgear and motor-generators, required for further tramways electrification:—

(1) High and Low-tension Switchgear.

Switchgear Co., Ltd.	(accepted)	£3,517
Johnson & Phillips, Ltd.		3,625
Spagnoletti, Ltd.		3,670
Ferranti, Ltd.		4,112
Electric Construction Co., Ltd.		4,176
General Electric Co., Ltd.		4,225
British Westinghouse Electric and Mfg. Co., Ltd.		4,864

Estimate of chief officer of tramways, £3,550.

(2) Motor-Generators.

*Lancashire Dynamo and Motor Co., Ltd.		£3,457
General Electric Co., Ltd.		3,821
*Bruce Peebles & Co., Ltd.		3,939
Dick, Kerr & Co., Ltd.	(accepted)	4,206
British Electric Plant Co., Ltd.		4,231
British Westinghouse Electric and Mfg. Co., Ltd.		4,291
Brush Electrical Engineering Co., Ltd.		4,997
Electric Construction Co., Ltd.		5,428

Estimate of chief officer, £4,750.

* Not to specification.

Messrs. Dick, Kerr's tender was accepted because the Council already has a large number of their machines of the kind working very satisfactorily.

Southwark.—The B.C. has received the following tenders for the motor-generating plant for Kennington Theatre:—

British Electric Plant Co.—(*a*) Two 40-kw. motor-converters, £550; (*b*) switchboard, £68; (*c*) two 8-kw. motor-converters, £96; (*d*) switchboard, £32.
General Electric Co. (accepted for *a* and *b*).—(*a*) £398 10s., (*b*) £37 5s., (*c*) £88 10s., (*d*) £26 10s.
Electric Construction Co.—(*a*) £386, (*b*) £67 10s., (*c*) £85, (*d*) £24.
Pooley & Austin.—(*a*) £376, (*b*) £57 10s., (*c*) £94, (*d*) £19 10s.
Siemens Bros. Dynamo Works.—(*a*) £394, (*b*) £88, (*c*) £86, (*d*) £47.
Crompton & Co. (accepted for *c* and *d*).—(*a*) £389 (alternative, £363, less 10 per cent.), (*b*) £53, (*c*) £88, (*d*) £3 6s.
Westinghouse Co.—(*a*) £400, (*b*) £102, (*c*) £87, (*d*) £102 (switchgear included).
Lancashire Dynamo Co.—(*a*) £414, (*b*) £100, (*c*) £106, (*d*) £17.
Mather & Platt.—(*a*) £422, (*b*) £91 10s., (*c*) £100, (*d*) £35 12s.
Electrical Co.—(*a*) £440 (switchboard included), (*c*) £82 (switchboard included).

Sweden.—The Korsnäs Share Co. has recently, through a firm in Gothenburg, ordered two steam turbines for the new pulp mill at Karskär from the English firm of Willans and Robinson, and also two electrical generators of 1,500 kw. The latter will be made by the Swedish General Electric Co., whose tender was lower than those of the British electrical manufacturers. The whole contract amounted to about 200,000 kr. (£11,111). The turbines are specially arranged so that part of the steam can be used for heating and drying at a pressure of 1½ atmospheres. Similar turbines were supplied by Messrs. Calvert & Co., of Gothenburg, to a factory at Ortviken.

Walthamstow.—The U.D.C. has accepted the tender of Henley's Telegraph Works, Ltd., at £690, for feeder cables.

War Office.—Messrs. J. G. Childs & Co., Ltd., of Willesden Green, N.W., have just obtained an order from the War Office for three lifts for the Royal Army Clothing Factory at Pimlico. They have also received another order from the London, Brighton and South Coast Railway for a crane for Brighton, making the third supplied this year.

Watford.—The U.D.C. has accepted the tender of the British Westinghouse Co. for the annual supply of transformers.

Woolwich.—The B.C. has accepted two tenders as follows for carbons for the next 12 months:—

Oliver Arc Lamp for B and E.
Siemens Bros. for C and D.

With regard to "A," the Council decided, in view of the variation in the amounts of the different tenders, which seemed to indicate a great difference in the quality of the carbons offered, to have tests made of the various samples.

Worthing.—The T.C. has accepted the tender of the Callender Cable and Construction Co., Ltd., for 4,110 yards of vulcanised bitumen-sheathed concentric and triple-concentric cables, at £1,038. The other tenders received were:—

Johnson & Phillips, Ltd.	£1,097
W. T. Glover & Co., Ltd.	1,099
British Insulated and Helsby Cables, Ltd.	1,099
Henley's Telegraph Works Co., Ltd.	1,100
Western Electric Co.	1,102
Siemens Bros. & Co., Ltd.	1,107
St. Helens Cable Co., Ltd.	1,130
Frankenburg & Sons, Ltd.	1,196
Anbert Grenier & Co.	1,428

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 29th. At 8 p.m. Extra meeting. Resumption of discussion on Prof. W. E. Dalby's paper on "Heat Transmission."

North-East Coast Institute of Engineers and Shipbuilders.—Friday, October 29th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Annual meeting. Paper on "Notes on Marine Boiler Design, Construction and Economy," by Mr. D. Myles.

Northampton Institute Engineering Society.—Friday, October 29th. At 5.45 p.m. Paper on "The Development of the Marine Steam Engine," by Mr. A. T. Barber.

P. & O. Batti-wallahs' Society.—Monday, November 1st. At 8 p.m. At the Holborn Restaurant, Council Chamber. Smoking concert.

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 2nd. At 7.30 p.m. At the University, Manchester. Paper on "The Electric Ignition of Internal Combustion Engines," by Mr. J. W. Warr.

Institution of Civil Engineers.—Tuesday, November 2nd. At 8 p.m. Presidential address by Mr. J. C. Inglis, presentation of medals and prizes, and reception by the President.

Tuesday, November 9th. At 8 p.m. Papers on "The Single-phase Electrification of the Heysham, Morecambe and Lancaster Branch of the Midland Railway," by Messrs. J. Dalziel and J. Sayers; and "The Equipment and Working Results of the Mersey Railway under Steam and Electric Traction," by Mr. J. Shaw.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, November 3rd. At 7.30 p.m. At the University, Birmingham. Inaugural address by Mr. R. K. Morcom.

Civil and Mechanical Engineers' Society.—Thursday, November 4th. At 8 p.m. At Caxton Hall, Westminster, S.W. Paper on "Technical Popular Fallacies," by Mr. A. S. E. Ackermann.

Roentgen Society.—Thursday, November 4th. At 8 p.m. At 20, Hanover Square, W. Presidential address by Mr. C. E. S. Phillips.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 9th. At 7.30 p.m. At the Mosley Hotel, Manchester. Supper and smoking concert.

Institution of Electrical Engineers (London).—Thursday, November 11th. At 8 p.m. Opening meeting. At the Institution of Civil Engineers. Presidential address by Dr. Gisbert Kapp.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for next week:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 1st.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, November 2nd.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, November 3rd.—Gymnasium, 6.30 to 9.30 p m.

Thursday, November 4th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, November 5th.—"D" Company. Technical drill, 7 to 9.30 p.m.

(Signed) P. H. Campbell. Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

National Electrical Manufacturers' Association.—The next committee meeting of this Association will be held on Tuesday, November 9th, at Balfour House, Finsbury Pavement, .C., at 2 30 p.m,

NOTES.

Inquiries.—A correspondent wishes to know where he can obtain information on the subject of "The Thermal Conductivity of Heat Insulators," in the form of papers or books. Probably the "Engineering Index" and "Science Abstracts" would help him. Another wants the name of maker of the "King" magnetic separator.

Magneto Ignition.—We were recently asked by a well-known engineer, "Who invented magneto ignition as applied to gas engines?" Can any of our readers tell us to whom belongs the credit of this invaluable invention?

Parliamentary.—Electric Light Employes.—In last Friday's Parliamentary papers, Mr. Steadman asked the Postmaster-General whether, in view of the fact that a scale of wages to govern the electric light employés of his department had been submitted by the Executive of the Association to which the men belong, he was in a position to signify his acceptance of the rates, and if not, would he state the grounds of his objection. Mr. Sydney Buxton replied that the Select Committee of the Post Office Servants recommended that as regarded the electric light staff, the Post Office should pay the wages and observe the conditions of labour which were, from time to time, agreed upon in the various districts by the organised masters and men. He further stated that inquiries were proceeding on the subject, and he hoped the matter would soon be settled.

The Engineering Department of the Post Office.—Mr. Tyson Wilson, in Friday's Parliamentary papers, asked the Postmaster-General whether a number of construction hands in the engineering department had recently been dismissed, and whether he would state the reason of their discharge; and further, whether the men would be provided with work during the winter months. Mr. Sydney Buxton, in reply, said that it had become necessary during the last 18 months to take on extra hands for the strengthening and partial reconstruction of some of the main telephone trunk routes in the North of England, which could not be delayed. The work had now come to an end, and the general quantity of Post Office work had reverted to its normal level. The men paid off would be taken on again as soon as circumstances permitted.

Electric Lighting Acts Amendment Bill.—In the House of Lords on Tuesday, after some discussion on the amendments made by the House of Commons, an amendment was moved by Lord Belper, who desired to permit electric supply companies to supply current for energy to railway companies for purposes connected with their undertakings. According to the *Daily Telegraph*, Lord Hamilton of Dalzell opposed the amendment on behalf of the Government, but did not divide the House. The amendment was agreed to, and the other amendments made by the Commons were accepted without further discussion.

Electricity in Mines.—On Monday a visit was paid to the works of the Electric Construction Corporation, Ltd., Wolverhampton, by the South Staffordshire, Warwickshire, and Worcestershire branch of the National Association of Colliery Managers; the visitors, numbering over 20 members (headed by Mr. Arthur Hall, president), were courteously conducted over the works by Mr. W. Bulloch, the manager, who explained the technicalities of the various processes in the manufacture of electrical equipment. Subsequently a vote of thanks was accorded the company, in replying to which Mr. Bulloch pointed out that, while electricity was extending in underground operations, there was great scope for its further use.

Electrolytic Disinfectant.—The report of the Public Health Committee of the Poplar Borough Council on the working of the electrolytic plant during the past summer shows that the demand for the fluid could not be fully met, although the plant was worked overtime. The stability of the fluid during the hot weather was found to be very good. The total output for the year to the end of August was 17,794 gallons; during August the output was 4,326 gallons. The total cost of materials was £37 19s., including electrical energy (2,988 units at 1½d.), £18 13s. 6d.; the cost per gallon, therefore, was slightly over ½d. During the past four years nearly 80,000 gallons of the fluid have been made, at a cost, for electricity and materials, of under £160, and a great saving has been effected in outlay that would otherwise have been necessitated. The plant is in good order, and extensions are under consideration, with a view to meeting the increased demand, the estimated cost being £430. By far the largest item of cost is that of wages, mainly incurred in bottling and issuing the fluid, and amounting to £416 for five men, apparently from January to August, 1909, inclusive. This, on the basis of 18,000 gallons, means over 5d. a gallon issued. and including sundry expenses, the total cost appears to be about 6d. a gallon. The Works Department is supplied, however, at 1d. a gallon. The mode in which the accounts are presented renders it difficult to arrive at a definite decision as to the unit cost, for on the first page we find the cost of materials, bottles, &c., from February, 1906, to January, 1908, inclusive, and from January, 1908, to December, 1908, inclusive; on the second page, the cost of the same items from January, 1909, to August, 1909, inclusive, a detached statement as to the total quantity manufactured during four years, an account of wages over a period unstated, and a statement of total cost of the fluid, bottles, &c., from 1906 to 1909; on the third page, a statement of capital and maintenance costs of the plant, cost of carbolic disinfectants for the years 1903, 1904 and 1905, and wages spent on bottling and issuing carbolic acid during those years. The whole forms a remarkable jumble, such as we have rarely met with in connection with a public department.

Two interesting reports have been issued by Dr. Alexander on the use of the fluid for disinfecting and deodorising the water in public swimming baths. It seems clear from the tests and analyses made, as well as from observation of the appearance and odour of the water, that an immense improvement is effected in the state of the water by treatment with a comparatively small quantity of electrolytic disinfectant—some 40 gallons to a bath of 75,000 gallons on the first day, and 20 gallons a day afterwards, the same water being used for three or four days. It was found that the water remained unpolluted for several days when thus treated, and the bathers expressed their appreciation of the improvement.

Impregnation of Field Coils.—In a report of the Committee on Equipment to the Convention of the American Street and Interurban Railway Engineering Association, the impregnation of both new and old field coils was highly recommended. In carrying out the impregnation process with wire-wound field coils the wire is insulated with asbestos, which is held on by a thin cotton covering. The coil is wound in a form of definite dimensions. After winding, the coil is taken out of the form and wrapped with porous tape. The coil is then filled with asphaltum compound by the vacuum process. This process consists of putting the coils in an air-tight pot or kettle, the same being heated; while the coil is hot the air is exhausted from the kettle, thus taking the air out of the coil. When a good vacuum is obtained, hot melted asphaltum is allowed to flow in from another kettle, and as soon as the coils are covered with asphaltum, it is turned off and air pressure is applied on top of the asphalt in the compounding kettle, and thus the asphalt is forced into all the spaces in the coil. When cooled down slightly, the coils are taken out and allowed to become fairly cool. Then clamping plates are placed on the coil, both back and front, to bring the compounded coil to the exact dimensions desired. After the coil is cold the clamps are removed, the first taping is removed and varnished cambric insulation is put on the coil. This treatment makes a compact coil of definite dimensions which, when bolted up in the motor, will maintain its dimensions and is not liable to become loose.—*Electrical World.*

A Moral Tale.—We have received the following story, founded on facts in connection with a London contract recently awarded:—

THE KIND BURGLAR. (A Story and a Moral.)

By A. H. P.

Scene: Inside a villa. "*The Pad-Tec-Stute.*"

Time: A week ago.

Characters: Bill Sykes (*alias* Bill Westingcastle), standing 7 ft. high, and broad at that.

Mr. Willie Contractor (rightful owner of above villa), short of stature and weak of muscle.

Mr. W. C. wakes up (after having peacefully dreamed that he had a tender accepted), to find that B. S. has ransacked the place. The latter is standing near by, calmly smoking.

Mr. W. C. (very, very timidly): "What are you doing here, *please?*"

B. S.: "What am I adoin', eh? Why! ain't I a Socialist, and believes in sharing everything with me pals? (Wiv a bit over on my side.) What are yer agrumblin' at, Cocky? Shut up, an' let me do the job in peace, I ses." (Threatens Mr. W. C. with a bludgeon.)

Mr. W. C.: "But . . . please, it's really mine . . . I . . ."

B. S.: "Less of it—but look 'ere, I've took a fancy to yer, like, so 'ere yer are—'ere's yer chance, me boy. Just come here." (Proceeds to pull Mr. W. C. out of bed, and takes him downstairs, where Mr. W. C. observes that his silver is on a wheelbarrow ready to be moved.) "Now, you wheel that 'ere barrow to my 'ouse, and *I'll give yer a bob*—'an come on quick before the 'Cop' comes round."

(Mr. W. C. looks at Bill's 7 ft., and then at the bludgeon, and proceeds to *earn* the bob.)

Moral: Half a job is better than none at all.

An Inventors' Exhibition.—An exhibition of inventions will be opened next year by the Royal Central Board of Trade at Stuttgart. The chief object of the exhibition is to call the attention of manufacturers and capitalists to inventions which ought to be economically exploited. The exhibition will include only inventions which are patented in Germany, or for which applications for patent have been made. The most noteworthy feature of this exhibition is that it is the Government itself, represented by the Board of Trade, which has taken the initiative. In the first instance, a great number of patent agents from all parts of Germany were asked to express their views on the matter, and by them the suggestion was warmly approved of. Of special interest are the views of the Government with regard to this matter, which were expressed by the President of the Board of Trade in a speech which formed the introduction to a discussion of the proposal. The President first drew attention to that branch of the Board which dealt with the protection of industrial rights It was a common experience, he said, that people of small means, who wished to protect their ideas or inventions, were frequently quite helpless and fell into the hands of unscrupulous patent agents or others. This circumstance had led the Government to open an office, which gave advice free of cost to all interested in industry. During so short a period as nine months, the office had already given professional advice to 500 persons. The President then proceeded to explain the objects of the exhibition, which were to bring inventors and manufacturers into touch with one another, to enable the former to show their inventions to the greatest possible number of interested persons, and to give the latter the opportunity of making themselves acquainted with the existing inventions and improvements. The idea seems to be a good one, and might be given a trial in other countries also.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER LOCAL SECTION).—We have received the syllabus of meetings for the new Session, showing that the following papers will be read:—

November 2nd.—J. W. Warr, A.M I.E.E.: "The Electric Ignition of Internal Combustion Engines."
November 16th.—L. E. Wilson: "Telephones."
November 30th.—Prof. E. W. Marchant, M.I.E.E., and E. A. Watson: "Recent Developments in High-Tension Transmission on Overhead Lines."
December 14th.—L. J. Lepine, Student, and A. R. Stelling, Dipl.Ing., Student: "Notes on Methods and Practice in the German Electrical Industry."
January 11th, 1910.—Prof. A. Schwarlz, M.I.E.E.: "The Testing of Rubber for Electrical Work."
January 25th.—W. P. Durtnall, M.I.Mar.E.: "The Generation and Electrical Transmission of Power for Marine Propulsion."
February 8th.—A. G. Cooper, A.M.I.E.E.: "Three-Wire Balancers."
February 22nd.—B. Thomas, A.I.E.E., and E. Thomas, B Sc.: "Some Modern Developments in Automatic Switch Gear."
February 25th.—Annual Dinner.
March 8th.—Miles Walker, M.I.E.E.: "The Short-Circuiting of Large Electric Generators, and the Resulting Forces on Armature Windings."
March 22nd.—Annual General Meeting.—W. Pollard Digby, A.M.I.E.E., and D. B. Mellis: "Some Properties of Switch and Transformer Oils."

On Friday last the chairman, Mr. S. J. Watson, delivered his inaugural address.

SOUTH AFRICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The seventh annual meeting of this Association was opened at Bloemfontein on Monday, September 27th. His Excellency the Governor delivered the presidential address on the "Application of Chemistry to Agriculture."

INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).—The book of rules, list of members, &c., has been issued, and gives the dates of meetings in the new session, which opens on November 3rd with the inaugural address of the chairman, Mr. R. K. Morcom. The annual dinner will take place on November 12th at the Grand Hotel, Birmingham; applications for tickets should be sent to the hon. secretary, Mr. H. B. Matthews, Winchester House, Victoria Square, Birmingham.

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON).—The opening meeting will take place on November 11th, when premiums will be presented, and the President, Dr. Gisbert Kapp, will deliver his inaugural address.

INSTITUTION OF CIVIL ENGINEERS.—The Council has made the following awards, amongst others, for the year 1908-9: Telford Gold Medals to Prof. B. Hopkinson, M.A., B.Sc. (Cambridge), and Mr. G. R. G. Conway (Monterey, Mexico); Watt Gold Medals to Messrs. D. A. Matheson (Glasgow) and W. C. Popplewell, M.Sc. (Stockport); George Stephenson Gold Medals to Messrs. E. H. Tahor (London) and A. J. Knowles, B.A. (Cairo).

The Electric Driving of Textile Factories.—We publish elsewhere in this issue the interim report of the special committee of inquiry appointed by the Bradford Engineering Society on this subject. The report bears on its face indications of partisan tendencies which compel us to regard it with grave suspicion. Why, for instance, wherever possible, are saving clauses inserted to discount the advantages of electrical driving? Where are "known methods of destroying synchronous vibrations" employed? Where is "some form of power meter" worthy the name in use in connection with a mechanical drive? The Committee has been nearly two years at work, and yet produces no details of tests or other data. Were the members of the Committee unanimously in favour of the conclusions put forward in this report? The impression left upon our minds is that the report constitutes merely an attempt to "damn with faint praise" electric driving, and we regret to have to say that we have no confidence in its findings, nor can we regard it as a serious contribution to knowledge.

National Institution of Apprenticeship.—The first list of contributions to the funds, in response to the Lord Mayor's recent appeal, amounts to upwards of £470; but a sum of £13,000 is needed. Donations may be sent to the Lord Mayor, the Right Hon. Lord Avebury, 15, Lombard Street. E.C., or to the Hon. Secretary, Mr. J. S. Ballin, 39, York Place, Baker Street, W.

Glasgow and Unemployed.—The various departments of the T.C. have been asked to report on what work they can provide for the unemployed during the incoming winter, when a continuance of the distress is expected. The Tramways Committee reports that about 50 men will be required in connection with the roads leading to and the erection of the proposed new car depôts, while the Electricity Committee states that about 100 men will be employed for four or five months in connection with the new extension of the generating station at Port Dundas (already reported in the REVIEW).

Copper.—European visible supplies, as shown by Messrs. Merton's circular, continue to rise. The return for October 15th is 96,612 tons, an increase of 2,761 tons on that for the end of September. About 2,000 tons of this increase is to be found in Standard copper in English ports, the remainder being afloat from Chile and Australia (increase 500 tons). So far as can be judged from the mid-monthly figures, American supplies are below the average, Spanish to this country considerably so, while shipments from Chile and Australia remain steady.

Ice-Making Machinery.—A correspondent having inquired the cost and size of plant, space occupied and power required to produce 1 ton of ice per day, with a motor-driven compressor, Mr. F. H. Davies replies as follows:—

Replying to "L. E. W.'s" inquiry: Without a full knowledge of the local conditions, it is impossible to say which would be the best type of machine to employ for producing 1 ton of ice per day. Both ammonia and CO_2 plants have, to some extent, their special sphere; and while the former is, perhaps, more extensively used, there are circumstances under which CO_2 might be preferable. On this point it would be best for "L. E. W." to consult a prominent firm of manufacturers making both types, laying before them the full circumstances of the case. With regard to the remaining queries: assuming an ammonia installation, the initial cost of a motor-driven plant of the above capacity per 24-hour day, complete with a charge of chemicals, would be approximately £235. The power required would be 5 h.p., and the floor space occupied by the ice tank and compressor about 10 ft. × 13½ ft. The motor can, of course, be fixed to the ceiling or the wall, but if both these alternatives are impossible, floor space must be allowed for the motor and its drive. The particular machine the writer has in mind turns out the ice in 17-lb. blocks measuring approximately 3 in. × 7 in. × 24 in.

With regard to the expense of running: in addition to the cost of current, repairs, wages, depreciation allowance and capital charges, it is necessary to take into account the cost of the condensing water. With a 20-cwt. machine about 150 gallons of water per hour will be required, and unless it can be used for other purposes after having passed through the machine, it will have to be wasted. There are also further items for ammonia and sealing oil for the glands, which, together, may amount to about £5 per annum.

Holmes v. Associated Newspapers, Ltd.—With reference to the judgment in this action, which is reported on another page, we are informed as we go to Press that notice of appeal is being given.

The Departmental Committee on Electricity in Mines.—It is announced that the Home Secretary has appointed a Departmental Committee to inquire into the working of the existing special rules for the use of electricity in mines, and to consider whether any, and, if so, what, amendments are required. The Committee is composed of Mr. R. A. S. Redmayne, His Majesty's Chief Inspector of Mines (chairman), Mr. Charles H. Merz, and Mr. Robert Nelson, His Majesty's Electrical Inspector of Mines. It is stated that correspondence may be addressed to Mr. Nelson, at the Home Office.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Hoylake U.D.C. has decided to increase the salary of its electrical engineer, Mr. Turner, by £20 per annum.

General.—At Wednesbury recently, Mr. J. L. Andrews, electrical engineer at the Patent Shaft Works, was presented with an illuminated address and a cheque for £22, subscribed for by nearly 600 of the employés, on the occasion of his leaving the firm after 10 years' service.

Mr. George Mallet, late of the Bolton Electricity Works, has been appointed electrical engineer to the Afghan Government, with headquarters at Kabul.

Mr. Albert E. Wilkes, formerly engaged in the service of the D.P. Battery Co. and the Chloride Electrical Storage Co., has been appointed storage battery engineer to the Canadian General Electric Co., Ltd., of Toronto, who are sole agents for the Electric Storage Battery Co., of Philadelphia.

Alderman T. B. Watson, Mayor-Elect of Stockton-on-Tees, is head of the firm of T. B. Watson & Son, electrical engineers, Bishopton Lane.

Mr. E. S. Franklin, chief electrical engineer of the Bengal-Nagpur Railway Co., who is at present staying in London (communications will reach him if addressed c/o the company, at 132, Gresham House, E.C.), will conclude his nine months' furlough in England shortly. He will return to India early in December, and would like to receive from manufacturers particulars of electrical apparatus specially applicable for use in locomotive workshops, and also telegraph and telephone work. The Bengal-Nagpur Railway Co. now have extensive workshops worked entirely by electricity on the d.c. 220-volt system. Mr. Franklin is specially interested in any advances recently made in the application of electricity to tool hardening and tempering furnaces, driving portable tools, control gear for large motors, lighting of shops, &c.

Obituary.—Francis Hastings Medhurst.—It is with profound regret that we record the untimely death of Mr. F. H. Medhurst, B.Sc., M.I.E.E., which occurred under most tragic circumstances on Tuesday morning at the King's Arms Hotel, Croydon, at the age of 38 years. From the Press reports it appears that the deceased gentleman was originally educated for the Indian Civil Service. He was apprenticed to Messrs. C. A. Parsons & Co., of Newcastle-on-Tyne, and some 16 years ago—at the age of 22—he opened an office at Westminster as a consulting electrical engineer. It was in this capacity that he was engaged in partnership at Victoria Street, S.W., as Medhurst & Brewer, at the time of his death. During his electrical career he had acted as consultant for a number of undertakings in this country and abroad, the original municipal and workhouse installations at Fulham being among them. In recent years, however, he had turned his attention enthusiastically to politics, and twice he unsuccessfully contested West Islington Parliamentary seat in the Unionist interest. He was the founder of the Trade Unionist Tariff Reform Association, and was only recently adopted as the Conservative candidate for Borough of Stafford. Recently Mr. Medhurst had been spending a good deal of his time abroad. It appears that he left his office last Saturday with the intention of journeying to Paris, but it seems that he never went there. On Monday night he engaged a room at the hotel named, and next morning, after writing a letter to the landlord apologising for the trouble to which he was putting him, he, it is reported, shot himself in the head, death ensuing a few minutes after his admission to the Croydon Hospital.

Mr Oswald Haes, M.I E.E., to whose death we alluded briefly in our last issue, had been in ill-health for several years, and was only 44 years of age. Supplementing the particulars which have already appeared regarding his life and work, we are now able to add that in October, 1904, Mr. Haes attended the Electric Conference in Melbourne as the engineer of the Brush Co. at Sydney. In July, 1896, he installed the electric light in the steamship *Airlie*, belonging to the E. & A. Co. at Sydney. In August, 1901, he read a paper before the Electrical Association of New South Wales, on "Electric Power Transmission Plant at Rotorua, New Zealand," and in June, 1904, he opened a discussion at a meeting of the Electrical Association on "Economies in Electricity Supply Stations." In July, 1904, Mr. Haes was associated with the installation of the new electric light system of Sydney.

NEW COMPANIES REGISTERED.

Magneto Co., Ltd. (105,528).—This company was registered on October 21st, with a capital of £500 in £1 shares, to acquire the business belonging to H. W. van Raden and J. J. Horne, formerly carried on by them at Dreadnought Works, Phillip Street, Aston, as the Magneto Co., and to carry on the business of magneto and electrical manufacturers, dealers and inventors, manufacturers of and dealers in motor-cars, engines and fittings, &c. The subscribers (with one share each) are:—J. Woodward, 92, Station Road, King's Norton, accountant; Dorothy L. Shepherd, 91, Jakeman Road, Balsall Heath, Birmingham, typist. Private company. The number of directors is not to be more than five: J. J. Horne is the first. Registered office, Dreadnought Works, Phillip Street, Aston.

Howe Electrical Engineering Co., Ltd. (105,542).—This company was registered on October 22nd, with a capital of £5,000 in £1 shares, to take over the business carried on at 16, Redcross Street, and 14a, Moor Street, Liverpool, and at 24, New Road, Blackburn, as the "Howe Electrical Engineering Co." The subscribers (with one share each) are:—S. Lord, 20, Roxburgh Avenue, Birkenhead, electrical engineer; L. F. S. Siogton, 47, Hamilton Terrace, St. John's Wood, N.W., electrical engineer. Private company. The first directors are S. Lord, J. W. Garsden, 5, Hope Terrace, Duke's Brow, Blackburn, and L. F. S. Sington. Registered office, Mersey Railway Buildings, 18, James Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issue on March 29th of £2,000 and on May 20th of £2,000 debentures, parts of a series of which particulars have already been filed.

Electrolytic Alkali Co., Ltd. (64,360).—Issue on October 11th of £3,200 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Paris Compressed Air Co.

At the end of May reference was made in this journal to a reported transaction between a French syndicate headed by the Société Générale and the Banque de Paris et des Pays Bas and a German group in regard to the latter's extensive holding of shares in the Compagnie Parisienne de l'Air Comprimé, Force Motrice et Eclairage Electrique. Negotiations on the subject were certainly in progress at the time, but the French group were indisposed to accept the terms proposed by the group led by the Disconto Gesellschaft, and the operation was not completed. The negotiations were, however, recently re-opened, and it is understood that the French banking institutions have now accepted the conditions proposed a few months ago whereby the shares will be disposed of at the rate of 145 per cent., which will yield the Disconto Gesellschaft a book profit of from £250,000 to £300,000.

The transaction recalls the fact that the Paris lighting company in question was very largely of German origin; it has indeed been termed a German undertaking. In 1890 the Disconto Gesellschaft formed the Internationale Druckluft und Elektrizitäts Gesellschaft with a share capital of £1,500,000. The company acquired the patents of Victor Popp, of Paris, and the Compagnie Parisienne de l'Air Comprimé was constituted to work them, the former company holding the majority of the latter's shares. Owing to unfavourable results the Paris company was compelled to reconstruct its share capital in 1898 by reducing it from £800,000 to £320,000, and then raising it to £1,000,000. The new shares were taken over by the parties principally interested, who had to renounce a claim for £348,000, represented by interest and money due. The Internationale Druckluft und Elektrizitäts Gesellschaft had to subscribe £492,000 of the new shares and release £260,000 in interest and money due, whilst the company's total loss, including that resulting from the reduction in the share capital, amounted to £600,000. As a consequence the International Co. in turn was compelled to reduce its capital by one-half, and the name was changed to that of the Internationale Elektrizitäts Gesellschaft.

Since the reconstruction of the finances of the Compagnie Parisienne de l'Air Comprimé, the position of the undertaking has improved, not from the compressed air business but from the lighting concession which expired in 1907, and was extended to 1913. No dividend was paid down to the year 1906, the profits being allocated to a special reserve fund which amounted to £1,360,000, and out of which the sum of £200,000 was repaid on old advances, and thus enabled the International Co. to return this amount to its shareholders. The Paris Co. was able to distribute 6½ per cent. to its proprietors in each of the years 1906-7 and 1907-8. As the operations of the International Co. in the course of years were limited to its holding in the Paris Co., it was decided to dissolve it in 1908 in order to obviate expenses, and the shares were accordingly transferred to a group under the lead of the Disconto Gesellschaft, the first liquidation balance-sheet showing security assets of £461,400 representing substantially the value of the interest in the Paris Co.

It is considered that the present assumption of the shares by French banking interests is principally due to the circumstance that the concession held by the various electric lighting companies in Paris will expire with the year 1913, when a new company—the Compagnie Parisienne de Distribution d'Electricite—will control the supply, and in which the compressed air company has secured a large interest. The new company is financed by the Société Générale and the Banque de Paris et des Pays Bas which are also the principles in the acquisition of the shares from the Disconto Gesellschaft. On the other hand, the German interests have preferred to dispose of their holdings at a profit, rather than keep them, as the social conditions in Paris, particularly the recurring strikes, might act as an obstacle to the further development of the undertaking in that city.

Drake & Gorham, Ltd.

At the annual meeting held on Wednesday last week, Mr. B. M. Drake, in moving the adoption of the report (see Electrical Review, October 15th, page 627), said that the financial results were not as favourable as those of the previous year, and this would scarcely come as a surprise when the depressed state of the country during the period was borne in mind. The prevailing sense of insecurity amongst owners of property, and the necessity for avoiding anything in the nature of a luxury, had caused a reduction in turnover, besides which the stagnation in trade, especially in Lancashire, had stopped the firm's progress in the electrification of mills. Owing to the new conditions brought about by the advent of metal lamps, the value of individual contracts was enormously reduced; and although a considerable influx of business in lighting small houses was anticipated (for the public were beginning to appreciate the fact that electric light was now the cheapest form of illuminant, and undoubtedly the best to install even in the smallest houses), yet it must be remembered that these small houses required as much individual attention as larger contracts, so that it remained to be seen whether a corresponding advantage would accrue to the company from a financial point of view. In any case, the cost had hitherto been the deterrent to a more general adoption of electric light, and that objection might now be taken as having been removed. The firm's trade department for the wholesale supply of metal lamps to the trade and large users had been very busy, a number of important contracts having been secured. This department was worked independently, so as to remove any scruples which contractors might have in dealing with possible rivals. From the large increase in the number of accounts that had been opened with contractors, it was evidently appreciated not only that their interests were safeguarded but that there was a distinct advantage in dealing with a firm which was thoroughly conversant with their requirements under all conditions. In the motor-car department arrangements had been concluded during the year, in conjunction with Messrs. Thrupp & Maberly, for working the sole agency for the Riley motor-car for the southern counties and a general agency elsewhere. They were, however, also acting as buying agents for any well-known make of large or small cars. The chairman proceeded to give names of some of the principal clients for whom lighting contracts had been carried out during the year. They had equipped with light and some power a large bleach and cotton works at Milford for the English Sewing Cotton Co., and had acted as buying agents for well-known mining companies in Africa. A list of contracts now in hand was next given. The firm's factory had, in addition to meeting their own requirements, manufactured switchboards and other apparatus for the War Office, Buckingham Palace, Houses of Parliament, Royal Hospital, Chelsea, Maidstone Corporation, Buxton District Council, Mexborough Corporation, Duke of York's Schools, Dover, and others. As a result of their experience with suction-gas producers for use in connection with gas engines, they had been able, in conjunction with a well-known expert, to place upon the market a producer of their own. A number of these had been put to work, and they were giving better results than they had been able to obtain with any other make on the market. Although the dividend was below what it had been in previous years, this was due to special conditions which he trusted might soon be changed. Their aim was still, as ever, to do only first-class work at the lowest possible figure consistent with the use of materials and labour which would maintain their reputation. He felt sure that the moment the general condition of the country improved they would be able to show better returns to the shareholders.

The report was adopted, and a dividend of 2½ per cent. on the ordinary shares was approved.

Edison & Swan United Electric Light Co., Ltd.

The directors' report states that the net revenue account for the year ended June 30th, 1909, shows that the sum of £26,836 has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £15,702; £5,500 has been set aside as depreciation on freehold and leasehold property, plant and tools; £4,000 has been applied in writing down values of stocks, and the sum of £1,213 has been reserved on account of bad and doubtful debts. The result, as shown in the net revenue account, is a credit balance of £421, to which must be added the sum of £9,606 brought forward from the previous year, thus making a total of £10,027, which the directors propose to carry forward. Cost of establishing the business, goodwill, &c., £390,432, has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1909, less depreciation charged in net revenue account. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to be satisfactory, and has paid a dividend on its shares of 7 per cent. for the year ended December 31st, 1908. Its indebtedness to this company has been reduced during the year by £155. There has been expended on capital account during the year ending June 30th, 1909, £19,813, almost entirely on account of additions to buildings and plant in connection with the manufacture of metal-filament lamps. The manufacture of metal-filament lamps has been considerably extended during the year, and the satisfactory results attained justify the directors in looking forward to a large and remunerative trade in the future. The directors regret to announce the death of their colleague, Mr. H. Wolfenden, jun. Mr. Wm. Murray has been elected to fill the vacancy. Mr. Eustace C. Quilter has also been elected a director.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Northern Light, Power and Coal Co.—$2,000,000 first mortgage 5 per cent. 20-year gold bonds.

To appoint a special settling day in:—

Marconi's Wireless Telegraph Co.—Further issue of 25,569 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 625,081 to 652,649.

And to allow the following securities to be quoted in the Official List:—

Edmundson's Electricity Corporation.—£55,543 5 per cent. prior lien debenture stock.

Underground Electric Railways Co. of London.—£1,000,000 4 per cent. first power house debentures, Nos. 1 to 2,500 of £100, 2,501 to 3,000 of £500, and 3,001 to 3,500 of £1,000 each.

Prospectuses.—*The Rubber Estates of Kedah, Ltd.*—This company has been offering for subscription 700,000 shares of 2s. each at par. It is acquiring estates in the State of Kedah, on the bank of the Krian River, which divides Kedah from Perak Territories, Fed. Malay States.

Lok Kawi Rubber, Ltd.—100,000 guaranteed shares of £1 each have been offered for subscription. The concession to be acquired is in British North Borneo. 5 per cent. per annum is guaranteed by the Government for six years.

Clyde Valley Electrical Power.—At the half-yearly meeting held in Glasgow, Mr. James Mackenzie presiding, it was reported that the accounts showed a credit balance on net revenue account on the half-year's working of £4,084, which had been carried forward. Contracts for the supply of power to the extent of 27,725 H.P. had been entered into as at June 30th, 1909, an increase of 3,341 H.P. on the half-year.

Monte Video Telephone Co., Ltd.

The annual ordinary general meeting was held on Wednesday at Winchester House, Old Broad Street, Mr. Chas. Lock presiding.

In moving the adoption of the report (see Electrical Review, October 22nd, page 667), the Chairman said that a comparison of the report now before them with that of the previous year would reveal a steady expansion in the company's business. The gross receipts from all sources amounted to £43,045, as against £39,261 for the previous year, an increase of some £3,800. The interest on securities was about the same. On the other hand, the working expenses had increased by some £3,000. That figure, however, included the £500 paid to their late chairman, and also included the special payment to Sir John Gavey in connection with his visit to Monte Video at the request of the board. There was also a further expense in the removal of lines caused by the pulling down of old houses in the town, which were being rebuilt on more modern lines. The increase in London office expenses was trifling, and the amount under the item of income-tax was slightly larger. The net profit for the year was £19,931, as compared with £19,400 for the preceding year, or an increase of over £500. In past years, out of this balance, they had been in the habit of appropriating an amount to the reserve fund. This year, however, they had taken the same amount, but had placed it to "depreciation." It was merely a matter of account, but if they succeeded in obtaining a concession from the Government to lay an underground plant, it would naturally entail some capital outlay, and this fund would be used for the purpose. They proposed to pay a final dividend of 2½ per cent. on the preference shares, and 3 per cent. on the ordinary, which, with the interim dividend already paid, would make a total dividend for the year of 5 per cent. on the preference and 6 per cent. on the ordinary shares. They had been in the fortunate position for the third year in succession, of declaring a 6 per cent. dividend on the ordinary shares. He thought they would all admit that was a satisfactory return. Turning to the balance-sheet, the "value of the property and capital outlay" up to July 31st, 1909, was £212,071. The real estate in Monte Video stood at precisely the same figure as last year. The investments at cost, showed a slight increase of £12,000, and their total investments for which they paid £12,688, at the present moment had a value of some £14,000. The liquid assets, debts, bills receivable, and cash, stood at £17,400, as against £10,800 for the preceding year. He thought from the figures he had given them they would agree with him that the business showed signs of steady progress. At the same time, however, he would point out that it was a business which required careful and close handling and economical managing for it to turn out profitable. The chairman then proceeded to deal at length with the question of the proposed installation of a Government undertaking, and a concession to the company for an underground plant. He said that immediately the board heard that the Government had retained an English engineer to report upon the feasibility of the Government installing a plant, they sent out Sir John Gavey, their consulting engineer, to Monte Video. That gentleman, in company with the board's legal advisers, took steps to urge upon the public authority the fair and legitimate claims of the company. So far the question had not been discussed by the legislative body, but the company understood that the President had recommended that body to consider it during the extraordinary session which was now sitting. He did not believe that the matter had been considered up to that moment, as they had heard nothing from their local representatives. It seemed to the board and to their legal advisers in Monte Video that the public had nothing to gain by the installation of a Government system. To administer a telephone system with satisfaction required a carefully-trained staff, which could not be improvised at short notice. Moreover, it appeared to the company that the profits of the business were never very large. One would therefore think that the Government would hardly find sufficient inducement to invest public money in a telephone system, and so far as the directors had been able to learn, out of a considerable amount of money voted by the Chamber for public purposes, no portion of it had been appropriated for the provision of a telephone system. Having regard to all the circumstances, they were not unhopeful that businesslike counsels would ultimately prevail, and that a concession would be granted to that company, which had for so long sought to give an efficient and up-to-date service to the Monte Video public.

Mr. G. Le Marchant seconded the motion, and the report was adopted.

Cuba Submarine Telegraph Co., Ltd.

Mr. C. W. Parish presided on Wednesday at the offices, 58, Old Broad Street, over the seventy-sixth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, October 22nd, page 667), the Chairman said it represented the busy period in Cuba when the sugar mills were hard at work, and their produce was being dispatched to various ports for shipment. The success or failure of the sugar crop was naturally of extreme importance to the island, and although at one time it was feared that the prospect of a large crop was somewhat doubtful, yet a period of favourable weather during the harvest saved the situation, and the actual result turned out to be quite satisfactory. On the other hand, the tobacco crop in the western portion of the island was not good, and fell short of the previous year. Generally speaking, the conditions of the island remained much the same, which explained why their traffics were also about the same this year as last year. Although their revenue came largely from through traffic, yet they found that generally the same conditions which maintained in the island of Cuba existed also further south, excluding, of course, those occasions when earthquakes, cyclones and political disturbances brought about a special rush of Press and private traffic. The earnings for traffic receipts amounted to £15,926, as compared with £16,352 last year—a decrease of £426. The interest for investments was £1,772, against £1,719, and, with transfer fees, they finally arrived at total receipts of £17,706, against £18,079, or a reduction of £400. Really the reduction was less than that, because in the sum of £16,352 was included £194 belonging to the previous half-year, and, consequently, the decrease in traffic only amounted to £232. On the other side of the account they would find that the expenditure amounted to £6,635, against £6,523 in the corresponding six months of last year, and the slight increase was more than accounted for in the item for expenses at stations, and was due to some small cable repairs which figured at £524. The results enabled them to place £3,000 to the reserve fund, pay the usual dividend at the rate of 10 per cent. on the preference shares, amounting to £3,000, and to pay a dividend on the £160,000 ordinary share capital at the rate of 6 per cent. per annum free of income-tax. He thought they might again be satisfied with such results, especially in a period when, generally, business from one cause or another was greatly depressed in many ways. Their reserve fund now stood at the respectable figure of £114,000, but they would not let it stop there, for they had to remember that each year increased the age of their cables, and the reserve fund contained the provision they made for their gradual depreciation. Most of them were acquainted with the working of cable companies, and knew the way to maintain the value of their property was to have a strong reserve capable of meeting any calls which might be made upon it. All the cables were in good working order, and they had no difficulty in dealing rapidly and accurately with all the traffic they had. In conclusion, the Chairman mentioned with great regret that he had asked his colleagues to relieve him of the duties of chairman, and Mr. Keith had agreed to take his place. He had been a director for 18 years and chairman for 14, and there was no board more united in their policy and in the conduct of their business. They had always worked together in perfect harmony to the best of their ability for the good of the company, in which they had always been greatly assisted by their most efficient secretary, Mr. Scott. Mr. Keith had been closely connected with the company for 33 years, either in Cuba or in this country.

Mr. Geo. Keith seconded the motion, and it was carried.

Replying to a Shareholder, the Chairman said he was not retiring from the board, but he had not been well of late, and had to knock off some of his work.

Allis-Chalmers Co.

The annual report for the year ended June 30th, 1909, as quoted in the *Electric Traction Weekly*, shows that total earnings, after deducting cost of manufacturing and selling, taxes, general expenses, &c., were $1,809,009; and net earnings were $135,431. During the year the company suffered with other industrial corporations from a business depression, which, existing with fluctuating severity for three-quarters of the preceding year, continued with little change throughout the first half of the fiscal year ended June 30th, 1909. This condition was reflected in the volume of the company's sales, which compelled the works to be operated during the year at about 50 per cent. of their normal capacity, and although improved methods decreased the cost of production, yet the fixed charges (interest, taxes, insurance, depreciation, &c.), necessarily continued nearly constant, and prevented the company from showing for the year larger net earnings. New business booked commenced to show substantial gains in January last, and for the last half of the year averaged per month nearly 65 per cent. more than the monthly average for the first half. This increase with advancing prices has continued to the present time.

In a supplemental report it is stated that for the three months of the current fiscal year the expectations expressed in the annual report of an "increasingly heavy volume of orders," have been realised to the extent of a regular increase in amount for each month. "In September the total amount of business booked exceeded every month but one since the organisation of the company, and for the present month (October) there was an equally favourable prospect."

Parsons Marine Steam Turbine Co.—The report for the year ended June 30th states that the profits, after providing for depreciation on buildings, plant, machinery, and office furniture, upkeep of patents, &c., and transferring £5,171 to the experimental work account and £5,000 in reduction of patent rights account, amount to £26,699. The amount available for distribution is £36,941. The directors recommend a dividend at the rate of 10 per cent. per annum (of which an interim dividend of 5 per cent. has been paid) and a bonus of 2½ per cent., leaving £10,531 to be carried forward.

Western Telegraph Co., Ltd.—The directors have, after transferring £90,000 to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund, decided to recommend a final dividend of 3s. per share, making with the previous distributions, a total dividend of 6 per cent. for the year ended June 30th, 1909, and also the payment of a bonus of 2s. per share, both free of income-tax. The balance of the account is carried forward.

MARKET QUOTATIONS.

Wednesday, October 27th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochlorio	per cwt.	5/-	..
a	,, Nitric	,,	22/-	..
a	,, Oxalic	,,	28/-	..
a	,, Sulphuric	,,	5/6	..
a	Ammoniac, Sal	,,	42/-	..
a	Ammonia, Muriate (crystal)	per ton	£29	..
a	,, ,,	,,	£30	..
a	Bleaching powder	,,	£5 10	..
a	Bisulphide of Carbon	,,	£18	..
a	Borax	,,	£16	..
a	Ferro-Silicon (50 %)	,,	£11	..
a	Copper Sulphate	,,	£18 10	..
a	Lead, Nitrate	,,	£26 10	..
a	,, White Sugar	,,	£23 10	..
a	,, Peroxide	,,	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (75/80 %)	per ton	£20	..
a	,, Chlorate	per lb.	3½d.	..
a	,, Perchlorate	,,	3¾d.	..
a	Potassium, Cyanide	,,	7d.	..
a	Shellac	per cwt.	75/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	,,	£6 10	..
	,, Recovered	,,	£5 10	..
a	,, Lump	,,	£5	..
a	Soda, Caustic (white 70 %)	,,	£10 15	..
a	,, Chlorate	per lb.	3⅝d.	..
a	,, Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks	per lb.	3d.	..
a	,, Cyanide (basis 100 %)	,,	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£75	..
b	,, Wire, in ton lots	,,	£112	..
b	,, Sheet, in ton lots	,,	£120	..
p	Babbitt's metal ingots	,,	£50 to £136	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c	,, Tube (brazed)	,,	8¾d.	..
c	,, ,, (solid drawn)	,,	7¼d.	..
c	,, Wire, basis	,,	6½d.	..
c	Copper Tubes (brazed)	,,	8¾d.	..
c	,, ,, (solid drawn	,,	8¾d.	..
g	,, Bars (best selected)	per ton	£70	£1 dec.
g	,, Sheet	,,	£70	£1 dec.
g	,, Rod	,,	£70	£1 dec.
e	,, (Electrolytic) Bars	,,	£60 10	..
e	,, ,, Sheets	,,	£77	..
e	,, ,, Rod	,,	£65 10	..
e	,, ,, H.C. Wire	per lb.	7⅞d.	..
f	Ebonite Rod	,,	3/3	..
f	,, Sheet	,,	6/-	..
n	German Silver Wire	,,	1/6	..
h	Gutta-percha, fine	,,	5/6 to 6/6	..
h	India-rubber, Para fine	,,	9/-	3d. inc.
j	Iron Pig (Cleveland warrants)	per ton	51/3	6d. dec.
l	,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g	Lead, English Ingot	,,	£13 5 to £13 10	5/- dec.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£8 17 to £8 17 6	inc.
d	Mica (in original cases) small	per lb.	6d. to 1s.	..
d	,, ,, ,, medium	,,	2/6 to 4/-	..
d	,, ,, ,, large	,,	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	,,	1/- to 1/1½	..
p	,, ,, rolled bars & rods	,,	1/1½ to 1/3	..
p	,, ,, rolled strip & sheet	,,	1/2½ to 1/6	..
o	Platinum	per oz.	111/6	variable.
e	Silicium Bronze Wire	per lb.	9d.	..
r	Steel Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	,,	£135 10 to £136 10	£1 inc.
n	,, Wire, Nos. 1 to 16	per lb.	1/9	..
p	White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k	Zinc, Sh't (Vieille Montagne bnd.)	,,	£27	10/- inc.

Quotations supplied by—

a	G. Boor & Co.	h	Edward Till & Co.
b	The British Aluminium Co., Ltd.	j	Bolling & Lowe.
c	Thos. Bolton & Sons, Ltd.	k	Morris Ashby, Ltd.
d	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd.
e	Frederick Smith & Co.	m	W. T. Glover & Co., Ltd.
f	India-Rubber, Gutta-Porcha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
g	James & Shakspeare,	o	Johnson, Matthey & Co., Ltd.
		p	The Phosphor Bronze Co., Ltd.
r	W. F. Dennis & Co.		

Hurst, Nelson & Co, Ltd.—According to the *Times*, the report for the year ended July 17th states that the accounts, after deduction of repairs, directors' fees, management salaries, and all other charges, show a gross profit of £33,283, and deducting income-tax, interest on the purchase price of the business from July 18th, 1908, till settlement, and bank interest (£9,270), depreciation on machinery, plant and wagon stock (£11,903), and portion of expenses of forming the company (£1,200), there is a balance of £10,910. The directors recommend a dividend at the rate of 6 per cent. per annum on the preference share capital from May 15th to July 17th, 1909, placing to special reserve fund for security of dividend on preference share capital £686, and carrying forward £6,170.

Electrolytic Alkali Co.—The annual report, according to a financial contemporary, shows a net profit for the year, after allowing for depreciation, debenture interest, general upkeep, &c., of £11,919, making, with the balance brought forward, a credit balance of £22,174. There are now three years' dividends due on the preference capital. The directors propose to pay 12 months' dividend and to carry forward £15,177.

STOCKS AND SHARES.

Tuesday Afternoon.

The Stock Exchange has once more drifted into troubled waters. Three rises of the Bank Rate in as many weeks were quite enough to upset the balance of the markets. The usual over-trading evidences stand revealed in the shape of what the newspapers call an unwieldly bull account. Liquidation of this has led to losses that had to be made good by realisations of investment securities, and the consequence is that prices all round are either dull or weaker. Flickers of occasional revivals, however, show that all is not yet over between the Stock Exchange and its clients.

That improvements in electrical issues should this week be scarce as strawberries goes almost without saying. There are, in fact, very few departments in the markets to which the same remark would not be equally applicable.

Pronounced flatness in the Home Railway market was one of the first results of the rise in the Bank Rate to 5 per cent. A faint recovery set in early this week, but it failed to wipe out the whole of the previous losses of which the electrical stocks had had their full share. Metropolitan Consolidated and Surplus Lands stocks are both lower. Districts sagged away to 16¼. Underground Electric Railway 4½ per cent. bonds fell a point. City and South London eased off, but managed to regain the loss, the forthcoming revision of certain of the fares being put forward as one explanation for the support. There have been no alterations in Central London stocks.

Amongst electricity supply issues, the few changes are downward, except as regards a small further rise in River Plate Ordinary shares, which have risen to 1⅝. There are small declines in London Electric Ordinary and in Metropolitan Ordinary. The threatened closing of the Crystal Palace has been ignored as a market factor in any way, and none of the electrical companies' shares are affected. A slump in South African mining shares caused Victoria Falls Power Preference to ease off, but the reduction is extremely slight.

Directors of electricity supply undertakings might well make a note of the example of a well-known suburban gas company which, along with its demand notes for payment of the Michaelmas accounts, has distributed a little slip stating that it is about to issue some more of its stock, and inviting customers to apply for particulars. As an inexpensive way of making a new issue of stock, the procedure might commend itself to those interested in such matters.

Rio Trams at 90 are flat, showing a drop of 3 points. Mexico Tramways and the company's bonds are 1 down, while Mexican Light and Power Common and Preference are 1 and 2 points lower respectively. Canadian General Ordinary and Preferred have come into line at 120. British Columbia Electric Railway Deferred fell 1, after its substantial rise, but the Preferred gained a further 2 per cent. Anglo-Argentine Tramways are dull, both as regards the shares and the Debenture stock. British Electric Traction Preference maintained their improvement, and British Westinghouse 4 per cent. Debenture at 43 exhibits a gain of 1½. A little speculative buying was stimulated by the better reports, quoted here last week, which are being received as to the progress of the American Westinghouse Company.

As American Railway shares are jumping violently and irregularly, the trans-Atlantic wire varieties are mostly rather lower. Anglo-American Telegraph Deferred naturally gave way, and Direct United States shares are easier. Commercial Cable Debenture drooped, American Telegraph and Telephone capital stock fell 2. New York Telephone scrip has kept wonderfully firm, considering the circumstances, at 2⅞ premium for cash. Great Northern Telegraphs rose 30s.

Eastern Telegraphs and Eastern Extensions developed dullness, and West Coast of America shares are a trifle easier.

United River Plate Telephones reacted ⅛ after their good and steady rise. Monte Videos, however, are strong; although, on the other hand, Oriental Telephones are rather lower. In the National Telephone list, the only change is a fall of 1 in the price of the Deferred stock.

Manufacturing issues are quiet and featureless. The Edison and Swan issues did not move, on the announcement that the company will pay no dividend on its Ordinary shares. Electric Construction Debenture rose a point. Rubber shares are fluctuating freely, and the prices on balance show slight losses as compared with those of a week ago.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended October 1st, 1909, were 974,050, compared with 782,821 units in the corresponding five weeks of 1908.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Oct. 19th.	Closing Quotations Oct. 26th.	Business done week ended Oct. 26th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3 — 3½	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	95 — 98	95 — 98	95½	..	..	5 2 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	143 —145	..	..	—2	5 10 4
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3¼%	3⅞%	3½%	£3 4s.	61 — 63	61 — 63	..	..	..	5 3 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102 —103	102 —103	102⅜	102	..	5 16 6
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21¾— 22	21⅜— 21⅝	21 13/16	21	— ⅜	1 16 11
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	8	..	..	4 14 1
2,431,850	Commercial Cable, Stlng, 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88 — 90	87 — 89	89	..	—1	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝— 9⅜	8⅝— 9⅜	..	..	..	6 8 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½— 18¾	17½— 18½	..	..	..	5 8 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13⅛— 13⅝	13 — 13½	13⅛	..	— ⅛	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	127 —130	126 —129	128	127	—1	5 8 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	83½— 85½	85	..	— ½	4 1 10
1,396,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	105½	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11⅝— 12⅛	12⅛	11⅝	— ⅛	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10¼	..	..	5 8 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅝— 14⅛	13½— 14	13⅝	..	— ⅛	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26½— 27½	28 — 29	..	..	+1½	6 4 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	..	..	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 95	93 — 95	..	..	— ½	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	17/6	15/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— ⅞	13/16— 15/16	17/6	..	+ 1/16	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	13/16— 15/16	..	..	+ 1/16	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	108¼	107½	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	120 —122	122¼	120¼	+ 1	4 18 4
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10¾	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	5 9/16	..	..	4 7 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 15/32— 1 19/32	1⅜— 1½	28/9	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	..	..	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 — 7¼	6⅞— 7⅛	7 3/32	7 1/16	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 8 10
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	2½%	1 7/16— 1 11/16	1⅜— 1⅝	30/-	..	— 1/16	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13½— 14	13¾	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	15/-	13/9	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	3 %	6 %	6 %	8¾— 9¼	8¾— 9¼	9⅛	8 31/32	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½— 9½	8½— 9½	..	..	..	15 15 10
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Oct. 19th.	Closing Quotations Oct. 26th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝— 4⅞	4 9/16— 4 13/16	95/-	88/9	— 1/16	5 2
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 7/16— 4 11/16	4¼— 4½	85/-	..	— 3/16	5 6
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	92 —93	91 — 92½	92¾	91¾	— ½	4 6 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	20 %	4 7/16— 4 9/16	4 7/16— 4 9/16	90/-	88/9	..	4 7 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	½— 1	¾— 1¼	..	..	+ ¼	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	151 —156	150 —155	153	151	—1	5 3 3
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —126	123 —128	124	..	+2	4 13 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	110½	109¾	..	4 9 8
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	100 —102	103	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝— 1	⅝— 1	15/9	12/6	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2⅜— 2⅝	2⅜— 2⅝	50/-	46/8	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82½— 85½	82½— 85½	85	84½	..	5 9 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	62 — 66	60 — 64	..	..	—2	5 17 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼— 7⅝	7¼— 7⅝	..	..	..	7 0 8
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	¼— ½	¼— ½	..	..	..	Nil
1,616,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 43	42 — 44	43	42	+1½	9 1 9
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	4½%	4⅝— 5⅛	4½— 5	96/3	..	— ⅛	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜— 11⅛	10⅜— 11⅛	10 13/16	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5¾	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	5/6	5/8	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 1/16— 2 3/16	2 1/16— 2 3/16	43/1½	42/6	..	5 19 1
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	107 1/16	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	60 — 62	60 — 62	61¼	60	..	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	85½	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44¼	44	..	5 11 1
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅜%	1½%	30 — 31	30 — 31	..	..	..	4 16 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 19th.	Closing Quotations Oct. 26th.	Business done week ended Oct. 26th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	21/10½	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	20/9	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅙%	4⅙%	2½%	1½%	5/32 — 9/32	5/32 — 9/32	3/6	..	..	27 5 4
17,189	Do. "A" shares, 01—017,189	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8¼— 8¾	8¼— 8¾	..	..	..	5 14 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87 xd	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	18/-	15/-	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103¼	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13¼	12½— 13¼	..	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	15 — 15¾	15 — 15¾	15½	15 5/16	..	6 14 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2¼— 2¾	..	..	..	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	37¾— 38¼	37¼— 37¾	37⅝	37¼	— ½	1 6 6
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 —67	64 — 66	65	64	—1	4 3 4
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16½— 17	16 — 16½	16½	16	— ½	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 11/16	13/32 — 11/16	..	..	..	6 10 11
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	23/32 — 27/32	23/32 — 27/32	..	..	..	6 7 0
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½— 96½	94½— 96½	95½	94⅜	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	127 —130	126 —129	127½	126⅛	—1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	91 — 93	92⅞	91¾	—1	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	35¼	..	..	5 0 0
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 6
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102½—103½	103	102½	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	86 — 88	87¾	86⅛	—1	5 2 3
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	32 — 34	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Oct. 19th.	Closing Quotations Oct. 26th.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅜	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	8 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	3⅞— 4⅜	78/9	77/6	— ⅛	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	77/6	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	71/3	..	..	5 12 6
175,000*l*	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10⅜— 10⅞	10 15/16	10 7/16	..	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	12¼	12⅛	..	4 12 4
400,000*l*	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7⅞	7 13/16	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10 15/16	10⅞	..	5 7 10
400,000*l*	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	105 —108	106⅜	..	+1	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	4/4½	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅜— ⅞	⅜— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 91	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	100½	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	7⅛	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —101	..	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅞— 2¼	1¾— 2⅛	..	..	..	4 18 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅞— 5¼	4⅞— 5¼	5⅛	5 3/32	..	5 14 3
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	94	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛— 4⅝	4 — 4½	82/6	..	— ⅛	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	106½	..	..	4 3 4
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	84⅜	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	80 — 82	.	..	—2	6 1 11
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	72 — 76	71 — 75	72⅜	..	—1	4 13 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	105 —109	105 —109	107¼	107	..	6 8 5
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	85 — 87	87	85¼	—1	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4¾— 5¼	..	..	..	4 15 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	95/-	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 13¼	12¼— 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	6½	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1½— 1⅝	1 9/16 — 1 11/16	32/6	30/9	+ 1/16	4 14 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	104½	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000*l*	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜— 3	2⅜— 3	55/-	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	71½— 78½	74½— 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	15/16 — 1	29/32 — 31/32	18/9	..	— 1/32	5 3 11
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½— 9	8½— 9	..	..	..	5 11 1
61,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	5 3/16	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1909.

So far as the exports are concerned, the September returns of electrical business are rather disappointing.

The gross total for the month, amounting to £260,436, compares with £302,849 in August, and is the smallest since February; it includes some £34,132 worth of telegraphic material, deducting which we obtain £226,304 as the value of general business comparable with the amount recorded by us in September, 1908, viz, £224,913.

It is possibly some consolation to know that the month's business is still above the average of 1908.

The imports, with a total of £138,462, are some £8,000 in excess of the August total, but are less than the average obtaining in 1908, while the re-exports show an improvement on the month, standing at £17,662, as compared with £15,591 in August.

In the export section the electrical machinery returns exhibit a considerable decrease in value, and this also applies to telegraphic material; cables and telephonic plant, however, show an upward tendency.

The lamp imports have increased from £25,084 in August to £33,897 in September, cable and telephonic imports are also somewhat higher in value.

India, Natal and China proved very good customers during the month, while Germany, the States and France, in the order given, were the most prominent importers into this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	273	328	27	150	15	4,873	...	3	...	18	1,612	7,299
Germany and German West Africa	264	45	74	93	84	901	...	46	...	12	322	1,841
Netherlands and Java	323	648	24	104	114	531	...	7	...	15	5,970	5,736
Belgium	177	716	57	82	743	2,788	...	5	...	348	214	5,130
France and French West Africa	75	...	49	448	....	1,229	...	...	...	20	134	1,955
Portugal, Madeira, Portuguese Africa and India	226	224	63	233	51	2,355	409	...	16	46	973	4,596
Spain and Canary Isles	189	...	20	100	...	2,041	...	...	8	23	288	2,669
Switzerland, Italy and Austria-Hungary ...	46	40	10	54	1,069	3,313	...	334	...	112	890	5,888
Greece, Roumania and Turkey	88	74	74	26	50	309	33	69	...	9	156	888
Channel Isles, Gibraltar and Malta	99	137	12	12	...	137	466	22	...	28	1,573	2,486
U.S.A., Philippines and Cuba...	173	...	...	11	...	1,187	...	...	...	...	41	1,412
Canada and Newfoundland	275	1,823	81	333	1,181	161	3	52	...	...	531	4,440
Bahamas, British West Indies and British Guiana	21	20	45	...	...	342	...	38	...	93	...	559
Mexico, Gautemala, Nicaragua, Venezuela, Colombia and Panama	36	402	14	...	...	2,105	...	...	...	82	113	2,752
Peru and Uruguay	195	254	...	75	...	348	...	103	75	515	190	1,755
Chile	111	...	109	91	...	473	...	6	14	79	771	1,654
Brazil	698	905	541	284	273	7,932	961	46	18	7	2,570	14,235
Argentine	152	7,173	142	1,073	311	6,172	651	454	342	1,296	1,095	18,861
Egypt, Tunis and Persia	54	161	235	87	...	112	22	...	...	165	269	1,105
British West Africa and St. Helena	74	339	...	28	21	96	15	3	14	39	378	1,007
Cape of Good Hope	674	676	381	525	94	3,271	...	1,566	...	...	67	7,254
Natal	705	12,219	39	119	...	13,454	20	...	...	...	1,209	27,765
Rhodesia, Orange River Colony and Transvaal	2,134	3,389	98	757	15	1,649	...	305	66	67	159	8,639
Mauritius	23	...	...	33	...	...	5	8	...	...	15	84
China and Siam	1,669	848	158	510	142	5,237	26	503	34	99	13,970	23,196
Japan	241	2,168	250	320	556	3,718	740	341	...	3,432	391	12,157
India	958	7,475	1,916	1,084	558	17,835	1,333	1,147	172	1,321	273	34,072
Ceylon	38	21	29	33	86	220	330	231	...	59	...	1,047
Straits Settlements and Fed. Malay States...	321	526	9	167	90	676	96	28	...	211	174	2,298
Hong Kong	343	323	95	135	26	351	3	17	...	15	...	1,308
West Australia	177	132	...	144	11	200	...	12	...	...	...	676
South Australia...	490	1,737	21	177	161	1,070	430	146	...	432	...	4,664
Victoria	1,408	3,281	132	620	131	4,929	...	632	...	4,748	...	15,881
New South Wales	2,207	1,750	261	563	472	10,495	1,710	1,153	64	246	...	18,921
Queensland	60	242	39	42	...	1,279	148	...	...	37	...	1,847
Tasmania	16	...	...	...	...	270	...	...	...	...	...	286
New Zealand	977	4,227	167	560	131	1,411	160	41	...	4,615	1,784	14,073
Total, £	15,990	52,303	5,172	9,073	6,405	103,470	7,561	7,318	823	18,189	34,132	260,436

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£		£
Norway, Sweden and Denmark	...	...	9	5	...	455	...	338	...	3,843		4,650
Germany	847	14,187	2,894	24,689	2,134	18,786	863	1,652	4,062	12,199		82,313
Holland	...	8	14	3,073	5	29	...	...	51	18		3,198
Belgium	104	614	4	31	85	2,093	...	132	425	5,269		8,757
France	134	561	534	1,457	198	2,179	...	2,219	2,592	3,763		13,637
Switzerland	13	492	382	74	75	2,909	...	2	9	...		3,956
Italy	74	1,671	24	...	...	...	...	...	...	530		2,299
Austria-Hungary	25	385	38	271	...	70	...	8	472	128		1,397
United States	1,524	110	781	4,297	86	5,146	5,462	552	...	261		18,219
Total, £	2,721	18,028	4,680	33,897	2,583	31,667	6,325	4,903	7,611	26,011		138,426

Additional imports: Spain, carbons, £25; Canada, instruments, £3; New South Wales, goods, £8.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	2,276	1,189	...	2,691	...	4,952	...	197	242	6,115		...

Total Exports: £260,436. **Total Re-Exports: £17,662.** **Total Imports: £138,462.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

TRADE STATISTICS OF CHILE.

The following figures, showing the imports of electrical and similar materials into Chile during 1907, are taken from the Annual Consular Report on the trade of Chile, just issued; figures of increases or decreases, as against the previous year, are added for purposes of comparison:—

	1906.	1907.	Increase or decrease.
Coal.—	Tons.	Tons.	Tons.
From United Kingdom ...	744,000	1,089,000	+ 345,000
„ Australia	235,000	346,000	+ 111,000
„ Germany	24,000	32,000	+ 8,000
„ Other countries ...	17,000	35,000	+ 18,000
Total ...	1,020,000	1,502,000	+ 482,000
Acids—sulphuric, nitric, &c.	Kilogs.	Kilogs.	Kilogs.
From United Kingdom ...	33,000	175,000	+ 142,000
„ Germany	196,000	553,000	+ 357,000
„ France	3,000	27,000	+ 24,000
„ Other countries ...	2,000	74,000	+ 72,000
Total ...	234,000	829,000	+ 595,000
Earthenware, crockery, &c.—			
From United Kingdom ...	952,000	1,412,000	+ 460,000
„ Germany	1,401,000	1,180,000	— 221,000
„ France	43,000	52,000	+ 9,000
„ Other countries ...	288,000	188,000	— 100,000
Total ...	2,684,000	2,832,000	+ 148,000
Porcelain.—			
From United Kingdom ...	52,000	54,000	+ 2,000
„ Germany	462,000	396,000	— 66,000
„ France	32,000	46,000	+ 14,000
„ Other countries ...	29,000	19,000	— 10,000
Total ...	575,000	515,000	— 60,000
Iron and steel wire.—			
From United Kingdom ...	828,000	1,978,000	+ 1,150,000
„ Germany	4,194,000	6,656,000	+ 2,462,000
„ Belgium	844,000	1,585,000	+ 741,000
„ U.S.A.	2,126,000	4,996,000	+ 2,870,000
„ Other countries ...	86,000	77,000	— 9,000
Total ...	8,078,000	15,292,000	+ 7,214,000
Copper and bronze wire.—			
From United Kingdom ...	28,000	75,000	+ 47,000
„ Germany	119,000	250,000	+ 131,000
„ U.S.A.	30,000	57,000	+ 27,000
„ Other countries ...	1,000	3,000	+ 2,000
Total ...	178,000	385,000	+ 207,000
Lamps of various metals for electric and paraffin lights, and mining lamps.—			
From United Kingdom ...	44,000	34,000	— 10,000
„ Germany	114,000	116,000	+ 2,000
„ U.S.A.	26,000	29,000	+ 3,000
„ Other countries ...	20,000	23,000	+ 3,000
Total ...	204,000	202,000	— 2,000
Pipes and tubes of iron for drains, &c.—			
From United Kingdom ...	18,415,000	12,913,000	— 5,502,000
„ Germany	5,635,000	4,441,000	— 1,194,000
„ Belgium	1,919,000	4,093,000	+ 2,174,000
„ U.S.A.	271,000	611,000	+ 340,000
„ Other countries ...	591,000	5,000	— 586,000
Total ...	26,831,000	22,063,000	— 4,768,000
Cranes and lifting machines.—			
From United Kingdom ...	417,000	421,000	+ 4,000
„ Belgium	21,000	—	— 21,000
„ Germany	68,000	48,000	— 20,000
„ France	1,000	2,000	+ 1,000
„ Other countries ...	2,000	11,000	+ 9,000
Total ...	509,000	482,000	— 27,000
Machines for industrial uses.—			
From United Kingdom ...	2,670,000	4,239,000	+ 1,569,000
„ Germany	2,221,000	2,649,000	+ 428,000
„ Italy	14,000	46,000	+ 32,000
„ Other countries ...	977,000	1,809,000	+ 832,000
Total ...	5,882,000	8,743,000	+ 2,861,000
Railway coaches and cars.—			
From United Kingdom ...	6,699,000	4,436,000	— 2,263,000
„ Germany	1,923,000	4,552,000	+ 2,629,000
„ Belgium	4,541,000	8,542,000	+ 4,001,000
„ U.S.A.	175,000	556,000	+ 381,000
„ France	127,000	36,000	— 91,000
Total ...	13,465,000	18,122,000	+ 4,657,000
	1906.	1907.	Increase or decrease.
Locomotives and tenders.—	Kilogs.	Kilogs.	Kilogs.
From United Kingdom ...	538,000	2,472,000	+ 1,934,000
„ Germany	4,116,000	3,983,000	— 133,000
„ U.S A.	326,000	1,850,000	+ 1,524,000
„ Other countries ...	73,000	15,000	— 58,000
Total ...	5,053,000	8,320,000	+ 3,267,000
Electrical machinery.—			
From United Kingdom ...	546,000	1,422,000	+ 876,000
„ Germany	951,000	1,512,000	+ 561,000
„ U.S.A.	494,000	454,000	— 40,000
„ Other countries ...	22,000	44,000	+ 22,000
Total ...	2,013,000	3,432,000	+ 1,419,000
Mining machinery.—			
From United Kingdom ...	14,586,000	10,090,000	— 4,496,000
„ Germany	3,445,000	3,162,000	— 283,000
„ Belgium	16,000	247,000	+ 231,000
„ U.S A.	253,000	389,000	+ 136,000
„ Other countries ...	—	29,000	+ 29,000
Total ...	18,300,000	13,917,000	— 4,383,000
Rubber and gutta-percha goods.—			
From United Kingdom ...	42,000	35,000	— 7,000
„ Germany	46,000	44,000	— 2,000
„ France	10,000	9,000	— 1,000
„ Other countries ...	22,000	23,000	+ 1 000
Total ...	120,000	111,000	— 9,000

Kilog. = 2·204 lb.

THE NEW GUTTA-PERCHA CO., LTD.

In our issue of February 26th, 1904, we gave some interesting particulars regarding Gutta-Gentzsch, a cable-insulating material which the New Gutta-Percha Co. had placed on the market, and which, as a substitute for vulcanised rubber and gutta-percha, had obtained considerable success on the Continent.

At that time the company's operations were restricted to the manufacture of the insulating material which was made up into cables elsewhere.

This arrangement, however, did not prove a commercially workable one, and, therefore, with a view to competing in the British cable business on favourable terms, the directors decided to extend their Greenwich factory and add the necessary machinery for manufacturing cable throughout.

These extensions were carried out in 1907, under the guidance of Mr. A. E. Garbutt, who had joined the company as general manager. Mr. Garbutt brought with him a 20 years' experience in the cable business, and it is therefore not surprising that during the last 18 months the company's output has more than quadrupled, necessitating constant additions to machinery.

As to the exact composition of Gutta-Gentzsch—or Pernax, as one quality of this insulation is named—we are naturally in the dark, but its constituents include the finest quality Para rubber, and certain wax-like materials which are chemically treated in order to produce the desired consistency.

The first stage in the manufacture of Gutta-Gentzsch is the preparation of the pure para, which, after being soaked in water for some hours, is passed through a washing mill in order to get rid of grit and dirt.

The rubber is then fed into special masticating machines, together with a proportion of the chemically-prepared material to which reference has been made, the mixture subsequently passing through mixing mills and calenders, from which it emerges in thin sheets, black in appearance and highly tenacious in character.

It is then ready for wire-insulating purposes, and is passed on to the covering machines, which are specially designed for this material.

Amongst the machines in use here, we were particularly interested in a high-speed stranding machine for small cables, which is capable of turning out 6 miles of 7/22 conductor per day. There are also in the same shop ordinary stranding machines for medium sizes, and a large one for dealing with conductors up to 91 strands, this is also adaptable for laying up three-core cables, and for armouring with steel tapes or galvanised iron wires.

Three covering machines are provided; two of these are six-nozzle machines, driven by 16-H.P. motors, for applying the insulating material to single wires, small and medium-sized strands; the third is a large three-nozzle machine for dealing with the output of the large stranding machine previously mentioned, and is driven by a 20-H.P. motor.

These machines consist essentially of an enclosed die box, through which the conductors are drawn, and into which the insulating material is forced under pressure by feed rollers, this operation incidentally revealing the extraordinary tenacity of the insulating material even under the high temperature which results from frictional effects produced by the feed rollers.

Emerging from the die box, the covered conductors are drawn through tanks of cold water to solidify the insulation before being coiled on drums.

The cores are then carefully inspected and tested and afterwards taped or braided, according to requirements, and finally treated with preservative compound.

The taping and braiding processes are carried out in a braiding shop which contains winding frames, taping machines and 16 and 24-spindle braiders in sufficient numbers to cope with the output of the covering machines. The latest addition to the plant is a 32-spindle heavy braiding machine, for large cables up to 3½ in. in diameter.

These wires and cables are manufactured for ordinary purposes in three qualities, viz., 2,500 and 600-megohm grades, insulated with Gutta-Gentzsch, designed for use in situations where, prior to the introduction of this material, those insulated with vulcanised india-rubber of similar grades were the only suitable ones obtainable, and a third quality insulated with Pernax intended to compete with 600-megohm class "Non-Association" V.I.R.

As these insulations are free from sulphur, and do not undergo vulcanisation, it is not necessary to use tinned wires, and taping under the braid is not needed, the braid and preservative compound affording adequate protection under ordinary conditions. However, if required, tinned wires and tape are supplied at a small extra charge.

The dielectric is of the same radial thickness as specified by the Engineering Standards Committee, but the overall diameter is rather less than in other types of wires and cables, owing to the absence of tape. This is greatly appreciated by wiring contractors, as it enables them either to use smaller tubes and casings, or to draw a greater number into a given size. Other features which appeal to users are great flexibility and the fact that Gutta-Gentzsch withstands alternations of wet and dry without deterioration, which is of the greatest importance.

For high-tension work, Gutta-Gentzsch only is employed, and the cables are made up to specification or designed to suit any special requirements.

The works are provided with a 160-H.P. Marshall engine and Lancashire boiler, although the bulk of the machinery is normally operated by electric motors supplied from the South Metropolitan Co.'s mains; other indispensable features are a completely equipped test room, and the necessary stores.

It is somewhat of a habit in this country to regard a thing as new, and, possibly, untried, for the first 10 years or so of its existence, and it is, therefore, necessary to emphasise the fact that Gutta-Gentzsch insulated wire underwent prolonged and satisfactory tests by the German Postal authorities as far back as 1899; the material was also extensively tested in this country some five or six years ago with equally good results.

However, the average man is probably inclined to regard time as the crucial test of durability, and it is therefore interesting to note that several of the leading British railways have been regular users of these wires for the past six years; indeed, a portion of the company's Greenwich works was wired with its own product six years ago, and inspection shows that this is in excellent condition.

The company is now fully equipped for a large output, and judging by its *clientèle*—including, as it does, a dozen railways, some 50 municipal authorities, the National Telephone Co., and many large works, collieries and contractors—one can scarcely doubt that this dielectric is pushing rapidly into favour, despite the strenuous competition of the older forms of insulation. We are indebted to Mr. Garbutt for facilitating our inspection of the works and kindly explaining the special processes there carried out.

NOTES ON TRADE ABROAD.

(*Continued from page* 638.)

Our Electrical Business in India; Fiction and Fact.

In a report prepared in reply to a number of requests sent to him by American manufacturers of electrical machinery for information about the chances of making sales of their goods in India, U.S. Consul-General Michael, of Calcutta, told his countrymen that the "electrical machinery made in the United States is considered by electrical engineers in India as the best made in the world, and the same is true of electrical supplies." We would modestly suggest that this is just a trifle American in the manner of its expression. The Consul's figures, which follow, do not bear the mark of authority, he does not say they are "official," and we are inclined to regard them as more or less imaginary, as we show later. Is it not a wonder that we can get anything British in at all, and yet we do! Three years ago, 1906-7, the electrical machinery and goods shipped into India, according to this report, were valued at £372,000. Of this "it is claimed that British manufacturers furnished £75,000," and "*the bulk of the balance*, £297,000, went to the United States." We are interested to know why he says *it is claimed*, and further, we should like to know exactly what he means by the "bulk of the balance." Reference to our own Tables of Electrical Imports and Exports during the period, shows that our exports from this country to India were at least £328,000, exclusive of telegraph material and of trans-shipments; if that were all it tells quite a different story. It would be worth inquiring from what official source, if any, Mr. Michael's information was derived, and also whether there is anything in the method of classification which could lead him so far astray. To complete his own version, however, before we allude to what we believe to be more trustworthy British Blue Book statistics, and whether his figures be correct or not, we quote his statement showing how his £372,000 total is made up:—"Electrical machinery and goods shipped into Bengal, £122,700; into Bombay, £53,300; into Sind, £9,500; and into Burma, £56,400; other provinces helping to make up a grand total of £372,000."

Twelve to One.

Now let us refer to the issue of the Electrical Review for June 4th, 1909, page 922, in which appeared an article on the "Import Trade of India." We showed there by quoting from Government Blue Books that the electrical import figures for 1906-7 were:—

From the United Kingdom—Electrical instruments, &c., £296,612; electrical machinery, £154,265 = £450,877.

From the United States—Electrical instruments, £27,782; electrical machinery, £8,733 = £36,515. That is, the electrical imports into India from the U.S. were *one-twelfth* of those sent from the United Kingdom! The figures for the year 1907-8 are still more unfavourable to the United States, their total being only £21,897, while ours was £450,536.

Really, if these figures mean what we think they do, they do not indicate that U.S. electrical manufacturers are regarded by Indian electrical engineers as being "the best in the world." Consul Michael might be a safer guide for his American electrical countrymen if he were to quote from the Electrical Review, of London, next time he desires to send them statistics in "reply to a number of letters."

In Afghanistan.

In Afghanistan there are at Kabul and Quetta gold-mining and other industries established, including a modern boot factory, a new woollen mill; electric power supply is available at Kabul, and coal has been found not far off, though it is of inferior quality.

Small Indian Installations.

A U.S. Vice-Consul at Calcutta, reporting on electrical equipments and supplies, wrote as follows :—

> There seems to be an excellent opening in India for small electrical installations for furnishing light and running fans in country places, and in places away from power stations. A number of successful installations have recently been made for 25-volt lamps, one for which details are available, being arranged for 30 lights, and 8 electric fans. The battery is easily contained in an unused corner, and occupies floor space of 7 × 4½ ft. The power house containing the dynamo, which is driven by a small oil engine, is placed some distance away. The whole installation is a very compact one and is quite simple in operation. There is a large field for similar installations, and American electrical companies are urged to investigate this opening.

New Railways.

During the year 1908 there were opened in India 616 miles of new railway, bringing up the total mileage to 30,576 miles. Last March 2,992 further miles were either under construction or sanctioned. The railways had 525,583 employés, of whom 73,444 were Europeans. It is reported that the English hold on the market for rolling stock is not so great as it was. In regard to local manufacturing, the limit of the length of span of railway girders which may be purchased locally was nearly doubled recently. "Orders have been issued to three State lines for the gradual introduction of electric lighting in all first and second-class carriages." The American Consul adds :—

"Heretofore all structural iron and certain other iron and steel commodities used by the State railways, and, for the most part, other railways under Government control, were purchased in England, but the rule has been relaxed. This loosening up of the home influence must be regarded as noteworthy." Quite so, and if true, it must be seriously regarded by English manufacturers who do not nowadays expect to have things all their own way in the commercial struggle. Some extracts from the *Review of the Trade of India* appeared in the Electrical Review for October 9th, 1908, and these will be found of general interest.

Electricity for India's Coal Mines.

Turning to the possibilities that lie before us in the matter of electrically equipping the coalfields of India, the U.S. Consul-General at Calcutta stated not long ago that many of the collieries would have to put in new machinery, some of them requiring complete new equipment; this need led to the organisation in Calcutta of the Coalfields Power Syndicate with £140,000 capital, with the object of providing cheap power. This company in its prospectus stated that 10 per cent. of the coal mined in India was consumed at the mines for power, which, for 1907, would be a consumption of 915,296 tons, worth $3 per ton. The company proposed to sell electric current at 1 anna (2 cents) per unit, and it also proposed to handle up-to-date colliery equipments, which would be kept in stock in order to meet any emergency. It was believed that the gross revenue would be $113,666 for sale of power, and $31,150 from rentals of colliery equipments. The prospectus, from which we quote in order to indicate the position generally, stated—

> At the present time many collieries have to face an early replacement of much of their plant, and it is partly owing to this that the present demands on the syndicate for power are so large. It is only since the construction of the railways that the coalfields have been seriously worked, and although the progress for many years was slow, the development has been extremely rapid of late, as the following table of coal raised in Bengal will show :—

Year.		Persons employed.	Output in tons.	No. of companies.	Capital.
1904	...	14,896	7,058,980	28	$6,964,366
1905	...	33,496	7,234,103	33	7,916,152
1906	...	36,194	8,677,820	37	8,448,517
1907	...	39,365	9,993,348	77	15,358,000

> The above table shows that the number of companies and their capital employed in coal mining increased very slowly until 1907; since then the expansion has been very rapid, but, as will be noticed from the column of output, there has not yet been time for the new companies to develop their mines, and a large part of the increased capital is therefore not yet productive. A natural result of this expansion is the shortage of labour from which the coalfields are now suffering, and which is considerably restricting the operations of fully developed mines. In fact, as shown in the table, the number of miners available has not kept pace with the output, and shows little elasticity, in spite of a greatly increased demand. The slow development of the recently opened mines is also largely due to deficient labour.

Cauvery Falls.

Another Consular report for the year 1907-8 referred to the Cauvery Falls power scheme. This was undertaken, as our readers are aware, primarily for the purpose of supplying electric power to the Kolar goldfields, but it also supplies the lighting of Bangalore. It is stated to have proved a most useful and profitable investment. The net revenue from this source during the year was $500,853, which was a big return on the capital outlay. The gold mines which have been equipped with up-to-date machinery, made possible by the electric energy supplied by the Cauvery plant, yielded during 1907-8 $8,225,540, compared with $10,344,850 in the previous year. The cause of this decrease is not satisfactorily explained, although assurance is given that the decrease is in no sense to be taken as indicating the exhaustion of the mines.

Mills need Electrifying.

It is interesting to note from a further report that there are 26 jute mills near Calcutta, 24 of which in a recent year showed profits amounting to £740,000, the highest profit for a single mill being £8,270. If what we hear be correct, there will be interesting work for our firms in mill electrification shortly.

Tata's Iron and Steel Works.

The new steel mill of the Tata Iron and Steel Co. of India, which is the first in the country, and is being put up in Bengal, at Kahmati, will be on a large scale. The site of the works is some 20 square miles, and the construction of the works and necessary residential buildings involved the employment of 4,000 men, the construction of many roads, and a 45-mile railway was constructing last year. It had been hoped that the works would be ready to manufacture finished products by the end of December, 1910, but we are not sure whether that is likely to be accomplished. The electrical installation work, as was stated in our pages a few weeks ago (Elec. Rev., September 3rd), has been placed with Lahmeyer Electrical Co. The Tata Co. is partly owned by Americans, and from a U.S. report we gather that the engineer in charge of this vast enterprise, as well as his first assistant, are Americans, who have had practical experience in mill work near Pittsburg, U.S.A. The Tata Co. left the selection of the works equipment in their hands, also the selection of works officials and staff, and an American Consul may therefore feel justified in adding, "This being true large orders have been, and will probably be, placed for modern mill machinery in the United States," for that is the way things often do eventuate. The placing of the electrical installation with a Continental firm, however, is an exception, the reason for which has not reached us.

Burma.

Consul E. C. Wakefield, of Rangoon, reporting on the opening for machinery, says that when the tide turns business is expected to resume normal conditions. Here we may remark that the latest news respecting Indian trade is to the effect that there are satisfactory signs of expansion, and the season's crops promise to be above the average. "This province is very rich in natural resources and should prove a good market for standard American machinery of various kinds, including machinery for sawmilling, mining, smelting, oil drilling and refining, rice milling, agriculture and for all other industries which are sure to be established. The future of Burma is very promising, and the next few years should witness a great change in methods and results. Cheap labour has been the principal handicap in introducing modern machinery. Wages are, however, slowly but steadily advancing to a point that will ensure the employment of machinery to perform much of the work now done by manual labour."

Various Points.

Consul Wakefield in another report condemns American packing of goods as compared to English and German, and he urges that boxes containing light goods should be firmly nailed with iron straps round both ends of each and every box, large or small. He mentions cases or packages having been opened in transit and part of the consignment abstracted. "These occurrences are not infrequent." "The consignee makes claim on the shipper for such losses, the claim is seldom allowed, and possibly a good customer is lost." "A bureau in Bombay and Calcutta for the exclusive exploitation and sale of American goods would be useful, as has been suggested at various times. Thus far, however, there has been no concerted action along this line. A few industrial firms who have acted upon the suggestion are reaping satisfactory returns from their ventures, and others might do likewise."

North-Western India.

In recent years Karachi, in North-Western India, has become of increased importance as an importing and trading centre. American Consul Wallace Bond recently told his countrymen that nearly all the large importers at Karachi are really branches of English and German firms, established there for the sole purpose of building up trade with their respective countries. Practically the only importing firms with headquarters in Karachi are native concerns—Parsee or Indian. It must be remembered by any English electrical firms who desire to open up connection there, that representatives ought to be sent out to study the customs and needs; they must also bear in mind that caste and peculiar customs practically constitute the law of the land, while religious prejudices and scruples enter largely into business; for instance, no Mohammedan will sell intoxicating liquors, lard, bacon, ham, &c., while a Parsee may do so—these are not electrical goods, though it is said that some of them have been known to enter into electrical relationships at home at Christmas time (that was before we had a N.E.M.A. to send out circulars!). We mention them purely as an illustration of the necessity of remembering a foreigner's peculiar susceptibilities and idiosyncracies if you want to make him your client. The foreigner is not alone in having his own peculiar views and predilections. He may be very entertaining, even from some points of view ludicrous; his religion may be the most heathenish thing among all beliefs, that is not our concern in this connection. It is his custom that we want, and we want him to be a satisfied consumer, so that we may retain his electrical custom for the future. He must, therefore, have the thing he needs, not what we may prefer to sell him because we already make it or have it in stock. In the year 1907-8 practically 80 per cent. of the miscellaneous machinery shipped into Karachi went from Great Britain, but America is being urged to "watch this spot," because north-western India is considered to present "a most attractive outlook as a future market for American machinery, particularly for such articles as gasoline engines, small pumps, windmills, and agricultural implements." It is not stated that our trans-Atlantic friends would have particularly encouraging results immediately, but they are being advised to commence "an industrial campaign in Karachi district as a proper and necessary preliminary for building up a great future trade." As we showed several weeks ago American electrical manufacturers have succeeded in getting important electrical plants introduced in certain parts of India during the past 10 years. A number of leading British electrical firms are alert up and down India, doing a fairly good business, but with the more settled state of affairs which we all hope for out there, there should be greatly increased opportunities. We must not let it be imagined that there is any body of manufacturers in the world better capable of catering for the electrical needs of the Indian market than are firms in this country. The connection that we have we must endeavour to hold against all comers, and in the very large new undertakings that are bound to be required before long, as well as in the innumerable private electrical installations that are continually being called for, we must be aggressively to the fore.

Rangoon Ways.

U.S. Consul Wakefield, of Rangoon, in an entertaining report on the manner in which trade is conducted in Burma, described the bazaars and the system on which they are run for the great bulk of the retail trade.

Every town and village has its bazaar section or sections, and, considering the relative size of average transactions, the amount of trade transacted is surprisingly large.

The stocks in view are not very imposing, although it is really surprising how much some traders keep, considering the small limits in which they carry on business.

Some carry reserve stocks at their homes or in godowns, while others buy, from importing agents and dealers in local supplies, quantities sufficient to meet immediate requirements. The importing agents are not usually confined to any one particular line, but handle almost anything which finds a profitable market. It is this peculiarity in the Rangoon trade which makes it difficult to list importers in particular lines of trade.

The bazaar trade is very large and constantly growing in volume as the city increases in population.

To secure a much larger proportion of this trade for American products, it is only necessary to give the same attention to details as is given by other exporting nations. American trade suffers because of inaccessibility of stocks, length of time required for delivery, practically cash-payment requirements, and improper packing. The latter, however, is being improved, and the others would largely disappear if a sales depôt or commission house were established at some point between Bombay and Singapore.

Some Indian Installations.

What is being done in India by the Calcutta Electric Supply Corporation, Ltd., and the Calcutta Tramways Co., Ltd., by the Madras Electric Tramways Co., Ltd., the Bombay Electric Light and Tramways Co., Ltd., the Oriental Telephone and Electric Co., Ltd., the Colombo Electric Light and Tramways Co., the Indian Electric Supply and Traction Co., Ltd., the Burma Electric Tramways and Lighting Co., Ltd., the Delhi Electric Tramways and Lighting Co., Ltd., the Rangoon Electric Tramway and Supply Co., Ltd., and some other English companies concerned with the supply of electric light and power and the provision of traction facilities, our readers are already familiar with. These, as they are continually developing, must be in need of extensions of plant and mains, which British manufacturers are in a position to supply. There are also (as reference to the *Universal Electrical Directory*, Colonial and General Section, will show) electricity works, either operating or constructing, at Allahabad, Bangalore Government scheme, Barrackpore, Bikanir State, Lahore, Decca, Darjeeling, Agra, Kolar mines, Lashgar, Mogok, Mussoorie, Srinagar, Pondicherry, and so on. Some of them are municipally owned, others are the property of private parties, but all of them are certain customers for the future, for where was there an electricity works put down which remained unextended for long at a time, especially where it "cut new ground," and where were there ever electrical consumers, whether for light or power, who were not wanting something more? A consumer gained anywhere is generally to be regarded as a permanent purchaser from the electrical industry. That is what we say at home, and it applies quite as appropriately to the Indian user of electric lights, fans, cooking apparatus and everything else used in the modern installation. The Jhelum water power utilisation scheme for supplying electricity to the silk factories at Srinagar we fully described in the Electrical Review of March 5th and 12th, 1909. It is hoped that early in 1911 some of the plant will be ready for operating at the station of the Simla hydro-electric scheme, 14 miles from Simla. Last year, in connection with the proposed electrification of the Nilgiri Mountain railway, it was proposed to light Ootacamund, Coonoor, Wellington and Ooty. Just now, as a notice on another page shows, the city authorities of Lucknow are inviting proposals for electricity supply.

(*To be continued.*)

THE LEBLANC CONDENSER.

Describing this comparatively new form of combined air-pump-condenser as made by the Westinghouse Co., *Le Génie Civil* premises that a jet condenser is preferable to a surface condenser for certain reasons, such, for example, as the difficulty in thoroughly removing oil from condensed steam for use as boiler feed-water.

The new system described is that of M. Maurice Leblanc of the Westinghouse Co. The condenser contains no valves or clacks. It makes use of two centrifugal pumps; one is a water pump to supply condensation water, and the other a pump to remove water from the condenser after it has done its work. The supply pump is the air pump.

It is known that in a centrifugal pump the diameter of the rotating part for a given angular velocity is proportionate to the square root of the height of delivery.

In order to standardise manufacture the whole apparatus is constructed in series, with the water pump dimensioned to maximum diameter, or for a height of 10 metres above the pump axis. If a less height will serve, the pump blades are turned down to the proper diameter.

The air pump is quite novel. Fig. 1 (p. 716), a vertical section, shows its arrangement. Air enters at A. There is a reversed turbine T, which is motor-driven, and water is fed to a part of the circumference from an inner chamber *i*. The flat jets of water extend across the passage A, and have a downward movement as of so many water pistons. These act somewhat on the principle of the mercury air-pump or sprengel. If, for example, there is a pressure difference of six units above and below the water pistons, and there are six water pistons at one time in the passage, then there will be about one unit of pressure difference at each piston.

In fig. 2 *a* is the injection chamber of the condenser, *c* the condensation cone, and *g* the injection jets from the water passages *f*. Air is drawn away by way of the outer case *b* to the passage A of fig. 1. At *e* is a valve for the purpose of destroying the vacuum at will. The turbine is seen at *i*, *j* is the air-pump body, *k* the water chamber, and *l* the plate disk carrying the wings of the air pump.

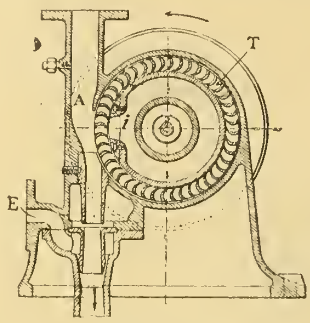

Fig. 1.—Section of Air Pump.

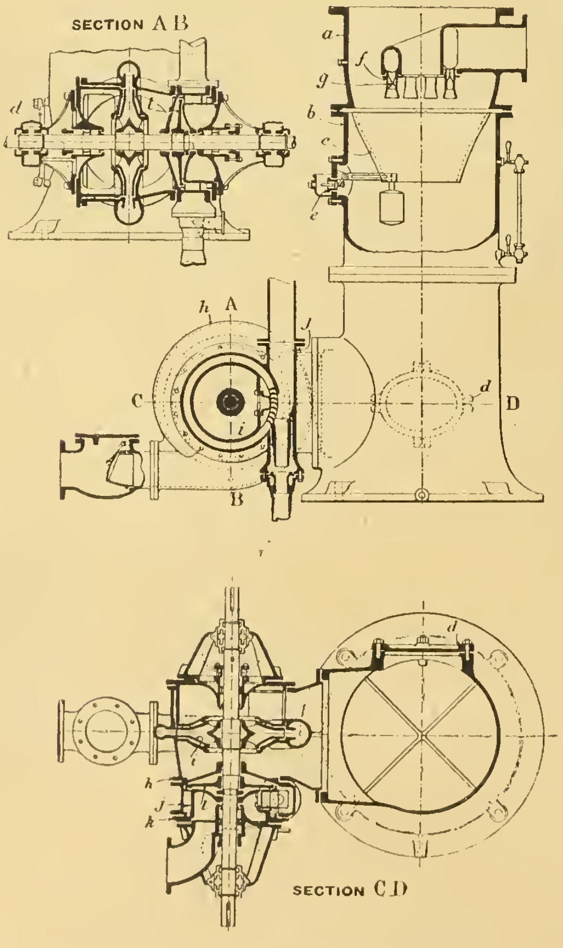

Fig. 2.—Sections of Condenser and Pumps.

Water is fed into the air pump at the centre at a considerable pressure, and issues as described, and the water escapes with its load of air through the cones, being helped if need be by a jet of live steam entering at E (fig. 1). The air and the water pumps are keyed on one spindle, and encased in one body as a compact unit. The speed is 2,500 revs. per minute.

Injection water is admitted through jets furnished with internal metal spirals which cause the water to spread throughout the condenser in the form of spray. A first compression of the air is given in the cone *c*. The float below the cone breaks the vacuum if the water rises too high.

An ordinary water jet gives the following results:—

Pressure of aspired air, 60 mm. of mercury.
Water temperature, 9·5° C.

Initial water pressure	0·5	1·0	2·0	3·0	4·0 atmospheres.
Litres of air entrained per litre of water	0·2	0·4	0·75	1·00	1·35

If the centrifugal pump has an efficiency of 85 per cent., the cubic metres of air entrained will be:—

Water pressure in atmospheres ...	0·5	1·0	2·0	3·0	4·0
Cubic metres of air per hour entrained per horse-power	9·2	9·2	8·62	7·67	7·78

In a Leblanc pump of about 40 H.P. working with convergent air ajutages perfectly calibrated to an efficiency of unity, the following results were obtained with a speed of 480 R.P.M., and a water temperature of 8·5°:—

Water in litres per second.	Horse-power absorbed.	Diameter of air inlet mm.	Weight of air per second. Grammes.	Absolute pressure in the pump in mm. of mercury.	Volume of air aspirated.	
					Litres per litre of water.	Cubic metres per H.P.-hour.
16·0	22·0	0	0·00	9	0·0	0·0
27·0	28·0	2	0·75	11	6·5	23·5
35·5	36·5	4	2·87	18	5·0	17·6
34·0	36·5	6	6·16	24	4·4	15·0

These results justify the development made by this condenser especially in its application to turbines.

The vacuum obtained is high, and is limited only by the temperature of the water fed to the cones.

There are no waste spaces such as prevent an ordinary air pump from securing equal results, for since such pumps draw moist air, they work as though they really had considerable lost volume.

The Leblanc condenser is claimed to be excellent for central plants which do not give vacua of above 85 to 90 per cent. In a well-installed plant the pressure is alike at all points, being the sum of the pressures of the air and water vapour.

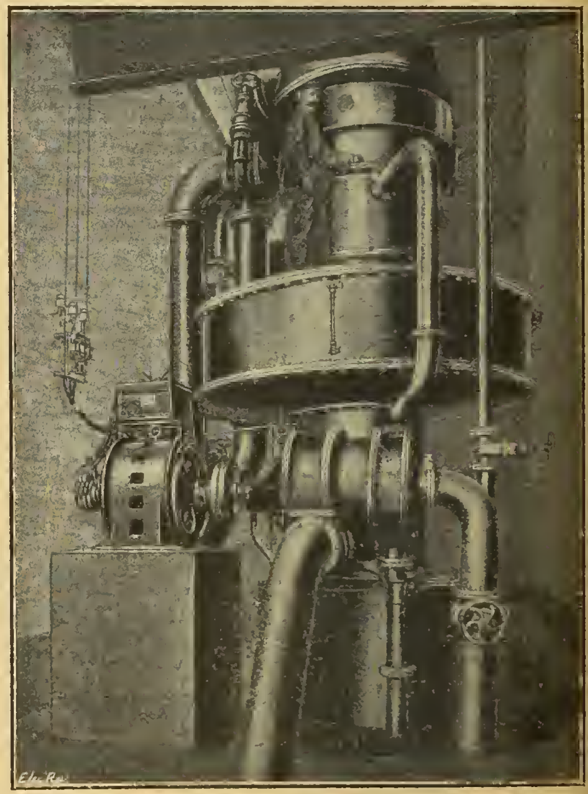

Fig. 3.—Complete Leblanc Condenser.

Thus take the case of a condenser with a pressure of 60 mm. of mercury, condensing water at 15° C. initial temperature being supplied in such proportion that it becomes heated to 34° C.

If the pump is a piston pump extracting air and water, it takes the air at a pressure of 60 mm.; water vapour at 34° has a pressure of 39·6 mm.—or say, 20·4 mm. less. The pump should engender A cubic metres if one counts on a volumetric output equal to unity. But if the pump is of Leblanc type, it takes air at 60 mm. diminished only by the pressure of water vapour at 15·5°, or 12·7 mm.—*i.e.*, at 47·3 mm., and should engender a volume $A \frac{20{\cdot}4}{47{\cdot}3} = 0{\cdot}43\,A$ only, or less than half that demanded in a piston pump.

At the coal mines of Anzin, where the system has been at work nearly a year, there is a winding engine of 850 H.P. with two cylinders of 800 × 1,500 mm. at 45 R.P.M., a compressor of 150 H.P., with two cylinders of 500 × 1,200 mm., a Rateau fan with a Baulte-Labordière motor of 340 × 590 × 360 of 150 H.P. at 280 R.P.M., and an electrical generator of 90 H.P. at 70 R.P.M. The hourly steam consumption is 10,000 kg., but owing to intermittent working it fluctuates between 3,600 and 21,600 kg., this latter rate lasting for 25 seconds per draw. There are 25 draws per hour.

There is a Balcke water tower with chimney and water delivery 5 metres above the pump axis of the condenser. The Leblanc condenser has a capacity of 16,200 kg. of steam per hour. It is worked by a three-phase asynchronous motor of 60 H.P. at 480 R.P.M. The water return pump delivers directly to the cooling tower. With an injection of 10° C. and a barometer of 770 mm., the vacuum realised varied from 89·5 to 100·7 of the theoretical vacuum due to the temperature of the outflow water, the highest percentage of vacuum accompanying the hottest outlet water, and being due therefore to the effect on the air of the inlet water temperature. The air pump is fed with cold water, which becomes the make-up water of the cooling tower.

After six months' work a test was made with injection water at 20° C. and a barometer of 757 mm., and the percentage vacuum was from 95·8 to 98·0 per cent.

This air pump, therefore, appears to be particularly efficient, and of special value for turbine work.

PROCEEDINGS OF INSTITUTIONS.

Steam Turbines.

By Gerald Stoney, M.Inst.C.E.

(*Abstract of* Cantor Lectures *delivered before the* Society of Arts, *March and April*, 1909.)

(*Concluded from page* 678.)

In the last lecture some account is given of the greatest development in the application of the steam turbine, that is, to the propulsion of ships.

The large and increasing amount of horse-power, and the greater size and speed of the modern engines tend towards some form which shall be light, capable of perfect balancing, and economical in steam. The marine engine of the piston type does not fulfil these requirements. In January, 1894, a pioneer syndicate was formed to explore the application of the steam turbine to marine propulsion. After three years' hard work and many failures the *Turbinia* was completed, and in her the problem of adapting the turbine to work a screw propeller was worked out, and, like almost everything else in engineering, resulted in a compromise.

In the first lecture it was shown that for any given amount of expansion and a given velocity ratio, a certain spindle volume was necessary for good economy. By dividing up the turbine into three parts, each had only one-third of the total volume, and at the same time the blades were three times as high as if there were three separate turbines, each with drums of the same diameters as the divided ones. Also, since the expansion in each is moderate, there is no need to step the drums, and thus they are cylinders of one diameter only, very short and stiff, and enabling fine clearances to be used.

The total result was that the weight was probably about one-third and the leakage one-quarter of what there would have been with three separate turbines, each having the full expansion carried out in it, and it was this dividing up of the turbines that more than anything else made the *Turbinia* the success she was. A separate stern turbine was fitted on the centre shaft for going astern. After the *Turbinia*, the *Viper* and *Cobra*, torpedo-boat destroyers, followed, but the next great step was the introduction of the turbine into the mercantile marine, when the *King Edward* was built in 1902 at Dumbarton, the engines being made by the Parsons Marine Steam Turbine Co., of Wallsend.

The success of the *King Edward* was the starting point for the success of the turbine in the mercantile marine for ships above 18 knots. At sea as well as on land one of the most important questions is coal consumption, and it was found by Messrs. Denny that this was some 20 per cent. less than in the case of similar vessels with reciprocating engines; also the cost of oil, which generally amounts to something like 5 per cent. of the coal bill, was reduced to well under 1 per cent., and at the same time the upkeep of the machinery was found to be very small, and it was most reliable. Vibration was also less, and the necessary engine-room staff much reduced.

In 1906 the Admiralty decided to fit turbines in all new fighting ships, and the Commission appointed to consider the question of the 25-knot Atlantic liners to be built by the Cunard Co. decided on turbines instead of reciprocating engines for these great vessels.

The Admiralty went up from the 15,000 H.P. of the *Amethyst* to the 23,000 H.P. of the *Dreadnought* and the 41,000 H.P. of the *Indomitable*.

The Cunard Commission went up from the 8,000 H.P. of the cross-channel boat *Queen* to the 70,000 H.P. of the *Mauretania* and *Lusitania* in a single step, a thing requiring the greatest courage and confidence on the part of the Cunard Co. How successful these ships have been has been proved by the recent trip of the *Mauretania*, in which she crossed the Atlantic in less than 4½ days at an average speed of 26 knots.

In these Cunarders each low-pressure turbine weighs about 300 tons, is some 50 ft. in length and 17 ft. 6 in. in diameter; in the *Queen* they were only 25 tons weight, 20 ft. long, and 6 ft. in diameter.

In these vessels, on account of their great size, it was decided to have four shafts, both to reduce the size of the turbines and to give increased reliability in case of accident. Thus each side, port and starboard, is complete in itself, having a high pressure and a low pressure turbine on separate shafts.

In the case of warships also, especially of large size, a similar arrangement of four shafts is adopted, and such an arrangement has the great advantage that each set of engines is completely independent of the other, and thus, although one may be disabled by gun fire or torpedo, the other is unaffected, a condition which it is not possible to arrange with three shafts.

During the past 12 years there has been a distinct improvement in the steam consumption of turbine ships. In 1897 the *Turbinia* consumed 16 lb. per shaft H.P.; in 1907 the *Mauretania* consumed 11½ lb. The last figure represents about 69 per cent. of the energy available in the steam, according to Rankine's Cycle.

Part of the improvement is due to increased size, which as a rule, under similar conditions, gives more economy, because of the reduction in the ratio of clearance to length of blade, and consequent reduction of leakage. Part also has been due to improvements in manufacture and design, especially in the direction of better vacua. Increase in the steam pressure above, say, 120 to 150 lb. at the turbines, as a rule, improves the efficiency of the turbine only a little, and adds to the weight not only of the turbine, but also the boilers, steam pipes, &c. More can be done at the lower end of the range of expansion, that is, by improving the vacuum.

The application of the steam turbine to the propulsion of slow-speed ships, that is, ships of below 15 to 18 knots, has up to the present been difficult owing to the low speed of revolution of the screws making the turbines large and heavy, as well as not economical. This difficulty has now been got over by the use of an arrangement patented by Mr. Parsons some years ago, viz., the combination of reciprocating engines and exhaust turbines, similar to what was described before for land work. Here each utilises the part of the expansion for which it is best suited—the reciprocating engine for the high pressure part of the range, and the turbine for the low pressure where the volume of steam is large. The reciprocating engine, as explained before, is not economical for low pressures and large volumes, and the steam turbine, especially when the rate of revolution is small, is large, heavy, and uneconomical for high pressures and small volumes; but the turbine for low pressures, even at low revolutions, is an exceedingly economical heat engine. Thus the combination is more economical than either alone.

The first ship to be fitted thus was the *Otaki*, which at 13 knots sea speed required only 5,000 H.P. With 200 lb. pressure and without superheaters being fitted, the very low consumption of 12·3 lb. steam per shaft horse-power for all purposes was attained on trials, and better results are expected after more experience is gained in the working of the ship. But even this trial consumption is better than that which could be attained by the use of either reciprocating engines or turbines alone.

It is interesting to note that in the early days of the screw propeller the great difficulty was to make the engines run fast enough for the screw, and spur gearing was adopted in many cases in the first half of the last century. Now the difficulty is to make the turbine run slow enough for the screw, and once more gearing is being considered, so as to make the turbine adaptable for use in slow-speed steamers, which constitute by far the greater part of the shipping of the world.

The electrical gearing is especially promising, one or more turbines with dynamos or alternators, practically identical with those used on land, being employed to drive one or more motors on the screw shafts at reduced speeds of revolution. Again, in the combination system of reciprocating engine and turbine, the exhaust turbine may be a high speed one, driving a motor on the shaft of the reciprocating engine instead of a screw on its own shaft.

Such questions are now receiving much attention, and may result in all the steamships of the world being wholly or partly turbine-driven, instead of only those vessels of comparatively high speed.

At the present date there are about 120 vessels actually on service fitted with turbines, representing about 1,250,000 H.P., and these comprise practically all the high-speed ships which have been recently built. Some 70 more are under construction, representing another 1,000,000 H.P., or a total of 2,250,000 H.P., and the curve of progress as yet shows no sign of saturation.

It has taken 200 years to bring the reciprocating engine to its present high state of efficiency; the steam turbine in a practical form is only 25 years old, and already has in many instances proved its superiority to its older rival.

The Physiological Effects of Radiation.*

On September 28th, Dr. C. P. Steinmetz delivered a lecture before the Illuminating Engineering Society on this subject. He said the statement had frequently been made that short wave lengths were harmful to the eyes, and it had often been said that lamps which produced short wave lengths necessarily had an injurious effect on them. The fact of the matter was that daylight contained proportionately even more ultra-violet light than any of the light from the common artificial sources. Beyond any doubt, harm had been produced as a result of the introduction of artificial lighting, but such harm was attributable to the fact that humanity now made use of the eyes for more hours per day than formerly, rather than to any injurious effect produced by artificial light itself.

The harmful effects due to radiation which did not fall within the visible spectrum might be classified as indirect, direct and specific. One of the indirect effects was that connected with the attempt of the eye to match colours when the light was of an improper tint.

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* Abstract from the *Electrical World*.

In such a case there was an over-straining of the eye which attempts to overcome the deficiency by adjusting itself to the abnormal conditions. As a direct effect, what might be called a "power blow" upon the eye, was produced when energy reached the eye at a rate considerably greater than that for which the eye was momentarily adjusted. The mechanism of the eye was so arranged that the pupil contracted in order to reduce the light reaching the retina to the proper value. When radiations suddenly impinged upon the eye at an excessive rate, the mechanism was unable to act instantaneously, and the eye received a damaging blow; such a blow was caused by the light from an electric arc in the case of a short-circuit. Exposure to an explosion of this nature produced temporary blindness, but the recovery of the eye was relatively quite rapid. The blow could be said to be due almost exclusively to the infra-red radiation.

High-frequency ultra-violet light in considerable quantity was very harmful. The harm produced by such radiations became apparent at a very slow rate, and the recovery therefrom was extraordinarily gradual. For example, there might be cited the case of an investigator who subjected his eyes to the unshielded mercury vapour arc; the recovery from the injury to his eyes required practically eight years. The symptoms of trouble from high-frequency radiations were headaches and a blurring of the vision.

The radiations from the commercial form of incandescent electric lamps contained practically no ultra-violet light. The common carbon arc lamp gave forth a limited amount of ultra-violet radiation. Arc lamps of the flaming and luminous types gave a considerable amount of ultra-violet light. Such lamps must be provided with enclosing globes. For this purpose even clear glass was quite effective, because it was opaque to ultra-violet light. The common low-temperature mercury-vapour lamp produced ultra-violet light in considerable quantity, but was harmless on account of the fact that the arc was surrounded by glass. The high-temperature mercury-vapour lamp was provided with a quartz tube, through which the ultra-violet light, if produced, would pass readily; however, the high-temperature lamp gave forth almost no ultra-violet radiations. An effective method of detecting the presence of ultra-violet light was by noting the odour of ozone, which was either caused by, or produced simultaneously with, such light.

Among the advantageous characteristics of radiation not found within the visible spectrum might be mentioned the beneficial effect upon plant life, and the destructive effect upon certain germs.

Factory Lighting.

At the same Convention of the Illuminating Engineering Society, the disadvantageous features of localised and highly concentrated illumination, as commonly used in many factories, were discussed by Mr. L. B. Marks. In installations of this kind the illumination produced by each lamp is confined to a very small zone which is brilliantly illuminated, while contiguous parts of the working space, where good light is needed, are in comparative darkness. The actual intensity of illumination directly underneath the lamps is in most cases several times as much as is desirable to secure the best vision.

With the localised system of illumination as installed in factories, there is a maximum of direct reflection of light from the working parts of the machines. The direct reflected light does not increase the ability of the operator to see the object, but, on the contrary, decreases his visual acuity and necessitates the use of a far greater amount of localised light than would be needed if there were no direct reflection.

In a system of localised illumination, such as is employed in factories, it is necessary to readjust frequently the height and position of the lamps to suit the requirements of the work. There appears to be a natural tendency on the part of the operator to place his lamp as close as possible to the field which is to be illuminated. The operator may be content for a while with the localised lamp 2 ft., or even 3 ft., above his work, but experience shows that when the matter of adjustment is left to him, he will, as a rule, ultimately lower the lamp to a position as close to the work as it is possible to locate it without actual physical interference with the operation of the machine or the performance of the work.

The frequent handling of the lamps by the operators to adjust the height and position of the lighting units results in soiling the lamps and reflectors. It is not unusual, in most of the departments, to find finger marks on the glass bulbs and on the reflecting surface of the shades, which latter are in many instances so smutted from handling that they are practically worthless as reflectors. The proximity of the lamps and reflectors to the machines accounts in some cases for the rapid accumulation of gritty and oily material on the former. This is especially true of the grinding, the buffing and the automatic-screw machine departments, in which the lamps and reflectors are begrimed and oil-spattered. Measurements have shown that almost double the amount of light was given on the working plane when a clean reflector was substituted for a deteriorated reflector.

The handling of the lamps by the operators and the disposition of the latter to place the lamps as close as possible to the work sometimes lead the operators to bend the reflectors and force them into some convenient part of the machine close to the work. In some instances where it is impossible to lodge the lamp in a convenient part of the machine because of the large size of the reflector, the reflector is removed by the operator and the bare lamp used.

The frequent adjustments and readjustments of the lamps unnecessarily occupy the time of the operator and to some extent distract his attention from his work. The multiplicity of dangling wires from the drop lamps presents an unsightly appearance. Moreover, those wires are apt to be in the way of moving parts of the machinery, &c.

In some cases the eyes of the operator are very close to the reflector, and are affected by the heat of the lamp. Objectionable shadows are cast by the reflectors, lamp supports, drop cords and hangers. The shops present a gloomy appearance at night. Even when all the local lamps are in operation, the intensity of the general illumination on the working plane in locations outside of the restricted field illuminated by the drop lamps is at best only about 0·25 foot-candle, being less than 0·15 foot-candle in most of the departments, and in some less than 0·03 foot-candle. The extremely low degree of general illumination in the shops makes it difficult, if not impossible, for the foreman to exercise the same character of supervision at night as he does in the daytime, and makes it more difficult to guard against factory accidents.

With the present system of localised illumination in shops, advantage cannot be taken at night of the reflecting and diffusing value of the walls and ceilings, whereas in the daytime the walls and ceilings are used to great advantage in reflecting and diffusing natural illumination.

A remedy for the objectionable features of concentrated factory lighting lies in the use of a suitable degree of general illumination and moderate intensity of localised lighting.

The Electric Driving of Textile Factories.

At a meeting of the Bradford Engineering Society, on November 28th, 1907, a Committee of Inquiry, including representatives of mechanical and electrical engineering firms, the Bradford Corporation Electricity Department, textile firms, and the textile department of the Bradford Techical College, was formed to inquire into this subject.

A programme limiting the scope of the inquiry was drawn up, and it was decided, in the first place, to carry out certain experiments to determine the actual cyclical variation occurring in prime movers and electric motors and in shafting and machinery driven by them.

An exhaustive series of trials was carried out by Prof. Charnock and Mr. Barker at Dock Ing Mills, Batley, by kind permission of Messrs. Brigg & Sons, the proprietors. This mill was selected as an example in which the plan of the buildings necessitated power being taken off in various directions by means of spur and bevel gear, belt and rope driving, with long lengths of shafting intervening in some cases. The machinery driven included mules, cards, drawing and looms. From a report prepared by Mr. Barker, it was found that even under such circumstances, the amount of cyclical variation was not nearly so great as had been anticipated. Further tests were made at the Leigh Mills Co., Ltd., Upper Mills, Stanningley, with worsted-drawing machinery driven by an induction motor, using current from the Yorkshire Electric Power Co.'s supply, and also on spinning machinery driven by shafting from a compound tandem Corliss engine. Various other tests were made at works in the city, and Mr. W. B. Woodhouse kindly arranged some experiments to demonstrate the speed variation due to slip in three-phase motors under varying load. The committee also visited the Thor Mill, Whitworth, near Rochdale, on the invitation of Messrs. Siemens Bros. Dynamo Works, Ltd., who supplied the equipment for electric driving. The point submitted was that, with this arrangement, the increase in steadiness of turning was such as to lead to increased output and better quality, commanding a higher price on the market. Of this no actual evidence could be supplied, and the committee have been unable to obtain any proof whatever based on actual experience.

The committee, after very carefully considering the above results, and after a thorough discussion of all the information before them, arrived at the following conclusions:—

1. That in good installations there is practically no difference in cyclical variation between mechanical and electrical transmission when measured at the end nearest the main drive.

2. That any initial cyclical variation which may exist at the driving end of the above shaft is liable to be increased if transmitted through long shafts. This can, however, in many cases, be controlled by known methods of destroying synchronous vibrations.

3. That so far as any irregularity is concerned (excluding breakdowns), electrical transmission will maintain its condition better than mechanical transmission.

4. That in modern textile, combing, spinning, and weaving factories, where those factories are of ordinary dimensions, and where the power is generated on site, power is conveyed with less loss by mechanical than by electrical transmission; but where the plan of the buildings is irregular, involving awkward angles of drives or irregular arrangement of machinery, the saving in power by electrical transmission begins to appear. The Committee find it difficult to arrive at a definite decision as to the exact point where the friction due to mechanical transmission is excessive, owing to the very varied conditions which obtain, but make the following suggestions:—

5. That the friction loss with mechanical transmission is excessive if over 30 per cent. By "friction loss" is meant the proportion which the collective friction of the engine drives, and shafting with the belts on the loose pulleys of the driven machines, bear to the total horse-power when the whole load is on the engine.

6. That electrical transmission is likely to be most efficient—

(*a*) Where there are long lengths of shaft from which power is not taken off at intermediate points.

(*b*) Where machinery is distributed and requires starting and stopping frequently during the day.

(*c*) Where machines require to run at various speeds and have those speeds altered during motion.

(*d*) Where there are excessive lengths of shafting, making it desirable to separate these into two or more lengths.

The question as to the adoption of electrical or mechanical driving is largely one of cost, which can only be decided by careful investigation of each individual case. By adopting electric driving, the following advantages can be obtained, whether the power be generated on site or taken from an outside source of supply:—

1. Ease of checking daily the power required for running individual machines and departments, and of detecting any faults or deterioration of the plant. In the case of mechanical driving, this may be done by employing some form of power meter.

2. Ability to run only a portion of the plant—as, for instance, on overtime—without serious loss in transmission. With mechanical transmission, the same object may be attained by the judicious application of clutches or similar mechanical devices.

3. Reduction in the number of belts, shafts, gears, &c., with consequent improvement in lighting and cleanliness when individual driving is adopted.

4. Ease of regulating the speed and of introducing periodical speed variations in certain machinery, if individual driving be adopted.

5. Ease of utilising the available space to the best advantage and of extending into adjacent buildings at any time, irrespective of the layout of the same.

6. Saving in the cost of the engine house and its foundations, the latter made possible by the adoption of a high-speed generating set. Care must be taken that the possible extra cost of other portions of the plant or buildings, or reservoirs, does not more than balance any saving in the direction indicated.

The following further advantages may be obtained if an outside source of supply is available:—

1. A reduction in the first cost of the installation and buildings due to the absence of power generating plant. This, in conjunction with the corresponding saving in floor space, may be utilised for the installation of productive machinery.

2. Freedom to run only parts of the plant, and to work overtime without any increase in the cost per brake-horse-power of the power used.

3. Unlimited supply of power available.

4. Less liability of total stoppage, due to the standing plant of the supply authority, as compared with private generating plant.

This report is not to be regarded as complete or final, but is presented to the Society as an indication of the work already accomplished by the Committee.

G. F. Charnock, *Chairman.*

DOMESTIC ELECTRICITY.

By MAUD.

After a somewhat chequered and interesting experience with regard to electric lighting and the simpler forms of electric heating and cooking, I decided to try an electric oven. The majority of housewives shrink from this mode of cooking chiefly on account of cost, but the information which I have at hand, based on my own experience, contradicts this commonly asserted notion, that electricity is very dear for cooking purposes.

Let us take first the simplest and most commonplace method of cooking—that of a coal fire—and suppose we have to deal with an average-sized cooking range; this, I find, costs, on an average, to cook a dinner consisting of a joint (about 5 lb.), pudding, pastry and vegetables, about 2½d. in coal, allowing for coal at 16s. per ton; you may say that for this price you also have a constant supply of hot water, but this is not always the case, as usually the boiler damper must be closed to allow sufficient draught to heat up the oven, and therefore the cost of heating water for the house is an entirely separate charge.

Passing on to gas cooking, which is undoubtedly the most popular method of cooking at the present time, it is found that this costs for the same dinner 3d.; this price does not include the time and gas taken to heat up the oven or the greater time taken to rid the oven of the objectionable smells (if the latter precaution is not taken the smell permeates the food).

Thirdly, we come to electric cooking, as regards the cost of which the majority have such hazy notions. This costs for the same dinner 2½d., with electricity at 1d. per unit. On the top of the oven stands a boiler for vegetables, &c., all the rest of the cooking being done in the oven. This oven is controlled by a switch, which allows for three heats: the first of these is low, costing a third of 1d. per hour; the second, which is medium, costs a little under three-quarters of 1d. per hour; the third is high heat, with all the heaters in use, the cost being a little less than 1½d. per hour, with electricity, as previously mentioned, at 1d. per unit.

The electric oven takes a very short time to heat up to its maximum temperature, and when so heated can be easily regulated by the aforementioned switches, with the result that meat can be cooked to perfection, and cakes and pastry browned, in a way almost impossible with the ordinary cooking range. It will also be found that the lighter forms of confectionery can be cooked after the current has been switched off, by means of the heat contained in the oven.

As will be seen by this article, I am enthusiastically in favour of electric cooking, though I must confess that previous to my experience with this most useful form of cooking, I was rather sceptical both as regards the cost of electricity for cooking purposes, and as regards the reliability of cooking utensils, but I have now nothing but praise for the same, after having given this oven a good and fair trial.

It would probably be interesting to many readers to know whether electric cooking is as satisfactory as cooking by coal or gas. My experience has taught me that electric cooking is far ahead of either of these, its competitors, for cooking purposes, owing to the very even temperature obtained, which, as every lady knows, is essential to produce satisfactory results. The only fault I have to find is the entire absence of a ventilator on the oven; the want of this ventilator means that there is always, when cooking, a fair amount of steam in the oven, and this tends to take up some of the heat which should be given to the contents of the oven. I am sure this small thing has only to be appreciated by the makers to be remedied.

On the score of cleanliness the oven has no equal; all that is required after cooking is wiping out with a damp flannel, as there is no possibility of dust and dirt as with fires, and absolutely no smell is left in the oven after cooking is done. When the oven is switched on, that is all that is necessary for the heating of it, and there is not the continual poking and building up as with the coal fire, which must be done to keep the oven to a maximum even heat, the result of all this poking being that the heat of the ordinary oven is continually varying.

From the numerous questions I have been asked with regard to electric cooking, it is clear that ladies are extremely interested in the subject, and I feel confident now that the bogy of cost is rapidly disappearing that the electric oven will soon become a household article.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GRENADA.—The following goods are admitted free of duty:—Any articles for the use of His Majesty's service or for the use of the Government, and machinery or appliances considered by the Governor-in-Council to be useful for the development of local manufactures or products, or to be imported for the development of any business or manufacture carried on by, or belonging to, the importer.

The following duties are payable:—

Carriages and other vehicles on springs ...	... 10% ad val.
Earthenware (not being porous and unglazed) and glassware	... 10% „
Iron and steel, whether partly or wholly manufactured	... 10% „
Goods not specially mentioned in the tariff	... 7½% „

The value of imported goods for the purpose of calculating duty is the true invoice price, excluding freight, insurance and other charges.

N.B.—No person may install, erect, maintain or use in the Colony, any apparatus or instrument for the purpose of wireless telegraphy without a licence from the Governor.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,161. "Improvements in gas controllers, electric time switches and other timing devices." G. O. H. Horstmann, E. H. Horstmann, A. Horstmann, S. A. Horstmann and W. T. Edgar. October 11th.

23,177. "Improvements in magnetic ignition apparatus." R. J. Isaacson. October 11th. (Complete.)

23,179. "Improvements in or relating to electrical transmission and distribution systems." A. F. Berry. October 11th.

23,217. "Improvements in and relating to the control of electric motors." H. C. Leake. October 11th.

23,224. "Improvements in make and break switches." J. Wilson. October 11th.

23,225. "Improvements in insulating compounds and processes of making the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 11th.

23,227. "Improvements in electric cut-outs." T. E. Murray. (Date applied for under Sec. 91 of the Act, October 17th, 1908, being date of application in United States.) October 11th. (Complete.)

23,228. "Improvements in electric cut-outs." T. E. Murray. (Date applied for under Sec. 91 of the Act, November 9th, 1908, being date of application in United States.) October 11th. (Complete.)

23,229. "Improvements in electric cut-outs." T. E. Murray. (Date applied for under Sec. 91 of the Act, November 30th, 1908, being date of application in United States.) October 11th. (Complete.)

23,247. "Double-pole spark plug for use with internal combustion engines and the like." C. H. Naylor. October 12th.

23,269. "Improvements in mouthpieces for telephone transmitters." M. S. Hufschmidt and V. F. Wagner. (Date applied for under Sec. 91 of the Act, November 10th, 1908, being date of application in United States.) October 12th. (Complete.)

23,291. "Improved arrangement for the prevention of brush sparking in rotary electric frequency transformers having commutators." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) October 12th. (Complete.)

23,307. "Combination of an electric cable jointer's hand-cart and an electric cable drum." Callender's Cable and Construction Co., Ltd., and T. Petersen. October 12th.

23,310. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) (Application for Patent of Addition to No. 14,239, 1909.) October 12th. (Complete.)

23,319. "Improved arrangement of a combined collector, ring, commutator, and switches, for use with a small battery to start petroleum engines fitted with magneto starting apparatus." A. S. J. Chapman. October 12th.

23,323. "Improvements in machines for manufacturing electric-welded wire chains." C. L. Graves. October 12th. (Complete.)

23,324. "Improvements in and relating to telegraph bulletin printers." H. W. Lake. (Electric Press Bulletin Co., United States.) October 12th. (Complete.)

23,328. "Improvements in and relating to telegraph transmitting apparatus." H. W. Lake. (Electric Press Bulletin Co., United States.) October 12th. (Complete.)

23,379. "Improved detector for use in radio-telegraphy or telephony." W. T. Ditcham. October 13th.

23,384. "Combined lampholder and wall plug for use in connection with electrical fittings." A. W. Maconochie and T. H. Carey. October 13th.

23,397. "Improvements in or relating to current-collectors or trolley-heads for electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. October 13th.

23,404. "Improvements in electricity meters." F. Becker. (Date applied for under Sec. 91 of the Act, October 15th, 1908, being date of application in Germany.) October 13th. (Complete.)

23,415. "Improvements in and relating to the voltage regulation of alternating electric current distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 13th.

23,416. "Improvements in and relating to the voltage regulation of alternating current circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 13th.

23,421. "Improvements in or relating to the manufacture of a composition of matter intended particularly for electric insulating purposes." F. Walton. October 13th.

23,429. "Improvements in electric telegraphy." A. Muirhead and Muirhead & Co., Ltd. October 13th.

23,459. "Improved attachment for preventing the breakage of the conductors in the flexible leads used with electric irons." E. T. Pick and W. Robb. October 14th.

23,466. "Electric bell piano." A. Hodgkins. October 14th.

23,494. "Improvements in field and telegraphic signalling and recording." B. S. Weston. October 14th.

23,500. "Improvements in and relating to incandescent electric lamps having filaments of refractory metal." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 14th.

23,502. "Improvements in or relating to electric prepayment meters." Electric Prepayment Meters, Ltd., and E. Schattner. October 14th.

23,504. "Improvements in trolleys for use in electric tramways on the overhead system." E. J. Fredericks, D. R. Fredericks, L. E. Russell, C. W. Wedding and J. Connelly. October 14th.

23,506. "Improved burglar electric alarm." A. S. Newman. October 14th.

23,526. "Improvements in electrical switches of the push-button type." Firm Watt-Installationen fur Stark-und-Schwachstrom Carl Schulz. (Date applied for under Sec. 91 of the Act, October 16th, 1908, being date of application in Germany.) October 14th. (Complete.)

23,541. "Improved connecting device or terminal for electrical conductors." A. H. Robinson. October 14th.

23,553. "Improvements in or relating to windings for alternating-current motors." M. Stern. (Application for Patent of Addition to No. 12,326/08.) (Date applied for under Sec. 91 of the Act, October 15th, 1908, being date of application in Germany.) October 14th. (Complete.)

23,582. "Improvements in alternating current transformers for conversion of polyphase currents to single-phase currents." O. L. Roberts. October 15th.

23,601. "Improved electrical burglar or other alarm or indicator." J. Wright and T. Douglas. October 15th.

23,619. "Improved governor for use with electric motors." H. C. E. Jacoby. (Date applied for under Rule 13, December 23rd, 1908. An invention comprised in application No. 27,967, dated December 23rd, 1908.) October 15th.

23,628. "Improved detector of electromagnetic waves." A. G. Rossi. October 15th. (Complete.)

23,649. "Improvements in and relating to electric transformers." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 15th.

23,650. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 15th.

23,670. "Rigid suspended plate-handling electric crane." B. Wrightson Head. October 15th.

23,704. "Starting device for electric motors." W. N. Stewart and E. Foss. October 16th.

23,719. "Improvements in and relating to electric circuit closing devices." A. J. Boult. (Acme Automatic Street Indicating Co., United States.) October 16th. (Complete.)

23,742. "Improvements in devices for the automatic counting and recording of telephone calls." J. Kiessler. October 16th. (Complete.)

23,747. "Improvements relating to electric signalling means." E. A. Graham. October 16th. (Complete.)

23,756. "Improvements in dynamo-electric machines." H. Lippelt. (Date applied for under Sec. 91 of the Act, October 16th, 1908, being date of application in Germany.) October 16th. (Complete.)

23,759. "Improvements in sound-augmenting devices for use in telephony." S. G. Brown. October 16th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Inductor Coils and Transformer Apparatus. H. F. Bigge, F. R. Butt and J. H. Webb. 19,885. September 22nd.

Time-Element Devices, applicable to Electric Circuit Breakers and other Apparatus. J. G. Statter. 20,468. September 29th.

Brake Blocks, Electric Collector Shoes, and the like. J. Taylor. 20,472. September 29th.

Control of Electric Motors. J. G. V. Lang and Johnson-Lundell Electric Traction Co. 20,721. October 1st.

Electrolytic Decomposition of Sodium and other Chlorides in the Manufacture of Caustic Soda and other Useful Products. R. J. Levy. 20,787. October 2nd.

Electrically-driven Trains, especially Applicable to Trackless Trains. F. Wagner. 21,490. October 10th. (Application for Patent of Addition to No. 4,637, of 1908.)

Protective Devices for Electric Distribution Systems of the type known as Lightning Arresters. British Thomson-Houston Co. (General Electric Co.) 22,134. October 19th.

Sheathing of Electrical Wires. J. J. Rawlings, H. W. Handcock and A. H. Dykes. 24,348. November 12th.

Electric Automatic Call Boards for Controlling Time Signals and Apparatus connected therewith. J. Appleby and A. E. Drew. 24,618 November 16th.

Regulation of the Power Factor in Systems of Alternating Electric Current Distribution. British Thomson-Houston Co. (General Electric Co., U.S.) 25,556. November 21st.

Electric Clocks. T. J. Murday. 26,239. December 4th.

Improvements in, and in the Production of, Tilting Shade Holders or Carriers for Electric Lamps. M. Lawton and H. Whatson. 27,816. December 22nd.

Electric Batteries. A. J. Boult. (T. McNaughton.) 28,285. December 28th.

Electric Self-Winding Clocks. A. J. Boult. (H. O. Jackson and T. McNaughton.) 28,286. December 28th.

Electric Secondary Clocks. A. J. Boult. (H. O. Jackson and T. McNaughton.) 28,287. December 28th.

Voltmeters, Ammeters, Wattmeters, and like Electrical Indicating and Recording Apparatus. W. O. Smith and W. Phillips. 28,522. December 31st.

1909.

Apparatus for the Production of Electric Impulse Charges for the Purpose of Wireless Telegraphy. S. Eisenstein. 17,217. July 23rd. (Application for Patent of Addition to No. 10,019 of 1908.)

Dynamo-Electric Machines. A. Boeckel, O. Grünberg, J. K. Krukovski and E. Luxembourg. 72. January 1st. (Date applied for under Rule 13, September 24th, 1908.)

Electric Furnace. Aktiebolaget Elektrimetall. 4,553. February 24th. (Date applied for under International Convention, March 10th, 1908.)

Locking Device for Electric Switch-Boxes. C. Wustet Cie. 4,561. February 24th. (Date applied for under International Convention, April 15th, 1908.)

Protective Devices for Alternating Current. Allgemeine Elektricitäts Ges. 5,717. March 9th. (Date applied for under International Convention, March 12th, 1908.)

Electrical Heating Device. G. Cooper, F. C. Sharp and T. A. Stevens. 12,562. May 27th.

Suspension Devices for Supplying Electric Current from Overhead Wires to Arc Lamps and other Apparatus. A. Schweiger. 13,661. June 10th.

Electric Contact-Breakers particularly Applicable for Induction or Sparking Coils. R. W. Grant. 14,117. June 16th.

Regulation of Alternators Running in Parallel. Allgemeine Elektricitäts Ges. 17,199. July 23rd. (Date applied for under International Convention, July 23rd, 1908.)

Telephone Systems. E. W. Smith. 2,151. January 29th. (Application for Patent of Addition to No. 22,638, 1907.)

Electric Apparatus for Controlling the Operation of a Number of Machines or other Devices from a Distant Point. O. Wirth and C. Beck. 5,811. March 10th. (Date applied for under International Convention, March 11th, 1908.)

Machines for Covering Wire or other Electric Conductors with Insulating Material. H. L. Owen. 7,531. March 29th.

Aerial Electric Cut-outs, Electrical Bridge Couplings, and the like. E. Wechmar. 9,803. April 21th.

Device for Starting and Cutting-out Electric Motors. Zucker Fabrik Frankenthal. 12,258. May 24th. (Date applied for under International Convention, June 1st, 1908.)

THE
ELECTRICAL REVIEW.

Vol. LXV. NOVEMBER 5, 1909. No. 1,667.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

MUNICIPAL APPOINTMENTS.

FAR oftener than we like do we receive complaints of favouritism in the appointment of public officials. Correspondents who smart under failure to secure berths for which they thought they were fairly in the running, hint at many things that they do not care to enlarge upon for publication. It is favouritism, they say, not merit, that decides who shall succeed. Men elected in the public interests to seats in municipal councils, besmirch our public life, and the reputations of their colleague councillors, by taking private advantage of public office. They are, of course, only the black sheep, but the act of one or two unfortunately discredits the whole municipal family, and men who could, and ought to, serve the public well, too often hold aloof, because the public suspects the candidate for electoral position of having private personal ambitions. Sometimes the misdeeds or unfair favouritisms leak out, and reputations of offenders are nailed to the municipal pump, for all comers to study, and studying to profit thereby. But for every actual case that is revealed there are many others where our correspondents can see nothing more than smoke, the cause thereof lying concealed. We are prepared to make every allowance for a man out of work, or for an unsuccessful seeker after promotion, so in the absence of actual evidence we prefer to take their complaints *cum grano salis*, or, at any rate, very guardedly. Considering that we have such a very large number of councillors, and that there is practically an open door for the lowest and least educated class of man with little more than his bag of tools to call his own, to obtain office, also that too many men of the right stamp regard municipal life with contempt, our standard of municipal purity as revealed is wonderfully high, but that standard will only be maintained, or improved upon, by our making as public as possible an example of those whose guilt is proved. The Guardians prosecutions of several years ago cleared the air very considerably, and in doing so must have caused much fluttering in the dovecotes of the undetected ones. These prosecutions related more to dishonesty in contract transactions. It would not be wise to write all the things we know about some municipal appointments, how they have been arranged or secured, how councillors have even tried to arrange matters with prospective candidates in advance before anyone was supposed to know who the candidates were! We do not ask engineers who have had experiences of these kinds to write them to us, for some of them are better forgotten—we do not want to stir up mud, especially when we remember that councillors are ever on the change, and that those now in office might be reflected upon by allusion being made to the sins of their predecessors in office. But while we do not ask for such epistles, we do not doubt that these few words will remind this and that electrical engineer of something he has either experienced himself, or has heard of concerning some *confrère*. When men whose occupation brings them in a pound or two a week have the giving away of berths varying from three to ten times their own annual incomes, they are plunged into a new and unaccustomed sphere that is attractive, no doubt, but one which is fraught with dangers unless the councillor's moral standard be absolutely beyond reproach. But as we have said, we do not believe that cases of public office being made to save personal ends are numerous. One actual case may set suspicions working in a dozen places, and legendary growths are matters of common occurrence. It is quite easy to allow mistrust to be engendered for which, if one knew the actual facts, there would be no justification. We ought to be carefully on our guard before we sear the reputation of any man. We may be very confident that we are the only person on earth possessing the advertised qualifications for a particular post—that is a mistake to begin with, for there are a good many things about that job that we know nothing of, and there are more good men about than we remember until we enter into competition with them. Tell us that somebody who is a far-removed relative of the least influential member of the Committee has secured the appointment, and we are quite ready to believe that his success was unfairly come by. Sometimes our suspicions may be justified.

Only last week, according to the *Daily Express*, one of the London Borough Councils was engaged discussing an unwise action on the part of one of its Aldermen and its electrical engineer. The agenda, it seems, contained the following :—

> That the committee find that a young man, who is the son of Alderman Hennessey, was engaged at the King's Road Station in April, 1909, as an improver, under the name of MacCarthy, at the suggestion of the chief electrical engineer and with the consent of Alderman Hennessey.

After discussion at the St. Pancras Council meeting, it was resolved to let the matter drop, "as it was considered" (we are quoting from our daily contemporary) "that Alderman Hennessey had been punished sufficiently by the appearance of the Committee's finding on the Council's agenda. Arrangements have been made which will prevent anything of the kind occurring again. Mr. Hennessey is a Socialist Alderman, and a J.P."

But what about the remark "at the suggestion of the chief electrical engineer"? We are sorry that that appears in the minutes, and that it has gone forth to the public. There might have been nothing whatever wrong in the appointment of Hennessey under his own name, he may be most acceptable as an improver in a central station, but suspicions of unfairness and favouritism are likely to arise when there is an attempt to make Hennessey appear to be somebody else because he is the son of an Alderman.

Common-Sense Contracting.

A note appeared in our "Contracts Closed" column last week on the results of tenders for motor-generators for the London County Council. The order was placed with Messrs. Dick, Kerr & Co. at a price considerably above the lowest tendered because the Council "already had a number of their machines of the kind working satisfactorily." Without in any way casting aspersions on those firms who quoted lower prices, it may be said that this is a somewhat unusual step to take, and the County Council may be congratulated on allowing a question other than that of first cost to influence its decision, though this is a policy that has by no means usually been followed by municipal bodies in recent years.

It is a frequent complaint of the municipal contractor that manufacturing goodwill must be regarded as a very small asset, and that any special pains to make a good job, give extra assistance, or do work beyond the strict letter of the contract, are to all intents and purposes thrown away if in future competition for work a rival contractor, perhaps one without the same reputation or experience, happens to quote a few pounds lower.

It has often happened that after one make of plant has given satisfaction, a cheaper make has been adopted on extensions being required, and not merely has the cost of upkeep or loss from breakdowns been many times the saving in first cost, but the reputation of the undertaking has suffered in consequence. One of the chief arguments against municipal trading is that highly technical business departments are too much under the control of committees of laymen, who frequently disregard the recommendations of their salaried engineers.

It may be said that those who have given practical credit to contractors for good work done, while at the same time encouraging reasonable competition, obtain far more satisfactory results, in the long run, than those who jump at the lowest tender regardless of obvious circumstances, and in consequence turn their power stations or other undertakings into collections of odd and assorted plant.

One can, however, go to the opposite extreme in this question of preference, and some of the leading manufacturers of electrical plant have at times made loud complaints of consulting engineers, favouring certain concerns, particularly those from abroad, and refusing to allow British firms of repute reasonable opportunity for tendering for important work. This has especially been the case in some classes of work in connection with mines lighting and power stations.

Experts are employed by municipal bodies and private parties for the purpose of preparing designs, issuing specifications and adjudicating on the most favourable all-round offers received. The effect of placing all orders in one direction, on the ground that some machinery manufactured in this country during the early days of high-tension work gave trouble, or that responsible firms at home have not previously supplied plant fitted with easily designed details, is not only to purchase at non-competitive prices, but also to defeat the main object with which experts are employed, that is, to furnish technical advice and unbiased opinions.

Some engineers think themselves hardly used when their motives are questioned by those in the trade, after one firm has been particularly favoured to the practical exclusion of all others, but in matters of this kind, the more open and above-board the inquiries and contract arrangements, the less is the opportunity for dissatisfaction on the part of unsuccessful tenderers.

The remarkably good results so far obtained from the engines, turbines, generators and sub-station plant of British design and construction, supplied to the London County Council, at a time when very little had been attempted at home previously on so large a scale, tend to show that those who run down all plant made in this country, or confine all their orders to one firm, must be actuated not merely by prejudice, but must be in a state of ignorance of the all-round progress that has taken place at home in recent years.

The Effect of the Eight Hours Act.

The need for engineers in charge of large central stations to keep a sharp eye upon the quality of the fuel which is now being delivered to them, especially when this fuel is slack or small coal, is emphasised strongly by some figures which have been published lately in the chief organ of the coal mining industry in this country,[*] relating to the increase in the percentage of ash in the small coal produced by the South Wales coal mining district.

In the year 1887 the percentage of ash in the coal from 16 leading collieries using Cardiff as their port of shipment averaged 8·43 per cent., while in August, 1909, the corresponding figure was 14·2 per cent. Similarly, in Monmouthshire the percentage of ash has risen from 12·04 to 15·58 per cent. To quote the paper and article from which these averages are compiled :—

> This statement speaks very largely for itself, and will probably both astonish and grieve those who have at heart the best interests of the trade. It will be seen that in many cases the yield of ash has been doubled; that in a few it has been more than trebled; and that only in rare instances has it been kept stationary. Of course, analyses vary appreciably, even in short periods, but they have never shown such unsatisfactory results as they have done since the Mines Eight Hours Act has been in operation. In order

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[*] *Iron and Coal Trades Review*, September 24th, 1909, "The Small Coal Problem."

to minimise that Act's restrictive effect on outputs, every effort has been made by colliery managers to accelerate the rate of production, and, apparently, one of the many consequences, unfortunately, of these efforts, has been increased carelessness in the filling of trams, and a corresponding decline in the quality of small coal. A few instances may be mentioned in illustration. In February last, the percentage of ash yielded by colliery A was 11·20--last month the percentage was 14·18; in the case of D it has increased from 10·83 to 13·28; whilst in other cases it has increased from 8 90 to 13·96—from 11·0 to 13·52—from 11·32 to 12·40—from 11·10 to 13 96, and from 16·36 to 18·88.

As proof that this deterioration in quality is not confined to the South Wales mining district, we may quote the experience of a firm in South Lancashire, who have been sampling and testing their supplies of small coal regularly since the beginning of the year, and who have found a notable increase in the percentage of ash in the coal delivered during the last two months.

Under these circumstances we advise all engineers to peruse carefully our leading article of September 24th, upon "Fuel Supply Contracts," and to consider whether it will not be advisable to adopt one or other of the systems of purchase there referred to, in the framing of the fuel contracts for the coming year.

The Japan-British Exhibition.

We have received from Mr. W. H. Stentiford, the secretary of this Exhibition, which is to be held at Shepherd's Bush next year, a batch of documents describing the undertaking. Electrical firms who propose taking an interest in the matter can obtain copies of the prospectus by writing to him at the Exhibition Offices at the Exhibition. It is expected that the unique character of the Far Eastern exhibit, which is wholly under the auspices of the Imperial Japanese Government, will have greater drawing powers than even the Franco-British Exhibition. Though the Exhibition is not officially recognised by the British Government, a keen interest is being taken in it by many of the most eminent personages in the kingdom and by members of the Government, and it is hoped that the British section will not be less interesting than the display of arts, crafts and products of Japan and its neighbouring countries. The members of the British electrical industry are being circularised, drawing attention to the excellent opportunity that will be afforded of bringing our manufactures under the notice of the many Far Eastern and other desirable foreign visitors—possible purchasers of engineering material. Many visitors are expected from the Continent and America. We have before us a plan showing the proposed arrangement of the different classes of engineering exhibits in the Machinery Hall. The electrical engineering exhibits will lie between the spaces devoted respectively to gas and mechanical engineering stands on the British side of the Hall. A supply of direct, single-phase and three-phase current will be available for lighting and power. The tariff for space will be the same as at the Franco-British Exhibition of last year. Mr. Stentiford will send copies of the plan, together with space application forms, to any firm interested in the matter. We hope that our manufacturers will not allow the matter of this exhibition to be shelved without giving the fullest possible consideration to the chances of deriving benefit directly and otherwise from a demonstration of their capabilities before Far Eastern visitors.

The Rolled Steel Wheel.

Not so long ago there was considerable controversy as to the best type of wheel for electric tramcars, but the struggle then was between chilled iron and steel tires. It was well fought upon both sides, and the steel tire won in the end, although the chilled wheel is used largely still in its home across the Pond, and in the British home of its adoption.

During that controversy whispers reached us of another rival in the field, and in the interval we find it a champion grown, already at fisticuffs with its fore-runners. This is the rolled-steel wheel, partaking of the nature of both predecessors, for it is solid like the chilled iron wheel, and it is made of the same material as the rolled steel tires. Therefore, if the newcomer finds the universal favour which some of its admirers predict, it may be said that the battle between "chilled" and "tire" resulted in no win for either but a compromise.

It is evident, from the report presented by a committee to the American Street and Interurban Railway Engineering Association, that the rolled one-piece wheel is making rapid progress in the U.S.A. Fifty companies returned data on these wheels, and it is said that many of the larger concerns are adopting them as safer and more economical than the steel-tired wheel.

The diameters used vary from 30 in. to 37½ in., and the radial wear seems to be the same, whether tired or solid wheels are used. In some cases rims are worn to an extreme limit of ½ in., but the majority of roads use limits ranging from 1 in. to 1½ in.; ¾ in. is considered perfectly safe with a rolled steel wheel, but tires worn to this degree tend to loosen.

As might be expected, the wheel makers were not anxious to give away anything about the composition of their products, and only one reply was received to the question asking for specifications. This maker uses the following mixture :—

Carbon	...	0·65 to 0·85 per cent.
Manganese	...	0·60 to 0·90 per cent.
Phosphorus	...	0·60 per cent.
Silicon	...	0·15 to 0 35 per cent.
Sulphur	...	0·05 per cent.

As no indication is given of the status of this maker, or where his wheels are marketed, it is not possible to judge whether the analysis is good, bad or indifferent in practice, although it appears to be similar to the usual composition of British steel tires.

Probably it is the same maker who provides an interesting outline of the process of working up the wheel from the ingot. A long ingot is cast vertically and cropped cold, discarding all segregation and shrinkage defects. The resulting billet is pressed into rough shape under a 12,000-ton hydraulic press, whence it emerges from 6 in. to 10 in. less in diameter than the finished wheel. It is of the utmost importance that the metal shall be homogeneous and solid, and the centre of the "blank" which comes from the press contains any piping or segregation. The centre is punched out to make the bore of the wheel, so that the imperfections are removed in the punching, which weighs 18 lb. and upwards. The blank is now rolled in a specially-constructed very heavy mill, in which the work is done on the plate (web) and rim, expanding the diameter until the finished section is obtained. The rim is entirely surrounded by rolls, except that portion from which the web springs. Rolling increases the density of the metal, as with steel tires and rails.

Makers are unanimous in declaring that the rims of rolled-steel wheels are uniformly hard throughout their depth, but the experience of users is that the last turning is slightly softer than the first.

The Committee conclude that at the present time there is not enough experience to enable them to make a definite statement as to which type of wheel is preferable; but it would seem reasonable, in their opinion, that a one-piece wheel should be better, or at least safer, than one made of several parts. Although the rims are not quite homogeneous throughout their life, they have a greater safe-wearing depth than steel tires, and the scrap value is in favour of the one-piece wheel.

Little or nothing has been heard of the rolled-steel wheel on this side of the water, but American practice is sure to be reflected here sooner or later, just as British improvements always influence American standards, albeit without much acknowledgment in most cases. Oft-times an innovation is overtaken by the fate which is natural to exotics treated as hardy plants, but upon occasion a long and useful life follows the transplantation. In this particular case the chances seem to be that the rolled-steel wheel will strike a true graft in these islands, but it may not be for another while.

FEATURES OF THE DESIGN AND OPERATION OF ROLLING MILL MOTORS AND THEIR ACCESSORIES.

By W. Manktelow.

A reasonable knowledge of the general method of manufacturing iron and steel rolled sections is here assumed in order to allot the maximum space possible to the consideration of the following matters :—(*a*) A brief discussion of the relative advantages of electric and steam drive for the rolls ; (*b*) the energy and horse-power required in rolling mill motors ; (*c*) the proportion of the maximum H.P. demand that need be taken as the basis of the continuous rating of the various machines ; (*d*) allowance to be made for auxiliaries ; (*e*) types of electric motor used for roll driving ; (*f*) gearing of motors to rolls and reversal considerations ; (*g*) use and design of fly-wheels as large energy reservoirs ; (*h*) secondary batteries as load equalisers.

(*a*) *Electrical v. Steam Driving.*—Electric driving for rolling mills has now proved commercially economical in working over periods of several years in many Continental and American works, and is at present installed in several large English concerns. The high capital cost of electrical operation, particularly when its adoption necessitates the scrapping of an existing steam plant, is its chief objection ; but even so, it has been repeatedly justified by results. By the substitution of an electric for a steam drive, it is usually possible to work at higher daily outputs while running shorter shifts and employing fewer men.

Not only is electric operation more efficient, it is also more reliable and steady ; this, combined with the higher rolling speeds permissible, results in an increase of output of from 20 to 50 per cent. being obtained. Electric motors and their control gear occupy far less floor space than the corresponding steam equipment, and extensions are more readily made. The adoption of electric drive for the mill motors is usually accompanied by a complete replacement of all steam power in the works, all the advantages consequent on the centralisation of power then accruing. The ease with which the energy consumption in any operation can be accurately measured is a most valuable feature in aiding the evolution of economical means of working.

(*b*) *Energy and Horse-Power Required.*—The *energy* required to effect a given purpose is naturally the true criterion of the efficiency attained, the *horse power* expended being mainly concerned with the speed of working. In the present case, however, the capital cost of the installation and hence its indirect working charges depend on the horse-power that must be installed, hence the importance of the latter amount. The energy required per ton of metal rolled depends on the weight and shape of the block dealt with and of the section ultimately required. In general, the heavier the ingot, the less rolling it needs, and the more compact its initial and final forms, and hence the hotter it keeps during rolling. The energy consumption per ton rolled is, therefore, less in such cases than in the case of light rails, channels, plates, &c., where the relatively large surface and great length of material per ton weight favour rapid cooling and high roll friction. Plates, for instance, frequently cool from 1,200°-1,300° C. to 800° C. during rolling, so necessitating a large increase in the relative energy expenditure during the final passes. As illustrative of this point and as a useful guide for estimating purposes, the following figures may be noted :—

	KW.-hours per ton.
Mean energy consumption for rolling rods and rails ...	42·3
" " " " channels and plates	91·1
Mean of 20 tests, including both the above sets... ...	59·4

As regards the horse-power allowance to be made when designing a new scheme, figs. 1 and 2 present useful information. Fig. 1 shows the relationship between the prolongation of ingot and the horse-power per ton of ingot for various weights of the latter. For a fairly low number of prolongations, say 10 to 20, it is necessary to install motors relatively far more powerful than are required for heavy blocks whereas, as the number of prolongations increases, the horse-power allowance approaches a common value for all cases (roughly 4,000 H.P. per ton of ingot).

Fig. 2 shows the increasing horse-power necessary if higher outputs per hour are to be attained ; the number of passes per ingot must be reduced by the use of a heavier draught, this being made possible by the more powerful motors installed. Under these conditions the horse-power required per ton of output per hour falls rapidly as the latter increases. The advantage of working on as large a scale as possible and of keeping the whole plant fully loaded is emphasised ; by this means also the relative importance of friction losses is reduced to a minimum. To obtain the maximum output from the installation, it is advisable to arrange the passes and draught in each case so that the motor torque is constant so long as the machine runs at about the same speed. Such improvements in manipulation as the introduction of hydraulic or electrically-operated tipping tables, live rolls, furnace chargers and withdrawers, &c., as well as the higher speeds consequent on electric driving, have resulted in great reductions in working costs.

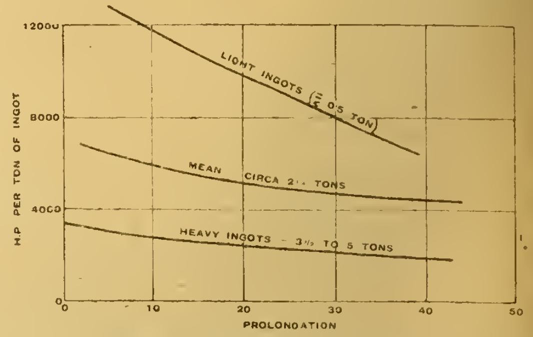


Fig. 1.—Curves Showing Relation Between Ingot Prolongation and H.P. per Ton.

(*c*) *Power for Auxiliaries.*—Among the chief auxiliaries of a rolling mill are the live roll motors, tipping tables, and so on, while the excitation of the main motor and the machines of the fly-wheel set and their auxiliaries require a considerable expenditure of energy. The "live" or traversing rolls require 50-100 H.P. each in many cases. In a particular installation each of the live rolls (before and behind the main rolls) was fitted with two 40-H.P. series motors, running at 500 R.P.M. and of 200 kg. m. torque, while in another equipment 80 H.P. was required to excite the generator and mill motor fields and the special accumulative compound winding for the latter. In most cases the auxiliary energy consumption amounts to from 5 to 10 per cent. of the total.

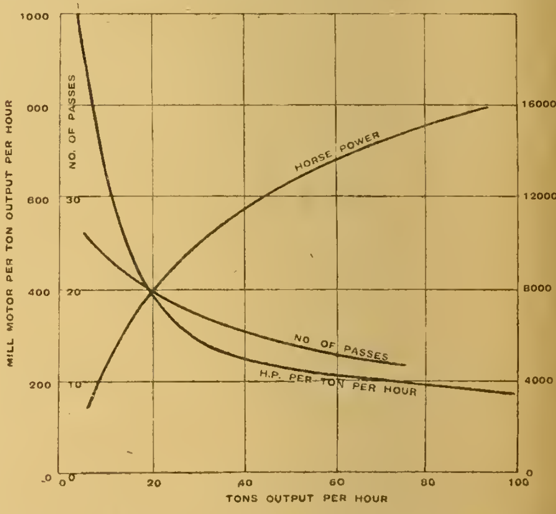


Fig. 2.—Curves Showing Relation of H.P. and Output.

(*d*) *Types of Motor Used.*—The load on rolling mills being one of the most variable kinds to which electric motors are applied, it is obvious that shunt motors are not suitable for the purpose, though in at least one installation two 3,500-H.P. D.C. shunt motors are used for such a load. The armatures are on one shaft, and the extreme overload capacity of the two machines is 30 per cent. above the normal maximum of 7,000 H.P. Simple series machines are impossible because of their racing tendency on light load and their too drooping speed characteristic on heavy load. Thury series motors have been successfully employed, and possess many valuable features in this connection. It is obvious that, being constant-current machines, no harm can be done to them, even should they be brought to a standstill by an overload. A fly-wheel is still employed as an equaliser in such cases, but is placed on the same shaft as the generator and prime mover. The generator voltage is automatically varied as required by the load. The motors, being direct-current machines, are more suitable for their work in many respects than alternating-current machines. No switchgear, beyond a simple "on" and "off" lever, is required, all regulation being automatically effected by brush movements on the generator. Such a simple and robust system, though open to the grave dangers of all constant-current systems, is otherwise excellently suited to its work, its surroundings and its manipulators.

Accumulatively compounded D.C. motors have a very suitable speed characteristic for the present purpose, though it is no longer necessary to rely wholly on a drooping characteristic in the main motor to enable the fly-wheel's stored energy to become operative. The fly-wheel or buffer battery, as the case may be, is electrically compelled to take on part of the load when necessary.

Three-phase motors are very common, not because of any inherent advantages in their characteristics, but because of the well-known conveniences afforded by alternating currents where large amounts of energy are concerned. In practically every instance a modified Siemens-Ilgner winding equipment is employed.

In April, 1908, 230 rolling mill motors in Europe totalled 190,000 normal H.P. and 410,000 maximum H.P. (according to Hooghwinkel), giving an average of 830 H.P. each and a mean overload capacity of 2·15 : 1. The largest single motors regarding which information was then available were the two 7,500-H.P. machines of the Rombacher Hutte—both coupled to the same shaft.

Overload capacities of 3 : 1 for short periods are not uncommon in rolling mill motors, which have, in general, to operate under a worse load factor than colliery winding engines in spite of recent improvements (the figures in the two cases being 40 per cent. and 49 per cent. respectively). Where an electro-mechanical fly-wheel storage system is employed, as is usual in electrically-driven mills, the horse-power of the converter motor, *i.e.*, the *steady* horse-power supplied to the circuit usually varies from $\frac{1}{5}$th to $\frac{1}{10}$th the maximum output of the main motor. In several of the largest Continental and American installations the ratios have the values shown in Table I (see also fig. 3 for mean values).

TABLE I.

Maximum H.P. of main motor.	H.P. of converter motor.	Ratio.	Main motor. H.P.	Converter H.P.	Ratio.
± 15,000	2,800	5·35 : 1	± 12,000	1,000	12 : 1
± 10,000	1,400	7·15 : 1	± 12,000	1,800	6 7 : 1
± 7,000	1,300	5·4 : 1	± 10,000	1,000	10 : 1
± 3 600	950	3·8 : 1	± 4,000	700	5 7 : 1
± 9,000	1,200	7 5 : 1	± 1,100	100	11 : 1

(*e*) *Gearing and Time of Reversal, &c.*—As a rule the driving motor is direct coupled to the roll shaft, some degree of flexibility in the coupling being desirable in the case of motors of very large horse-power. Convenient forms of flexible couplings for such machines consist of 20 or more tapered steel rods or leather bushings in the holes for the bolts of the flange couplings.

If the main motor be not direct-coupled to the rolls it is geared down to them, usually in the ratio 2 : 1 or 5 : 1, the torque available at the rolls being correspondingly increased. In some cases the roughing rolls are direct-coupled to the driving motor, the finishing rolls being rope-driven from pulleys on the first shaft; such an arrangement is neither neat nor convenient, but is cheap. The arrangement, employed in some installations, of assisting an electric motor direct-coupled to the rolls by a gas engine, also coupled-up when needed, is not to be recommended if at all avoidable. The overload capacity of gas engines is very poor, they being the worst prime movers in this respect. The characteristics of gas engines render them quite unsuitable for use in parallel with electric motors.

The necessity for rapid reversal of the rolls will be appreciated from what has already been said regarding the importance of maintaining as high a mean temperature as possible in the metal during rolling. In Table II are shown the times of reversal of several modern electrically-driven rolls of the R.P.M. stated. The number of times the rolling cycle can be completed per minute is also given:—

TABLE II.

Reversal from	Is effected in	The rolling cycle being completed
± 120 revs. per min.	6 seconds.	7 times per minute.
± 110 "	4½ "	12 "
± 100 "	2½ "	14 "
± 90 "	2 "	15 "
± 60 "	1½ "	28 "

The statement that electric motors are inferior to steam engines in rapidity of reversal and acceleration cannot be justified, and in any case would be purely a matter of the horse-power and starting torque of the motor installed and the inertia to be overcome.

(*f*) *Fly-wheel Use and Design.*—The fly-wheels used in rolling-mill installations present problems of design exactly akin to those met with in the design of colliery winding, balancing fly-wheels. Only the best material, usually cast-steel or forged nickel steel, must be used, and it must be run at as high a peripheral speed as possible. Built-up fly-wheels made from layers of armour-plate have proved in many respects more satisfactory than simple castings for the largest wheels. Owing to the difficulties and risks of manufacture of large wheels, two small ones are sometimes employed in place of the equivalent single wheel. The moment of inertia obtained per ton of metal is then reduced, the only advantage of the process being simpler and safer construction.

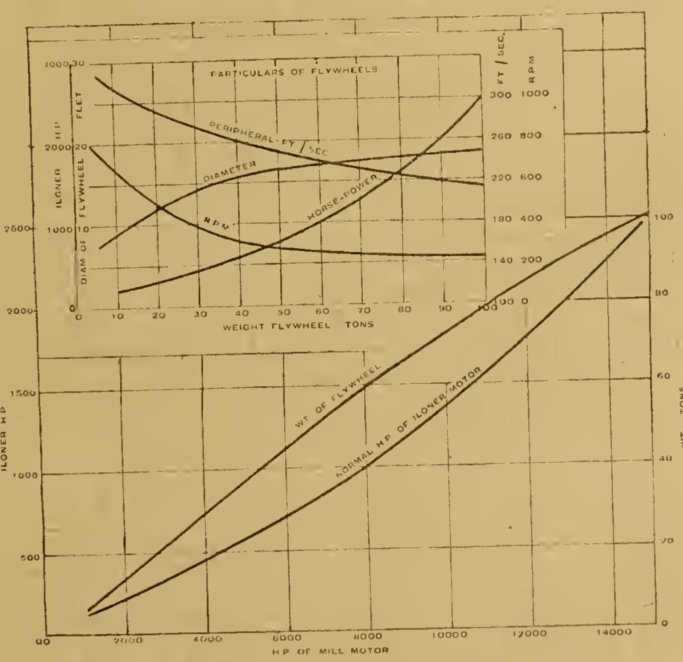


FIG. 3.—PARTICULARS OF FLY-WHEEL WEIGHT, ILGNER MOTOR H.P., &C.

A recent American design for large fly-wheels consists in the dovetailing of thin sheet steel stamped sectors to a suitable cast-steel spider. The overlapping points of the stampings are staggered layer to layer, and the whole is bolted between massive steel cover plates. Failure of such a wheel owing to unobserved defects of material is very improbable. The largest wheel yet built on this principle weighs 200,000 lb., is of 168,500 ft.-lb. units of moment of inertia, and is run at 258 ft. per sec. peripheral speed. An added advantage in the use of twin fly-wheels in cases where the load factor is very variable is that it is sometimes possible to disconnect one or both wheels when the maximum demand does not exceed the output of the Ilgner set motor. The bearing and windage losses of the fly-wheels are thus avoided and the accelerating periods considerably reduced. The curves of fig. 3 show the usual weights of fly-wheel for various horse-powers of main motor, and, inset, the horse-power of Ilgner motor required to drive the fly-wheel, and the diameter, R.P.M. and peripheral speed of the latter. The fly-wheel shaft must be of the most careful and liberal design and manufacture, and, as a tentative value, its diameter may be made = D in. = $3\sqrt[3]{\frac{W\ S}{2}}$, where W = weight of fly-wheel in tons ; S = bearing span in feet.

The excessive weight of balancer fly-wheels, together with their relatively high R.P.M., necessitates very special bearings. The simple bush type, lined with white metal and designed on the basis of a very moderate pressure per square inch of bearing, is most satisfactory. Forced lubrication, by gravity or by an oil pump, is necessary, and a hand pump should also be fitted in case of failure of the ordinary system of lubrication, which failure should be at once and unmistakeably indicated to the attendant by an alarm device. The enclosure of fly-wheels in metal casings considerably reduces their windage losses, and, to further this end, their surface should be as smooth as possible. A plain disk wheel is the best as regards low windage loss. Exhausting the enclosing casing, though beneficial, presents obvious practical difficulties.

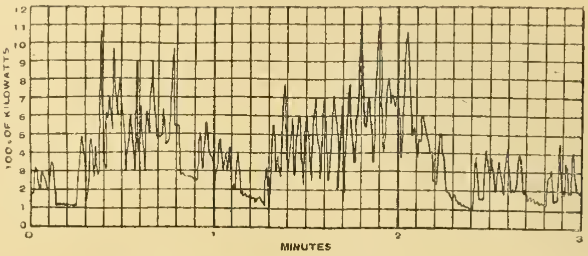


Fig. 4.—Rolling Mill Load Curve.

In order that the kinetic energy of the fly-wheel may be available to assist the rolling motor over the peaks of its load, it must be slowed down by some means on the occurrence of a peak. If the fly-wheel is on the main motor shaft, this necessitates a fall in speed of the main motor, such as is automatically obtained in accumulatively compounded D.C. machines or in three-phase machines when resistance is inserted in their rotor circuit. Otherwise the fly-wheel is compelled to slow down, meanwhile adding its kinetic energy to the main supply of energy through the intermediary of an auxiliary generator to which it is coupled, as in the Ilgner system.

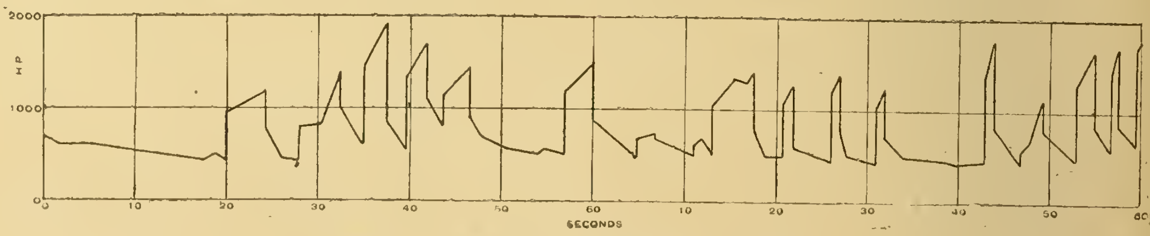


Fig. 5.—Typical Rolling Mill Load Curve.

Where three-phase motors are used, the rotor resistance, introduced to cause "slip" when desired, is obviously wasteful of energy. The waste may be reduced by decreasing the slip necessary, *i.e.*, by increasing the weight of fly-wheel used, and for maximum economy the interest on the capital cost of the fly-wheel plus the money equivalent of the energy wasted in the rotor resistance must be a minimum. The use of automatic slip resistances affords some saving in this respect. Such a resistance is only switched into circuit when the demand from the mains exceeds the desirable predetermined value, and thus the loss of energy in the rotor resistance during light loads is avoided, and the fly-wheel is enabled to speed up again more rapidly after a high load period, but it must be remembered that during the high load periods in which the major part of the losses occur, the rotor resistance is of necessity still in circuit. Though it cannot be definitely stated whether, in general, automatic slip resistances are good or bad, the extra complication they involve frequently only results in a gain of efficiency of 1 per cent. if the maximum load periods are frequent ; if they are separated by fairly long light load runs, the saving is of course considerable. As regards the percentage variation desirable in the fly-wheel speed, this varies from 7 to 15 per cent. in most cases, the kinetic energy available being directly proportional to the difference between the squares of the initial and final R.P.M. The average horse-power available from a fly-wheel of weight W tons running at a maximum peripheral speed v ft. per sec. and retarded from angular velocity w_0 to w_1 rad. per sec. (where $w_1 = \frac{1-p}{100}w_0$) in a period of t seconds is given by—

$$\text{H.P.} = \frac{W\,v^2}{316{,}000 \times t}(200\,p - p^2) \quad . \quad . \quad . \quad . \quad (1)$$

(*h*) *Batteries as Load Equalisers.*—A study of the load curves shown in figs. 4 and 5—typical of rolling-mill practice—and an appreciation of the enormous magnitude of the variation in demand, will explain and justify the statement that electro-chemical storage is quite unsuitable for equalising such loads. The life of secondary cells in such a service, subjected to great overloads both of charge and discharge, is very unsatisfactory. It is, of course, not impossible to use chemical storage, but the cost of so doing will, in most cases, far exceed that of storage on any of the well-known electro-mechanical schemes (Westinghouse, Siemens-Ilgner, Creplet-Lahmeyer, &c.). The Iffland system is typical of those employing a "floating" battery to aid the main generator, and, apart from the above inherent disadvantage, has the advantage of avoiding friction and windage losses, while the battery will serve as the sole source of energy for a short period in case of breakdown in the normal supply circuit. Such duty as the latter is, however, very destructive to the battery. The efficiency of electro-chemical storage, especially on short alternate charge and discharge, is very high, being frequently over 95 per cent.

In the mills of the Carnegie Co. there has recently been installed a battery of 125 secondary cells having 10,000 amperes normal discharge current with an output of 15,000 amperes over short periods.

In general there can be no doubt that electro-mechanical is preferable to electro-chemical storage, in spite of the difficulties involved in the manufacture and running of sufficiently heavy wheels, and, electrically, in voltage control and the elimination of sparking. The use of commutating poles and Deri windings has enabled direct-current motors to be run sparklessly, even with such variations of load as are shown in figs. 4 and 5.

When designing rolling-mill equipments it is necessary to ensure compactness of arrangement while preserving easy accessibility for repair, substantial and shock-resisting construction and easy, simple and safe control, preferably from an elevated platform, whence the whole machinery controlled can be overlooked. All these desiderata can be much more readily fulfilled in electrically-driven than in steam-driven installations.

A 100,000-volt Sub-station.—The Denver substation of the Central Colorado Power Co. is now complete. The oil switches and lightning arresters for the incoming 100,000-volt lines are located some distance from the main building, and the pumps for the transformer oil-cooling are also in a separate building at the edge of a small creek. The main building is used for purely sub-station purposes, and is without a pound of combustible material in its structure ; and a transformer oil fire is the only possible damage. This, however, is safeguarded against by every possible precaution, and the tanks are so arranged that the transformer room can be flooded with carbonic acid gas in case of necessity.—*Electrical World.*

ASYNCHRONOUS PLANT AT THE PRAHRAN (VIC.) DESTRUCTOR.

The asynchronous generator, although discussed in text-books on electrical generating machinery and now and then noticed in the electrical journals, is rarely met with in practice. Very soon after the introduction of the asynchronous or induction type of alternating-current motor, proposals were made and patents taken out for the use of these machines as generators under various arrangements, but for reasons not easy to discover the method has been seldom applied. Advocates of this type of generator, however, from time to time make themselves heard, and quite lately an excellent paper was read by Mr. W. L. Waters before the American Institute of Electrical Engineers, again drawing attention to the type and expressing surprise at the neglect of its good qualities. One of the latest notices of an asynchronous generating station in actual operation appeared last year in the technical papers in a description of an hydraulic installation on the Rheinbinnenkanal, Switzerland, in which two asynchronous generating stations are run in conjunction with, but at several miles distance from, the master synchronous station. Two important characteristics may, after all, explain the apparent neglect of this type of generator. These are, first, its somewhat low power factor; secondly, its incapacity to generate unless running in conjunction with a synchronous generator; where the choice lies between such a set and one which can independently generate the station engineer will naturally prefer the latter. There are, however, conditions in which the characteristics of the asynchronous generator are of special value; hence a description of an installation lately completed in Australia may be of interest.

Prahran Destructor, showing the Cells.

The Council of the City of Prahran, the largest suburb of Melbourne, with a population of 43,000, decided to erect a refuse destructor, and an order was ultimately placed with Messrs. Meldrum Bros. for two independent units of their Simplex type. As the refuse to be burned varied between 20 and 35 tons per day, and averaged throughout the year 26 tons per day, it was evident that a good deal of waste heat would be available, and accordingly a Babcock water-tube boiler of 1,426 sq. ft. heating surface was incorporated in each unit. A portion of the steam generated was reserved for operating a mortar mill, and a clinker-crushing and grading machine, as well as for use with the feed pumps and forced draught, and it was decided to use the remainder in the generation of electricity for sale. Before deciding as to the generating plant to be installed, careful consideration was given by Mr. Calder, the city engineer, to all the conditions surrounding the proposed supply, with the result that the following desiderata were formulated:—

(*a*) Before all else, it should be recognised that the destructor was a destructor of refuse, and not a power house for the supply of electricity to consumers. Complete destruction of the refuse was the primary consideration; the generation of electricity a secondary one only.

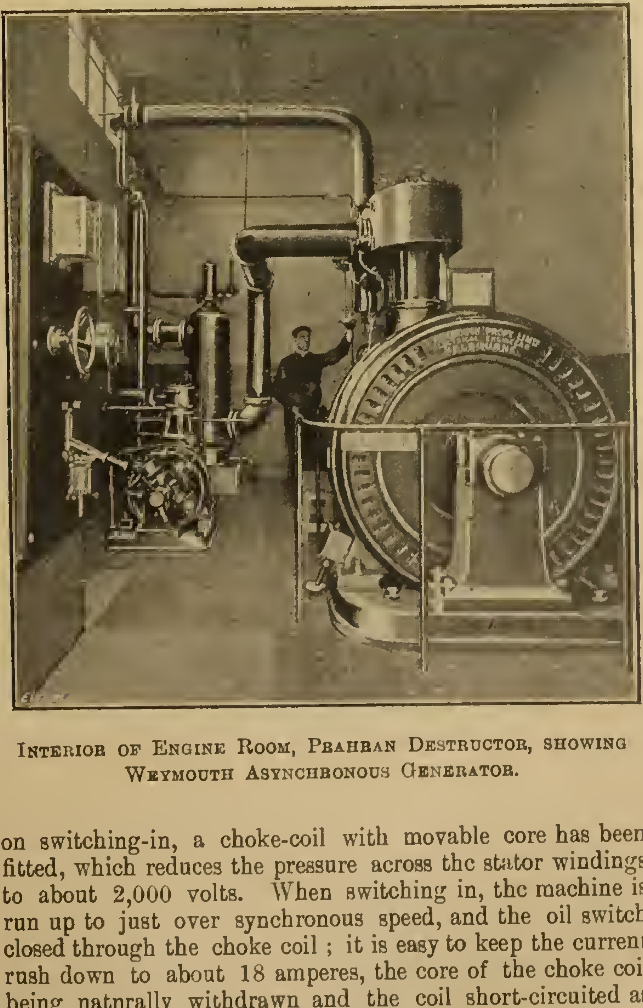
(*b*) The consumer of electricity supplied from a destructor should not prescribe to the Council the rate at which electricity should be supplied or the times when it should be available, for the requirements of the ordinary consumer would be inimical to the proper operation of the destructor as a destructor, and lead to considerable waste of steam. Hence the ideal consumer was one who would provide, as it were, an "electric sink," into which the destructor could pour its by-product when and as fast as made, and who would not grumble even if, at times, no supply were forthcoming.

(*c*) The generating machinery must be so arranged that the output would automatically follow the ever-varying rate of steam production as closely as possible.

(*d*) In order to save labour, which in Australia is an important item, the machinery should be as automatic and simple in operation as possible, so that the existing staff at the destructor could operate it without difficulty.

The ideal consumer was found in the Melbourne Electric Supply Co., the electric undertakers for Prahran and the surrounding suburbs, who undertook to provide the "electric sink" required under Condition (*b*). They, however, stipulated that the destructor staff, naturally unskilled in electric supply, should not find it necessary to undertake the somewhat delicate operation of synchronising their generator on to the company's mains, and this stipulation, coupled with the requirements of Conditions (*c*) and (*d*), led naturally to the choice of an asynchronous generator.

The company's system, covering an area of over 40 square miles, distributes by single-phase alternating current, 50 cycles, at a pressure of 4,000 volts. (For a description of this undertaking, see our issue of July 9th last.) The Council's asynchronous generator was, therefore, built for this pressure, by Messrs. George Weymouth & Co., Melbourne, and has a maximum output of 125 KW., an efficiency of 88 per cent., and a power factor of ·87. The alternator is direct-coupled to an Allen non-condensing compound engine, running at 375 R.P.M. Synchronising gear is, of course, absent, but in order to keep down rushes of current on switching-in, a choke-coil with movable core has been fitted, which reduces the pressure across the stator windings to about 2,000 volts. When switching in, the machine is run up to just over synchronous speed, and the oil switch closed through the choke coil; it is easy to keep the current rush down to about 18 amperes, the core of the choke coil being naturally withdrawn and the coil short-circuited as soon as switching in has been effected.


Interior of Engine Room, Prahran Destructor, showing Weymouth Asynchronous Generator.

The perfectly automatic operation of the generating set is obtained in the following manner :—The shaft governor of the engine is so adjusted as to be quite inoperative at ordinary working speeds, which at 50 cycles and about 1·35 per cent. slip, lie between 380 R.P.M. at full load and 375 R.P.M. at the point of no load—*i.e.*, just before the generator ceases to generate, and becomes a motor. The pressure at which the boiler safety valves are set to blow off is 200 lb. ; but in order to take advantage of what thermal storage effect would be obtainable in consequence of the mass of water in the boilers, it was specified that the engine valves should be so set by the manufacturers that the full-load torque on the shaft, equivalent to the maximum load of 125 KW. at full-load speed, should be obtained with steam at a pressure of 150 lb. per sq. in. at the fully opened stop valve, the shaft governor, as mentioned above, to be inoperative. In the steam pipe, therefore, a reducing valve has been inserted, and carefully adjusted under actual running conditions. It is interesting to note that the setting of the valves was so well predetermined that the above conditions were found to be satisfied when the reducing valve was set for 146 lb., a very small deviation from the specified figure. With this arrangement, tests have shown that the steam pressure may vary from 200 lb. down to about 35 lb. at the boiler with fully opened and untouched engine stop valve before the generator ceases to generate. In this manner perfectly automatic operation is secured, and in practice the engine is not touched during the run of about 10-12 hours per day. The output exactly adjusts itself automatically to the rate at which heat is at any time being passed through the boiler plates from the burning refuse, and only those who have had practical experience of destructors know how enormously variable this rate is. The following are some test figures :—

Frequency of current, 51 cycles, and pressure 4,400 volts, both fixed by the main synchronous generators in the power house, and a load of about 0·8 power factor.

	Amps.	Volts.	KW.	Power factor.	R.P.M.	Boiler pressure.	Pressure at stop valve.
Full load ...	35	4,400	125·1	0·8125	387	170	146
No load ...	13·75	4,400	—	—	382	175	35·7

In practice, reversal or motoring does not take place ; it is evident that a very small amount of steam is required to overcome engine and generator friction, and keep them running at no-load and synchronous speed. The only use made of the shaft governor is as a run-away governor, and it is set so as to come into operation at about a 10 per cent. increase of speed over the normal.

As regards output, the results obtained during the first two or three months of operation give an average of 42 units per ton of refuse ; no allowance has been made in this figure for the steam used for the air-blast, steam pumps, mortar mill and clinker crusher. Considering that the climate of Melbourne is responsible for a much smaller percentage of household grate ash in the refuse than obtains in English refuse, the result is not unsatisfactory. The choice of the asynchronous type of generator has thus been fully justified ; in consequence of its characteristics, special labour has been rendered unnecessary ; the destructor staff cannot interfere with the pressure or frequency of the general supply, and the power to create trouble during the delicate operation of synchronising has been taken out of its hands. The "electric sink" provided by the company, moreover, enables the Council to make profitable use of every ounce of steam generated, and there is no reason to either blow off steam or tamper with the proper working of the destructor in the attempt to conform to the ever-varying requirements of the ordinary consumer. The Council of Prahran and its engineer, Mr. Calder, may well be satisfied with the success of this somewhat unusual installation.

An Aluminium Understanding.—It is stated that the principal producers of aluminium have now arrived at an understanding only to proceed with sales for deliveries until the end of next March. The makers include the Neuhausen Aluminium Industry Co., the French works, with the exception of a small factory, the American works and, it is said, the British Aluminium Co. It is believed in interested circles that the arrangement represents the preliminary step in the direction of reconstituting the international syndicate.

THE RELATION OF ELECTRICAL DISTRIBUTION TO STREET TRAFFIC.

By a CIVIL ENGINEER.

Electricity supply engineers who are interested in the design and lay-out of systems for the distribution of light and power are apt to discover that many of the problems presented to them are hardly those which can be combatted by the theoretical instruction, however sound, that they may have received in a technical college course. In very many cases the difficulties can only be met by an intelligent application of common sense, and in the design of distribution systems a considerable amount of foresight is necessary in order to avoid difficulties which upon completion would appear obvious to even the man in the street.

One of the great troubles which are found, more particularly in our larger cities, is the question of the extent to which street traffic will interfere with the installation of electric appliances. This does not merely apply to the interference which is caused to the easy installation of the plant in the first instance ; it may very easily affect the working conditions of the finished design. As the subject is of such importance from the point of view of the municipal engineer, it may be worth while elaborating the matter by noting one or two examples which have been actually met with in practice.

A very simple case, and one which, during the last year or two, has been brought very prominently into public observation, is the question of the location of arc lamp-posts for public street lighting. Undoubtedly the ideal system from the point of view of minimum obstruction to traffic is the placing of the arc lamps upon brackets secured to the premises on either side of the thoroughfare. This, however, involves two difficulties, one being the fact that it is in many cases difficult to obtain permission from the owners of such premises for the support of the brackets, except at an exorbitant rental ; the other difficulty is that with a system of street lighting from lamps situated at a distance from the centre line of the thoroughfare the light distribution upon the street is likely to be unequal, and a larger number of lamps per mile is required than if they were placed along the middle of the thoroughfare. The first difficulty is partially got over by mounting the arc lamps on standards placed close to the kerb. By the use of brackets on these standards, projecting over the roadway, a closer approximation to central lighting is obtained, but at the same time obstruction to passenger traffic is caused by the bases of the poles, and this is aggravated in many cases by the unwieldy proportions which the bases often assume due to mistaken notions as to ornamental design. In many instances the side-post construction has been abandoned, more particularly in wide streets, and centre poles have been placed in the middle of the thoroughfare. This arrangement gives the best possible distribution of light, but except where the street is a main thoroughfare of considerable width, the obstruction to horse and motor traffic is of very great importance. Where such a construction is adopted, it should be noted that every arc lamp-post should be protected from collision with vehicular traffic by means of an "island" raised some 6 in. above the surface of the roadway, and protected by hard stone kerbing. Even with this protection it has been found in the Metropolis that collisions caused by motor-omnibuses, which have a tendency to skid on slippery road surfaces owing to their great weight, have been very frequent, and means have been sought to avoid this trouble by some other means of suspension. One of the modes suggested, which appears to be meeting with favourable consideration, is the fixing of small rosettes in the walls of premises adjacent to the thoroughfare, from which steel span-wires are taken at the centre of which the arc lamps may be slung. The annual rentals for such rosettes would be smaller than those required for brackets, although it must be ascertained that the buildings to which they are fixed are structurally strong enough to withstand the heavy strain of the span wire.

In cases where the side-post type of lighting is adopted, which is the most common solution of the difficulty at present, great care should be taken to see that every lamp column is placed at the statutory distance away from the edge of the pavement, as where this point is neglected any claim for compensation for damage caused by the knocking-down of such columns by vehicles in foggy weather or where the roads are greasy will be nullified.

The question of trimming the arc lamps has a very serious bearing upon the placing of arc lamps for street lighting purposes, and in some cases it would almost appear as if this point had been overlooked, or at any rate as if insufficient precaution had been taken to avoid accident. It is, for example, the custom in many cases where the municipality owns a tramway system to utilise the standards employed for supporting the overhead conductors for the purpose of giving a central system of street arc-lamp lighting, by placing the arc lamp on the top of the pole bearing the brackets for the conductors. This in itself is quite a sound construction so long as care is taken to select a type of arc lamp whose steady effect is not interfered with by the vibration due to the periodical passage of car trolleys. In some instances, however, owing to the narrowness of the streets, or to an attempt to economise on first cost, the tracks are laid so close together that very little clearance is left between the side of the car and the column; where this is the case the arc-lamp trimmer is given a narrow ladder which he has to plant with great exactitude against the column, and the clearance between the edge of the ladder and the side of the passing car in some instances is only a fraction of an inch. It is obvious that a very slight error of judgment in such a case would cause a very nasty accident, should a passing car knock the ladder away when the trimmer is engaged in putting in new carbons or cleaning the lamp. Even where due precaution is observed as to the clearance of tramcars, it does not follow that safety is ensured to the arc-lamp trimmer. Some little time ago in the metropolitan area an arc-lamp trimmer was very seriously hurt owing to the fact that he was working on the top of a ladder provided with wheels, used for trimming street arcs. A passing 'bus skidded and collided with the ladder, bringing the man to the ground. Fortunately there was no loss of life, and only minor injuries to the man, but the injury so upset the man's nerves that he was afterwards unable to carry out such work, and the result might easily have been still more serious.

The subject of interference with electricity supply owing to street traffic does not, however, end with the question of arc-lamp columns. The switch pillar, which is frequently adopted in order to give adequate space for the housing of tramway and other switchgear without incurring cost of excavation work, comes under precisely the same category as the arc-lamp columns as regards obstruction to traffic, more especially as the switch pillar often contains a large amount of apparatus and heavy connections, and must therefore either be of large dimensions or else have very cramped internal arrangements. The tendency is to place such switch pillars as near to the edge of the pavement as ever possible, in order to avoid obstruction to passenger traffic. This, however, has its danger. In one instance a switch pillar placed right on the edge of the pavement in a main thoroughfare had one of its sides smashed in by the wheel of a passing cart. The cart in drawing up to the kerb completely broke in one side with its wheel, as the cover was made of cast-iron only $\frac{1}{8}$ in. thick. The broken side fell inward and came in firm contact with a live terminal, making the whole framework alive and rendering any passer-by liable to shock. Fortunately the voltage of this terminal was only 200, but the matter was sufficiently serious to show the danger of placing such a post in a position where it was liable to vehicular concussion. In order to remove the danger of shock to pedestrians the broken side was lifted out, and wooden planks were wedged into place to serve as a safeguard against the inquisitive small boy until the pillar could be properly repaired. The question of constructing such pillars of mild sheet steel is worthy of some consideration.

The increasing weights of carts, lorries, &c., which are now coming into vogue, owing to the greater use made of petrol tractors, bring in their train the necessity for the reconsideration on the part of some electricity supply authorities of the design of the street service boxes which are used at corners of thoroughfares and other exposed positions for the purpose of connecting and inspecting the cables running in the streets. The usual urban by-laws provide for the burying of cables at a sufficient depth or their protection in some other approved way, to provide against disturbance due to the passing of heavy traffic; and up to the present the limits of safety in this direction have not yet been reached by the increase of size of traffic units. The weakest part of the system is, however, as may readily be imagined, at the point where the electric connections are brought nearest to the surface, that is to say, at the junction and inspection boxes, and it would be well for electrical manufacturers to examine their designs in view of the more stringent requirements which are now made necessary owing to the increase in weight of the traffic. As a case in point may be mentioned a fracture of a street box containing low-tension fuses, which had its cover entirely broken up by the wheel of a heavy traction engine. Pieces of the cover fell into the interior of the box, but the apparatus was fortunately protected by a glass lid, preventing earth contact being made. Fortunately this glass did not break at the time of impact. In order, however, to protect the street box from subsequent injury, a temporary repair pending the replacement of the cover had to be made by letting in a paving stone of the required size flush with the road. The lesson to be learnt is that such expedients should not become necessary, and that in order to meet the case designers should take pains to construct their street boxes with a very large factor of safety, in spite of the severe competition which at present undoubtedly exists between makers of such apparatus.

It will sometimes be found that even when considerable care has been taken in the design and construction of electrical apparatus, and due regard has been given to the probable conditions under which it will have to be worked on the part of the manufacturer, his efforts are nullified by oversight on the part of a district authority or other governing body of such a simple matter as the influence of traffic conditions. Numerous cases of this kind can be mentioned, but it will be sufficient to typify them all by one example which will sufficiently indicate the nature of such trouble. A certain urban supply authority has erected a small substation on the corner of a road at the foot of a fairly steep hill. This station is a static transformer station for the purpose of converting from a high-tension supply at 3,000 volts to a low distributing pressure. It contains not only transformers, but also high and low-tension switchgear, the necessary bus-bars and connections. All this apparatus is of good design and thoroughly adapted to the work for which it is intended. The sub-station, however, which is made of cast-iron structural work, the plates being about $\frac{3}{16}$ in. in thickness, is situated above ground on the edge of the pavement, this being a fault in location which will sooner or later almost inevitably induce a most serious accident. It is quite possible that on some occasion a vehicle will fail to turn the corner and will almost certainly crash into the station. It is quite conceivable that under such circumstances the broken metallic side of the substation may rest on the high-tension plugs, and the results to the curious crowd which will inevitably collect would be too terrible to be imagined with equanimity. It may be argued that this is rather an exceptional instance of short-sightedness in the location of electricity distribution and utilisation devices, but it will probably be found that a good many instances of inattention to traffic conditions can be found in a considerable number of the supply systems operating in congested areas. The consideration of traffic conditions in electrical plant design will therefore probably be worth the attention of our engineers in a more marked degree than at the present time is apparently the case.

South African Trade.—There are signs of improvement in South Africa. Reuter's Cape Town representative says that the imports from the United Kingdom to South Africa have increased 2 per cent. during the past nine months. Foreign imports decreased 1 per cent., as compared with the corresponding period of 1908. "For the month of September the former show an increase of 4 per cent. and the latter a decrease of $5\frac{1}{2}$ per cent. against September last. This is the first decided turn for several years."

WAGES IN THE ELECTRICAL TRADE.

The Labour Department of the Board of Trade has issued a report in which it is stated that the standard hourly rates of wages and usual working hours in a full week (exclusive of overtime) recognised at October 1st last by the Electrical Trades Union for its members in the undermentioned towns of the United Kingdom were as follows:—

District.	Electric fitters and wiremen.	Armature winders.	Cable jointers.	Instrument and switch makers.	Weekly hours of labour.
England & Wales.	*d.*	*d.*	*d.*	*d.*	
Barrow	8	8	...	...	53
Birmingham ...	8½	9	9	8	53
Bolton	8½	9	...	...	50
Bradford ...	8	8	9½	...	50* 54†
Bristol	8	...	...	...	...
Cardiff	9	9	9	...	54
Hull	8	9	9½	8	53
Leeds	8	8	10	...	...
Leicester ...	8½	8½	8½	8	53* 54†
Liverpool ...	9	9	9	9	50* 53†
London	9½	9	9½	9	54
Loughborough ...	8½	33s.‡	...	...	52½
Manchester ...	8½* 8¾†	8¾	8½	37s ‡	49 to 53* 53†
Middlesbrough ...	8	8	...	...	53
Newcastle ...	8	8	...	...	50* 53†
Norwich... ...	8	...	8	...	54
Nottingham ...	8	8½	7½	8	54
Oldham	8½	8½	...	...	52
Plymouth ...	36s.‡	36s.‡	36s.‡	...	48§ 54‖
Portsmouth ...	36s.‡	36s.‡	36s.‡	...	48§
Preston	8½	36s.‡	8½	...	50
Sheffield ...	8½	8½	8½	8½	50* 53†
Southampton ...	8	8	8	...	54
Southport ...	8½	...	8½	...	49½
Sunderland ...	8	8	8	...	53
Wolverhampton	8	8	8	...	53
Scotland.					
Aberdeen ...	7 to 8	8	...	...	51 to 54
Edinburgh ...	8	8½	...	...	51
Glasgow... ...	8	9	8½	...	54
Ireland.					
Belfast	8	8	8	...	54
Dublin	8	...	9	...	54

* Building trade. † Engineering trade. ‡ Per week.
§ Dockyard. ‖ Town.

THE "E.I.C." COAL TROLLEY.

In many public institutions, such as schools, workhouses, hospitals, and in small and moderate-sized electricity works, pumping stations and factories, it cannot be arranged to have every pound of coal weighed, and there is no simple method of knowing day by day how much coal has been consumed. The stock which remains at any given time is difficult to estimate in the rough pile, and no reasonable statistical accuracy is practicable. To get over this difficulty a new coal trolley has been devised by Mr. Chas. A. Clarke, superintendent engineer of the Brentford Union.

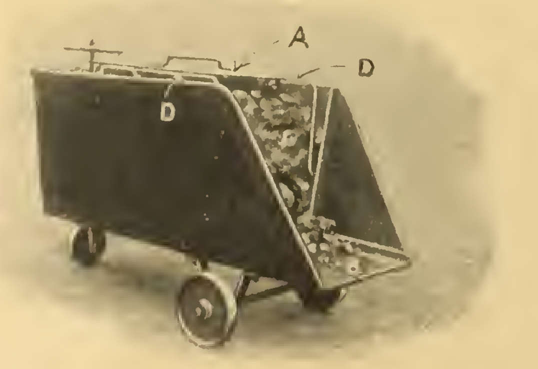


Fig 1.

This trolley is intended specially for the conveyance of coal from the pile to the boiler-house floor. It is a plate-iron box, open fronted, as shown in fig. 1, but the sides near the front end have a vertical sliding way, in which slides a shutter plate. At each side there is fixed also a round bar, bent to the outline of the trolley front and top edges, and these bars pass through a pair of eyes on the closing shutter. When the closing shutter is lifted so as to open the front of the trolley, it cannot be removed from the trolley, but can only be laid horizontally as a cover above the coal.

This movable slide is shown lying on the top of the trolley in fig. 1 at A; the restraining bars are seen at D D, while the upper horizontal part of each bar is visible in fig. 2.

The trolley has two leading wheels, and one trailing or steering wheel carried on a vertical bar at the back of the trolley, the bar being fitted with a T top, as shown, and with a locking pin at C. When being moved, the wheel is free to roll in the same direction as the front wheels, but when at rest on the boiler house floor, the T handle is turned through 90°, and the wheel is set across, as shown in fig. 2, and locked in this position. The slide is raised out of the guides, and the front platform B, fig. 1, forms an excellent shovelling floor. The coal is not emptied out on the floor, but is shovelled directly from the trolley, which is now prevented from moving by the transverse position of the back wheel.

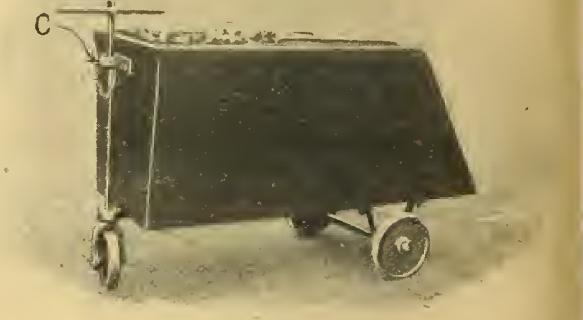


Fig. 2.

The dimensions of the trolleys so far made are such as to admit of 6 cwt. of Welsh coal broken down to proper firing lumps being shovelled into it, and experiment has shown that the accuracy is such that in a mass of 42 tons of coal, there was not found a discrepancy of more than 8 cwt., or less than 1 per cent., while a trolley taken at random was weighed and found correct within 2 lb.

It is necessary with different deliveries of coal to find whether the usual filling gives a weight differing from 6 cwt. If so, then the trolleys are so rated, but such check weighings need not be very frequent, and meantime, the weight once ascertained, it is only necessary to check the number of trolleys filled for a very close approximation to the coal consumption to be known. The position of the slide A on the top of the trolley prevents the filling of the trolley, and the slide is so easily run into position that there is no reason why it should not be.

The work of the fireman is rendered easier, because he has several inches less to stoop for each shovel of coal, and the platform B is smooth and easily shovelled from. An additional advantage is that the boiler-house floor is kept clear of fuel, and cleanliness generally is promoted, but these are all incidental to the particular object sought—namely, the checking of the fuel to within 1 per cent., which can be secured by an occasional test weighing of a loaded-up trolley to find if the coal bulks the same weight.

It is particularly claimed for this trolley that it obviates the dumping of coal in the boiler house, with the attendant dirt and dust. Three sizes are proposed to be made, of 4, 5 and 6 cwt. capacity, according to the coal consumption and the condition of the floor or roadway along which the trolley will be drawn, and its inclination to or from the boiler house.

The trolleys are made by Messrs. Pryke & Palmer, of Upper Thames Street, E.C., who are placing them on the market as the E.I.C. or Engineers-in-Charge Trolley.

While primarily intended for coal, the trolley is also useful for other approximations, as, for example, in mixing aggregates, sand and cement for concrete on extensive works.

American Telegraph Combine.—According to *Telephony*, Clarence H. Mackay, head of the Mackay Companies, a corporation which controls the Postal Telegraph Co., and is the largest stockholder in the American Telegraph and Telephone Co., when asked about the report that the Postal Co. had absorbed the Western Union, said that neither the Postal Co. nor the Mackay Companies had entered into any arrangement for the purchase or lease of the Western Union or the purchase of its stock, and neither the Postal Co. nor the Mackay Companies contemplated doing so, Competition would continue.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Power for Pioneers.

Re your article headed "Suction Gas as a Power for Pioneers," I should like to point out that it would be well-nigh impossible to transport a suction gas producer miles up country or in the back-woods, as it is now constructed, and a great question arises—Where are the pioneers to get the anthracite from? Surely the old "cranky" steam engine has the pull, as wood or any similar fuel would be easily procured and equally easy to burn in any boiler; but when the suction gas producer is designed to burn any class of bituminous coal or dross, then a wide field is surely opened up for that power which is wrongfully called "suction" gas.

R. V. Farnham.

Skelmorlie, *October 29th*, 1909.

A Question on Load Factor.

In reply to "Ratio's" letter under this heading, provided that the battery is fully charged each day from the generators during the time they are running, he will certainly be quite correct in assuming the station capacity at 200 KW. A station load factor, however, is usually reckoned on a 24-hour day basis, the actual hours of plant run only being taken into consideration in arriving at running plant load factor.

Return.

Train Lighting.

Regarding "Railway's" inquiry on page 688 of your issue for October 29th:—

(1) The G.W. Railway have, or had, one Moscowitz installation;
(2) The Leitner system has been adopted on the G.W. Railway;
(3) Turbo-generator sets on the locomotive are, or were, used in Belgium, the system being known as the Pieper & l'Hoest.

Lighting.

[Curtis turbo-lighting sets have been adopted as standard for the Chicago, Burlington and Quincy Railway's suburban traffic; see ELEC. REV. p. 864, May 21st, 1909.—EDS. E.R.]

The Possibilities of the Electric Vehicle.

With reference to your leading article in last week's issue, we have been endeavouring for some time past to interest the large business houses in London with a view to their adopting electric vehicles for parcel delivery.

Messrs. Peter Robinson, Ltd., hired one of our 15-cwt. electric delivery vans. During one week the distance covered was 204·8 miles, and the total number of units consumed for charging the batteries was 187·5. With energy at ¾d. per unit, this works out at ·68d. per van-mile run. The batteries are of the Tudor type, and their maintenance is undertaken at a cost of 1·2d. per van-mile run.

We shall be pleased to furnish full particulars to those interested.

F. A. Wilkinson & Partners, Ltd.,
F. A. WILKINSON,
Managing Director.

Harpenden, *October 27th*, 1909.

Refrigerating Plant.

With reference to the article on "Refrigeration" in your issue of October 22nd, I should like to say a few words.

In the main, there is little to criticise from a refrigerating point of view, especially in those parts dealing with generalities. They are concise and treat the subject skilfully. On certain points, however, it seems to me your correspondent has been misinformed.

First, as cold accumulators have been in use in cold storage (in a greater or less degree) ever since brine has been the cooling medium, it might have been advisable to leave out the name of the Pulsometer Co. as introducing the system. At least half a dozen firms were in front of them, each with an equally ingenious system.

Secondly, in publishing a table of capacities and powers, why select the very youngest of all the refrigerating firms for this honour? What have the dozen reputable firms done that they were not consulted, so that the table could be checked and the results be more accurate? The actual curve of powers is much steeper than that given.

A man with a store of 350 cb. ft. would be cross if told he required 2 B.H.P. to run his machine. He would says that at that rate he would have little advantage, if any, in cost over cooling by ice. The difference between 2 B.H.P. and the actual 1 to 1¼ at 2d. per unit would be great at the end of the quarter. Again, there are few machines chilling and maintaining 9,000 cb. ft. at 34° F. which only absorb 8 B.H.P.

It also appears to me to be a mistake to publish a statement that £90 will cover a man's outlay on a plant for 800 cb. ft. at 34° F. Nobody expects to get a plant at this price except at cutting rates. A manufacturer must have some profit, and surely enough cutting has already been done. "Cheap and nasty" is undoubtedly the term for this plant running 24 hours a day and then not satisfying the buyer. The machine is, however, sold from the maker's point of view, and the six months' guarantee time soon passes. The repair bill may recuperate him. On the other hand, many firms have gone under as the result of such tactics; those who ask reasonable prices are respected—and busy, too.

Most people are prepared to pay a fair price for a good and lasting article, but can this be said of a £90 plant?

There is, it is said, room for everyone at the top of the tree, and it should be the aim of every manufacturer to get there.

William Bell.

London, S.W., *October 26th*, 1909.

Finance and Industry.

Although not an inventor, I thoroughly sympathise with Mr. S. W. Martyn regarding the hopeless task of introducing any new idea to the electrical trade. This is partly due to the fact that wiring and installation work is so largely in the hands of ex-plumbers and men whose technical training does not allow them to judge of the merit of any new idea. I was recently called in to report on a 30-light job carried out by one of these men styling himself electrical engineer. My client had experienced a severe shock when standing in his bath and touching the wall, the pressure being 220 volts. The wiring was in conduit, and where the bend should have been the wire was simply taped with black tape and plastered over. Not a single bend or elbow or tee-piece could be found in the whole installation; yet this man does most of the builders' wiring work in the district!

No idea but "cheapness" would appeal to such a man. We have qualified registered plumbers; why not qualified and registered electrical contractors?

How few electrical contractors are able to give a customer any information regarding anything out of the ordinary run of things!

Six supply houses were recently asked to quote for an electric water-heater for bath-room use; only one was able to do so. In another case, a client asked a round dozen contractors to give particulars of an electrical water steriliser and filter, such as are very largely used abroad; not one of them could give him any details or even knew the apparatus. A firm of sanitary engineers were approached, and at once gave full particulars.

Until the electrical trade wake up, they must be content to see the German and American people run away with the plums, as they did in the early days of polyphase plant, and are still doing with colliery and electrical winding plant.

Flashlight.

The Coefficient of Self-Induction.

In reply to your reviewer's request for references, we may mention the following as typical:—Kapp, "Dynamos, Alternators and Transformers," 3rd German Edition, Chaps. xvi, xvii; S. P. Thompson, "Dynamo-Electric Machinery," Vol. II, pp. 18, 19, 21, 592; Steinmetz, "Alternating, Current Phenomena," throughout; A. Russell, "Alternating Current," Vol. II, pp. 299-301.

We fear that further correspondence will not bring us nearer to an answer to the question raised in our first letter, and we do not propose to continue it.

Before closing, may we ask any interested reader to look at our first letter, and then to study the following propositions, which we would especially commend to the earnest consideration of practical engineers and designers:—

1. It is practically impossible to calculate the self-inductance of copper coils near masses of iron.—October 1st.
2. Even if the calculation of Proposition (1) were possible, it would be a far too complicated function of the current to be of any use.—October 1st.
3. The coefficient of self-induction cannot be used in a vector equation at all.—October 15th.
4. When there is iron in the core of a coil, the ratio of flux to current is a double-valued function of the current (*sic*).—October 15th.
5. It is unnecessary for scientists to assume the humiliating attitude that approximations are necessary.—October 29th.
6. The idea of calculation by equivalent sine waves was exploded some years ago.—October 29th.
7. If the wire of a coil be infinitely thin, the inductance is infinitely great, whatever may be the shape of the coil.—October 29th.
8. If there is iron in the neighbourhood of a coil, the notion that the flux is proportional to the current is one which will appeal only to the simple ones of this world.—October 29th.

It is further stated of the approximations constantly made by every designer of alternating-current machinery, that "as it is absolutely impossible to calculate, even roughly, the magnitude of the errors introduced by these assumptions, the whole performance must remain a botching piece of work."—October 29th.

C. F. Smith.
William Cramp.

Manchester, *November 1st*, 1909.

Voltage of Country House Installations.

I am at present engaged by a firm who make a speciality of petrol plants for lighting country houses, and in all cases they recommend a 25-volt set; now this is contrary to my ideas, and I have ventured to suggest that we should be doing our clients justice in recommending 100-volt plants.

My objection to the 25-volt pressure is the unsteady light when the load on the accumulators varies; the considerable drop (D.P.) when the test is anything but infinity, or caused by dirty connection in lampholders, fuse boxes, &c.; that it is impossible to utilise the plant for heating, owing to the amperage required by even the most economical radiators, hot plates, water heaters or irons.

It has always been my idea that it would be preferable to put in a 100-volt plant, divide the lighting circuits into two equal parts, running back to the distribution board, and divide the accumulators in a like manner; this would enable the man in charge to change over, and light the more important parts of the house in the case of a temporary breakdown.

Re the heating, this I consider could be carried out with a certain amount of economy by running a separate circuit to 100-volt terminals on the board.

As regards the D.P., this surely would not be so noticable with the 50-volt circuit, and a steadier light would result.

As 50-volt metallic lamps can be obtained in a low H.C.P., I fail to see the reason for recommending 25 volts, and even when transforming from 100 or 200 volts, &c., have never suggested a lower voltage than 50 which has always proved satisfactory.

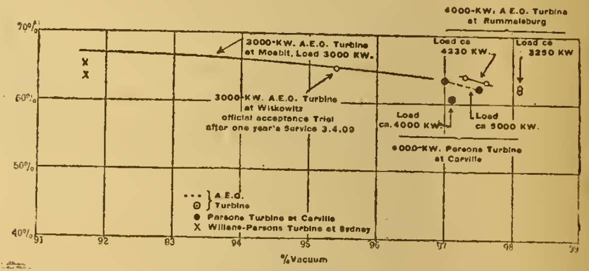
H. C. P.

[We quite agree that 25 volts is suitable only for small installations, where the distances are short and the load not great. A pressure of 50 volts affords a happy mean, requiring only 28 cells, while the current is nearly halved, and the percentage pressure drop in the leads is practically the same as at 100 volts. We doubt very much, however, whether the suggested division of a 100-volt battery, giving in effect a three-wire 50-volt system, would prove satisfactory in practice, without skilled attention to ensure the proper charging of the two halves of the battery. It is a simple matter to run heavy leads for heating circuits when required, and probably less costly than the method proposed by our correspondent.—Eds. E.R.]

Economy of Parsons and Impulse Turbines.

In an article entitled "Comparison of the Efficiency of Parsons (Reaction) and Impulse Turbines" (Electrical Review, June 25th, 1909, Vol. 64, No. 1,648, page 1062), the results of the steam consumption trials at Rummelsburg are contrasted with those of two Parsons turbines. The author comes to the conclusion that the Parsons turbines surpass the A.E.G. turbine in economy, but conducts his inquiry in such a superficial manner, that the strongest exception must be taken to his deductions.

The author suggests as the best basis of comparison for different turbines the *thermodynamic efficiency*, that is, the ratio of the steam consumption of the turbine in question to that of a theoretically perfect turbine working without losses and under identical conditions. According to him, this value for the 4,000-KW. A.E.G. turbine at Rummelsburg is not so great as for the 4,000-KW. Parsons turbine at Carville, nor for the 2,000-KW. Willans-Parsons turbine at Sydney (N.S.W.). Moreover, he states that with later Willans-Parsons machines still better efficiencies have been attained.



Curve 1.

Thermodynamic efficiency calculated on the load at generator terminals

$$= \frac{\text{Theoretical steam consumption per KW.-hour of a machine running without losses}}{\text{Measured steam consumption per KW.-hour.}}$$

The following is a reply to these statements:—1. The efficiency of 68 per cent. which is given for the Parsons turbines at Carville and Sydney is not correct. The Carville efficiency is apparently taken from the published table ("Zeitschrift des Vereins deutscher Ingenieure, 1907," page 1122). The author has neglected to observe that this value is based on the load in horse-power, and has been obtained by dividing the value for the KW. by 0·93 (electrical and mechanical efficiency of turbine and generator). It is manifestly wrong to compare the thermodynamic efficiency of a turbine reckoned on a basis of H.P. with that of another turbine calculated from the load in KW.

The thermodynamic efficiency for Carville, when reckoned from the load in kilowatts, is, at 5,164 KW., 63·4 per cent.; at 5,059 KW., 62·2 per cent., or a mean value of 62·8 per cent. This is the value which should be compared with the Rummelsburg value of 63·9 per cent.

The trials of the Sydney turbine were conducted with unfavourable steam conditions, as follows (*Engineering*, 1907, page 752):—150 lb. sq. in. boiler pressure; 145° F. superheat; $27\frac{1}{2}$-in. vacuum (Bar. = 30″) = 91·7 per cent.

If a drop in pressure of 15 lb./sq. in. is assumed to take place in the steam piping, the steam pressure at the stop valve will be only 135 lb./sq. in. The available heat contents in expansion from the pressure to the above vacuum is 338 B.TH.U. per lb., and the theoretical steam consumption:—

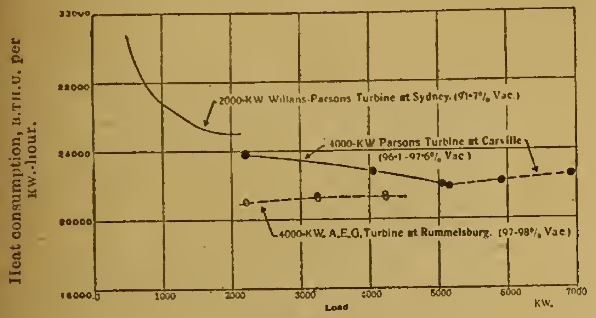
$$D_0 = 3{,}420/338 = 10{\cdot}12 \text{ lb./KW.-hour.}$$

Since the actual consumption (D) at 2,000 KW. is 15·5 lb./KW.-hour, the thermodynamic efficiency deduced from the electrical load is

$$\eta = D_0/D = 65{\cdot}0 \text{ per cent.}$$

2. The three turbines thus appear nearly equal. A comparison of the thermodynamic efficiencies is, however, not quite fair on account of the different heat drops utilised, and more particularly by reason of the different degrees of vacua. With the very high vacuum (from 97 per cent. to 98 per cent.) of which the A.E.G.

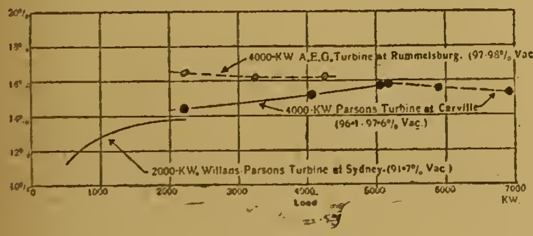
turbine in question had to make use, the specific volume of the steam at the exhaust end is so large that the steam velocities are very high, and consequently there is an appreciable exit loss, even when the blades are of the maximum permissible length. The efficiency with which the steam can be utilised is naturally thereby diminished. At 90 per cent. or 92 per cent. vacuum these disadvantages disappear, and higher efficiencies can be obtained. It is therefore necessary, in order to properly compare different turbines from the standpoint of thermodynamic efficiency, to select a method which takes this difficulty into account. The steam consumption, as is well known, decreases with increasing vacuum, but the attainable efficiency must also decrease, as is shown in the curve (fig. 1). On this curve is shown, in addition to the results of the above turbines, a series of actual measurements taken on a 3,000-KW. A.E.G. turbine in the Moabit station of the Berlin Electricity Works. These measurements took place in October, 1906, and were conducted to show the influence of vacuum on the steam consumption; the steam pressure was 192 lb. per sq. in. (absolute), and the steam temperature 600° F. (222° F. superheat). The results of the official trial of a 2,000-KW. A.E.G. turbine at Witkowitz are also given. This curve clearly shows that under equal conditions of vacuum, the A E.G. turbine surpasses both the above Parsons turbines in thermodynamic efficiency.



CURVE 2.

Heat consumption = Heat contents of live steam minus the heat contents of the feed water, the whole divided by the boiler efficiency of 0·75.

3. While the thermodynamic efficiency is chiefly of interest to the designer and theorist, "thermal efficiency" is the station engineer's only true guide to the economy of his machinery, and when considered on this basis, the superiority of the A.E.G. turbine becomes still more marked. By thermal efficiency is to be understood the ratio of the energy actually produced electrically, to that contained in the coal or other fuel. If the boiler efficiency is assumed to be 75 per cent., and the feed temperature is equal to the temperature of the condenser (t_0), the heat corresponding to the coal will be :—



CURVE 3.

$$\text{Thermal efficiency} = \frac{\text{Electrical energy}}{\text{Energy in coal}}.$$

$$W = (i_1 - i_0)\,D/0{\cdot}75 \text{ B.TH.U.},$$

where i_1 = total heat contents of one pound of steam at the turbine stop valve,

i_0 = total heat contents of one pound of steam at the condenser,

and D = the steam consumption in lb. per KW.-hour.

The thermal efficiency reckoned from the coal to the electrical energy is then—

$$\eta_{th} = 3{,}420/W.$$

The loss by radiation may here be neglected. The values for the heat consumption and the thermal efficiencies are graphically depicted in the curves Nos. 2 and 3. These show in an explicit manner the undeniable superiority of the A.E.G. turbine.

The superiority of the A.E.G. turbine depends also on its ability to carry under continuous working conditions the highest steam temperatures; Parsons turbines are not able to do this. The steam consumption results, with such turbines, taken at low steam temperatures, are often reduced to the corresponding values at higher temperatures, in order to obtain better figures. Such a computation is evidently not permissible, when it has not been previously proved that the turbines in question can safely run under working conditions with such high temperatures.

The author is incorrect in his assertion at the conclusion of the above-mentioned article, that "up to now turbines of the impulse type have not been set to work, which have surpassed the results obtained on a commercial scale with turbines of the Parsons type," at least so far as the A.E.G. turbines are concerned.

On the contrary, there have not been, up till now, figures published to show that any other turbine has reached the economy of the A.E.G. turbines here mentioned.

The Electrical Co., Ltd. (A.E.G.).

London, W.C., *November* 1*st*, 1909.

Rose's Code Economiser.

In your "Telegraphic Notes" last week you referred to "Rose's Universal Code Economiser," and I feel it only just to myself to endeavour to correct the wrong impression which may possibly be conveyed by the fact that several important advantages claimed, and not embodied in other systems, have been overlooked. It is also somewhat unfortunate that eleven-letter words should have been chosen as examples, while omitting to mention that the section under which they are compiled is merely a supplementary one, provided in view of future developments, and with a range of no less than 64,000,000 code words.

May I ask that a few examples be chosen under Section C, applicable to any code word number from 0 to 159,999, which is well outside the range of the majority of recognised code books in present use. Take the four words—

PHRYGIANUL PHTHISIQUS IAPYGIORUN IASPACHATI.

The "cumbrous task" referred to (that of dividing the serial numbers of these words by 20 three times, allotting to the resultants their corresponding consonants as per key table, and inserting the connecting vowel U) I have just performed in considerably under two minutes, producing the words—

GUHUKUM GUHUKUR LUFULUM LUFUMUG.

I venture to assert that these four examples fully substantiate my claims, which are :—

1. Extreme simplicity, owing to the fact that the words handed in for transmission are of the same character, length, and pronounceability.

2. The certainty of immediate correction by the receiver, he merely having to lay out the signals representing the mutilated words and delete the Us, leaving the consonants originally transmitted.

3. The expeditious manner in which a message can be coded and decoded, my four examples, as above stated, having been compiled in less than two minutes.

4. The ease with which the system lends itself to rapid transmission by the operator, the position and frequency of the connecting vowel U being imprinted on his mind.

5. The economy to be effected by writing down the words continuously and ticking off the letters in tens for transmission.

6. The secrecy instantly secured by making one of the innumerable possible rearrangements of the key table.

In addition, the most suitable phrases can be selected from various code books and combined with catalogue matter, &c., without the necessity of using extra distinguishing text-words, each word being at once identifiable with its own particular code book, catalogue, or any other serially numbered matter, by means of the allotted prefix, as explained in the book. To further simplify the reading of a message the small u might be used in the transcript thus—GuHuKuM, GuHuKuR, LuFuLuM, LuFuMuG, &c.

F

Regarding Claim No. 5, the code words transmitted need not necessarily end with a consonant. In fact, the terminating letter U will always show that the words have been linked up and re-divided for the purpose of economical transmission. In the following example five words have been linked up, re-divided, and transmitted as four, showing a saving of 20 per cent.:—BULUGUM, SUTUMUG, DULUFUB, JUBUNUL, KUGUTUM,

BULUGUMUSU/TUMUGUDULU/FUBUJUBUNU/LUKUGUTUM.

Regarding Claim No. 6, the number of changes available is the enormous one of 2,432,902,008,176,640,000, from which it will be seen that a change may be made every day (with the concurrence of the correspondent) without fear of exhausting the possibilities of the system. Sections A, D and E are placed in the book for the use of those who wish to apply them to their own special cases, but Section C comprises all that is necessary for present requirements.

You mention that "We do not quite follow Mr. Rose in this claim" (to check irregularity or mutilation resulting from bad spacing by means of the deletion of the connecting vowel u). This I claim to do invariably within one minute of receiving the mutilated word. But I do not claim to replace a signal omitted entirely. No system can or does. The user, however, has a much better opportunity than ever before of replacing the lost signal, as our word contains only four unknown characters. The position of the error is definitely located, whereas, with an ordinary code word there is the danger of making a wrong replacement and producing an almost identical code word, yet one having an entirely different meaning, the results of which have, on many occasions, been disastrous.

A simple check system has now been devised, and will be issued to all users of the book, by means of which any omission either in indicating consonants or connecting vowels will at once be revealed.

You contend that, owing to the improvement in telegraphic working, the proportion of delays or serious consequences caused by errors is exceedingly small in comparison with the large number of messages handled. This I fully admit, and do not seek in any way to minimise the credit due to the cable companies and the compilers of codes for the magnificent results achieved. There still remains, however, an element of uncertainty, which it is my object to finally eliminate by enabling the user to compile his message on a purely mathematical basis. Errors of a magnitude with which other check systems would find it quite impossible to deal, are immediately located and corrected with absolute certainty. I claim that my system greatly enhances the value and adaptability of existing codes, and indefinitely extends their range of usefulness. It has received the cordial endorsement of eminent code compilers and cable representatives. But, like all new ideas, it has, in the first instance, to overcome the weight of public inertia, and to satisfy the experts, which I have every confidence of being able to do.

Sydney A. M. Rose, A.M.I.E.E.

London, W.C., *November 2nd*, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Electric Lamp Lock.

An extremely simple device for locking incandesent lamps in their holders has been introduced by the ELECTRIC LAMP LOCK Co., of 25, Wellington Street, Glasgow, under the name of the "Ellco" invisible lamp lock, for which a patent has been applied for. It consists of nothing more than a perforated washer of insulating material (fig. 1), which is dropped over the plungers in the holder. It is necessary to slacken back the ring at the top of the holder before inserting the lamp; after this, when the ring is tightened again, it is impossible to remove the lamp unless the trick is known, for the locking device is invisible from the outside. The high price of metallic-filament lamps renders some such device necessary where lamps are accessible to the public.

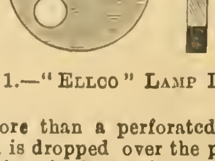


FIG. 1.—"ELLCO" LAMP LOCK.

The "Best" Electric Radiators.

With this happy and positively convincing title, MESSRS. BEST AND LLOYD, LTD., of Cambray Works, Handsworth, Birmingham, have issued a new catalogue (No. 77), in which they bring before the trade some fine designs of luminous radiators for the current season.

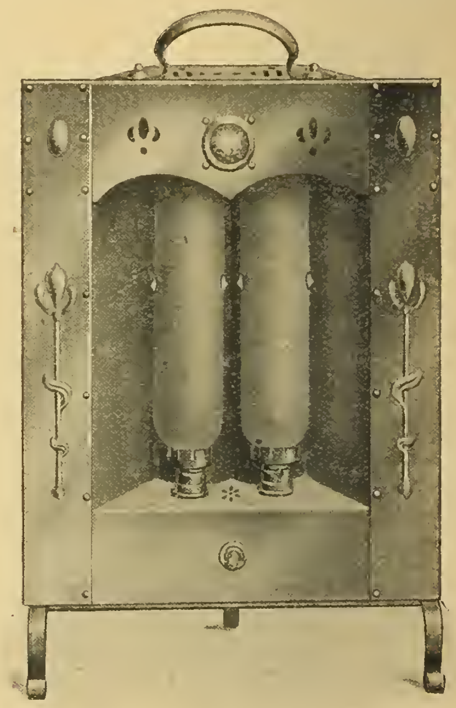


FIG. 2.—"BEST" TWO-LAMP RADIATOR.

There is something impressive about a number of the designs shown. To break forth into song regarding some of the firm's choice art metal-work in electric light fittings is not a difficult matter, but we have not often felt moved to rhapsody by the lines and curves of the metal-work enclosing the luminous bulbs of an electric radiator. However, in the list now before us the designs are very acceptable and more pleasing than many that we have seen; good blocks and careful printing have doubtless had much to do with the good effect. The registered designs are all shown to a scale of one-sixth, and they include two, three, four and six-lamp radiators, which are supplied with either wrought-iron or polished

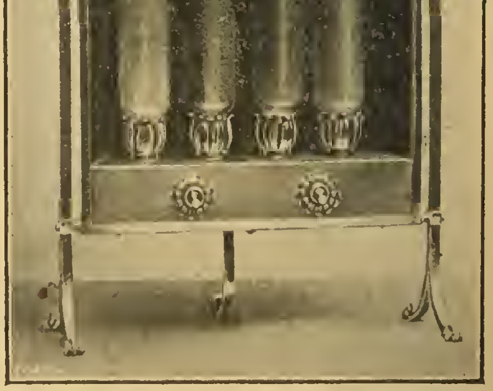


FIG. 3.—FOUR-LAMP RADIATOR, ADAM STYLE.

xydised brass frames, with polished copper interiors; also with shed copper or hammered antique copper frames, in "Sheraton" e with brass frame, Adam, Empire, Louis XVI, and circular s. In the two examples which are selected for illustration oses, fig. 2 shows a two-lamp registered design, with hammered ue copper frame and polished copper interior; fig. 3 is a four- design in Adam style, supplied with brass frame, and polished er interior with ornamental covers for lampholders.

The Venner Patent Sign.

n ingenious device has been put on the market by Messrs. nes & Co., of 6, Old Queen Street, Westminster. It consists etters composed of small clear glass balls, which are illuminated behind, and it possesses the special advantage that owing to peculiar optical properties of the balls, the letter can be read almost any position over a range of 160°. The effect, when sign is illuminated, is that of a continuous letter of light, the vidual balls being merged into one another by irradiation. letter is strong and of inexpensive construction. The

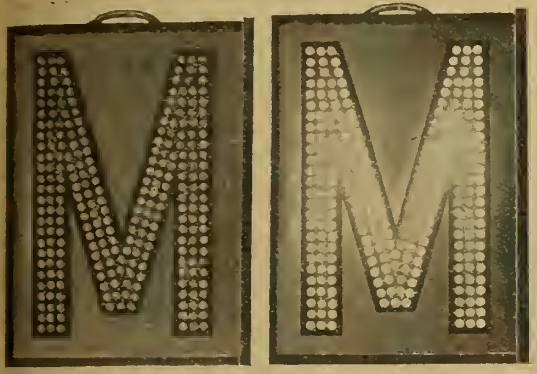


Fig. 4.—Venner Sign, by Day and by Night.

mpanying figures show a single letter, as it appears when t, and when illuminated by a single 16 c.p. lamp. When nted in a suitable frame, a series of these letters can be loyed, and they are readily interchangeable, so that a new nd can be displayed each day—a practice which has been pted by some theatres and electrical showrooms which have pted the device. Metallic-filament lamps can be used with this , and the frame is weather-proof. The extinction of one of lamps in a frame only causes a slight diminution in the nination, and does not leave a gap. Chromatic effects are ly arranged, with the aid of coloured lamps, which give a ety of graduated shades of colour. Uniform illumination of ft. letter with two 32-c.p. lamps is one of the advantages med for the system, and the sign at the middle of a street can ead from either end or any part of the street.

Howard-Cousins Patent Radiator.

he popularity of glow-lamp radiators has not owed anything to construction of the lamps usually employed, which, being lelled on the pattern of the lamps used for lighting, have long ped filaments and are held in holders of the ordinary type. In Howard-Cousins radiator, made by the General Electric Co., , of 71, Queen Victoria Street, E.C., the lamps are made double- ed, with zig-zag filaments, so that short circuiting inside the

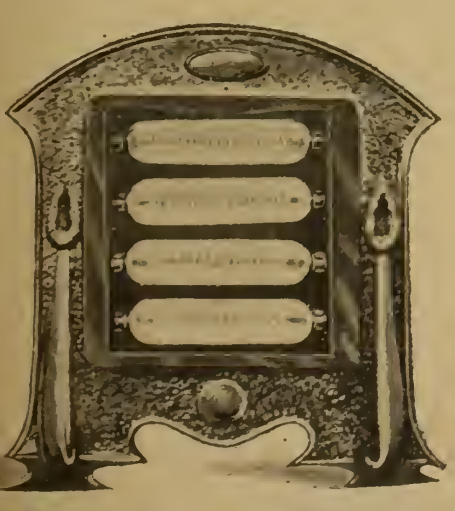


Fig. 5.—Howard-Cousins Radiator.

p is impossible; the massive end contact caps are held in strong ng clips, which provide secure support, and the lamps can be ed horizontally, as shown in the accompanying figure, or ically, as preferred. The elastic construction of the filament ders it immune from breakage due to shocks, and thus prolongs t life. The figure shows a radiator with the usual wire guard oved, to enable the lamps to be seen clearly.

The Antiforge Pen.

A new patent electric pen, the invention of Dr. Dinshah P. Ghadiali—the "Parsee Edison"—has been introduced by the Antiforge Pen Co., of 448, High Road, Chiswick. The essential feature of this device is that it writes by perforating the paper with electric sparks. The principle, of course, may not be new, but the methods adopted by Dr. Dinshah for carrying it out are certainly novel and ingenious. The pen, as illustrated herewith, resembles a stylographic pen, and is used in conjunction with a polished aluminium plate, on which the paper is laid. The plate is mounted on the bevelled glass top of a desk, which contains the whole of the accessory apparatus, as shown (fig. 6).

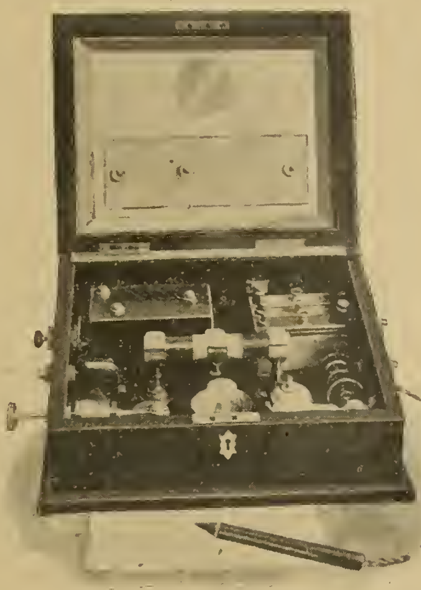


Fig. 6.—Antiforge Pen, and Desk, Open.

The spark is produced by an induction coil excited by a small battery of storage cells, such as is used for ignition purposes on automobiles. To increase the intensity of the spark a condenser is connected across the secondary terminals, and a highly exhausted vacuum-tube is also connected to these terminals, in parallel with the pen, to indicate (by glowing) the condition of the apparatus, besides acting as a ballast load on the coil, and providing a fixed limit to the maximum potential difference between the secondary terminals. The pen itself contains a mercury interrupter, which ensures that the primary circuit shall never be closed except when the pen is held point downwards. There is also a spring point actuating contacts within the pen, so that even when the pen is held in the proper position the primary circuit is not closed unless the pen is pressed on the paper in the act of writing. By these means the work of the battery, and the possibility of the operator's receiving a shock, are reduced to the minimum.

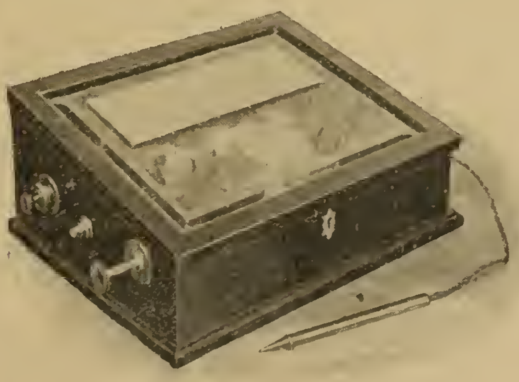


Fig. 7.—Antiforge Pen and Desk.

The effect of the condenser across the secondary is to give fat sparks, which not merely perforate but actually burn the paper, rendering the record absolutely indelible. By varying the resistance in the primary circuit with a rheostat, of which the handle is seen projecting on the left-hand of the desk, the intensity of the spark can be varied over a wide range, giving from the finest to the coarsest perforations. As it is impossible to produce two identical series of perforations, owing to the variations in the thickness of the paper, the pressure used in writing, and the speed of motion of the pen, the owner himself cannot produce an exact facsimile of his own signature, though each signature as a whole is unmistakeably his own. This property is utilised when signing a batch of related papers, as the signature is written on the top of the series, and all the sheets are perforated simultaneously; it is then impossible, even for the owner, to substitute a new sheet for any of the batch, without detection.

A graphite point is used in the pen to increase the legibility of the writing, though a metallic point can readily be substituted when only the perforations are required. The apparatus is of British manufacture, and should find many uses in business houses. The inventor, Dr. Dinshah, was formerly electrician to H.H. the Maharaj Rana of Dholpur, and afterwards electrical engineer to the Patiala State, and is a noted journalist and lecturer, as well as an inventor.

LEGAL.

The Summonses against the Welsbach Incandescent Co.

Further evidence was given before Mr. Bros at Clerkenwell Police Court on Saturday, in the case in which the Welsbach Incandescent Gas Light Co., Ltd., were charged on summonses issued at the instance of the Wolfram (Tungsten) Metal-Filament Lamps, Ltd., with selling and exposing goods for sale to which a false trade description had been applied. The alleged offence was in respect of electric lamps marked with the words "Welsbach" and "Aur."

Mr. Rufus Isaacs, K.C., M.P., Mr. H. A. Colefax and Mr. Ernest Lunge appeared for the prosecution; Mr. A. H. Bodkin and Mr. Walter were for the defence.

Last week Mr. Rufus Isaacs, in opening the case, said the Welsbach Incandescent Gas Light Co. was formed for the purpose of dealing with the inventions of Baron von Welsbach in regard to gas lighting, but not in regard to electric lighting. Baron von Welsbach's electric light inventions were acquired by a German company, known as the Auer Co., who, by agreement, appointed the General Electric Co. exclusive agents for the sale of the lamp. The defendant company published an advertisement in which there were illustrations of an electric lamp bearing the words "Welsbach" and "Aur," and he contended that this was calculated to lead persons to believe that the lamp was either invented or manufactured by Baron von Welsbach or the Auer Co.

Frederick Hale, of London Road, Bromley, assistant manager of the General Electric Co., Ltd., produced a copy of the *Daily Telegraph*, of September 23rd last, and said it contained an advertisement of the Welsbach electric light, issued apparently by the defendant company. On September 29th he received certain instructions from Mr. J. Y. Fletcher, manager of the electric light department of the General Electric Co., in consequence of which he went to 334-354, Gray's Inn Road, the address of the defendants. He was taken to the showroom there, and he asked to see a lamp as advertised in the daily papers. The young lady in charge showed him samples, and he asked, "Are these Baron von Welsbach's lamps?" She said "Yes." He ordered two and went downstairs to receive them and pay for them. As the lamps were being handed to him, he asked again, "Are these Baron von Welsbach's lamps?" and the salesman in the warehouse at once said "Yes." The lamps were similar to the one now produced.

Mr. Bros examined the lamp produced in Court, and observed that it had "made in Germany," and the words "Welsbach" and "Aur" upon it.

Witness, in continuing his evidence, said that on October 8th he received further instructions from Mr. Fletcher, and he went again to the premises of the defendant company in Gray's Inn Road, and asked for some more lamps similar to the samples he had previously taken away. He asked the attendant in the warehouse if he could assure him they were Baron von Welsbach's lamps, as the party for whom he required them had made a special point of it. The attendant said they were, and witness then said: "Will you kindly put it on the invoice to enable me to show my customer?" The salesman replied, "Certainly," and did so.

Mr. Rufus Isaacs: Are the lamps with this filament made by any particular firm or company?—Witness: Yes. The chief makers are the Auer Co., of Berlin. He added that he believed "Auer" was one of Baron von Welsbach's names.

In cross-examination by Mr. Walter, Witness said that when he went to the defendants' premises, he gave his name as Holloway, of Bath Road, Hounslow, and produced a trade card.

Mr. Walter: Where did you get that from?—Witness: From Mr Fletcher.

Do you know where he got it?—I don't know.

Do you know if there is such a person as Mr. Holloway?—I don't know.

Did the young lady in the showroom ask you to go to the trade counter?—Yes.

And at the trade counter did you say you were a member of the trade?—No; I simply asked for the lamps I had ordered in the showroom.

I put it to you, you never mentioned the name of Baron von Welsbach?—I did.

Then if the salesman you saw says you did not, it is not true?—It is not.

What were your instructions from Mr. Fletcher?—To purchase the lamps, and ask if they were Baron von Welsbach's.

Were your instructions on October 8th to get something in writing?—Yes; I was to ask them if they would give it.

Did you ask them if they objected to the words "Baron von Welsbach" appearing on the sale note, as your customer would not have the lamps unless that appeared on the receipt?—I did not.

Do you know if Baron von Welsbach makes any electric lamps?—I do not know.

Does he, to your knowledge, deal in lamps?—No; not to my knowledge.

Tell us how these words got on the receipt?—I said, "Are these Baron von Welsbach's lamps? My customer makes a special poin of it." The attendant answered "Yes," and I said, "Will you please put it on the invoice?"

The only metal-filament lamps you sell are the Osrams?—Yes at the present time.

The Osrams are not the invention of Baron von Welsbach?—They are made under his process, I believe.

Do you know?—No, I do not.

How long ago is it since the only metal-filament lamps you have sold have been Osrams?—Two and a half years.

Where have you seen anything about the Auer Co. in London?—I have seen their correspondence.

Are you aware that they are under contract not to use the word "Aur" or "Welsbach" in the United Kingdom?—No.

The only mention you have seen of the Auer Co. is in private correspondence with your firm?—Yes.

Are you aware that the trade mark "Aur" is put on all the good sold by the Welsbach Incandescent Light Co.?—No.

Do you know "Aur" is their registered trade mark in thi country?—I do not know.

The hearing of the case was further adjourned for a week.

Electricity in Fife Mines.

Mr. H. Rowan, district manager and agent of the Fife Coal Co. a Cowdenbeath, and as the superior to the certificated manager a the Foulford Pit, was charged in Dunfermline Sheriff Court with having contravened the special electrical rules by having inadequate electrical apparatus in the Foulford Pit. Recently the son of the managing director of the company and the certificated manager were similarly charged, and objections to the relevancy of the complaints were repelled. Mr. Rowan denied the charge, and the evidence in the three cases was fixed to be taken on the same date

Electricity Supply Co. for Spain, Ltd.

In the Chancery Division on Tuesday last, Mr. Justice Parker heard a petition by this company for a reduction of its capital.

Mr. Mark Romer, K.C. (with him Mr. A. G. Wright in support), stated that the company was formed in 1889 for the purpose of manufacturing and supplying electricity in Madrid and other towns in Spain. The original capital was £100,000 divided into 19,900 ordinary and 100 deferred or founders' shares of £5 each In 1901 the capital was reduced, the shares being written down from £5 to 5s., but at the same time that it was reduced it was also increased by the issue of 40,000 preference shares of £5 each On January 20th, 1901, therefore, the capital of the company was £205,000 divided into 19,900 ordinary shares of 5s. each, 100 founders' shares of 5s. each, and 40,000 preference shares of £5 each, the preference shares ranking for preference both as to dividend and capital. It was now proposed to reduce the issued capita by £86,650, and that was to be effected by reducing the value o the 34,660 preference shares that had been issued out of the authorised issue of 40,000. The whole of the loss would, therefore fall upon the preference shareholders, but the whole of the preference shares were held by a Spanish company, who also held a large number of the ordinary shares, and 90 of the founders' shares, and the whole of the shareholders in the Spanish company appeared before the Court and supported the petition. The proposal was to meet loss of capital amounting to £86,650 by reducing the issued preference shares from £5 to £2 10s., and it was shown by the evidence that the actual depreciation in the value of the company's assets was more than that sum. There was a preference in Madrid for a direct-current system over the alternating-current system, which was the one used by the company, and their distributing plant was thus reduced in value. The value of the company's land remained about the same, but the company's buildings had deteriorated from £10,300 to some £5,300; the boilers and engines were antiquated, and practically of no value; the electric plant had also very much deteriorated, and there was a very heavy falling off in the value of the wiring of the system. It appeared that for some years past the directors had been devoting the profits in writing off these depreciations, but they could not keep them down to the real value of the assets, and there was nothing to do but to reduce the capital. There were only nine shareholders, and they had all signed the balance-sheet and appeared to consent to the proposed reduction.

There was no opposition, and his Lordship sanctioned the reduction in accordance with the proposed minutes, and dispensed with the use of the words "and reduced" as part of the company's title.

Engineering Exhibition in Manchester. — Our monthly contemporary, the *Engineering Review*, is promoting an Engineering and Machinery Exhibition, to be held in Manchester from October 14th to November 5th, 1910. The head office is at 16, John Dalton Street, Manchester.

BUSINESS NOTES.

'atalogues Wanted.—As will be seen from an advertise- t in this issue, the representative of an Australian house, who be in London until the end of this month, will be glad to ive copies of catalogues of all classes of electrical manu- ures.

British Trade with Russia.—In our recent references he Russian market, a good deal of advice was given concerning best methods to adopt in strengthening the British position e. Some very interesting remarks on this subject appear in the 3 report of Mr. Consul A. W. Woodhouse (St. Petersburg), as racted in a Birmingham newspaper. He says that British ds, in spite of the keen competition, rank first in quality. Even illiterate peasant, whose only tool is an axe—which he uses h marvellous skill—will say with pride that it is "Anglisky," British, and has served him well for years. So it is with superior more complicated wares, especially machinery. But the con- er must be constantly reminded of the fact or he will forget it. gain a thorough knowledge of the requirements of the Russian ket, it must be studied on the spot. First and foremost, the iness methods of dealers necessarily conform to the economic ditions of their localities, and as ready money is scarce in Russia, y are obliged to give and take credit. Very little business, if , is done on spot cash terms. Our foreign competitors realised years ago, and acted accordingly, and that is precisely where y gained they advantage. They will readily supply goods on dit for periods up to a year, and will even then renew bills on y terms. On the other hand, British manufacturers are only now inning to realise the necessity of conforming to this custom. ay undoubtedly no longer insist on selling their wares "free on rd" at some British port and for cash against bills of lading. s method, so tenaciously observed, in spite of everything, gave eigners, and especially Russia's nearest neighbours, the oppor- ity which they promptly seized. They have established branches the chief cities and appointed agents all over the country. eir commercial travellers visit the markets regularly, taking with m samples and sufficient data to quote prices for delivery direct the retail dealer or the consumer. It follows that British manu- turers and merchants must do likewise. They can even at this r profit by the experience of others, before it is too late, and send commercial travellers possessing a knowledge of the vernacular. orance of the Russian language will only drive buyers to middle- n who can understand them.

Siemens's New Central Depôt.—On November 1st, v premises were opened by Messrs. Siemens Bros. Dynamo rks, Ltd., at 39, Upper Thames Street, E.C., as London stores l showroom. Here, henceforth, all the business of the Supplies artment will be conducted, including that hitherto carried on h at 6, Bath Street, E.C., and at 1, Abchurch Yard, E.C. We ently had the privilege of making a run through the building. e new premises comprise six spacious floors and basement. e ground floor is arranged for counter trade, and every facility is vided for promptly executing customers' orders. The first floor devoted to an extensive showroom, where the Siemens com- nies' specialities will be exhibited. One feature will be a tasteful play of the latest designs in artistic electric light fittings and des, exhibited in conjunction with the well-known tantalum ps. The showroom is specially prepared for effective display; s wired, like the whole of the other departments in the building, the Stanuos system, and circular selective switches control a mber of lights. The third floor is occupied by the manufactures Messrs. Siemens Bros. & Co., Ltd., and a stock of all sizes of es and cables is carried. The remaining floors contain a nprehensive stock of all articles required by the trade, luding tantalum and carbon incandescent lamps, electric ht fittings and shades, conduits and conduit fittings, arc lamps l arc lamp carbons, ampere-hour and watt-hour meters, small nerators and motors, electric accessories of all kinds, such as npholders, switches, fuses, ceiling roses, &c. A Waygood 1-ton t with a new type Siemens lift motor serves all floors, and re is a small lift beside for parcels. As our readers are aware, Siemens manufactures produced at their several extensive tories in this country cover a very wide range indeed, it is said t their manufacturing ability covers practically everything from mall incandescent lamp to motors of 16,000 H.P., and from the allest bell wire to an Atlantic cable. We are sure that this large p t in so central a position will be a convenience to the electrical de.

Bankruptcy Proceedings.—Eric Eaton, electrical gineer, 36, Alexandra Road, late 12, George Street, and 2, Streets rd, Mossley Road, Ashton-under-Lyne, Lancs. The first meeting the creditors in this case was held last week at the Official ceiver's office, Byrom Street, Manchester, but a sufficient number creditors to form a quorum did not attend. It was stated that liabilities amounted to £130, and the deficiency was put at 17. Debtor ascribed his failure to bad trade, lack of capital and s on contracts.

Philip Ernest Butler, promoter of the Electric Lamp novating Co., Ltd., and described under a creditor's petition late of Hill Street, Knightsbridge. This public examination s held on Wednesday last week before Mr. Registrar Giffard, the London Bankruptcy Court. The statement of affairs wed liabilities £1,666, and assets £1. In the course of examination, which was conducted by Mr. W. P. wyer, Assistant Official Receiver, the debtor stated that his father died in 1898, leaving him securities to the value of about £20,000. He had since been interested in a number of public companies, of most of which he was a director, and in connection therewith he had sustained considerable losses. In May, 1903, witness promoted the Electric Lamp Renovating Co., Ltd., to which he sold his interest in certain electric lamp patents, &c., previously acquired by him, some from the inventor, and some from the liquidator of a company in which he was a shareholder. The consideration of the sale, which was not completed until the end of 1904, was ultimately fixed at £13,000 in shares and an undertaking by the company to discharge liabilities amounting to about £491. One third of the shares were allotted to the inventor. The sale consideration covered expenses incurred by witness in equipping a factory, taken in his name, at Britannia Street, City Road, E. Witness attributed his failure and insolvency to losses estimated at £30,970 in connection with the above undertakings, and further losses to the amount of about £3,000 by Stock Exchange speculations. In most of the companies he purchased large blocks of shares partly for investment purposes and partly as speculations with the idea of selling out at higher prices. None of the eight companies in which he had been interested were old-established concerns. The examination was concluded.

Russian Platinum.—The fact is recalled that the platinum mineowners, particularly in the Ural, some time ago sought to induce the Russian Government to nationalise the industry, especially the mines in the Nishny-Tagil which produce about three-fourths of the total output in Russia. But the Government declined to embark upon the transaction, although a French syndicate had expressed its readiness to participate in a company for the working of the mines in question. It is now stated that such a company has either been constituted or is about to be formed by all the platinum producers in the Ural, in conjunction with the French firm of Bonardelle, which has hitherto purchased a large portion of the outturn in the Ural, and that the company will take over the Nishny-Tagil mines. In the circumstances it is expected that a slight upward movement in the price of the metal will take place. The French firm will subscribe for shares in the new undertaking to the extent of £600,000. The English firm of Matthey, which was formerly a large customer for platinum in consequence of long-term contracts with producers in the Ural, and which paid a comparatively low price, is reported to have been settled with by the payment of compensation by way of damages.

Catalogues and Lists.—Messrs. J. H. Holmes and Co., Portland Road, Newcastle-on-Tyne.—Several new pamphlets have just been issued relating to different departments of the firm's manufactures. One is a 28-page price list of electrical switchgear, including Holmes-Page switches, replaceable bridge fuses, oil switches, circuit-breakers, fuses in cast-iron boxes, solenoid main and starting switches; the second is a 36-page catalogue of the "Castle" motors and dynamos, motor-starting rheostats, &c., containing a large quantity of tabular matter, dimensional information, and directions for coupling up motors to mains. The third is a 24-page pamphlet containing a list in tabular form of electric lighting and power installations put down by the firm for mining work, electrically-driven plant being shown. All three lists are laid out in good style, and a large number of well-executed and boldly-printed half-tone illustrations appear in each.

The Lahmeyer Electrical Co., Ltd., 109-111, New Oxford Street, London, W.C.—Eight-page list describing and illustrating their automatic high-tension oil switches, which are specially suitable for working under severe conditions, such as are met with in fiery mines, atmospheres containing acids, and dangerous gases, &c., where open type switches are inapplicable. A second list in similar form and size gives a full description of the Lahmeyer turbo-alternators, the illustrations showing parts of 5,000-kw. and 3,000-kw. machines, and views of Continental stations with Lahmeyer turbine sets in position. The turbine list describes the firm's generators, both for alternating and continuous current. The Lahmeyer Co. are agents in this country for the "Zoelly" steam turbine as manufactured at Messrs. Escher, Wyss & Co.'s Works, Zurich, and are therefore well able to quote for combined plant.

Mr. G. Wuthrich, Oswaldestre House, Norfolk Street, Strand, W.C.—Leaflet giving illustrations of a number of their electrical machinery and apparatus manufactures; also an eight-page pamphlet containing a reprinted article on Oerlikon new five and six-speed three-phase motor.

The Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.—A number of leaflets relating to the "Valor" automatic waste oil filter, fire extinguishers, &c.

The Regent Electric Co., Ltd., 52, Regent Street, Piccadilly Circus, London.—Leaflets relating to the "Holmquist" electric heat pads and hat pads which have attracted a good deal of attention from visitors to the recent electrical exhibitions; also the "Holmquist" electric light bath cabinets.

Messrs. A. E. Harris & Co., 95, Camden Street, Birmingham.—Four-page illlustrated list of copper switch clips of standard sizes, fuse board clips, copper contacts, name plates, and stampings for the trade.

Messrs. Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.—Eight-page illustrated pamphlet giving descriptive information concerning their "Sentinel" double-acting forced lubrication high-speed engines, with tabulated sizes, outputs at various steam pressures, condensing and non-condensing, and prices, of two-crank compound, and three-crank triple-expansion engines. Weights and shipping particulars also appear. The illustrations show engines direct coupled to electric generators, but they can also be arranged with belt or rope pulley for factory and mill driving.

Messrs. Veritys, Ltd., 28, King Street, Covent Garden, London, W.C.—Postal card effectively drawing attention to their "Comet" arc lamp.

The Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—Price leaflet of their direct-current motors of from ¼ to 5-h.p.

The Liverpool Electric Cable Co., Ltd., Vauxhall Road, Liverpool.—Reprint copy of their latest catalogue (50 pages) of "Liverpool" electric wires and cables. The first few pages contain tabular information regarding standard sizes of conductors, and extracts from the I.E.E. wiring rules; particulars are next given of first quality and non-Association quality respectively, and the other sections that follow relate to silk and cotton-covered wires for dynamos and instruments, lead-covered and armoured cables for mining purposes, flexible conductors, electrolier wire, shot-firing cables, motor-car flexibles, resistance wires, dynamo flexible cables, jointing materials, clincher cable clips, &c. Various additions and alterations have been made in the tables since the last catalogue appeared.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Circular No. 25 (20 pages) giving very fully detailed information regarding the "Entz" booster, with curves, diagrams, and half tones, and with descriptions of installations of their boosters and Chloride batteries in industrial works. One of these installations is at the Dalzell Steel and Iron Works of Messrs. David Colville & Sons, Ltd.; others are at Halifax and Maidstone electricity works. A specification follows for standard "Entz" booster and switchboard for traction system, 400 amperes, 90 volts continuous output.

Schiersteiner Metallwerk, Schwerinstr. 3, Berlin W. 57.—Leaflets describing their cyclometer length measuring instruments for roads and railways, and for wires and cables.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, Cannon Street, London, E.C.—A 54-page catalogue is devoted to the description and illustration of many designs of electric radiators for the current season. "Notes on using the luminous radiators" preface the pages illustrating the different designs. The latter include new specimens in various periods and styles, such as Jacobean, Georgian, Tudor, Elizabethan, Sheraton, Adams, &c., with framework in ornamental wrought-iron, polished copper, antique hammered copper, block enamelled cast-iron, antique dull brass finish, ornamental brass with copper pillars, green Doulton ware, and other metals and finishes, all fitted with patent coppered interior and reflector. The Dowsing-Huntley patent combined radio-converter is a feature of the book. It is fitted with four luminous heat lamps, also with non-luminous elements, the total consumption being 2,000 watts. These radiators are specially recommended as efficient and rapid heating appliances. Some cheap designs in convectors or air heaters pure and simple, with non-luminous heating elements are included in the list. Mr. Dowsing has made radiators of this type for the past twenty years, but they have not been included in the firm's list of luminous radiators until now. Prices of all designs are boldly indicated.

Tramway Points.—It is reported from Brussels that the Brussels Tramway Co., the Chemins de Fer Economiques, the Société de Transports et d'Enterprises Electriques, the Société Générale d'Enterprises Electriques and the banks associated with them, are forming a company with a share capital of £10,000 for the introduction of the invention devised by the Italian Captain Dino Samaia for the automatic working of tramway points. The apparatus is operated from the driver's platform, and trials made in Brussels are said to have been carried out to the satisfaction of the experts who were present.

Book Notices.—*Magnetos for Automobilists—How Made and How Used.* By S. R. Bottone. Second edition, enlarged. London: Crosby Lockwood and Son. Price 2s. net.—We have a feeling of sadness in turning over the pages of this useful little work, as it is, perhaps, the last that will bear the author's name, for his death took place shortly after he had passed its pages for the Press. In view of the fact that during the past two years or so, magneto ignition has become the standard method of firing the explosive charge in the engines of petrol motor cars, the book is one that cannot fail to be both interesting and instructive to those motorists who take a practical interest in the details of their vehicles. To many the magneto and its method of generating an electrical current are still a mystery; a perusal of the simple explanation furnished by Mr. Bottone should, however, do much to render the principles on which this system of ignition is built up readily comprehensible by the merest novice. The subject is dealt with in a series of seven chapters, in the first of which the history and theory of the magneto is traced. Then follows an explanation, in simple language, of the component parts of a magneto machine, the functions of the same being described, and elucidated by means of a number of line drawings; other chapters deal with magnetisation and the armature screen. Although the late Mr. Bottone, judging from his remarks, was distinctly in favour of the low-tension form of magneto for ignition purposes, he did not overlook or disregard the high-tension machine, the method of generating a high-tension current being dealt with in a separate section, in which the Simms-Bosch, the Eisemann, and Gianoli—three of the types largely used—are fully described. Finally, we have "A Few Practical Hints" and "Latest Types of Magnetos," the last chapter—the *raison d'être* of the second edition—giving particulars of a number of new magnetos that have been put on the market since this form of ignition became the accepted type. The late Mr. Bottone was a prolific writer of popular handbooks, and in his "Magnetos for Automobiliists" produced one which is not only well worthy of perusal by all owners and drivers of motor-cars, but one that may usefully find a place on the "Reference Book" sh
of their libraries.

Annuaire pour l'An 1910. Paris: Gauthier-Villars. Price 1 fr. 5
—The year-book of the Bureau of Longitudes—the 115th of its ki
—contains this year tables and data relating to physics and chemist
which alternate with the geographical and statistical matt
Coming from so distinguished a source, the contents may be accep
as accurate and reliable, and an alphabetical index of unus
completeness, for a Continental work, renders them read
accessible.

The "Mechanical World" Pocket Diary and Year Book for 19
Manchester: Emmott & Co. Price 6d. net.—This pocket-bo
now in its twenty-third year, contains a new section on oil engi
by Mr. W. A. Tookey, who has also revised the section on
engines. Mr. B. M. Woodhouse has contributed some notes
centrifugal pumps, and a section on ball bearings has been add
The book is now printed on a thin tough paper of better quali
reducing its bulk without altering the number of pages.

"Report on the Tungsten Ores of Canada." By T. L. Wall
Ottawa: Department of Mines. 1909.

"The *Mechanical World* Electrical Pocket Book for 19
Manchester: Emmott & Co. Price 6d. net.

"The Physical Review." Vol. XXIX, No. 4. October, 19
New York: The Macmillan Co.

"Atti della Associazione Elettrotecnica Italiana." Vol. X
part 4. Milan: The Association. Price L5. The Central Offic
the Association has been removed to Via S. Paolo N. 10, Milan.

"Electric Cables: Their Construction and Cost." By D. Co
and F. J. O. Howe. London: E. and F. N. Spon. 1909. P
15s. net.

"Gas Works Directory and Statistics, 1909-10." Lond
Hazell, Watson & Viney. Price 10s. 6d. net.

In making its bow to the public the *Local Government Rev*
announces that it will "devote itself" exclusively to the adequ
and impartial treatment of the great range of subjects classed un
the term "local government" The contributions in the first is
(November, monthly 1s. London: Simpkin Marshall, Hamilt
Kent & Co., Ltd.) include articles on afforestation, poor law,
bridges, German municipal government, coast erosion, the rating
owners, municipal finance, and other subjects.

Trade Announcements.—We understand that, ow
to the success of their meters and motor-control gear, and
rapidly-increasing demand for them, The Electrical Appara
Co., Ltd., of Queen's Road, Battersea, are making considera
extensions to their works. These will be completed by Decem
1st. The demand for both meters and motor-control gear is
to be three or four times as big as it was eight months ago.
company are just placing on the market a new motor and pre
ment meter.

Mr. A. Feld and Mr. F. W. Sichtermann have resigned t
positions as managers in the Electrical Co., Ltd. (A.E.G., Ber
and have established themselves as suppliers of all electr
materials for lighting and power plants. The style of the fir
Feld Bros. & Co., Ltd., 25, Budge Row, E.C. (Telephone No. 1,
London Wall). They are putting on the market a new meta
filament lamp, of entirely British make, under the name
"Field." Price-lists will be issued shortly.

The Armorduct Manufacturing Co., Ltd., have issue
circular announcing further advances in the prices of vulcan
rubber insulated wires and cables and pure rubber insulated
ductors owing to the continued high price of rubber.

Dissolutions and Liquidations.—Solium Electri
Co., Ltd.—A meeting of creditors in this voluntary liquidatio
to be held at the office of the liquidator (Mr. Edward Harl
23, King Street, Manchester, on Friday, November 12th,
12 o'clock noon.

Vaughan & Cook, Ltd.—A meeting to hear an account of
winding up from the liquidator, Mr. L. V. Houseman, is to be
at 33, Bedford Row, W.C., on December 3rd.

Howe Electrical Engineering Co., electrical engine
Redcross Street and Moor Street, Liverpool and Blackbur
Messrs. W. Sutton, S. Lord, and J. W. Garsden have dissol
partnership. Messrs. Lord & Garsden will attend to debts
continue the business.

LIGHTING and POWER NOTES.

Australia.—The Sydney Council has agreed to
Forbes Mackay, city electrical engineer, negotiating with the G
municipality with a view to laying mains and supplying electri
in the area, Glebe to have the right of purchase in 25 years
City Council has decided to petition against the North Syd
Electric Lighting Bill.

Bury.—A letter has been received by the Electri
Committee from several local photographers pointing out that
lamps were used in connection with their businesses, both du
the daytime and evenings, and asking that the price charged
electricity might be reduced. The application, after discussion,
been acceded to.

Caerphilly.—The *London Gazette* contains notice of the intention of the U.D.C. to transfer its prov. order to the South Wales Electrical Power Distribution Co. for £10.

Castleford.—The U.D.C. has informed the B. of T. that if the Council could be assured that the Electric Distribution of Yorkshire, Ltd., would be in a position to carry out the E.L. order within the early months of next year, it would hesitate before taking steps to apply for an order on its own behalf. But in view of the long delay in carrying out the provisions of the order, the Council is somewhat dubious as to the promise of early attention, and it had been decided to proceed with the necessary steps to obtain an order. Since then the B. of T. has granted the application of the Electrical Distribution of Yorkshire for an extension of time for carrying out its order.

Cleethorpes.—On October 28th a L.G.B. inquiry was held into the application of the U.D.C. for a loan of £4,000 for laying mains in the busiest part of the town, where 81 residents, including 54 tradesmen, have signified their intention of becoming consumers. It was stated that in 1912 the Council would exercise its right to take over the power station erected by the Grimsby Street Tramway Co. for £17,000, less depreciation. It was also intimated that new property being erected was being wired in anticipation of the scheme going through. There was no opposition.

Continental Notes.—Austro-German Water-Power Dispute.—A new difficulty has arisen in recent months in connection with the proposals for the utilisation of water-powers in Bavaria for State and private purposes, in consequence of differences of opinion between Bavaria and Austria in regard to sovereign rights and obligations in respect of the adjoining territory. Austria claims the right of artificially diverting waters rising in Austria and flowing over into Bavaria, but the latter country disputes the possession of the right. If the dispute were a theoretical one the solution could be left for the distant future to solve. But Austria seems to make the supply district of the Chiemsee a serious matter, and to desire to withdraw about one-third of the water-power of the Alz. So long as this danger threatens, it is considered that no industrial undertaking will be willing to assume a concession for the use of water-power in the country. The Badische Anilin und Sodafabrik has for years been seeking a concession for the erection of nitrogen works by the use of a portion of the fall of the Alz, which is the second largest water-power in Germany. The Government made inquiries of manufacturers as to their prospective demands for power, but these were unsatisfactory, and it then seemed as if the Baden company's application would be granted. In the meantime the dispute has arisen with Austria, and although the subject was discussed several months ago in Vienna between representatives of both Governments, no progress was made towards a settlement. It is believed that Prussia is also interested in the question, although to a less extent than Bavaria, and the hope is expressed in the latter country that Austria will consent to have the problem referred to the Hague Court of Arbitration for decision.

Belgium.—A large electricity generating station has just been completed and put in operation at the works of the Societe Metallurgique du Hainaut, at Charleroi. The plant includes two 1,250-H.P. gas engines.

Dundee.—Mr. Richardson, the Corporation electrical engineer, reported to a meeting of the Public Health Committee that there was reason to believe the material used for the electric lighting of King's Cross Hospital was not up to specification. Mr. Richardson was instructed to enforce the carrying out of the terms of the contract.

Eccles.—The T.C. has fixed the following scale of charges for meters:—2½-ampere, 1s. 6d. per quarter; 5-ampere, 1s. 6d.; 10-ampere, 1s. 6d.; 20-ampere, 2s.; 40-ampere, 2s. 6d.; 80-ampere, 4s.; 120-ampere, 4s. 6d.; 200-ampere, 5s.

Hull.—Messrs. Wray & Sanderson have applied to the T.C. for a supply of electricity in bulk to their works in Morley Street.

The E.L. Committee has voted £50 for the purchase of small apparatus for heating and cooking by electricity, with a view to popularising the use of the supply for these purposes.

India.—The Punjab Chamber of Commerce has decided to address the Punjab Government with a view to obtaining certain amendments in the Indian Electricity Act of 1903, which would have the effect of facilitating the supply of energy by overhead transmission wires, especially where it is necessary to pass over private property.

Japan.—It is announced that the Tokio Electric Light Co. has decided to increase the capacity of its hydro-electric plant from 35,000 H.P. to 50,000 H.P.

Kingston-on-Thames.—At the last meeting of the Council the 15th annual report of the borough electrical engineer, Mr. J. E. Edgcome, was presented, and showed a deficit balance of £1,251 on the year's working. The receipts fell from £11,190 to £10,987, while the expenditure had risen from £12,074 to £12,239. The decrease in income was ascribed to metallic-filament lamps, and the reduction in the price of current for motor and heating purposes, while the increase in the expenditure was put down to the fact that, by direction of the L.G.B., the payment of employés was charged to revenue account, whether the staff were employed on works of a capital or a revenue character.

Lees.—The Oldham T.C. has applied to the U.D.C. for for consent to its supplying energy in the district, there being prospective consumers. The U.D.C. has decided to ascertain what consideration Oldham is prepared to pay for the privilege.

London.—Hammersmith.—At a recent Guardians' meeting the question of electricity supply to the Infirmary came up for discussion. One of the Guardians, a Mrs. Graves, thought it would be useful if a committee of women was appointed, as men had been considering the matter for 18 months with practically no result.

Stepney.—We are informed by Messrs. Bruce Peebles & Co., that the 2,000-K.V.A. turbo-alternator at the B.C.'s new station at Blyth's Wharf, is a Willans-Bruce Peebles set, and not as stated last week.

Luton.—The adjourned L.G.B. inquiry into the application for a loan of £11,707 for electricity purposes, was held on October 26th. The Inspector (Mr. H. R. Hooper) had reported to the Board with respect to £7,207 for buildings and machinery, leaving for further consideration the item for mains, in order that the suspense accounts might be made up to April 1st of this year. The application was not increased by £3,000 for mains, and, as a result of the suspense account submitted, £646 14s. 5d. was struck out of the proposed loan. The Inspector said he thought they now had a perfectly fair basis to start upon.

Navan.—The scheme for the electrical lighting of the Union, recently formulated by Mr. A. Scott, Dublin, has been submitted to the L.G.B. The U.D.C. is applying to the B. of T. for a provisional order empowering the Council to supply electricity in its jurisdiction for public and private purposes.

Newcastle (Staffs.).—At a recent meeting of the Council a question was raised as to whether Mr. de Renzi was the electrical engineer to the Council or not. It appeared that every member of the Committee thought he was, but no minute confirming the appointment could be unearthed, so eventually the Mayor tried to settle the matter by adding to a report, "Mr. de Renzi is hereby appointed electrical engineer of this borough." This apparently easy way out of the difficulty was, however, disallowed on the vote.

Portsmouth.—At a meeting of the T.C. held on October 26th, the Electric Lighting Committee submitted the report of the consulting engineers on the contract of Messrs. Willans & Robinson, for the supply and erection of a 1,000-KW. alternator and condensing plant, and recommended that the firm be required to raise the efficiency of the plant to meet the requirements of the contract, and that the maintenance guarantee be extended for a period of four months. It was also recommended that four superheaters be installed at a cost of £713.

The Finance Committee has purchased £2,500 worth of Portsmouth Corporation stock at 87¾ per cent., as an investment for the Electric Light Committee's reserve fund.

Reigate.—The T.C. has applied to the B. of T. for permission to supply electricity outside the borough. A prospective consumer has agreed to bring his cable up to the terminus of the Council's cables, and thus there will be no capital expenditure on the part of the Council.

Royton.—The U.D.C. has definitely decided to allow Oldham T.C. to supply electricity in the Royton area.

St. Helens.—In order to supply energy to the Sherdley Colliery, the Electricity Committee of the T.C. has decided to extend the overhead feeders from Sherdley Glass Works.

South Africa.—At a Council meeting held at Benoni (Transvaal) on September 30th, it was agreed to accept an offer from the Kleinfontein G.H. Co. to supply current at 2½d. per unit at the switchboard for seven years. A similar offer was made by the Victoria Falls Power Co.

Spalding.—The canvas of the compulsory area for probable consumers of electricity has not proved very satisfactory, and the U.D.C. has decided to ask the B. of T. for a further extension of the order.

Stevenage.—With reference to the transfer of the E.L. order, a syndicate has informed the U.D.C. that it will canvass the district with the object of ascertaining the prospect of providing an installation. If the results are favourable, it will take over the order on a 14 years' lease, under certain conditions.

Wimbledon.—The T.C. has approved of the specification submitted by the B.T.-H. Co. for a horizontal Curtis turbine to be substituted for the vertical turbine recently installed by the firm.

The borough electrical engineer reports that the Howden 1,000-KW. turbo-alternator was completed and in working order on October 7th. The question of enforcing payment of penalties for non-completion within the specified contract time was left over for further consideration.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Electricity Committee has considered the remit made by the T.C. in regard to enforcing the arbiter's award between the Corporation and the Suburban Tramway Co. as to price charged for energy. It was agreed, in the first place, to take the necessary step of obtaining the approval of the B. of T. before enforcing the award.

Belfast.—At the quarterly meeting of the Corporation on the 1st inst., various matters in connection with the tramways were discussed, and amongst others it was suggested that a line should be constructed to the top of the Cave Hill, the old world fortress which looms over the city, and which stands over 800 ft. above its level. Extensions of the system on the Donegall Road, Ravenhill Road, Shore Road, Ligoneil line, and Old Park Road, were urged by various members, and it is known that some of these will be attended to in the near future. It is a wonder that no effort has been made to construct a line to the top of the Cave Hill, a place which is constantly patronised by those who can do the stiff walk required to reach it.

Blackpool.—At the meeting of the T.C. on Tuesday, Alderman Brodie (chairman of the Tramways Committee), stated that up to the end of September the takings on the cars were £1,700 ahead of last year, and during the first fortnight in October, there was a falling off of £300. Up to Thursday night there was, however, a wonderful change, for the receipts showed an increase of £4,000 on the corresponding period of last year. There was no doubt the flying week had brought them an extra £2,000. Several months ago the Tramways Committee introduced an innovation by providing for children to travel free on all the cars on Wednesday afternoons, the only stipulation being that they should be accompanied either by their parents or guardians, and Alderman Brodie said they might almost allow everyone to ride free in the winter, as the receipts were comparatively small.

Brazil.—Serious disturbances occurred in Bahia on October 7th and 8th, owing to a car belonging to the Light and Power Co. having knocked down and killed a blind man who was crossing the street. The people in their indignation attacked various tramway stations and upset a number of cars, setting fire to several and throwing parts into the sea. The offices of the company were attacked, and one of the engineers in self-defence shot one of the crowd and injured several persons. The damage to the company's property is estimated at several hundred pounds, but it is believed that the company will ask for indemnification from the Government of the State of Bahia.

Continental Notes.—France.—The Paris, Lyons and Mediterranean Railway Co. intends, in conjunction with the Elektricitäts-Gesellschaft Alioth, of Basle, to convert the main line section between Cannes and Ventimiglia to electric traction. A short section from Frasse to Mouans-Sartoux will be equipped at once for experimental purposes. This section is specially suitable on account of its having gradients and sharp curves, and the fact that there is not much traffic on this part of the system. An overhead equipment for 12,500 volts single-phase will be installed on a new multiple catenary system. Wooden poles are to be used on the experimental section, but eventually steel girder supports will be adopted. The first locomotive will have four driving axles and a bogie truck at either end. It will be about 65 ft. long, and will weigh 140 tons, the drawbar pull will be some 16,000 lb. at 36 miles per hour, and 10,600 lb. at 62 miles per hour. The alternating current is to be converted to continuous current on the locomotive at any pressure up to 600 volts. Each driving axle will be geared to a 450-h.p. continuous-current motor.

It is stated that the Chemin de Fer du Midi has given out contracts for the conversion to electric working of 400 km. of main line between Bordeaux and Toulouse, a single-phase system at 15 cycles being adopted.

According to the daily papers, on Saturday last an electric train, running at high speed down a hill between Villefranche and Bourg-Madami, in the Pyrenees, left the rails owing to the driver having lost control, and fell into a ravine. Six persons were killed and 12 injured, all being railway employés who were testing the line, which is not yet open for public traffic. Among the killed was Major Gisclard, one of the engineers to the line.

Germany.—After remaining in abeyance for several years, the scheme for the construction of an electric railway between Cologne and Dusseldorf, with the privilege of utilising the tramways in each town, has made a certain step forward. The Prussian Minister for Railways has just declared himself prepared to entrust the project to private enterprise and to seek a royal concession for the purpose. As applications for a concession have been made by the two towns and by the large electrical firms, including the A.E.G. and the Bergmann Electricity Works, it will be necessary for these to combine their respective interests before the actual concession is proceeded with by the Minister.

Austria-Hungary.—Permission has been granted to the Abbazianer Elektrizitäts-und-Kleinbahngesellschaft, Vienna, for the extension of the Abbazia-Mattuglie electric railway to Lovrana *via* Volosca and Abbazia.

A scheme for the contruction of a narrow-gauge electric railway between Grein and Gross Gerungs is at present under consideration.

Belgium.—A new line of electric tramway in Brussels, between the Bourse and the Place des Guenx, was opened on Saturday last.

Darcy Lever.—The work of constructing tramways between Bolton and Darcy Lever village will shortly be commenced, the necessary surveys having been made.

Dunfermline.—The Dunfermline and District Tramways have now been completed and inspected by the B. of T. The company is to employ about 20 cars.

Liverpool.—The City Council, at the meeting on October 28th, passed a resolution to apply for sanction to the borrowing of £10,000 for the provision of additional cars for the electric tramway service, and, in reply to questions, the Chairman of the Tramways and Electricity Committee (Sir Charles Petrie) stated that the Corporation had been making its own cars for the last seven or eight years. Mr. H. R. Rathbone hoped that they would have an opportunity of discussing the question whether these new cars should be made municipally or by contract. It was an important question which they could not take for granted. They ought to have a report as to what the cars had cost and what they would have cost had they been constructed on contract.

Morecambe.—The T.C. has applied for a loan of £3,465 for the tramway permanent way.

Japan.—According to a local newspaper, a company is to be floated, with a capital of 2,000,000 yen (about £200,000), to construct and work an electric railway to run for a distance of some nine miles in the suburbs of Tokio, and to be connected with the Tokio Railway at Otuska.—*Board of Trade Journal.*

London.—In July last the L.C.C. decided to apply for authority to construct certain new tramways mainly in North London, at a total cost of £856,910. Since that date further proposals have been considered, and it is recommended that 15 miles of additional track in North London, to cost £328,695, should be adopted. This estimate does not include sub-stations, their equipment, and cars, or certain widening expenditure. The Highways Committee further proposes that the Mitcham Lane (Streatham) Garret Lane (Tooting) and Rainton Road to Chapel Street (Woolwich) tramways should be proceeded with, these lines being authorised by Parliament.

Conciliation Boards are to be established for the tramways for the (1) traffic; (2) rolling stock; (3) electrical; and (4) permanent way and building departments. On each of the first two the men will have six representatives, and on each of the others, three.

A regular experimental electric train service was started on October 29th, between London Bridge and Victoria Stations of the Brighton Co.; the service will be continued every week-day between 8 p.m. and 3 a.m. Experimental running has, of course, been in progress for some months during the day.

Pontypridd.—The receipts of the Council tramways have recently dropped considerably, and the manager (Mr. J. E. Teasdel) attributes the decrease in part to the operation of the Mines Eight Hours Act. The hours for the use of workmen's tickets having been extended, the ordinary traffic has been affected, and working expenses have at the same time been increased. The average weekly receipts have dropped by about £7, compared with last year's.

Rawtenstall.—The T.C. has unanimously decided to take steps for securing powers to construct and work an electric tramway in Lnmb Valley, from Waterfoot to Dean Lane—2 miles.

Rhondda.—The U.D.C. has decided to apply for Parliamentary powers for the construction of tramways to Mardy, Blaenrhondda, and Williamstown, and to lease the powers to a company.

South Africa.—The Transvaal Government has approved of the electric tramway scheme proposed by the Pretoria Municipality, provided that the system be constructed and conducted in conformity with the B. of T. Rules. The scheme is estimated to cost £160,000, and the Works Committee is authorised to call for tenders for such part of the work as it considers should be done by contract.

Stirling.—At the annual meeting of the Stirling and Bridge of Allan Tramways Co, which clings to the old-fashioned horse, a shareholder asked if there was no possibility of introducing another system of traction. Mr. T. A. Mortimer, of Rhynd, Dunfermline, the chairman, said that on two occasions they had provisionally sold the company for the purpose of having the tramways electrified. He thought the present rails could carry a light motor quite well. Mr. Henderson, the managing director, had been asked to make inquiries. A shareholder said that with a better system of traction they could double their dividends. The matter was left in the hands of the directors.

Sunderland.—The B. of T. has sanctioned the doubling of the track in Ryhope Road, Sunderland, from Villette Street to Spelter Works Road. This will enable an improved service to be run. The work, it is expected, will be commenced after the new year.

United States.—The Westinghouse Co. is stated to have secured the contract for two 25,000-h.p. water turbines coupled to 15,000 kw. generators for installation in the Edward's River power house of the Rock Island Southern Railway.

The Chicago Railways Co., operating over 170 miles of street tramways, has, since the present season commenced, built over 90 miles of track, which is considered a record for this class of work. The company has 650 pay-as-you-enter cars in service; 457 other ars are being remodelled to this type, and 350 additional cars of his type are on order.

It is reported, says *Electric Traction Weekly*, that a consolidation f Chicago public utility corporations is being planned by a group f Chicago and New York financiers—the total capitalisation epresenting 300 million dollars. It is proposed to consolidate the treet cars, the elevated railroads, the Commonwealth-Edison Co. nd subsidiary electric supply interests.

The Illinois Central Railroad directors have passed a resolution eferring electrification of the Chicago suburban service until "such ime as a continued study of the subject can intelligently determine the proper line of procedure." Upon learning this decision he Chicago City Council is reported to have drafted an ordinance ith the intention of compelling the electrification of all the steam oads in the city within two years, and prescribing a penalty of 100 for each day's delay in submitting plans, over six months from otification. The Railway Co. asserts that the traffic density is not ufficient to enable electrical working to pay; it also points to the ack of interchangeability and trouble caused from it, on the New ork Central and New Haven lines at New York, which conditions t is not desired to have at Chicago.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Commonwealth Government has accepted motion to the effect that wireless stations should be established ound the coasts of Australia. An allowance of £10,000 has been ade in the Estimates, for which, it is expected, two stations can e erected, one at Sydney and the other at Fremantle or Rottnest.

Cables Interrupted.—

Sitka-Valdez	October 28th.
Lowestoft-Emden	" 30th.
Balikpapan-Kwandang	November 1st.

Canada.—On October 18th the Canadian Pacific Railway laced in operation a telephone wire from Cartin, in Ontario, to randon, in Manitoba, a distance of 1,045 miles. This is the ucleus of a system which will stretch from the Atlantic to the acific, with telephones along the company's branches. For the ime being the wire from Cartin to Brandon will be used for mergency purposes only, but it is possible that the company will tilise it for dispatching trains before long. Every station and ection house between Cartin and Brandon is a telephone exchange, nd, in addition, each train will be fitted with apparatus which ill enable the conductor to obtain connection with the nearest own from any point along the line in the event of an accident. he company is also installing a similar wire between Swift urrent and Medicine Hat, and it is expected that this section will e linked up with the line now completed before the end of the ear.

Long-Distance Telephones.—The Swedish Board of elegraph Commissioners has obtained permission from the Government to purchase for kr. 25,000 the long-distance telephone invented y Messrs. Egnér & Holmström. It is stated that conversation is ossible with this device over a distance of 3,000 to 4,000 km. The Ericsson Co. has secured the patent rights for a new strong-current microphone for long-distance telephony, which, it is said, permits f iron being used more freely than hitherto, instead of copper wires.—*Affärsvärlden.*

The New Argentine Cable.—A Buenos Ayres German orrespondent confirms the report already announced by telegraph o the effect that the Western Telegraph Co. has been granted by he Argentine Congress a concession for the establishment of a irect cable between that country and Ascension, and states that the scheme was only a pretext to secure a cable monopoly. The monopoly, which was originally of practically unlimited duration, has been restricted to 25 years by the addition of a fresh clause by the Chamber, and it is also expressly declared that the company's privileges do not apply to wireless telegraphy. If, therefore, the German cable which is about to be laid to North Brazil cannot be extended to Rio de la Plata, the correspondent remarks that the way is still open for the eventual establishment of competition by means of wireless telegraphy.

Postal Telegraphs.—The report of the Postmaster-General, just issued, shows that during the year 1908-9 84,825,000 telegrams were transmitted, a decrease of 1·3 per cent. The total number of telegraph offices is now 13,490. The number of foreign telegrams, inward and outward, was upwards of 9,421,000, an increase of more than 274,000. Twenty-eight licences, covering 48 installations, were granted for experimental wireless stations. The trunk telephone exchanges open numbered 598, an increase of 47; during the year 141 trunk circuits were opened, making a total of 2,526. The capital expenditure on the trunk telephone system was increased by £736,138 to £4,682,796. The total number of conversations over trunk lines was 23,502,024, an increase of 6·86 per cent. The gross revenue from inland calls was £573,883, an increase of 7·25 per cent., and the average receipts per conversation were 5·86d. Continental calls brought in a revenue of £22,125, an increase of £938.

The telegraph revenue of the year was £3,099,724, a decrease of £1,216, and the expenditure, including interest on purchase capital, was £4,218,659, an increase of £44,776. The telephone revenue was £1,522,442, an increase of £139,262, and the expenditure was £1,567,570, an increase of £133,219, leaving a net deficit of £45,128.

There are now 25 commercial, 11 private, and 164 experimental wireless stations in the United Kingdom.

The underground telegraph line between Glasgow and Edinburgh is practically complete; the line running south from Newcastle has reached Stockton-on-Tees; that to the west, Penzance; and the extensions from Birmingham and Bristol have reached Worcester and Berkeley. It is intended to provide underground connections with the landing places of the principal submarine cables to the Continent.

The total number of British merchant ships now equipped with wireless apparatus is over 100, most of them being Atlantic liners. The International Radio-Telegraphic Convention has worked smoothly, and its effect has been distinctly advantageous to the Marconi Co., which has co-operated loyally with the Government in carrying out the provisions of the Convention. The number of outward radio-telegrams dealt with during the year was 1817, and inward 22,732.

During the year 102 P.O. telephone exchanges were opened in the provinces, and 55 public call offices connected with the trunk system. Numerous additions have been made to the rural call offices, which are served by adapting existing telegraph wires for local telephone working.

The total number of subscribers to the P.O. provincial telephone exchanges at the end of March, excluding Glasgow and Brighton, was 12,618, as compared with 11,579. The number of subscribers in Glasgow was 8,525, and the number of stations 15,595; at Brighton the numbers were 1,211 and 1,721. At Glasgow a new P.O. central exchange of the latest type is being constructed at a cost of £100,000, to accommodate 10,000 lines; when this is opened, the present exchange purchased from the Corporation will be closed, as it is worked on the call-wire system, and cannot meet the increasing requirements of the service with efficiency or economy.

The Hull municipal telephone system has 2,445 telephones (1,850 lines) connected, and that at Portsmouth 2,566 telephones (1,987 lines).

The rental of private wires provided by the Post Office amounted to £195,243. The London P.O. telephone service comprised 55,125 telephones and 682 call offices, with 2,417 miles of underground pipes, and 447,797 miles of wires; 124,571 miles of wire were rented by the National Telephone Co. Royalties for telephone licences amounted to £293,828 from the National Telephone Co. and to £2,618 from other sources.

The mileage of wire in the Post Office system now amounts to 304,562 for telegraphs, 548,694 for telephones, and 193,656 for private lines—total 1,046,912 miles—of which 412,434 miles are aerial, 623,930 underground, and 10,548 submarine.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Melbourne.—Telegraph and telephone material, for the P.M.G. See "Official Notices" October 29th.

Austria.—The Austrian State Railway authorities in Innsbruck have just invited tenders for an installation of electric lighting at the railway station at Schwarzach-St. Veit.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Birmingham.—November 6th. Electric cables, lamps and sundries, for a year, for Cadbury Bros., Bourneville. (Forms Nos. 3 and 4; applications for forms to be made by letter by November 6th.)

Bolton.—A correspondent says that the Tramways Committee will, ere long, be in the market for additional cars.

Bradford.—November 13th. General stores for the Tramways Department for a year (returnable deposit of £1 1s.). Tramway Offices, 7, Hall Ings, Bradford.

Bury.—The Tramways Committee is in the market for a motor tower wagon.

Canada.—Montreal.—Tenders are being called by the Saraguay Electric and Water Co. for turbo-generators of 2,000 kw. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4, Phillips Place.

Ottawa.—November 25th. Tenders are invited for the packing of material and supplies for points along the Yukon telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911 and 1912. See this column for October 29th.

Nelson.—The street railway by-law was carried almost unanimously. The company's plans as to initial equipment and extension comprise:—Motor-generator set, including sheds, switchboard, and necessary cable from sub-station to trolley lines, $11,000; two double-truck four-motor cars and two trailers, $12,000; car barns, machine shop, and full line of repair parts, $2,500; rotary broom, and apparatus necessary to attach same, $1,200; belt-line extension, $16,000; total, $43,700.—*The Canadian Engineer.*

Doncaster.—November 8th. Laying steel rails, permanent way construction, for two additional tramway passing-places, Bentley route, for the T.C. Borough Surveyor.

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" to-day.

Dundee.—The Corporation electricity department invites offers for the supply of a motor vehicle suitable for dealing with the transference of stores, &c. W. H. Blyth Martin, Town Clerk.

Eccles.—A correspondent understands that the Electricity Committee is in the market for electric heating apparatus.

Edmonton.—November 23rd. Electric light and power installation at the new infirmary. See "Official Notices" to-day.

Germany.—November 13th. The State Water Engineering authorities at Brunsbuttelkoog are inviting tenders for the supply of 24 electrically-operated centrifugal pumps.

November 15th.—The municipal authorities of Forbach are inviting tenders for the construction of an electric tramway in the town.

India.—Lucknow.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th.

London.—L.C.C.—Covering with asbestos tape about 2¾ miles of lead-covered high and low-tension electric cables in manholes. See "Official Notices" to-day.

Mexborough.—November 6th. Wiring skating rink. (Returnable deposit, 2s. 6d.) J. Willis, jun., 100, High Street, Mexborough.

Sherburn (Co. Durham).—November 6th. Electric light installation for the main portion of the parish, for the P.C. A. Stanley, clerk, Leamside, Fence Houses.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Warrington.—November 19th. Telegraph materials for a year, for the Cheshire Lines Committee. S. Saxon Barton, Stores Superintendent, Cheshire Lines, Warrington.

CLOSED.

Bury.—The Electricity Committee has accepted the tender of Messrs. E. Green & Sons, Ltd., for economisers for the works.

Canada.—Toronto.—The contract for one 650-kw. 120-r.p.m. engine-type alternator, together with switchboard, steam driven exciter and motor-generator set, has been awarded to the General Electric Manufacturing Co., of Sweden, through their representatives, Messrs. Kilmer, Pullen & Burnham, Toronto.

Calgary.—The order for four 750-kva. water-cooled step-down transformers for the Calgary Power and Transmission Co. has also been awarded to the General Electric Manufacturing Co., of Sweden, through the same firm.

The contract for about 8,000 lb. of wire, for the balance of this year's electric light work at Calgary, was let to the Canadian General Electric Co., who have just opened a branch in Calgary, at $17·20 a hundred, with a discount allowance of the half of 1 per cent. for 30 days' cash. The tender of the North-West Electric Co. was $17·70 with no discount, and that of the Enterprise Electric Co. $18·50. All these prices are f.o.b. Calgary.—*The Canadian Engineer.*

Electric Crane Contracts.—Messrs. Royce, Ltd., Trafford Park, Manchester, report that they have recently booked the following orders:—Two 45-ton overhead electric cranes for Canada; two 125-ton electric cranes for a Japanese Dockyard; and 23 electric capstans for the Clyde Navigation Trustees, 14 of the latter being of the "Royce" patent free barrel type.

Heywood.—The Electricity Committee has accepted the tender of Mr. Thomas Hollinrake for 2,000 tons of coal.

Portsmouth.—The T.C. has accepted the tender of the British Thomson-Houston Co. to supply 8-c.p. and 16 c.p. incandescent lamps for the ensuing 12 months, at 5s. per dozen.

South Africa.—Durban.—At the Council meeting held on October 7th the tender of Messrs. C. A. Parsons & Co. was accepted for the supply of a turbo-generator set, at a cost of £6,250.

The following tenders were also accepted for cable:—

Henley's Telegraph Works Co.—1,200 yards ·75 sq. in. l.t. cable, at £503; 7,000 yards ·25 sq. in. l.t. cable, at £1,185.
A.E.G. Electric Co.—330 yards ·5 sq. in. vulcanised rubber cable, at £142.

Stockport.—The T.C. has accepted the tender of Messrs. W. A. Shaw & Co., of 6, Warren Street, Stockport, for electrical supplies to the sewage outfall works.

Turkey.—Constantinople.—According to a special dispatch from Constantinople to the *Financial News*, it is now reported that among the firms which have submitted tenders for the construction of the telephone installation (to which we recently referred in "Notes on Trade Abroad") are the following:—Antwerp Telephone Co., Antwerp; Deutsche Telephonwerke, Berlin; Siemens & Halske, Berlin; Milde et Fils, Paris; Brenon, Paris; Société Générale de Télégraphie de l'Est, Constanka; Skon Skirakian, Constantinople; and several English firms. "No decision has been arrived at yet by the Turkish Government, but it is said that the offer of a French firm is likely to be accepted."

Wordsley.—Staffs. Education Committee has accepted the tender of Messrs. Whittaker Bros., of Dudley, for installing the electric light at Wordsley Schools, at £84, and for mains, at £17.

FORTHCOMING EVENTS.

Association of Teachers in Technical Institutions.—Saturday, November 6th. At 8 p.m. At St. Bride Institute, E.C. Annual meeting.

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 8th. At 8 p.m. Paper on "The Commercial Testing of Railway Materials," by Mr. T. H. Sanders.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 9th. At 7.30 p.m. At the Mosley Hotel, Manchester. Supper and smoking concert.

Institution of Civil Engineers.—Tuesday, November 9th. At 8 p.m. Papers on "The Single-phase Electrification of the Heysham, Morecambe and Lancaster Branch of the Midland Railway," by Messrs. J. Dalziel and J. Sayers; "The Equipment and Working Results of the Mersey Railway under Steam and Electric Traction," by Mr. J. Shaw; and "The Effect of Electrical Operation on the Permanent-way Maintenance of Railways, as illustrated on the Tynemouth Branches of the North-Eastern Railway," by Dr. C. A. Harrison.

Institution of Electrical Engineers (London).—Thursday, November 11th. At 8 p.m. Opening meeting. At the Institution of Civil Engineers. Presidential address by Dr. Gisbert Kapp.

Institution of Electrical Engineers (Birmingham Section).—Friday, November 12th. At 7 for 7.15 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society.—Friday, November 12th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Further Notes on the Physiological Principles underlying the Flicker Photometer," by Mr. J. S. Dow, and other papers.

Junior Institution of Engineers.—Tuesday, November 16th. At 8 p.m. At the Royal United Service Institution, Whitehall. Presidential address, on "Recent Warship Machinery," by Engineer Vice-Admiral H. J. Oram.

Illuminating Engineering Society.—Thursday, November 18th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W. Opening meeting. Inaugural address by Prof. Silvanus P. Thompson, D.Sc., F.R.S., first President.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for next week:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 8th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, November 9th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, November 10th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, November 11th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, November 12th.—"D" Company. Technical drill, 7 to 9.30 p.m.

Saturday, November 13th.—"A" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street station at 3 p.m. Dress: khaki, with haversack and greatcoat; knife, fork, and toilet requisites to be carried in haversack. Tickets will be issued at the station before entraining.

(Signed) P. H. Campbell, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

Inquiries.—A correspondent wishes to obtain grinding machinery to convert a previously crushed crystal into a material of the consistency of French chalk.

The makers of "Chain-o-lite" lamps are asked for—a series of spherical and oval lamps hooked together in the form of a chain.

The Batti-Wallahs' Smoker.—The first smoking concert of the P. & O. Batti-Wallahs' Society was held at the Holborn on Monday, November 1st, Mr. C. L. Lichtenberg appropriately being in the chair. A most pleasant evening was spent, and Mr. Walter Waters delighted the audience with his humorous song, "What's the Use." Mr. Davis rendered "A Farewell" excellently. Our old favourite, Miss Annie Bartle, was there, and Miss Mary Strangeways, while Miss Saidee Hamilton supplied humorous songs. Nor should we omit mention of Mr. Jas. Davis, Mr. Chas. Wreford and Mr. Harry Heap, all of whom, with Mr. Jack Treval, combined to make a full evening of song and humour such as we now expect at the meetings of this Society, which are always pleasant and free from stiff formality.

Tramway Accident and Its Sequel.—Some time ago a man was knocked down by a tramcar in the Harrow Road, and killed. The jury returned a verdict of "Accidental Death," but the tramway company discharged the driver, a man named Smales. A 16-year old son of the latter was overcome by the thought of the poverty which stared the family in the face, and after returning from church on a Sunday night, he committed suicide on the railway, leaving behind a pathetic letter, stating that he did it in the belief that the publicity that would be secured would obtain redress for his father. It was reported a few days later that the Metropolitan Tramway Co. had sent for Smales, and had given him work as an examiner of tramcar motors at the depôt.

Gas Out.—Last week a turncock, intending to cut off the water supply in a Sunderland street, turned off the gas instead, depriving the centre of the town on the south side of the river, as well as Monkwearmouth, Roker and Fulwell, of the supply, shortly after 6 o'clock in the evening. The mistake was rectified in a few minutes, but its consequences persisted for a much longer period. All gas lamps went out, in the streets and indoors; the former were relighted by the gas company's men, but great alarm was occasioned in houses, especially where the owners had gone out, leaving fires and lights burning. It was at once realised that, the gas having been turned on again unlighted, explosions in such houses would be inevitable unless immediate steps were taken to turn off the taps, and in many cases, says the Sunderland *Daily Echo*, neighbours in fear for the safety of their own houses got into vacant premises and turned the gas off. Fortunately, no serious results were reported, but it is obvious that widespread disaster might easily have occurred. No such risks attend the temporary interruption of a supply of electricity, nor could it be brought about by a careless turncock.

Institution and Lecture Notes.—NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS.—On Saturday, October 23rd, a party of members visited the works of Messrs. J. H. Holmes & Co., Newcastle-upon-Tyne, to inspect the works, and in particular to examine a selection of mining electrical machinery. This included a 20 H.P. haulage gear fitted with a slip-ring motor and speed control device, a number of squirrel-cage motors suitable for mining purposes, auto-transformers and starters. A special feature was made of the Holmes-Page patent three-pole switch and fuse pedestal, which has been designed especially to meet conditions of mining practice, and is of the interlocked type.

On Saturday last the members of the GLASGOW UNIVERSITY PHYSICAL SOCIETY visited the Blythswood laboratory and museum, Renfrew, which was founded and equipped by the late Lord Blythswood.

GLASGOW TECHNICAL COLLEGE SCIENTIFIC SOCIETY. — On Saturday last Mr. A. G. Collis, A.M.I.E.E., read a paper on this subject, in the course of which he referred to the indifference to danger shown in many switchboard designs, and emphasised the strange ideas of economy prevalent in some stations, where the cost of the switchgear was cut to the lowest possible amount, although such extravagances as oak pannelling and mosaic floors were considered necessary.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—The annual meeting of this Association will be held to-morrow, November 6th, at the St. Bride Institute, Fleet Street, E.C. The chair will be taken by Mr. J. Wilson, who is to be President of the Association for the coming year. The annual report of the Council will contain an abstract of the educational and professional work accomplished during the year, including the consideration of such questions as syllabuses in Applied Mechanics and Electrical Engineering, the Training of Craftsmen, the Preliminary Training of Technical Students, and Higher Education in London. Amongst professional matters dealt with are registration of teachers, superannuation, legal matters and a minimum scale of salaries for teachers in technical institutes.

ROYAL SOCIETY OF ARTS.—Sir William White, the chairman of the Council, will open the new Session of the Society on November 17th, with an address, the subject of which will be "An Imperial Navy." Among the arrangements for meetings before Christmas are papers by Mr. T. Thorne-Baker on "Photo-Telegraphy," and the Hon. Richard Clere Parsons on "Resilient Wheels for Vehicles." There will be one course of Cantor Lectures by Mr. Charles C. Turner, who will give a popular account of the progress which has been made in aeronautics.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the opening meeting on November 11th, a marble bust by Hamo Thornycroft of the late Dr. John Hopkinson, F.R.S., who was president in 1890 and in 1896, will be presented to the Institution by Prof. Bertram Hopkinson, on behalf of his mother, Mrs. John Hopkinson.

INSTITUTION OF ELECTRICAL ENGINEERS (LEEDS).—On Wednesday last week Mr. W. M. Rogerson, chairman, delivered his inaugural address, which consisted mainly of a retrospect of progress made in connection with electricity supply for lighting, power and traction. On Wednesday, November 17th, a paper is to be read by Mr. W. T. Maccall on "Some Experiments on Single and Stranded Fuses."

JUNIOR INSTITUTION OF ENGINEERS.—The annual general meeting of this Institution was recently held at the Royal United Service Institution, Whitehall. The Council's annual report, which was presented, showed that the membership had increased to 1,063. Nine ordinary meetings had been held, and 39 visits to works made, covering practically every branch of engineering. The Summer meeting in the Midlands had proved very successful. Birmingham had been made the centre on account of the Institution's first local section having been established there during the year. Mr. Geo. T. Bullock was elected chairman. The benevolent fund accounts showed that the amount standing to its credit was £189. A paper was then read by Mr. T. A. Watson, A.M.Inst.C.E. (member), on "The Reinforced Concrete Construction of the New General Post Office Buildings, London." On November 16th, Engineer Vice-Admiral Henry J. Oram, C.B., will deliver his presidential address on "Recent Warship Machinery."

INSTITUTION OF MUNICIPAL ENGINEERS.—The roll of the Institution now numbers 719. It is considered advisable that a class of associate members be attached to the Institution, such associate members to be entitled to the privilege of corporate membership, and a clause in the by-laws in respect thereto is under consideration.

N.E. COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—The new session opened on 29th ult. The report of the Council showed that the roll of members numbered 1,037. A paper on "Marine Boiler Design" was read by Mr. D. Myles, vice-president.

ROYAL INSTITUTION.—The Christmas Course of Juvenile Lectures will be delivered this year by Mr. William Duddell, F.R.S., his subject being "Modern Electricity." The course, which will be experimentally illustrated, commences on Tuesday, December 28th, at 3 o'clock, and will be continued on December 30th, 1909, January 1st, 4th, 6th and 8th, 1910.

Late Legal.—LITHOLITE, LTD., *v.* HALL.—In the Shoreditch County Court on Tuesday, before his Honour Judge Bray, Messrs. Litholite, Ltd., of 55, Hackney Grove, N.E., manufacturers of electric insulators, sued Mr. R. F. Hall, of 137, Suffolk Street, Birmingham, consulting engineer, for £30, money expended and work done in connection with dies for electric insulators. The plaintiffs' case was that they supplied insulators made of litholite, which was a cheap substitute for vulcanite, to customers. They took an order from the defendant, he supplying the thing he required, from which they made the dies. When they had finished the work, however, he complained that the litholite was unsuitable for what he required the insulators for, as it "roughened up." They offered to put any defect right, as they were convinced their goods were of the best, but the matter dragged on until they were forced to sue. The defendant appeared in person, and said that when the traveller called upon him, he told him that he had got a special job on, and showed him what it was, asking him at the same time if he considered litholite would answer the purpose. He was assured that it would, and on that understanding he ordered the stuff, but he now found it of no service at all. He asked the plaintiffs if it was not a fact that they had some trouble with the Electrical Ignition Co. in a similar way. Plaintiffs' representative said it was not so. They supplied some insulators, and after they had been used, the company complained of leakage of current across the surface. They could not make out what had caused it, and it was some time before they discovered that there was a thin coating of lacquer on the litholite which contained carbon, and caused the surface leakage. They were under the impression at first that it was the dies that were wrong, but so soon as they found out the cause of the leak they paid £15 to the Electrical Ignition Co., the whole of the cost they had been put to. That defect had now been remedied. The defendant said he had had to pay compensation to the people to whom he had supplied the goods, and he considered it very hard on himself. He was prepared to call witnesses as to this, and also expert evidence, but a little later counsel for the plaintiffs mentioned to his Honour that the defendant was more inclined to settle the matter on the spot, and judgment was entered for the plaintiffs for £12, with £20 costs.

Fires at Cable Factories.—On Wednesday morning a fire broke out at the works of Messrs. Connolly Bros., Ltd., of Manchester. Although rather serious damage resulted, the firm are making arrangements so that little delay will be occasioned in the execution of orders, as they are able to utilise their branch works in place of the portion damaged.

It is reported in the daily Press that on Saturday morning last a fire occurred at the Victoria Works, Charlton, of Messrs. Johnson and Phillips, Ltd. One of the buildings used in one of the processes of cable manufacture is said to have been burned out, but an adjacent building used as a strand shop was saved.

To-day's Great Thought!—M.D. doesn't mean "medical doctor." It stands for "Merry Devil."—DR. WALFORD BODIE, M.D., Ph.D., D.Sc.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. J. WRIGHT, the senior shift engineer to the Hounslow electricity undertaking, has resigned, and his place has been filled by the promotion of MR. GOLDING, second engineer. MR. WOODS, third engineer, has been given the second engineer's position, and MR. FLETCHER, of the Nottingham and Derbyshire Power Co., has been appointed third engineer.

At Thornhill, recently, MR. A. E. WAINWRIGHT, of the Yorkshire Electric Power Co., was presented with a Gladstone bag by the members of the staff on the occasion of his leaving the service of the company. Mr. Wainwright takes up the position of engineer-in-charge to the Stalybridge Corporation.

We understand that MR. OSWIN HANSON, the electrical engineer for the Fleetwood Council's recently acquired electric light and power undertaking, has been appointed general manager of the Liverpool and District Electric Lighting Co.

The staff of the Bridlington Electricity Works have presented an oak clock to MR. H. W. HARGH, mains foreman, on his marriage.

The Wrexham T.C. has increased the salary of MR. W. J. PICKVANCE, electrical engineer, from £225 to £250 per annum, as from April 1st.

MR. G. FRANCIS, A.M.I.E.E., rolling stock superintendent with the Hastings Tramway Co., was presented with a gold watch by the work staff, on the occasion of his leaving the company's service.

General.—It is announced that MR. MERVYN O'GORMAN has been appointed by the War Office to undertake the organisation of the construction department at Aldershot for the manufacture of engines for dirigible airships and aeroplanes.

MR. KICKI KOBORI, chief electrical engineer of the Nji River Electric Co., at Kyoto, Japan, was at Niagara Falls last month, inspecting the works of the power companies, with a view to gathering information as to the installation and operation of power plants. The *Canadian Engineer* says that his company will construct the biggest plant in Japan.

MR. G. W. FARRALL, a member of the works staff of the Electric Construction Co.'s works at Bushbury, Wolverhampton, was last week presented by the workmen of the Brush-gear department with a smoking cabinet on his retirement after being employed at the works over 20 years.

MR. I. E. WINSLOW is removing his offices from 20, Bishopsgate Street Within to 8, Crosby Square, E.C., as from the 8th inst.

Obituary.—THE LATE MR. MEDHURST.—The inquest was held on Thursday last week into the death of Mr. F. Hastings Medhurst, which was referred to briefly in our last issue. A personal friend said that the deceased gentleman "burned the candle at both ends always," and in 1904 he was persuaded to go to Canada for his first holiday, after at least 10 years' hard work. The evidence given by Mr. Medhurst's father showed that he had several times tried to persuade him not to overwork himself. He was most ambitious. He had been suffering from sleeplessness, and frequently after working all day had made night trips to Stafford in connection with his candidature. In a letter to the hotel landlord, Mr. Medhnrst asked that the cash found upon him should be divided between the waiter and chambermaid at the hotel, and that his cigarette case should be given to his valet. The jury returned a verdict of "Suicide during temporary insanity," and expressed their sympathy with the relatives.

MR. JOHN E. PITCAIRN.—We regret to record the death, at the age of 59 years, of Mr. J. E. Pitcairn, J.P., who retired from active service under the Edinburgh Tramways Co. in 1906, after being manager for 22 years.

MR. W. I. BUCHANAN.—Shareholders and others interested in the British Westinghouse Electric and Manufacturing Co., Ltd., will have learned with regret of the sudden death in London last month of Mr. W. I. Buchanan, who was for a time chairman of that company. Mr. Buchanan was a man of fine presence and personality and one of the best types of American statesmen. For several years he acted as deputy-chairman of the company and as a director of some of its associated companies.

CITY NOTES.

Cape Electric Tramways, Ltd.

IN their report for the year ended June 30th, 1909, the directors state that the profit and loss account, after providing for debenture interest and redemption of debentures, and taking into account the balance brought forward from last year, shows a balance to credit of £5,955, which has been carried forward. During the year the tramways carried in Cape Town 11,888,180 passengers, earning £117,715, against 14,742,155 passengers, earning £120,910 in the preceding year. In Port Elizabeth 2,978,217 passengers were carried, earning £31,455 against 3,561,211 passengers, earning £37,048 in 1907-8. The dividends declared by the sub-companies amounted to £47,029, against £46,081 last year. This result has been obtained by stringent economies in the working of the undertaking, and in spite of a decreased traffic. The Cape Town system shows an improvement in the profit earned over last year. This increase is unfortunately almost counterbalanced by the decreased earnings of the Port Elizabeth system. In the month of November of last year, a disastrous flood occurred in Port Elizabeth owing to the overflowing of the Baakens River. This catastrophe caused considerable damage to the rolling stock, power station and other buildings, amounting to nearly £6,000. Of this amount £4,667 still remains to be charged against the future profits of the Port Elizabeth tramway, it being decided that this exceptional loss should be spread over a period of years. The financial depression in Port Elizabeth has been most acute; and in Cape Town, although no marked improvement was shown, the results that are now coming forward are encouraging to the extent that the returns have begun to give indications of a gradual increase, which can reasonably be expected to be sustained, as local conditions all point in that direction. The directors place on record their highest appreciation of the services rendered by the local boards in Cape Town and Port Elizabeth, by Mr. A. S. Giles, and Mr. J. A. Barkley, the general managers, and by the staff under them.

In an accompanying report, Mr. A. S. Giles, general manager of the Cape Town companies, says: "The gross profit shows an improvement on last year, and has been due to reduced working expenses, and notwithstanding the fact that the total receipts show a falling off as compared with last year. The following table gives the traffic returns for the past three years:—

Year ending June 30th.		Mileage.	Passengers.	Receipts.	Aver. receipts per car-mile.
1907	..	2,074,656	12,563,303	£131,594	15·22d.
1908	..	2,185,103	14,742,155	£120,909	13·28d.
1909	..	1,874,802	11,888,180	£117,714	15·07d.

The two routes, Southern Suburbs and City, show a substantial increase in traffic, while the other routes, especially the residential lines within the City of Cape Town, show a large decrease. The public residing in the suburbs continue to make use of the increased facilities given them by the increased length of the stages and the adoption of cheaper fares between Mowbray and Wynberg. The traffic between Claremont and Cape Town has much improved by the extension of the 6d. cash stage from Westerford Bridge to a point near Station Road, Claremont, and it is this traffic which has increased the receipts on the Southern Suburbs and City lines. The serious decrease on the Gardens route, more especially Kloof Street, Tamboers Kloof, and Oranjezicht, is the result of continued bad times, and shrinkage of population. Traffic on the Sea Point line has been, of course, very much less than in the previous year, but, with a smaller service of cars, and consequent reduced expenditure, we have earned a better return on this route, although the total receipts are a little lower than last year. The actual working expenses for the year amounted to £78,623, and compare favourably with previous years.

Year ending June.		Mileage.	Expenses.	Average per car-mile.
1907	..	2,074,656	£86,940	10·05d.
1908	..	2,185,103	£88,656	9·73d.
1909	..	1,874,802	£78,623	10 06d.

The car-miles run during the current year are considerably less than in previous years, for, on account of the continued falling-off in receipts, the service of cars has had to be reduced to effect economies. This reduction of mileage has caused the average cost per mile to exceed the average of the previous year. The result is due to the fact that the standing charges do not vary in proportion to the mileage; these have to be met, and are practically the same as last year, when the mileage was 16 per cent. greater. The power costs for the year average 1·0398d. per KW.-hour, a figure lower than any obtained in previous years. The plant has been well maintained throughout and is in good working condition. Notwithstanding the reduced output, economies have been achieved in fuel consumption, and the total costs have been reduced largely. The permanent way throughout the system has been properly maintained. During the year, the asphalt paving in Long Street and in Darling Street was completed, and these routes, it is hoped, will require but little upkeep for many years to come. The cars have been overhauled and repaired, and thoroughly kept in working condition. The result of careful inspection and testing, and a system of metering the current consumed by each car, has had the effect of lowering the cost of energy per car-mile. I anticipate reduced cost of car repairs during the ensuing year by the system I have now adopted."

A matter which at one time during the year assumed serious dimensions arose by the Cape Divisional Council bringing an action against the Southern Suburbs Co., requiring extensive alterations to the track between Mowbray and Wynberg. The ruling of the Court couples with it a sort of compromise, and calls upon the company to carry out certain works at the points along the tramway which are considered dangerous. These works it is estimated will cost a comparatively small sum, and must be completed by March of next year.

In the report of MR. J. A. BARKLEY, the general manager of the Port Elizabeth Electric Tramway Co., Ltd., it is stated:—"The business depression has increased in severity and its effects upon our revenue are deplorable. The prosperous conditions of the Transvaal and Rhodesia, and the resulting demand for labour in these Colonies, has depleted our population almost as much as the retrenchments made in previous years. This applies to the skilled mechanic as well as to the native labour, and to so great an extent as to render it difficult to secure workmen and labourers of satisfactory quality. When a business revival does come, the local demand for help will soon be felt, and an increasing population will be the natural result. Until then no great improvement in our business may be expected. The flood of November 16th, 1908, was most disastrous to your property, severely damaging as it did our entire equipment and buildings, but also seriously disorganising our service. This is particularly noticeable in our November and early December returns, and accounts for a substantial part of our decrease in revenue. The loss sustained on this account was £5,749." The operating expenditure for the year totals £21,579, which includes the following extraordinary expenditure:—Flood losses written off, £1,050; smoke stack losses written off, £359; total, £1,409; which brings the real operating expenditure down to the sum of £20,170.

Metallic Seamless Tube Co., Ltd.—The accounts show a net profit of £1,170, plus £4,540 brought forward. A dividend of 7½ per cent. on the ordinary shares is recommended, carrying forward £4,157.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The report for the half-year ended June 30th shows gross receipts amounting to £290,931, against £290,295 for the corresponding half-year of 1908. The working expenses, including £23,799 for maintenance of cables were £156,976, against £150,889 for the corresponding period of 1908, leaving a balance of £133,954. Deducting £3,068 for income-tax payable in England, and £15,048 for interest on debenture stock, £115,838 remains as the net profit for the half-year. After adding £18,005 brought forward, there is an available balance of £133,844. After paying two quarterly interim dividends of 1¼ per cent. each, amounting to £75,000, a balance of £58,844 is carried forward.

Norwich Electric Tramways Co., Ltd.—The directors recommend a dividend for the past year at the rate of 1¾ per cent. per annum (against 1½ per cent. last year), less income-tax. £500 is placed to reserve and £193 carried forward.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

November 8th.—Marconi's Wireless Telegraph Co.—Further issue of 10,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 625,081 to 635,080.

November 9th.—Marconi's Wireless Telegraph Co.—Further issue of 50 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 635,081 to 635,130.

November 10th.—Marconi's Wireless Telegraph Co.—Further issue of 2,232 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 635,131 to 637,362.

November 11th.—Marconi's Wireless Telegraph Co.—Further issue of 10,782 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 637,363 to 648,144.

November 12th.—Marconi's Wireless Telegraph Co.—Further issue of 4,505 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 648,145 to 652,649.

And ordered the undermentioned securities to be quoted in the Official List:—

Rosario Electric Co.—Further issue of 2,563 6 per cent. cumulative second preference shares of £5 each, fully paid, within Nos. 15,001 to 20,000.

Electrolytic Alkali Co., Ltd.—The annual meeting of this company was held at Liverpool on October 28th. Colonel Lee Pilkington, the chairman, in moving the adoption of the report, said (as reported in the *Financial Times*) that the increase of £20,333 in the trading account was gratifying and was the result of large sales. The price of the company's principal products, however, was still abnormally low; otherwise the result of the year's trading would have been eminently satisfactory to all the shareholders. The net profit for the year was £11,919, against £10,411 in the previous year. The figures in all departments proved that the company was making progress, especially considering the dulness of the trade. The disposal amount at profit and loss account was now £22,174, as against £17,252 last year, and that was more than sufficient to discharge all the accumulated arrears of dividend on the preference shares. Nevertheless, the directors, after giving the matter full consideration, had deemed it prudent to recommend a payment of one year only, which would leave to carry forward £15,177, or nearly £5,000 more than in the previous year. In the present bad state of trade they considered it wise to keep a large balance in hand against any contingencies that might arise. The report was adopted, with five dissentients.

Prospectus.—*Lumut Rubber Estates, Ltd.*—An issue of 150,000 shares of £1 each at par has been offered to the public this week. The company will acquire the Sungei Wangi and Riverside Estates, in the State of Perak.

Companies Struck off the Register.—The following have been struck off the register, and are accordingly dissolved:—

Anglo-Iberian Electric Light and Power Co., Ltd.
Carl Oppermann Electric Carriage Co., Ltd.
Electric Carriage and Storage Co., Ltd.
London Electric Supply (Joint Committee), Ltd.

Change of Address.—The Norwich Electric Tramways Co., the Coventry Electric Tramways Co., and the New General Traction Co., Ltd., are, on 8th inst., removing their offices from Bishopsgate Street Within, to 8, Crosby Square, E.C.

Rosario Electric Co., Ltd.

The seventh annual general meeting of the shareholders of this company was held on Tuesday at River Plate House, Finsbury Circus, Mr. W. T. Western presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, October 15th, page 627), said the accounts showed continued progress. The units of current sold were 32 per cent. in excess of those sold in the preceding year, about one-fourth of which was for power, as against one-fifth in the previous year. The gross receipts had increased from £73,100 to £91,300. They had received slightly less per unit consequent upon the larger proportion used for power and public lighting. Their works costs of running were very nearly the same as last year, which, at first sight, seemed an anomaly. The explanation was that, in the previous year, the company bore the cost of trimming the street lamps in respect to the street lighting. This year the Municipality had borne those charges, paying them for the current used only. Making that correction, their cost of working had gone up by £1,900—the smallness of the figure being accounted for by the lower prices of fuel, and still more so by the benefit they had obtained by using their own condensing plant. After providing for depreciation, there remained £35,000, as against £23,000 last year. Last year they had to provide for £1,700 special charges, which did not recur on this occasion; and they were enabled to pay a dividend of 8 per cent. on the ordinary shares, and to place £15,000 to the reserve, making that fund £30,000. He trusted the shareholders would consider those results satisfactory. Their relations with the municipal authorities had been harmonious. They had expended £33,700 on capital account, which included the completion of their condensing plant and about £13,000 for additional mains. He had only recently returned from a visit to Rosario, where he went specially on the business of the company, in order that he might study on the spot the lines of future development. It was only four years since his last visit, and the development of the town in that time had been remarkable—it might be summed up in the statement that the population had increased by something like 20 per cent., and that the conveniences of the town in the way of paving, lighting, water supply and tramway service had all been improved. If there was a fly in the ointment, it was that municipal taxation had increased to an extent which had caused a general protest in a vigorous form. He had the great advantage of the presence of Mr. Merz, who was in the Argentine on other business, and who inspected their station, and gave them the benefit of his counsel. He also met the members of their Advisory Committee, and consulted with them. The important point to decide was as to the lines of development. At their present station they had room for more plant, which might be sufficient to provide for their business increasing at a normal rate for two or three years, and which might, by a rearrangement of the plant, and at considerable cost, be made to last for another four or five years. In view of the general development of the town, he thought they ought to look ahead for a longer period. They had, therefore, agreed to purchase some land at Sorrento, just outside the municipal boundary, having an area sufficient to last them for many years. Upon the site they contemplated erecting a turbine plant of the latest pattern, with its proper equipment of condensing plant. That would cost £100,000 to £120,000 for the station, to which would have to be added the cost of cables and transformers, making in all, perhaps, £200,000. That would give them a station about equal to their present one, or, say, double their present effective capacity. It might seem a large sum to expend in the course of the next three or four years, and was a departure from their past policy of looking ahead to next year's demand only, but he was convinced that it was no longer sound policy to take short views, and that the policy of at once commencing to erect a new station was preferable to filling up their existing site to its possible maximum capacity and postponing the inevitable construction of a new station. Towards the cost of dividend on the new capital expenditure they already had a considerable margin of revenue, and, given a continuous growth of business even at a lower ratio than they had experienced in the past, he saw no reason to fear any reduction in the present dividends. Towards meeting the expenditure they proposed to call a special meeting shortly to sanction an issue of £100,000 new ordinary shares. As to the current year, he was pleased to say that the profits for July and August—which, of course, it was important to remember were their winter months—were over £3,000 in excess of the corresponding two months of last year.

Mr. W. F. Leese seconded the motion.

The Chairman, in reply to a shareholder, said that the metallic-filament lamp was coming into use in the Argentine, but not to the extent that was the case at home. He rather fancied that that was because the quality of the lamp sent out was not a particularly good one. For a time, no doubt, it would tend to reduce consumption, but in the end he believed it would be to their advantage, and, personally, he was always in favour of the consumer using the lamp that would give him the best results with the smallest amount of consumption.

The report was adopted.

City of Buenos Ayres Tramways (1904), Ltd.—The directors announce a dividend of 1s. 3d. per share, less income-tax, for the three months ended September 30th last.

West African Telegraph Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum, free of income-tax, for the past half-year.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held in Newcastle-on-Tyne on October 27th. The Chairman (Mr. Charles Emmott) moved the adoption of the report (see Electrical Review, October 22nd, p. 667). Dealing first with the balance sheet, he said, that the share capital remained the same as last year. An additional sum of £10,000 had been raised by first mortgage debentures, and further financial arrangements had resulted in the creation of 6 per cent. second mortgage debentures to the amount of £150,000. Of these they had placed £111,500, £75,000 of which had been taken up to date, and the balance of £36,500 would be issued as occasion demanded. The total amount due to creditors was, this year, £78,097, a decrease of, roughly, £31,000, as compared with last year—a satisfactory feature. Turning to the investments and loans, he said these had been increased, roughly, by £8,000—from £837,607 to £845,594—due to a further advance to their subsidiary company, the Northern Counties Electricity Supply Co., Ltd. The capital expenditure on works had been rather over £14,000, and had been spent chiefly on the erection and equipment of additional sub-stations. That was the smallest amount they had spent on capital account in any 12 months, and it reflected the bad state of trade in the district. During the previous year they had spent about £46,000 in that direction. There was an increase in the amount due from debtors to the company for current supplied, &c., of £8,800, the total due this year being £45,993, as against £37,109 at the corresponding date last year. With regard to the item of deferred shares that increased by £1,085, and completed the option which he had explained fully at their last meeting. He came now to the profit and loss account. At first sight the result of the year's trading did not appear to compare favourably with that of the previous 12 months. Dealing first with the receipts they would notice that the revenue was this year £68,457, as compared with £73,328 shown last year. The outstanding feature of the year as affecting the company's business, had been the increased depression in trade, which had been more severe during the period covered by the accounts than for very many years past. During the previous year they had felt the influence of strikes, which continued into the year under review, and trade consistently got worse. This had been reflected in the balance-sheets of nearly every industrial undertaking in the district, and generally to an extent much more noticeable than in their own, for, whereas their loss, after deducting debenture interest, was under £5,000, other companies had either lost or reduced their profits by a sum many times that figure. Trade depression had a three-fold effect on an industry such as theirs. First, it reduced the consumption of current of consumers already connected. Secondly, it retarded the volume of new business contracted for. Thirdly, it unfortunately did not permit, in their case, of a substantial reduction in working expenses, as was sometimes possible in other works where a whole department might be shut down. So far as the first two factors were concerned, it was not an unreasonable assumption that had the consumers connected consumed the amount of current which they would have used in normal times, the company's receipts would have been at least 25 per cent. greater, and if others had not delayed the completion of their installations pending trade improvement, but had changed over to electric driving with the usual dispatch, a further substantial revenue would have accrued. There were other firms again, too, which although anxious to modernise their plant, had perforce to decide upon a policy that for the time being no capital expenditure, however remunerative, should be incurred. So far as the third factor was concerned, they would appreciate that it cost very little more to run generating stations at their full capacity than it did to run at, say, half their possible output; for whether a station was run fully, or only half employed, the same staff was necessary to operate it. During the year under review the waste heat stations they operated had not been run at their best advantage. Owing to the reduction in the quantity of pig-iron produced, furnaces had been shut down, which had resulted in blowing engines being laid off duty, with a consequent reduction in the amount of steam placed at the company's disposal. A special word with regard to the electrification of collieries was necessary. They had in their area a very large number of coal mines, in fact, in East Durham and round about the district of Consett and Bishop Auckland there was practically no other industry carried on in which a large amount of power was used. In their area there were about 150 pits, most of which could, with profit to their owners and that company, be connected with the Cleveland Co.'s mains. They expected ultimately to do a very large business in that direction. The Eight Hours Act would not come into force in the counties of Durham and Northumberland until January 1st next. The owners refused to spend money until they knew what was going to happen in regard to that, but he thought that in order to increase their output in a given time, and to decrease working expenses, colliery owners would be compelled to adopt more efficient labour-saving plant. There was no doubt at all that those responsible for the management of colliery undertakings were more and more coming to realise the fact that they must make increased use of mechanical power, and that this could be applied far more conveniently and cheaply by electrical than by any other means. The use of electricity in mines was being rapidly extended all over the country, and there were many collieries in Durham which were run entirely by this form of power. While, therefore, the company's progress had been retarded for the moment, they could be sure that the considerations he had referred to would have a beneficial effect on their future results. Referring to the company's expenses, he said that they did not think that their working costs or business organisation could be improved upon. The cost of producing current was as low as the best engineering practice could get it. Summarising the last two years' trading, and taking into account only the company's permanent source of revenue, and excluding interest from their calculations, the trading results showed an improvement of £15,185. Now while there were signs that trade was improving, those best able to judge believed that it would be slow, and the directors had, therefore, thought it right to pursue a distinctly conservative policy in dealing with every item in the accounts upon which he had been commenting. They had taken no credit for any profits on uncompleted contracts with their associated companies. They, nevertheless, held strongly that that company's investments in the Cleveland Parliamentary Co. would prove a profitable one, and they had in no way modified their opinion as to the excellent area which the Tees and iron mines districts presented from a power supply point of view. They would be pleased to note that the connections with the company's system had considerably increased. All the connections were bound to lead to an increase of revenue as trade improved, and already the result showed considerable improvement for the current year as compared with the year covered by the accounts. The returns for the current year down to a fortnight ago, showed a revenue of £26,423 as compared with £20,315 for the corresponding period of last year. The profit was £4,008, as compared with £1,507. These were the combined figures for that company and its associated companies, of which that company held most of the capital. The improvement that those figures showed was a very substantial one. He did not think that he was at all over sanguine in prophesying that with a reasonable improvement in trade, advances on those figures might be looked forward to as the year proceeded. Amongst their more important new agreements entered into were those with Bolckow, Vaughan & Co., Ltd.; Head, Wrightson & Co., Ltd.; the Salt Union, Ltd.; North-Eastern Railway Co.; and the Ormesby Rolling Mills, Ltd. In addition to the improved figures which he had given them, they had room for some encouragement in the negotiations they had been able to resume with some very large power users in their area, and they were, therefore, confident that when they met them at that time next year it would be with much improved results to show.

The report was adopted.

The retiring directors (Mr. James Falconer, M.P., and the Hon. Robert James) were re-elected.

The American General Electric Co.—The *Electrical World* says that the American General Electric Co. is contemplating extensive improvements to its plants, both at Schenectady and at Lynn. It is said that contracts for two buildings have been made at Schenectady. One of the buildings, it is stated, will be 80 ft. × 400 ft. and five stories high, to be built of reinforced concrete and steel. The other is in the form of a 200-ft extension to building No. 50, which is a warehouse. The first of these buildings will be used for manufacturing purposes. In this connection it is also given out that the Lynn plant is to be extended by the erection of two mammoth new buildings at the river works. Building No. 74 will have an added length of from 300 to 500 ft., which will make the structure the largest single building for manufacturing purposes in New England. It is also understood that the employés of the Lynn plant will be increased from 9,200 to 15,000. The business of the General Electric has so materially increased that it is necessary to extend its manufacturing facilities.

Western Telegraph Co., Ltd.—The directors' report for the half-year ended June 30th, 1909, says that the revenue for the period amounted to £357,082 and the working expenses to £134,917. After providing £16,000 for debenture stock interest, and £6,743 for income-tax, there remains a balance of £199,421, to which is added £5,214 brought forward, making a total of £204,636. A quarterly interim dividend, amounting to £31,189, has been paid, £90,000 transferred to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund. The directors now recommend the declaration of a final dividend of 3s. per share, making with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving a balance of £6,464 to be carried forward. The dividend and bonus will be payable on November 11th. Lord Richard H. Browne has resigned his seat on the board, and the vacancy has been filled by Mr. John George Griffiths.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The report for the 12 months ended June 30th, 1909, states that the accounts show a profit of £7,006, plus £7,168 brought forward. After providing for the interest on debentures, there remains a balance of £4,846 to be carried forward. During the past year trade in Venezuela has been very bad owing to political changes, the renewed outbreak of plague at La Guayra and the inevitable interruptions to the telephone service caused by changing the subscribers over from the old to the new switchboard, and as a consequence the gross receipts show a falling off of £1,400. The expenses have increased by £850, chiefly owing to the cost of completing the work of conversion since September, 1908, having been charged to revenue. The conversion of the lines in Caracas is now completed, and the general manager says that the company has an absolutely first-class system. The capital outlay for the year was £1,633.

Western Union Telegraph Co.

The report for the year ended June 30th, 1909, states that there has been no change during the year in the amount of capital stock or bonded debt. The figures submitted in the report, says the *Financial Times*, are naturally favoured by a comparison with the adverse conditions of the previous year; but irrespective of this comparison, they show that the company has participated fully in the marked improvement in all lines of business which is being experienced throughout the country; 5,682,152 more messages were handled than during the preceding year, with a resultant gain of $1,958,860 in the gross revenue. An increase of 3,036 miles in the mileage of poles and cables is shown, with an increase of 23,070 miles of wire, of which 14,200 miles is copper. The number of offices has been increased to 24,321, due in part to the reopening of some of the offices temporarily closed by railroad companies. Disbursements on construction account aggregated $947,296, or $191,211 less than last year. Contracts covering 4,073 miles of railroad were closed during the year. A development since the close of the fiscal year is the sale of the company's holdings of New York Telephone Co. stock (namely, at par, $16,221,800, of which $9,733,100 is pledged to secure the convertible bonds). The plans of that company for acquiring other telephone properties involved raising an amount of additional capital by the sale to stockholders of an issue of $35,000,000 of new stock. It was thought inadvisable for the telegraph company to undertake to raise the large sum required for its proportion of the new issue, and advantage was taken of a favourable opportunity to dispose of the minority interest in the telephone company to the American Telephone and Telegraph Co. In connection with this sale, arrangements have been made for retiring on May 1st, 1912, the $10,000,000 4 per cent. convertible bonds of this company, which are redeemable at the pleasure of the company on and after that date. The revenue for the year was $30,541,073 and the expenses totalled $23,193,966, leaving a profit of $7,347,107. Interest on bonds absorbs $1,732,250 and cash dividends (2¾) $2,739,436—$4,471,686. The surplus brought forward was $14,393,856, while there is carried forward $17,269,277.

Cordoba Light, Power and Traction Co., Ltd.

The directors' report states that the balance of profit as at September 30th, 1909, after meeting all charges, including interest on debenture stock, is £13,411. Out of this profit the directors recommend that a dividend at the rate of 2 per cent. (less income-tax) be paid on the shares of the company, and that the balance of £5,192 be carried forward. The company now owns the share capital of the Cordoba Light and Power Co., and the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., with the exception of 10·2 per cent. of that of the Cordoba Light and Power Co. The original concession of the Cordoba Light and Power Co. for the use of the water-power of the River Primero, which would have expired in 1921, has been replaced by a new concession extending to 1948. To supplement the existing hydro-electric generating station during the periods of heavy load or shortage of water, steam plant of approximately 900 H.P. has been installed during the year, and a further addition of over 1,100 H.P. is on its way out from England. Construction of the tramways has proceeded actively, and the first section was opened to public service at the end of August with satisfactory results. In order to consolidate the position of the tramway, an agreement has been entered into for the purchase of the only important competing line. By this acquisition the efficiency of the service will be greatly increased and the expenditure upon construction distributed to greater advantage. Surveys have been made and plans are now in course of preparation for the works required to utilise the hydraulic power of another section of the river. For this purpose, and for the completion of the purchase and further construction of the tramways, additional capital will shortly be required. Two of the directors, Mr. T. Frame Thomson, the deputy chairman, and Mr. H. A. Trotter, visited Cordoba during the year.

The meeting was held on Wednesday at the offices, 62, London Wall, Sir J. Irving Courtenay in the chair.

The Chairman, in moving the adoption of the above report, said that it was the first annual meeting, and it would be useful if he recalled the purposes for which the company was constituted, and the progress which had been made. The primary object was the acquisition of the control of the Cordoba Light and Power Co.—an American Co. which had for some 12 years carried on the business of electric supply in the City of Cordoba in the Argentine Republic. That company's source of supply of energy was the River Primero, the waters of which were impounded by a dam, one of the largest in the world, built some 20 years ago by the Government of the Province of Cordoba, for the purpose of regulating the flow so that throughout the dry season of the year the water would be available for irrigation of the rich agricultural lands in the neighbourhood of the city. This regulation of the supply naturally lent itself also to the application of the hydraulic power due to the rapid slope of the river bed, in the production of electric energy for light and power. In the year 1897 the necessary works were carried out for utilising one section of the river for such purposes, and for many years the power so made available was more than sufficient for the requirements of the city. The population, however, had grown with great rapidity, and it was now an important manufacturing district, and an important commercial and railroad centre. Those causes would, of themselves, soon have sufficed to render the original installation unequal to the demand, and their action had been hastened by the restriction of the power available, resulting from the droughts from which the country had suffered during the last three years. The necessity for developing a further section of the river, and supplementing it by a reserve of steam or other mechanical power, had thus been urgent for several years past. That, however, involved a heavy expenditure of capital, and, unfortunately, the American company found itself in a difficult position for raising this new capital. The facts, however, that a considerable proportion of its capital was held in London, and that a favourable opportunity offered for associating with the light and power business an electric tramway concession (which included rights also to supply light and power) having a term of 75 years, offered a possible solution of the difficulty by the formation of this English company to control both concerns, and thus provide a basis broad enough for the financial requirements. He was happy to say that the experience they had gained during this preliminary year of the company's existence pointed to a complete justification of that policy. Naturally, they would not expect that this first year should show great results in the form of dividend. Steam plant, and especially hydraulic installations, took time to install and develop, and tramways also required a period in which to extend and reach their full yielding capacity. Undoubtedly the most important fact of the year was the securing of a 40-year concession for the American Co. That concession was the subject of long and anxious negotiation with the Government of Cordoba. He could pay to the representatives of that Government a high tribute in respect of the ability and technical knowledge which was apparent in the provisions it contained in the interests of the public. He could also congratulate them upon the fact that their subsidiary company now held a concession which not only extended the life of its business by 27 years, but placed it upon a footing of security in many respects much superior to that of the original concession. Active progress had been made in every direction during the year. Their holding in the American Co. had been increased by further exchanges of its shares for those of the new company, so that they now held 90 per cent. of its share capital. They had acquired the entire share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., which owned the 75-year concession to which he had referred. They had also entered into an agreement to purchase the more important of the other two tramways, viz., the Ciudad de Cordoba Tramway, a purchase which should not only materially improve the efficiency and economy of their tramway service, but would also strengthen their position very much in relation to the supply of electric energy. They made arrangements early in the year with Messrs. J. G. White & Co. for the preparation of designs and specifications for the new hydraulic installation, the studies for which were now well advanced, and a contract was being prepared with that firm for the execution of the work. Meanwhile, provisional steam plant of about 900 H.P. had been installed; permanent steam plant of 1,100 H.P. had been purchased, and was now on its way to Cordoba, and a further 800 H.P. had been ordered for early delivery. That would provide for the growth of the electric supply business during the construction of the new hydraulic installation. Construction had proceeded actively upon the tramway, and about 4½ miles were opened for traffic at the end of August. As the power available for tramway purposes was limited, it was not possible to put more than five cars in average service. In spite of this restricted service, the traffics were most gratifying, especially as the line was opened during the winter months, which was the period of low traffics. Two miles more were ready for service, and it was expected that there would be on the average 12 to 15 miles in operation during 1910. The directors were able to recommend a dividend of 2 per cent. on the shares of the company, leaving £5,191 to be carried forward.

Mr. T. Frame Thomson seconded the motion, and the report was adopted.

Eastern Telegraph Co., Ltd.—The report for the half-year to June 30th states that the revenue amounted to £592,686. After deducting £206,055 for the ordinary expenses and £72,909 for expenditure relating to maintenance of cables, sundry differences in exchange and income-tax payable abroad, a balance of £313,721 remains, to which is added £34,435 brought from the preceding account, making a total available balance of £348,156. After providing for income-tax payable in England, interest on mortage debenture stock and two quarterly dividends on the preference stock, which in all absorb £83,087, there is a balance of £265,069, out of which the directors have placed £110,000 to the general reserve fund, and have allocated £100,000 to meet the two interim dividends of 1¼ per cent. each on the ordinary stock; £55,069 is carried forward.

R. & J. Dick, Ltd.—The report for the year ended August 31st last shows a gross profit on the year's trading of £58,361; deducting income-tax and depreciation £7,197, there is a net profit of £51,163. There is to be transferred to the special reserve fund for securing payment of preference dividends £10,000. £10,000 is written off goodwill, and a dividend is to be paid on the ordinary shares for the year at the rate of 4 per cent. per annum, less income-tax.

West India and Panama Telegraph Co.—The board has declared dividends of 6s. per share on the first preference shares for the six months to June 30th, and 20s. per share on the second preference shares (on account of dividends accrued to June 30th).

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc·
Aberdeen	Oct. 27	2,458	— 120	21	31,884	— 728	..	..
Ayr	,, 30	388	+ 4	24	8,915	— 99	8	..
Bath	,, 27	1,434	+ 26	43	33,775	+ 1,377	..	..
Belfast	,, 29	7,524	+ 263	29	117,149	+ 4,977	37	..
Birkenhead.. ..	,, 31	2,133	+ 23	30	33,216	— 375	13·63	..
Birmingham Corp.	,, 23	13,741	+ 865	30	195,201	+ 5,476	56·5	..
Blackburn	,, 27	2,024	— 130	31	34,818	— 1,270	14·5	..
Blackpool-Fleetw'd	,, 30	1,142	+ 494	17	20,982	+ 1,405	..	..
Bolton	,, 31	4,443	+ 72	31	73,086	— 128	26	..
Bournemouth ..	,, 27	2,857	+ 139	30	54,098	+ 345	21·96	..
Bradford	,, 23	9,808	+ 707	29	147,141	+ 4,275	54·81	..
Brighton	,, 31	1,764	+ 168	31	32,981	+ 1,527	9·5	..
Bristol	,, 29	10,893	+ 1,070	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 22	468	+ 4	42	9,258	— 78	3·65	..
Barnsley	,, 22	351	— 7	,,	7,118	— 363	..	..
Barrow	,, 22	478	+ 42	,,	9,893	— 611	5·37	..
Cavehill	,, 22	135	+ 6	,,	3,765	— 72	..	..
Devonport ..	,, 22	748	— 224	,,	15,608	— 4,046	8·85	..
Gateshead ..	,, 22	2,074	+ 13	,,	41,991	— 490	11·25	..
Gravesend ..	,, 22	433	+ 42	,,	8,979	— 70	6·5	..
Greenock	,, 22	1,137	+ 146	,,	23,684	+ 1,313	7·25	..
Hartlepool ..	,, 22	482	+ 52	,,	10,038	— 153	6·72	..
Kidderminster ..	,, 22	174	+ 3	,,	4,652	— 175	..	..
Leamington ..	,, 22	394	— 27	,,	7,591	+ 222	..	..
Merthyr	,, 22	396	— 23	,,	8,989	+ 8	2·9	..
Metropolitan ..	,, 22	13,345	+ 1,062	,,	263,825	+ 19,652	22	..
Middleton ..	,, 22	651	+ 21	,,	14,349	— 926	8·5	..
Mid. Joint Com'tee	,, 22	12,065	+ 618	,,	241,276	— 1,408	..	..
Oldham—Ashton	,, 22	1,178	+ 62	,,	23,792	— 1,247	9·18	..
Peterborough ..	,, 22	238	— 12	,,	5,086	— 428	5·31	..
Potteries	,, 22	8,952	+ 249	,,	75,344	— 626	29	..
Rothesay	,, 22	102	— 29	,,	6,919	+ 148	2·75	..
Southport.. ..	,, 22	514	— 14	,,	12,476	— 355	8·17	..
S. Metropolitan ..	,, 22	1,651	— 39	,,	34,105	— 573	..	..
Swansea	,, 22	2,017	+ 96	,,	41,241	+ 1,200	12·5	..
Tynemouth ..	,, 22	397	+ 52	,,	10,785	+ 976	3·75	..
Weston-s Mare ..	,, 22	109	— 5	,,	6,917	+ 388	3	..
‡Worcester ..	,, 22	560	+ 2	,,	11,949	— 161	5·75	..
Wrexham ..	,, 22	188	— 19	,,	4,191	— 172	..	..
Yorks. Wool. Dist.	,, 22	2,054	+ 184	,,	38,875	+ 84	17	..
Miscellaneous ..	,, 22	428	+ 40	,,	8,934	+ 175	..	..
Burnley	,, 30	2,427	+ 245	..	..	..	..	..
Burton-on-Trent ..	,, 31	510	— 20	31	8,366	— 214	6·63	..
Bury	,, 31	2,213	+ 87	$30\frac{4}{7}$	36,839	— 384	22·5	..
Cardiff	,, 23	4,358	+ 275	30	67,340	+ 945	..	..
Carlisle	,, 30	315	— 12	43	7,234	— 840	..	..
Chatham and Dist.	,, 28	1,657	+ 50	43	35,828	+ 1,622	14·98	..
Cork	,, 28	947	+ 24	43	19,550	— 520	9·89	..
†Croydon	,, 8	1,793	+ 241	..	43,661	+ 2,9·6	11·25	4·75
Darlington	,, [illegible]	372	— 21	31	5,779	— 421	..	..
Darwen	,, 29	495	+ 19	30	7,685	— 187	4·36	..
Dover..	,, 23	402	+ 24	30	6,798	— 403	4·75	..
Dublin	,, 29	10,381	+ 306	..	99,801	+ 1,930	54·25	..
Dundee	,, 27	2,387	+ 81	$23\frac{4}{7}$	28,599	— 503	15	..
East Ham	,, 30	1,937	+ 160	$30\frac{1}{2}$	31,454	+ 4,219	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 30	34,576	— 196	..	371,505	— 5,223	$94\frac{1}{2}$	5
Hastings	,, 28	1,669	— 43	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeston	,, 27	314	+ 6	30	4,206	— 237	..	..
Ipswich	,, 30	716	+ 27	31	13,087	+ 142	10·5	..
†Kilmarnock ..	,, 23	150	+ 9	23	3,501	— 108	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	,, 27	2,473	— 1	43	57,280	— 763	39	..
Leeds	,, 23	14,075	+ 1,290	30	205,054	+ 5,297	54	6
Leicester	,, 30	4,461	+ 250	..	..	..	..	..
Leith	,, 23	1,188	+ 182	23	14,763	+ 1,916	9	3
†Liverpool ..	,, 21	10,997	+ 317	$42\frac{2}{7}$	455,084	— 1,764	58·5	..
‡L.C.C.	,, 16	78,974	+ 3,630	..	1,053,093	+ 39,782	124·7	2·375
London United ..	,, 30	11,147	— 938	..	265,318	— 28,365	..	..
Lowestoft	,, 30	865	+ 18	5	814	— 5	3·5	..
Manchester ..	,, 30	29,291	— 2,242	31	464,495	— 6,978	105	..
Newcastle	,, 30	8,164	+ 18	..	119,704	— 1,597	..	..
Newport	,, 23	1,317	+ 64	30	20,027	— 248	14·5	..
Oldham	,, 31	3,426	— 43	31	58,927	— 3,828	23·75	..
Pontypridd	,, 30	799	+ 27	$30\frac{1}{2}$	12,816	+ 1,011	5·5	1·75
Portsmouth.. ..	,, 30	3,666	+ 854	31	68,400	+ 2,147	11·5	·75
Preston	,, 27	1,463	+ 85	..	..	..	..	..
Rotherham	,, 21	1,169	— 35	30	17,937	— 885	10	·66
Salford	,, 25	8,965	— 78	$29\frac{5}{7}$	133,593	— 4,009	..	..
Sheffield	,, 31	11,414	+ 139	$31\frac{4}{7}$	177,682	+ 380	39·62	2·6
Southampton ..	,, 27	2,130	+ 133	30	33,449	— 283	..	..
Southend-on-Sea ..	,, 27	825	+ 108	30	17,832	+ 2,158	..	..
South Shields ..	,, 30	1,077	+ 21	$30\frac{3}{7}$	17,645	— 54	..	..
†Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 27	965	+ 57	17	7,728	+ 281	..	..
Wallasey	,, 30	1,703	+ 30	$30\frac{3}{7}$	29,845	+ 730	..	·22
†Walthamstow ..	,, 28	620	+ 49	30	20,516	+ 319	9	..
West Ham	,, 21	4,718	+ 306	29	69,674	+ 4,281	15·13	·43
Wolverhampton ..	,, 27	1,858	+ 279	30	25,386	— 224	14·25	1·75
Baker St.-Waterloo	,, 30	6,915	+ 25	17	51,525	+ 225	4·25	..
Cen. London Rly...	,, 30	11,272	— 5,624	17	87,051	— 42,896	6·32	·55
Char. +, Eus. Hamp.	,, 30	7,745	+ 640	17	62,685	+ 6,355	7·75	..
City & S. Lon. Rly.	,, 31	6,558	+ 80	17	52,611	+ 1,578	7·3	..
Dublin-Lucan Rly.	,, 29	340	— 9	17	2,699	+ 75	7	..
G.N. and City Rly.	,, 30	2,846	+ 9	17	22,070	+ 12	3.5	..
G.N., P'y. & Brmtn.	,, 30	11,730	+ 630	17	87,345	+ 1,750	9·25	..
L'pool Overh'd Rly.	,, 31	2,733	+ 59	17	25,569	+ 60	6·8	4·3
Llandudno-Col. Bay	,, 29	803	+ 82	48	18,744	+ 2,182	..	..
Mersey Railway ..	,, 30	3,888	+ 121	17	32,816	+ 1,224	4·5	..
Metropolitan Rly...	,, 30	32,490	— 1,378	..	270,805	— 6,525	24·5	..
Met. District Rly...	,, 30	20,852	+ 596	17	163,705	+ 6,347	24	..
Anglo-Argentine ..	,, 28	82,180	+ 6,853	..	1,687,240	+ 101,415	..	..
§Auckland	,, 8	13,794	+ 1,450	..	136,501	+ 12,460	22·8	1·38
Bombay (B.E.T.) ..	Sept. 30	4,852	— 82	45	97,671	+ 5,408	..	..
§Brisbane	,,	15,800	+ 1,310	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 30	6,477	+ 489	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Sept.	4,269	..	..	34,584	..	20·5	..
Madras	Oct. 31	1,408	+ 180	..	25,714	+ 936	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	,, 29	2,785	— 112	..	60,146	+ 675	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

The swing of the pendulum has been in the direction of great confidence, with the result that prices generally have recovere from some of their worst weakness on the money scare. Only i Consols and similar gilt-edged securities is improvement retarde Even Home Rails show a better tendency.

Amongst the electricity departments, the movement display itself mostly in a smart rally in Anglo-American Telegraph Deferre stock, where the gamble on the prospects of next February's dividend is resumed with vigour. The Canadian-Mexican group wa comparatively little affected in the earlier slump, so prices hav varied only narrowly.

Electrical railway stocks are motionless, neither Metropolitan nor Districts recovering from their falls. There is likely to be good deal of opposition to the District Railway's scheme fo reorganising the Guaranteed and Preference interest, and althoug it is probable that the directors will be able to command more tha sufficient stock to carry their scheme, the dissentients are marshalling forces in some strength. Underground Electric 6 per cent income bonds have fallen 3, and the other two issues continue dull market.

London United Trams have gained $\frac{1}{8}$. Brush issues are unaltered Further inquiry for British Westinghouse 4 per cent. Debenture stock raised the price a couple of points. Cape Electric Trams keep nominally about 6s. 3d., although the report just out is a miserable document. No dividend, of course, is paid; there has not been one on the Ordinary shares since July, 1905. The carry-forward of a credit balance of £5,900 is about £2,500 less than the same item a year ago. Certainly, the company appears to get more than its fair share of bad luck, but with South Africa reviving so refreshingly, it might have been supposed that important tramways at Cape Town and Port Elizabeth would have done better.

Victoria Falls Power Preference shares are better at a trifle under £1, another rise in Chartered supplying the motive power for their improvement. The London electricity companies' issues are quiet as usual. Westminster Ordinary are $\frac{1}{8}$ lower, and this is the only alteration. Mexican Light and Power, and Canadian General descriptions are steady. Electrical Development of Ontario 5 per cent. Gold Bonds were done at $81\frac{3}{4}$ the other day. Kalgoorlie Preference were sold at 15s. 6d. There are a few *ex* dividend markings in this section, but they have led to no changes of consequence.

Babcock & Wilcox shares were bid for most energetically at $4\frac{1}{2}$, although the Official List quotation is left with the price as the middle. Industrials once more are favoured, and business in the leading issues is fairly active. Rubbers are to the fore again, thanks to a fresh rise in the price of the product, and the stream of new companies threatens to set in with renewed force. India-Rubber, Gutta-Percha shares have gone up $\frac{1}{4}$, the shares being scarce.

With the restoration of a better tone to the stock markets, Anglo-American Telegraph deferred experienced a rapid recovery, and, as already noted, optimistic expectations of the next dividend are in great vogue at present. Direct United States Cable shares keep dull. Great Northerns are 10s. better, and the fall of 10s. in Indo-Europeans is more than accounted for by the deduction of the dividend of 12s. 6d. a share. The Eastern and Eastern Extension reports had no effect upon prices.

New York Telephone Debenture at $2\frac{1}{2}$ premium is the turn lower, although American Telegraph and Telephone capital stock gained a point. Cuba Telephone rallied to 3 discount, after changing hands at 5 discount. It is understood that underwriters were left with a large proportion. National Telephone Third Preference shares are a trifle easier. Business is rather more active in Marconi's than it has been recently; the price of the shares remains about 16s. 3d. United River Plate Preference are $\frac{1}{16}$ up, while Oriental Telephones at $1\frac{7}{16}$ are still somewhat weak.

Better prices are quoted for Mexico Trams Common stock, and 5 per cent. bonds, and for Rio Trams at 90. The Argentine division is quietly firm, the company's Debenture stocks, both 4 per cent. and $4\frac{1}{2}$ per cent., being steadily absorbed for investment.

Aluminium Corporation, Ltd.—The Court has directed separate meetings of the unsecured creditors and the holders of the preference and ordinary shares respectively to be held on November 11th at Winchester House, E.C., to consider a scheme of arrangement between the company and its creditors.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Oct. 26th.	Closing Quotations Nov. 2nd.	Business done week ended Nov. 2nd, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3 — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	95 — 98	96 — 99	..	..	+1	5 1 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143 —145	144 —146	..	..	+1	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 93	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£8 4s.	61 — 63	61 — 63	..	..	..	5 3 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102 —103	101¾—102¾	102⅜	101¼	— ¼	5 16 10
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21⅜— 21⅝	24⅝— 24⅞	24 11/16	21½	+2¼	1 16 8
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	7½	..	..	4 14 1
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	87½— 89½	88½	..	+ ½	4 9 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝— 9⅜	8⅜— 9⅛	..	..	— ¼	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½— 18½	17 — 18	..	..	— ½	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13 — 13½	13 — 13½	13⅜	13 1/16	..	6 4 7
48,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	126 —129	127½	126	..	5 8 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	83½— 85½	84⅞	84⅜	..	4 1 10
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	102½—104½	..	..	—2	3 16 7
300,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅝— 12⅛	11⅝— 12⅛	12	..	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10⅜	..	..	5 8 3
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13 13/16	13 21/32	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28 — 29	28½— 29½	28⅝	..	+ ½	7 0 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51½— 53½	51 — 53	..	..	— ½	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	17/6	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	13/16— 15/16	¾— ⅞	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	13/16— 15/16	¾— ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 - 108½	107½	..	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	120 —122	121	120	..	4 18 4
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5½— 5⅝	5 7/16	..	— 1/16	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	..	..	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞— 7⅛	6⅞— 7⅛	7 1/16	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5 7/16— 5 11/16	..	..	+ 1/16	4 8 4
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13½— 14	13⅞	13⅝	..	5 0 0
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9¼	8¾— 9¼	8⅞	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½— 9½	8½— 9½	8⅝	..	..	15 15 10
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½		..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 9/16— 4 13/16	4½— 4¾	95/-	90/7½	— 1/16	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼— 4½	4¼— 4½	87/6	85/-	..	5 6
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	91 —92½	91 —92½	91¾	91	..	4 6 6
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 7/16— 4 9/16	4½— 4⅝	91/3	90/6	+ 1/16	4 6 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	..	..	+ ¼	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	40/-	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	150 —155	150 —155	..	..	..	5 3 3
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —128	123 —128	125	124½	..	4 13 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	111	..	..	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	100 —102	103½	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝— 1	⅝— 1	15/3	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅛— 2⅝	2⅛— 2⅝	50/3	46/3	..	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82½— 85½	82½— 85½	84½	83	..	5 9 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 — 64	58 — 62	60½	58	—2	7 5 2
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7¼— 7⅝	7¼— 7⅝	7 11/32	7 5/16	..	7 0 8
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	6¼	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
304,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	¼— ½	¼— ½	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	42 — 44	44 — 47	..	..	+ 2½	8 10 2
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	† Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½— 5	4½— 5	97/6	92/½	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,820..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜— 11⅛	10⅛— 10⅞	10⅞	10¾	— ¼	6 18 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5¾	5⅜— 5¾	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105—107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 1/16— 2 3/16	2 1/16— 2 3/16	..	..	..	5 19 1
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890 690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	60 — 62	60 — 62	61¾	60¼	..	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86¼	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	41¾	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1¾%	2⅛%	2⅛%	1½%	30 — 31	30 — 31	30¼	30	..	4 16 9
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 98	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 26th.	Closing Quotations Nov. 2nd.	Business done week ended Nov. 2nd, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100—103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	5/32— 9/32	5/32— 9/32	2/6	..	..	27 5 4
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 78	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 3/16— 1 7/16	1 3/16— 1 7/16	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8¼— 8¾	8¼— 8¾	..	..	..	5 14 3
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108	102 —103¼	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13¼	12½— 13¼	12⅞	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15 — 15¾	15¼— 16	..	..	+ ¼	6 5 0
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2⅜— 2⅞	..	..	+ ⅛	18 0 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	67 — 70	68¾	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	37¼— 37¾	37¼— 37¾	37¾	37¼	..	1 6 6
2,540,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 — 66	64 —66	64½	..	..	4 3 4
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	16 — 16½	16⅛	..	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32— 11/16	19/32— 11/16	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	23/32— 27/32	11/16— 13/16	..	..	— 1/32	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½— 96½	93½— 96½	94¼	..	+ ¼	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	126 —129	124½—127½	127	125½	—1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	92¼	91¾	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
246,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	35¾	34⅞	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	8 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½—103½	100 —101	..	..	—2½	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	32 — 34	29 — 31	30⅛	..	—3	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Oct. 26th.	Closing Quotations Nov. 2nd.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	91 — 94 xd	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	8 18 6
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅞— 4⅜	3⅞— 4⅜	..	..	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4	4⅜— 4⅞	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4	3¾— 4¼	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	8 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	..	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	..	..	4 7 6
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10⅜— 10⅞	10½	..	..	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	101¾	..	..	4 7 6
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7⅞	7 27/32	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10 31/32	10 15/16	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	98 —101	..	..	— 2	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	59	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 6
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	8	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	101	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	..	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —1	100¾	100⅝	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1¾— 2⅛	1¾— 2⅛	63/3	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅞— 5¼	4⅞— 5¼	..	..	..	5 14 3
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	4 — 4½	80/7½	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	80 — 82	82	..	..	6 1 11
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	71 — 75	73	72	..	4 13 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	105 —109	102 —106	105	103	—3	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	85 — 87	86¼	85½	..	5 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅝	4 — 4½	..	..	— ⅛	2 15 1
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4 — 4½	..	..	— ¾	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 13¼	12¼— 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 9/16— 1 11/16	1 9/16— 1 11/16	32/3	32/-	..	4 14 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	8½	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	85½	..	..	8 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	½— ¾	9/16— 13/16	..	..	+ 1/16	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜—	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	27/6	..	..	14 5 4
275,000	Do. do. 4½% 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½— 78½	74½— 78½	..	..	..	5 14 8
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	23/32— 31/32	15/16— 1	..	..	..	5 3 11
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½— 9	8¾— 8⅞	8¾	8 7/16	— ⅛	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅜	4⅞— 5¼	5	..	— ¼	4 5 9

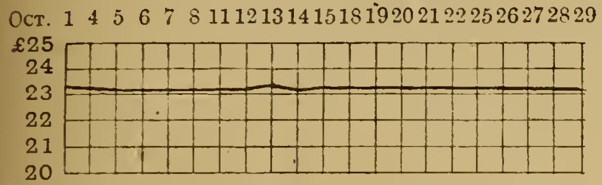
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909.

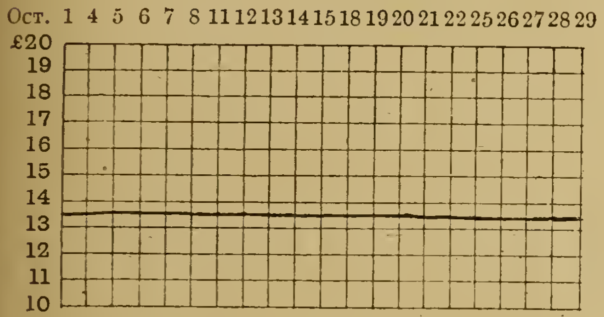
METAL MARKET.

Fluctuations in October.

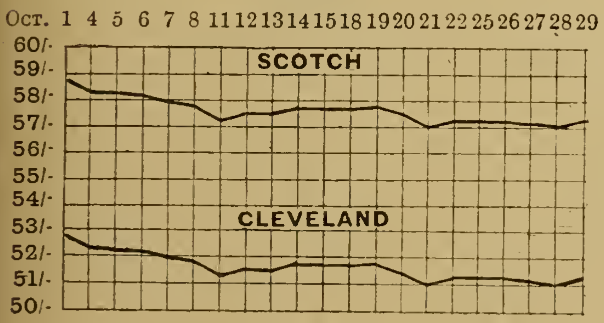
SPELTER (G.O.B's.).



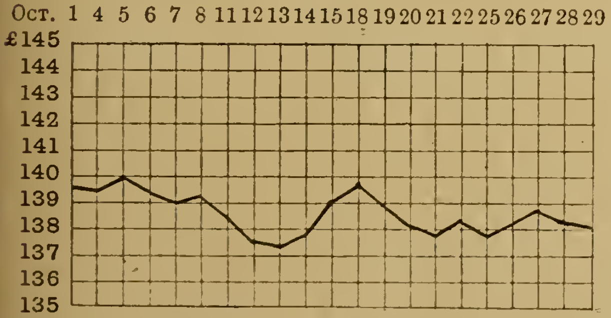
LEAD (ENGLISH).



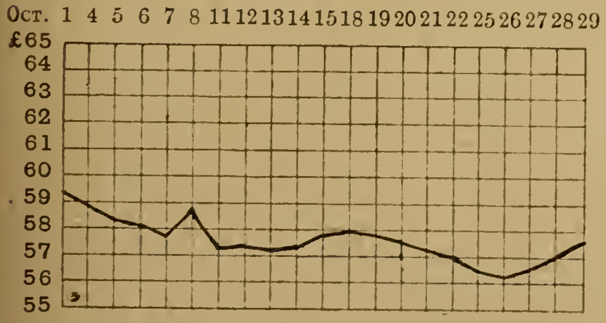
IRON.



TIN.



COPPER (G.M.B's.).

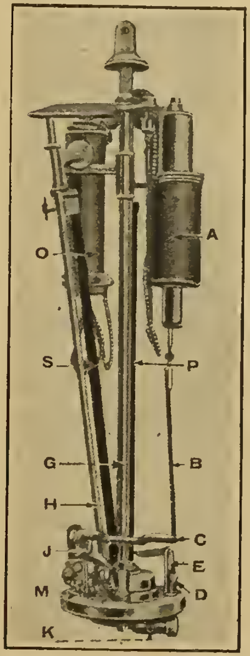


Radium in Sweden.—According to *Affärsvärlden*, a company has been formed in Sweden for the production of radium, of which, it is estimated, the output will be 4½ grammes yearly.

A NEW ARC LAMP WITHOUT CLOCKWORK.

The Regina-Bogenlampenfabrik, of Cologne, has recently introduced a lamp known as the "Conta Universal" lamp, which, possesses some novel features. It is called a Universal lamp because, besides being suitable for use with any type of ordinary round carbons, it is also possible to switch it over from direct to alternating current without any adjustment.

The carbons in this lamp are side by side and almost parallel, and they are geared together so that any motion of one is transmitted to the other. The end of the negative carbon P (see figure) rests with its point on a copper knob K below the economiser. This knob is attached to a bell crank D with a projection E above the economiser, which presses the carbon against the edge of the circular hole in the economiser. In this way a great part of the weight of the carbons is removed from the knob in consequence of the pressure exerted by the bell crank. The negative carbon, therefore, tends to burn to a very long point; when finally the point burns away the weight on the knob is removed and the pressure of the bell crank also ceases, and the carbon drops slightly until the point again rests on the knob. The material of which the knob is made must have a high melting point and a high boiling point, must conduct heat readily and have large specific and latent heats. Copper, or some alloy having practically the same properties as copper, has been found to comply best with these conditions. The surface of the knob is made considerable, so that the heat is readily dissipated, and it is found that practically no wear takes place. In fact, when the experiment was made of weighing the knob before and after a 10-hour run, a very slight *increase* of weight was found to have occurred due to oxidation. There is no danger of the arc becoming transferred to the knob, as the latter forms no part of the circuit. The knob and bell crank serve another purpose in the lamp as well. The negative carbon holder above the carbon is reduced somewhat in diameter, so that when the carbon is practically burnt away, the bell crank can advance a little further forward than usual. This withdraws the knob and allows the carbon point to clear it, and the carbon then automatically drops out of its holder into the ash tray and the lamp is extinguished.



Mechanism of the Conta Lamp.

The striking of the arc is effected, as usual, by means of a series solenoid drawing up an iron core. This motion causes the positive carbon S, which is normally slightly out of the vertical with its point in contact with the negative carbon, to be set vertical, and so open the circuit at the points. A dashpot is added to prevent jerky operation. The ampere-turns of the solenoid are so chosen that even if the current fell 50 per cent. the iron core would not be released. Consequently, the solenoid is entirely out of action once the arc is struck, and it in no way helps in the regulation of the lamp.

The regulation is, in fact, effected naturally by the burning away of the negative carbon, although it is aided also by the presence of a blow magnet M above the economiser, and by the action of the economiser itself.

The blow magnet not only keeps the arc to the points of the carbons, but also tends automatically to regulate the current, for any increase of current causes the arc to be lengthened, and to increase in resistance, whilst a reduction of current, from any cause, weakens the magnet and shortens the arc. The economiser helps the regulation, from the fact that its inside is filled with inert gases, so that the consumption of carbon is much quicker when the arc is formed beyond the economiser than when inside it. Should the positive carbon therefore, from any cause, not burn away as quickly as the negative one, it will project beyond the economiser, and will soon burn away to the right extent. If, on the other hand, the positive carbon burns away too quickly, its end will gradually recede within the economiser, and its rate of consumption will then be reduced.

The parallel position of the carbons in this lamp prevents the possibility of any very wide current variations, and consequently it is unnecessary to provide the special iron wire regulating resistances used in some recent simplified lamps.

When fitted with ordinary carbons, this lamp burns with about 80 volts, and, without any change even in the carbons, it can be switched over from a direct to an alternating supply if desired. —*E.T.Z.*

SOUTH KENSINGTON MUSEUM.

In amplification of the article on the electrical work at the new Victoria and Albert Museum, which appeared in the issue of the Electrical Review of August 27th, the figures given in the following table may be found of use to lighting engineers.

A few typical galleries only have been selected, but these give a very fair idea of the lighting of the whole building.

The figures in the column showing the approximate watts per square foot of floor space for the various methods of lighting are especially interesting, and, although no particulars are available of the difference in the resultant illumination, a visitor is able to judge of the effect for himself, and, with this table before him, to imitate or improve upon the results as he may consider desirable in any installations with which he may be dealing.

Similar figures have also been given for some of the galleries at the Natural History Section of the British Museum, which (as those members of the Institution of Electrical Engineers who are in the habit of attending the conversaziones are aware) has for some time been partially lighted, and the installation at which is being gradually extended.

EXTRAS.

[From a Legal Contributor.]

Of all the questions which arise from time to time between contractors and the persons who employ them, there are none more difficult than those which relate to extras. To draw a specification which shall include everything is well-nigh impossible. There must be an extra clause of some kind in the contract, and it is upon the construction of this clause that the chief difficulties arise.

It may be well, at the outset, to draw attention to one or two elementary principles of law in relation to extras. Assume that a contractor agrees to erect certain plant according to agreed plans and specifications for the sum of £1,000. Take the simple case in which there is no "extra" clause. When half-way through the work the contractor finds that, owing to a rise in the price of materials, he is unable to carry out the work, except at a loss. In such a case he cannot claim the additional cost to him as "extra" to the contract price. Again—to take another simple case—if the contract provides that no extras shall be allowed for unless they are ordered in a particular manner, the contractor can

Position.	Lamps.	Total watts.	Shape of room.	Approximate area.	Approximate watts per sq. ft. of floor.	Height of lights.
VICTORIA AND ALBERT MUSEUM.						
	Enclosed arcs, 2 in series on 200 volts.			Sq. feet.		Ft. in.
(*a*) Octagon Court, No. 40. Ground floor ...	12 pairs of 8 amperes.	19,200	Octagonal, diameter 110 ft. + 4 apses	12,000	1·60	22 0
Central Court, No. 43. " " ...	5 " "	8,000	90 ft. × 50 ft.	4,500	1·77	"
West Hall, No. 48. " " ...	13 " "	20,800	230 ft. × 50 ft.	11,500	1·80	20 0
East Central Court, No. 44. " " ...	8 " "	12,800	90 ft. × 70 ft.	6,300	2·01	"
Gallery 121. First floor	2 pairs of 3 amperes.	1,200	34 ft. × 34 ft.	1,150	1·04	18 0
Gallery 122. " "	7 " "	4,200	107 ft. × 30 ft.	3,210	1 30	"
Gallery 21. Ground floor	8 " "	4,800	106 ft. × 31 ft.	3,290	1·45	"
(*b*) Gallery 142. Second floor...	5 " "	3,000	50 ft. × 34 ft.	1,700	1 76	17 0
	Metallic-filament Incandescents.					
(*c*) Gallery 114. First floor	46— 63 watts, clear.	2,898	500 ft. × 16 ft.	8,000	0·36	9 6
(*d*) Gallery 47. Ground floor	27—125 " "	3,375	" "	"	0·42	14 0
(*e*) Galleries 70—73. First floor	10—125 " "	1,250	145 ft. × 20 ft.	2,900	0·43	9 6
(*f*) Gallery 137. Second floor	84— 28 watts, obscured	2,352	107 ft. × 30 ft.	3,210	0 73	"
(*g*) Gallery 75. First floor	132— 28 " "	3,696	155 ft. × 31 ft.	4,805	0·77	"
Gallery 136. Second floor	8—125 " "	1,000	34 ft. × 34 ft.	1,156	0·86	"
(*h*) Gallery 131. First floor	116— 28 " " (32 clear).	3,248	107 ft. × 30 ft.	3,210	1·01	"
	Tantalums.					
(*i*) Galleries 22—24. Ground floor	168—40 watts, clear.	6,720	230 ft. × 35 ft.	8,050	0 83	14 0
NATURAL HISTORY MUSEUM.						
	Inverted open-type arcs, 4 in series on 220 volts.					
(*j*) Bird Gallery. Ground floor	5 series of 10 amperes.	11,000	200 ft. × 50 ft.	10,000	1 10	11 0
(*k*) Gallery east of Hall. First floor... ...	2 " "	4,400	120 ft. × 18 ft.	2,160	2·01	11 0
	Flame arcs, 4 in series on 220 volts.					
(*l*) Main Hall. Ground floor	1½ series of 10 amperes.	3,300	120 ft. × 60 ft. (omitting side galls.)	7,200	0·46	30 0

Remarks.

(*a*) Lights hang in a circle: 41 ft. radius. (Except where otherwise stated, the lamps hang in two rows.)

(*b*) Lamps hang in an oblong.

(*c*) 19 of these points are two-light fittings having a spread of 4 ft. Fittings hang in a single row.

(*d*) Parts of this corridor receive a little additional light from the arcs in the adjoining courts. Lamps hang in a single row.

(*e*) This gallery is divided into 4 rooms, but with wide communicating openings. The lamps hang in a single row.

(*f*) 14 six-light fittings. Owing to position of beam, these fittings are hung too near the walls to give the best distribution of light.

(*g*) 22 six-light fittings.

(*h*) 14 six-light fittings; 32 lamps for top-lighting of wall-cases.

(*i*) 28 six-light ball pendants.

(*j*) 4 ft. 9 in. reflectors.

(*k*) Lamps hang in a single row.

(*l*) Alterations in contemplation.

have no redress unless the terms of the contract are strictly complied with.

It has been well stated that "In the absence of any provision in a contract that alterations or additions may be made in certain specified ways, the ordinary law of contract does not find any place for extras or alterations so-called, and any alteration or addition to the work originally contracted for must depend upon a new contract, express or implied."

Works which are indispensable to the performance of the contract cannot be regarded as extras. This is for the reason that those who employ a contractor are entitled to rely on his skill and judgment to put in what is right and proper for the purpose of making a satisfactory job. Hence, although details which were known to be clearly necessary for the purpose of carrying out the work are not expressly mentioned in the specification, yet the contractor will not be allowed to charge for such evident omissions as extras. For instance, when the specification omitted to refer to flooring, it was held that flooring could not be charged for as an extra to a contract for the building of a house (Williams *v.* Fitzmaurice 3 H. and N. 844).

No contract of any magnitude is ever signed unless it contains an "extra" clause. It will be convenient to consider the form which such a clause usually takes. As a rule, the duty of deciding questions relating to extras is left to the architect or the engineer, as the case may be.

A vexed question may arise with regard to extras ordered by the employer himself. Suppose that, in the case of a building contract, the building owner is constantly on the job watching all that is going forward. In these circumstances, alterations and improvements will be constantly occurring to his mind, and he may direct the builder to make changes without waiting for the approval or written authority of the architect. In such circumstances, it is conceived that he would be liable to pay for any extra work ordered by him. But the mere fact of the employer having assented to certain alterations is not sufficient to make him liable to pay for them as extras, unless he is either expressly informed or must necessarily, from the nature of the work, be aware that the alterations will increase the expense (Lovelock *v.* King, 1 M. & R. 60). But when it was shown that, in the progress of building, some process more expensive than that contracted for was ordered by the architect, with the knowledge of the employer, who was present at the time, and the builder's sub-contractor was told that it was to be charged as additional work, it was considered that there was sufficient evidence of a contract to pay the builder extra for it, and of authority in the architect to make such a contract with him (Wallis *v.* Robinson, 3 F. & F. 307).

The following is a common form of clause which deals with alterations and extras: "If any part of the said materials or work shall be ordered not to be used or done respectively under the handwriting of the engineer, the same shall be withdrawn, and the difference of expense occasioned thereby shall be deducted from the amount hereby agreed to be paid to the builder, and in like manner if the employer or the engineer shall in writing under his hand order any materials or work to be used or done, not included in this contract, the difference of the expense to be so occasioned shall be added to the amount of the sum hereby agreed to be paid, but no account or allowance shall be had or made in respect of any work omitted to be done, nor of any extra work which shall be done, unless the same be omitted or done by an order in writing under the hand of the employer or of the engineer; and all accounts and allowances for such omission or extra work respectively shall be ascertained and settled by the engineer from time to time as they shall be made or take place, and his decision shall be final and binding on both parties."

The foregoing clause makes it necessary for all extras to be sanctioned in writing, either by the employer or the engineer. This is of enormous importance to both parties, inasmuch as it tends to prevent any question arising as to whether extras have or have not been ordered. But what constitutes an order in writing? It has been decided that a sketch made by an architect and not signed by him, is not such a direction as complies with a contract containing a clause similar to the above (Myers *v.* Sarl, 30 L.J.Q.B., 9), but even apart from that decision no prudent contractor would embark upon any extra work without a definite order in writing.

The following cases may serve to illustrate how strictly the terms of such a clause must be observed. In Lorden *v.* Pryce ("Emden's Building Contracts," 4th ed., page 105), a building contract provided that orders for extras were to be signed by the secretary and treasurer of the employers, and countersigned by the architect. The builder having completed the work, the architect issued a final certificate which apparently included certain extras not signed for by the secretary and treasurer. It was held that the builder could not recover for such extras.

Where a contract provided that no claim should be made for extras without the written order of the architect, and no such written order as stipulated for was given, it was held that the *final* certificate of the architect, including such extra work, was conclusive, and that neither party could raise the question of whether or not there was a sufficient order in writing (Goodyear *v.* Weymouth 1 H. & R. 67). It is to be observed, however, that although the *final* certificate may be conclusive as to extras for which no written order as stipulated for has been given, this is probably not the case with progress certificates. So where a contract provided that no alterations or additions should be made without a written order from the employers' engineer, and during the execution of the contract the contractors were allowed to erect certain addditional works, and the particulars were entered in the "progress certificate," the House of Lords held that these certificates were not written orders, and that the claim was, therefore, excluded by the terms of the contract.

The question whether the architect or engineer employed in connection with a contract has power to order extras remains to be considered. The architect or engineer is only the agent of his employer to see that the works contemplated by the contract are carried out properly; he cannot, without authority, bind his employer to pay for additional work. Where, therefore, extra work is done by order of the architect, the builder must show an authority in the architect to give directions for extra work, and, when the architect is shown to be the employer's agent to bind him by any deviation or addition, it will be necessary to inquire whether the agency of the architect to order extras was general, or was limited to a specified extent (see "Emden's Building Contracts," 4th Edition, page 187).

It is material to notice that there are cases in which work in the nature of extra work may be claimed for, although the contract contains no "extra" clause. So where something has been done by the builder, beyond what he has to perform according to the special contract, and that has been done at the instance of the employer, the price of extra work, not being under the contract at all, can be recovered as for work and labour done; yet the contract must be proved in order that it may appear how much was extra.

If the builder, in completing a contract for a stipulated price, use materials of a better kind than those contracted for, he is not at liberty, on that account alone, to charge more than the stipulated price, nor, of course, can he require the materials worked into the building to be returned, because the employer will not pay an increased price on account of the better materials. (Wilmot *v.* Smith, 3 C. and P. 453.)

Canadian Boiler Regulations.—Mr. F. E. Leonard brought before the annual convention of the Canadian Association of Stationary Engineers this year the discrepancies which at present exist between the Acts of the different Provinces governing the construction and inspection of steam boilers. One province allows the usual re-inforced manhole in the shell, while another calls for the flanged-in or ellipse pattern. One will allow a cast-iron steam nozzle; another insists on cast-steel. One province allows the safety valves to blow off from the top; its neighbour insists on a side outlet. The provisions as to supports are equally confused. British Columbia was the first to lead the way in boiler legislation, while Ontario and Quebec have not put any restriction on industrial development. Mr. Leonard pleaded for co-ordination in these rules, so that a boiler might be purchased in any part of the Dominion and used anywhere from the Atlantic to the Pacific, if it had a certificate of inspection. The matter is a very important one to boiler manufacturers and central-station equipment firms in Great Britain who do an export trade to Canada, and should be the subject of their careful attention.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(Continued from page 672.)

The Heurtley Test Considered Graphically.

Mr. E. S. Heurtley, as an investigator of problems connected with exact localisation of copper-exposure faults or breaks in submarine cables, has, in the use of artificial copper-exposures, made an interesting step in advance. He does not merely compare test results from a real broken cable with those from an artificial "end" of more or less superficial area of exposed copper; he combines the comparison, so to speak, into one operation, and balances the broken or faulty cable with its natural exposure against the balancing resistance *plus* an artificial exposure.

The writer is aware that some good individual work in this direction was done many years ago by Mr. John Gott, and that this exposure-balance system had, in 1893, been clearly suggested by Messrs. G. K. Winter and G. B. Winter.* Mr. Heurtley, however, has reduced the matter to a complete system, and to an extremely simple formula with factors easily obtained.

Connections for Heurtley's test are shown in fig. 50 in combination with an extra resistance r and key K_2 which enable all bridge readings to be made to *false zero* by Mr. R. R. Black's reduced-current method, by means of which inconstancy of polarisation at f is minimised owing to a certain amount of testing current being made to flow steadily to line throughout the test, without the usual earthing intervals and disconnections of battery which accompany ordinary false-zero testing.

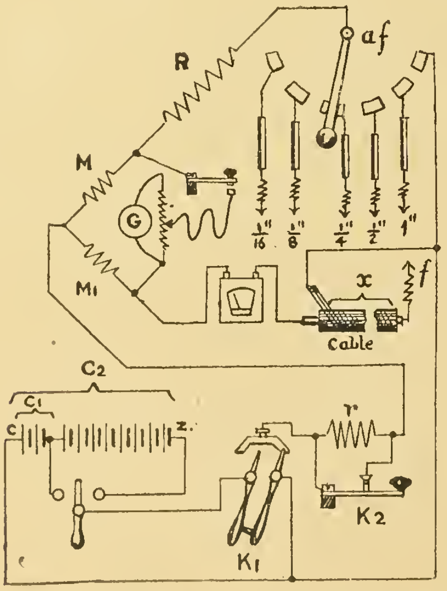


Fig. 50.—Heurtley's Test combined with Black's Reduced-Current False Zero Method.

Fig. 50 shows:—1. Switch for connecting either higher or lower battery power to Rymer-Jones Key K_1 which serves either to apply battery to bridge system, or to put the latter to *earth*.

2. Extra resistance r inserted between K_1 and bridge, and short-circuited at will by K_2.

3. A mil-ammeter which will be found useful to measur testing-current entering cable, if any plotting is to be don for *graphs*.

4. Resistance R used to balance x and fault or break, and connected to a switch by means of which R can be earthed direct to cable sheathing, or at choice through any one of several lengths of cable core—say, 130 Cu/130 G.P.—immersed in *earthed* salt water, and having at their further several extremities ($a\ f$) copper exposures varying from, say, 1 in. of conductor to a flush cut.

It is well here to note that smaller exposures than the above can be produced by a slit made with a sharp knife in the gutta-percha of the immersed core, and opened out or closed up as occasion may require for the balancing of f. Here, then, the cable *plus* the real fault or break f can be balanced against R *plus* the artificial fault or break $a\ f$—

So, when E.C. = zero,

balancing with higher current C_2:—

$$x + f = R + af$$

with smaller current C_1:—

$$x + f_1 = R_1 + af.$$

Heurtley has pointed out that the higher power is to be as high, and the lower as low as possible, as long as the test with the lower is not too insensitive. A current ratio 5 to 1 will often be found convenient.

The now well-known conditions based on investigational developments by Mance, Kennelly, Schaefer, and others have been aptly summarised by Heurtley in the following axioms:—

1. All exposures of equal effective area are, with the same current passing, of equal resistance, and vary equally in resistance under similar changes of the testing current.

2. That with two exposures of unequal area, that having the smaller area will not only have the higher resistance, but will vary more in resistance with a similar change in current, than the larger area.

3. That, other things being equal, the smaller the testing current, the greater the resistance of an exposure.

In developing the rationale of his test, Heurtley points out three cases to be considered:—

1. When the effective exposures at f and at af are equal or $f = a\ f$.

2. When exposure at $a\ f$ is greater than that at f or $af > f$.

3. When exposure at $a\ f$ is less than that at f or $af < f$.

From consideration of these three cases, Heurtley draws the following deductions:—

1. If resistance R remains the same for all strengths of current, then R = resistance up to the fault.

2. If resistance R with the higher current is less than that with the lower, then both these resistances are higher than the actual resistance up to the fault, and the artificial exposure ($a\ f$) is too large.

3. If the resistance R with the higher current is more than that with the lower current, then both these resistances are less than the actual resistance up to the fault, and the artificial exposure is too small.

4. In all cases, the result obtained with the higher current is a closer approximation of the resistance up to the fault than that obtained with the lower.

The practical routine of Heurtley's test is as follows:—

1. K_1 moved over so as to permanently apply battery (Z to L) to bridge.

2. False zero noted by R. R. Black's reduced-current method, viz., with K_2 depressed and r thereby inserted sufficient to about halve the testing current. Bridge resistance R to be adjusted till galvanometer deflection remains the same whether r be in or out. Obviously, owing to the capacity of the cable, the galvanometer, for the avoidance of undue deflection disturbance, must be short-circuited, or cut-out, during the actual depression or raising of K_2, *i.e.*, at the moments respectively of decrease or increase of the testing current. For this purpose, it is well in practice to have K_2 and the galvanometer key near each other for convenience in co-ordinate manipulation.

For each exposure condition, the above operation is effected twice, viz., first with the higher power and then with the lower. During the whole test the current is kept on permanently, alteration from a higher to a lower power, and *vice versa*, being effected by means of a sharply manipulated switch.

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* In a communication by G. K. Winter and G. B. Winter, published in the *Journal* of the Institution of Electrical Engineers, No. 106, Vol. XXII, June, 1893, the following passage appears:— . . . . "It seems to us, however, that by putting an artificial fault at the end of the balancing resistance, we not only eliminate directly the false resistance due to polarisation, but by altering the size of the exposed wire at the artificial fault until the measured resistance remains the same whether the testing current used be small or large, we may arrive, without calculation, at the result aimed at."

When an exposure ($a\,f$) has been found which causes R to remain the same whether the higher or the lower power be applied, then (with equal bridge ratio), $R = X$. It is not, however, necessary to exactly balance $a\,f$ with f.

All that is really necessary is for a test to be made under two exposure conditions, one with the artificial exposure too large, the other with it too small.

Each of these two tests is, of course, made with a higher current and a lower current, the balance being made as close as is easily practicable. The mean of the two bridge readings (R) with the higher power (viz., with $a\,f$ too large, and $a\,f$ too small) gives x.

Before any practical examples are given, a short inquiry may be made into the graph aspect of this test, for which reference may be made to fig. 51.

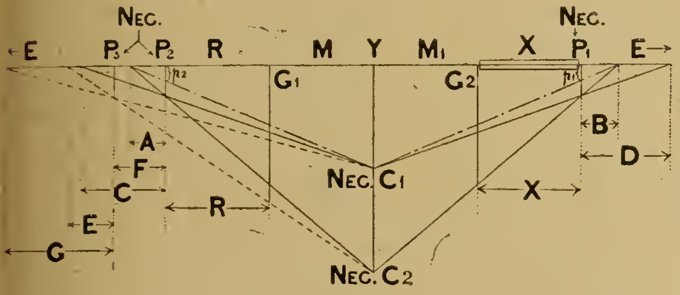

FIG. 51.

M, M_1 are bridge ratio resistances, taken as equal throughout.

Resistance R balances X, viz., that of broken cable (both to *earth* E).

Artificial copper-exposure in core immersed in earthed salt water, and connected to R, balances real exposure in the core of cable X, the broken end or fault being in the sea.

At bridge apex Y are applied higher and lower battery powers, Z to L, corresponding to C_2 and C_1.

G_1 and G_2 are points to which would be applied the galvanometer, for simplicity, here omitted.

P_1 represents polarisation P.D. at break.

P_2 is polarisation P.D. at artificial exposure.

P_1 and P_2 are opposite in *sign* to the P.D.'s primarily due to Cu-Fe elements at the two exposures previous to the application of the negative testing current.

A and B represent apparent increase in resistance, due to opposition of P_2 and P_1 to higher testing power C_2. C and D represent further apparent increase in resistance, due to opposition of P_2 and P_1 to lower testing power C_1.

Under the above conditions with both natural and artificial Cu exposures of equal effective area, on application of C_2,

$$X + B = R + A,$$

and with C_1 applied,

$$X + D = R + C.$$

But the two exposures being equal and—let it be granted—under uniform conditions in regard to cleanness of copper surface, and earth-connection resistance,

$$A = B \text{ and } C = D. \quad \text{Therefore, } R = X.$$

Let—for the sake of argument—the artificial exposure be of smaller effective area than that of the cable conductor. F then represents the consequent extra resistance at the artificial exposure, P_3 the polarisation P.D., E and G the apparent increased resistance due to the opposition of P_3 respectively to C_2 and C_1.

Under these conditions, that is to say, unless R be readjusted to a lower ohmic value, there is no balance, for with C_2, $X + B < R + F + E$.

$$\text{With } C_1,\ X + D < R + F + G.$$

A Heurtley test may best be made under conditions permitting the use of comparatively low testing currents, the relative value of the higher to the lower being, at the same time, as high as is practicable, not 2 : 1 as shown in fig. 51. A proportion 5 to 1 has given good results. A Heurtley balance—as has been shown—is obtained when the artificial exposure is so adjusted that bridge readings under the higher and under the lower testing current remain the same.

A graphic illustration of this is seen in fig. 51, if for the sake of argument we suppose the ratio between the higher and the lower testing currents to be much higher than the 2 : 1 shown in the diagram.

M and M_1 being equal, we have with power C_2 the equation $X + B = R + A$ with respective polarisation P.D.'s, P_1 and P_2. Then with power C_1, $X + B = R + A$ with respective polarisation P.D.'s P_1 and P_2.

$$\text{But } A = B \therefore R = X.$$

Any natural or telluric earth current from the cable would be accounted for by the two bridge readings being observed to false zero, if possible, by R. R. Black's reduced-current method as before described. The lower testing current must be sufficiently high to well overcome any possible natural, *i.e.*, telluric, current flowing counter to it.

In practice, however, as has already been shown, it is unnecessary to arrive at a perfect balance. On the contrary, when a fairly close approximation has been arrived at, the arithmetic mean of the two higher-current bridge readings (one with the artificial exposure too large, the other with it too small) gives X, viz., resistance up to fault or break.

Some actual tests by the Heurtley method are here tabulated. The table includes (b) number of Leclanché cells with corresponding effective current passing to line, and $\frac{1}{\sqrt{\text{m.a.}}}$ values with corresponding bridge readings, also details as to length of copper conductor exposure (core 130 lb. Cu/130 lb. G.P. per N.M.) and the reduction—or increase as the case may be—of A E the area of artificial exposure.

Test No.	(b) Cells Z to L.	M.A.	$\frac{1}{\sqrt{\text{M.A.}}}$	Bridge readings (F.Z.). ω	A.E.	Remarks *re* A E.	Graph plotting (See fig. 53).
1	25	5·3	0·434	6,013	½ in.	Too large.	A.
	5	1	1	6,020			
	25	5·3	0·434	6,010	reduced	Still too large.	B.
	5	1	1	6,013			
	25	5·3	0·434	5,997	again reduced	Too small.	C.
	5	1	1	5,996			D.
2	20	11 6	0·294	1,250	1 in.	Too large.	
	5	2·8	0·598	1,253			E.
	20	11·6	0·294	1,241	¼ in.	Balance.	
	5	2 8	0·598	1,241			F.
3	20	11·5	0·295	1,251	1 in.	Too large.	G.
	5	2·8	0·598	1,257			H.
	20	11·5	0·295	1,217	$\frac{1}{16}$ in.	Too small.	I.
	5	2 8	0·598	1,213			J.
4	20	9·6	0·323	1,261	1 in.	Too large.	K.
	5	1·1	0 954	1,382			L.
	20	9 7	0·321	1,231	$\frac{1}{16}$ in.	Still too large.	M.
	5	1·1	0·954	1,319			N.
5	20	13·0	0 277	1,248	1 in.	Too small.	O.
	5	4·1	0·494	1,222			P.
	20	13·0	0·277	1,218	$\frac{1}{16}$ in.	Much too small.	Q.
	5	4·1	0 494	1,179			R.

NOTE: 25 cells = 37·5 volts.
20 „ = 29 7 „
5 „ = 7·4 „
In Test No. 4, E.C. = 3ᵛ against testing current.
„ No. 5, E.C. = 3ᵛ assisting „ „

The writer is indebted for test No. 1 to the kindness of a friend. This test, believed by the writer to have been made by Mr. E. S. Heurtley, was made on a broken cable, and gave the result—

$$\frac{6{,}010 + 5{,}997}{2} = 6{,}003{\cdot}5 \text{ ohms.}$$

This was 1·5 ohms more than what eventually proved to be the correct resistance—viz., 6,002 ohms.

For the bridge readings in Nos. 2, 3, 4 and 5, which were made on an artificial cable and with artificial exposures, the writer is indebted to a colleague—Mr. J. G. H. Grey.

In tests Nos. 2, 3, 4 and 5 the correct resistance up to break was in all cases 1,240 ohms (ctd.). Readings were noted to F.Z. by Black's reduced-current method.

No. 2 affords an example of an exact balance—viz., 1,241 ohms, with both higher and lower testing currents; error, 1 ohm (+).

No. 3. The mean of the two readings with the higher current, or— $\frac{1{,}251 + 1{,}217}{2} = 1{,}239$ ohms. Error, 1 ohm (−).

No. 4. During this test the cable was influenced by an artificial telluric E.C. of 3 volts in opposition to the negative testing current. In this test the exposure adjustment was left incomplete, for a purpose which will be explained further on. The same remark applies to test No. 5, in which the conditions were similar to those in No. 4, excepting that the E.C. was not opposed to, but was in the same direction as the negative testing current.

(*To be continued.*)

THE ELECTRICAL TRADE AND RAILWAY RATES: INEQUALITY AND INCONSISTENCY.

By S. WHETTALL.

In certain sections of the electrical trade there has been a reduction in the cost of production and also a lowering in the prices at which the manufactured articles have been sold, but there has not been any proportionate reduction in the railway carriage charges, which therefore constitute a greater proportion of the price when sold and delivered than was hitherto the case. The reader will, therefore, probably appreciate the particulars given in this short article, and admit that the subject affects most traders connected with the electrical business in this country.

It has been evident for a long period that some traders have an advantage over others in connection with the railway carriage charges over equal or proportionate distances owing to the said rates being unequal, and when it is recollected that the electrical trade will probably pay over £4,000,000 in railway carriage charges every year, then the importance of the question of the disproportionate railway rates will be appreciated by traders and others interested in railway rates and in matters pertaining to railways.

To give the reader a clear idea of the subject under discussion, it may be as well to mention that railway rates are divided into eight sections or classes, and those which more particularly relate to the electrical trade are Classes C, 1, 2, 3 and 4.

Class C includes such traffic as cable tubes.

Class 1 includes such traffic as accumulator plates.

Class 2 includes such traffic as accumulator dynamos and motors.

Class 3 includes such traffic as electric arc lamps, &c.

Class 4 includes such traffic as electrical instruments, &c.

Class C rate includes the station terminals for use of railway company's stations, the service terminals for use of railway companies' sheets, loading and unloading, covering and uncovering, and also the rate for conveyance over the railway, which includes the wagon hire for use of the railway company's wagons. Cartage is not included in the rate for Class C traffic, and if cartage is performed by the railway company it is, of course, additional to the rate.

Class rates 1, 2, 3 and 4 include all the charges given as being included in Class C rate; the charge for cartage within the ordinary boundary is also included in these rates, with, however, some few exceptions. That the inconsistencies in railway rates are many cannot be gainsaid, and seeing that this is so, a wide field for discussion is opened up, and the tables given hereafter will probably throw some light upon a rather intricate matter.

Table I represents the station and service terminal charges.

Table II shows the maximum rates of conveyance.

Table III represents the actual mileage rates in operation between the places for traffic in Classes C, 1, 2, 3 and 4.

Table IV shows the class C rate as based upon the maximum service and station terminal charges plus the maximum conveyance charge.

The particulars given above will give the reader some idea as to the composition of the rates, and to make the subject clearer all details with respect to the rate charges are given hereunder:—

Maximum terminals along with conveyance charges constitute the basis of all railway rates with, however, one exception, and that is, cartage.

TABLE I.—Maximum Terminals —Per Ton.

In respect of merchandise comprised in classes.	Station terminal at each end.		Loading.		Unloading.		Covering.	Uncovering.
	s.	d.	s.	d.	s.	d.	d.	d.
C	1	0	0	3	0	3	1	1
1	1	6	0	5	0	5	1½	1½
2	1	6	0	8	0	8	2	2
3	1	6	1	0	1	0	2	2
4	1	6	1	4	1	4	3	3

TABLE II.—Maximum Rates of Conveyance.—Per Ton Per Mile.

In respect of merchandise comprised in classes.	For the first 20 miles, or any part of such distance.	For the next 30 miles, or any part of such distance.	For the next 50 miles, or any part of such distance.	For the remainder of the distance.
C	1·80d.	1·50d.	1·20d.	0·70d.
1	2·20d.	1·85d.	1·40d.	1·00d.
2	2·65d.	2·30d.	1·80d.	1·50d.
3	3·10d.	2·65d.	2·00d.	1·80d.
4	3·60d.	3·15d.	2·50d.	2·20d.

It should be noted that the conveyance rates shown above are not universal, as they differ slightly over some companies' lines, as sometimes they are fractionally less, and sometimes slightly higher, than those given above. It may also be mentioned that in some parts of the country a small toll is charged (for various reasons and purposes), and the toll is usually 1d. or 2d. per ton.

TABLE III.—Actual Mileage and Actual Rates in Operation.—Rate per Ton.

Between Grimsby and—	Miles.	Class. C.		Class. 1.		Class. 2.		Class. 3.		Class. 4.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1. London	155	18	3	28	7	35	11	41	9	50	1
2. Birmingham	132	16	11	23	7	26	3	33	8	40	2
3. Manchester	91	13	4	20	0	23	9	27	1	31	8
4. Leeds	53	7	11	11	8	13	4	16	8	20	0

TABLE IV.—Class C Rate, as Based upon the Maximum Station and Service Terminal Charges plus the Maximum Conveyance Charges.

Miles.	Station terminal at both ends. Per ton.		Service terminals. Per ton.	Maximum conveyance rate according to actual mileage. Per ton.		Total. Per ton.	
	s.	d.	d.	s.	d.	s.	d.
1. 155	2	0	8	15	0	17	8
2. 132	2	0	8	13	8	16	4
3. 91	2	0	8	10	11	13	7
4. 53	2	0	8	7	1	9	9

TABLE V.—Class 1 Rate, as Based upon the Maximum Station and Service Terminals plus the Maximum Conveyance Charges and an Approximate Allowance for Cartage.

Miles.	Station terminals at both ends. Per ton.		Service terminals. Per ton.		Maximum conveyance rate according to actual mileage. Per ton.		An approximate allowance for oartsge both ends. Per ton.		Total. Per ton.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1. 155	3	0	1	1	18	9	5	6	28	4
2. 132	3	0	1	1	16	10	3	0	23	11
3. 91	3	0	1	1	13	2	3	0	20	3
4. 53	3	0	1	1	8	9	3	0	15	10

A comparison, showing where the inequality of the rates is apparent, will be found in the following table:—

	Class C. Actual rate in operation.		Class C. Maximum basis rate per ton.		Class 1. Actual rate in operation.		Class 1. Maximum basis rate per ton.	
	s.	d.	s.	d.	s.	d.	s.	d.
London ...	18	3	17	8	28	7	28	4
Birmingham ..	16	11	16	4	23	7	23	11
Manchester ...	13	4	13	7	20	0	20	3
Leeds ...	7	11	9	9	11	8	15	10

From the figures, it is easy to understand that traders in Leeds have an advantage over other towns when traffic is forwarded thereto from Grimsby, and this instance is only one of many, so that one naturally asks why should railway rates be cheaper in one part of the country than they are in another; the only inference to be made is that the railway rates require adjusting.

Another instance of the inequality of railway rates is given hereunder, showing that such inequalities prevail all over the country :—

	Miles.	Class C rate actually in operation. Per ton. s.	d.	Class C rate as based upon the maximum terminals and conveyance charges. Per ton. s.	d.
Bristol and London	118½	13	1	15	7
Birmingham ...	87¾	10	6	13	3
Manchester ...	166	18	4	18	4
Leeds	202¼	20	4	20	4

In this case it will be seen that the traders in London and Birmingham receive a certain amount of benefit over and above probable competitors in either Manchester or Leeds, and such instances as these clearly prove the need of reform or amendment in railway rates, as it is unjust that some traders should obtain better rates than others.

OVER-RUN AIR PUMPS.

[COMMUNICATED.]

Engineers who are a little careless of their pipe joints have to pay for the same in poor vacua. This poor vacua they then endeavour to cure by over-running the air pump. Doing this is perfectly useless, and pays about as well as the endeavour of a man to lift himself by his own boot straps. To over-run an air pump is to vitiate the vacuum, for it is not possible under ordinary conditions to secure its best efficiency above a certain speed. Let an Edwards air pump be taken as an example. When the bucket descends, its conical base projects the water which has gathered in the conical bottom of the casing, round a curved passage into the pump barrel. The prompt return of the bucket covers the port through which the water has been shot, and through which also the air from the condenser has entered the almost vacuous space above the bucket. The two fluids are more or less converted into foam, and this proceeds to settle upon the face of the bucket in a layer of water and a superincumbent layer of air. Given time, this separation would be complete and the air would be discharged through the upper valves, followed by the excess of water beyond that requisite to fill the clearance space, but without sufficient time there cannot be complete separation, and there will remain on the bucket the clearance volume of foam at atmospheric pressure. The air of that foam expands on the down stroke of the bucket, and the vacuum formed above the bucket fails to attain to that proper to the temperature of the water; less air enters the ring port and the efficiency of the pump is permanently reduced. By slower running, such a pump would have a better efficiency. Because of this foaming, the clearance above the bucket should be a minimum in order that the clearance layer shall, if possible, be solid water, so as to ensure the fullest discharge of the foam layer. An inefficient pump may be improved by attending to the clearance. In an Edwards pump, wear of the bearings tends to shorten the rod and reduce the clearance, so that a pump needs to be watched against entire disappearance of clearance as well as against the lining up of bearings to give too long a rod and excess clearance.

In considering the interaction between an air-pump and the condenser to which it is connected, two conditions are prominent. Assuming the air-pump clearance is filled with water, the vacuum formed above the bucket is simply that due to the pressure of aqueous vapour. In the condenser, assuming the same temperature, there are two pressures combined—that of the aqueous vapour and that of the air which is present. The absolute pressure in the condenser is greater than that of the air-pump space by the amount of the partial pressure of the air. But two different pressures cannot exist in free communication, the gas at the higher pressure must rush into the lower pressure space until equilibrium is maintained. When the air-pump bucket opens this communicating passage, the mixed vapour rushes in from the condenser; this raises the pressure in the pump chamber, and the vapour already there partially condenses; and this action goes on until the inrushing vapour has carried with it so much air as to bring the ratio of air to aqueous vapour to the same figure in each vessel.

It is, of course, still assumed that the water temperature remains equal in both vessels. Presumably if a vessel of water is hotter at one end than at the other, any air that may be present will collect at the colder end in order to bring the sum of the two partial pressures of air and water vapour to the same figure. This is the scientific reason, in addition to others, why air is best drawn from the coolest part of a condenser, and it would conduce to efficiency of an air pump could its barrel be well cooled. Apparently the Edwards air pump, with a continuous small cold water spray into the barrel to maintain a full clearance space, would act well as a dry air pump, the water being removed from the condenser by a wet pump or even barometrically. Such a pump would represent a thoroughly cold end to the condenser, into or towards which air would rush automatically to maintain equilibrium of pressure. The laws of mixed vapours tell us that the space above water of a given temperature will always contain a definite weight of aqueous vapour per unit of space irrespective of the presence of other gases. This law underlies the action of the air pump, and explains why air will rush into a space until the ratio of air is brought up to that of the space whence the air flowed.

Equalisation of pressure is, of course, instantaneous or practically so, the molecular velocity of the gas or vapour involved being many hundred feet per second, and time being therefore negligible. But time is not negligible when there is any question of the settling out of foam into its constituents, gaseous and liquid. Hence the danger of over-running.

PROCEEDINGS OF INSTITUTIONS.

The Electrical System of the L.C.C. Tramways.

In connection with the above paper, by Mr. J. H. Rider, which was read at the meeting of the I.E.E. on March 25th last and discussed on two subsequent dates, our readers will remember that Mr. Rider's reply was held over owing to shortness of time. As many of the points raised were of considerable interest, we briefly extract some of Mr. Rider's remarks from his published reply in the *Journal* of the Institution of Electrical Engineers.

Mr. Rider said he considered the change of site from Camberwell to Greenwich to have been justified by the results; it had to be remembered that the railway company stipulated that the proposed siding at Camberwell should only be used for three hours in the night. A recent quotation by London coal merchants for Scotch coal showed a saving of 2s. 3d. per ton delivered at Greenwich as compared with Camberwell; there was also the question of condensing to be considered, as cooling towers would certainly have proved a public nuisance. He doubted whether the site would have been big enough to contain cooling towers for 22 million lb. water per hour. He could not agree that 25 per cent. spare boiler plant was too much if the best results were to be obtained; the new Babcock boilers were bigger than the original Stirling units, and anything larger would have involved more costly buildings. The type of reciprocating engine adopted at Greenwich was from experience the best for large powers, and its speed had not proved too high. The 6,600-volt pressure for transmission was adopted as being low enough to get rid of many of the electrical troubles experienced at higher pressures, while still sufficiently high for satisfactory economy when the average distance and load density were considered. Experience had shown that the 85 per cent. power factor for which the turbines were designed was more in accordance with actual work than the 94 per cent. of the reciprocating plant. The power factor of the plant as a whole, at full load was from 90 to 93 per cent.; at half load from 80 to 85 per cent., and at light load during the night about 70 per cent. Considerable economies had been found from the turbines which were run on heavy constant load, the reciprocating plant filling up the hollows, and also working at its most economical load, viz., ¾ full load. The coal consumption per unit delivered to sub-stations had decreased by something like 20 per cent. since the beginning of 1909. The impulse turbine was not adopted for extensions, because the author hoped to obtain any more reliability with it on account of larger radial clearances. The aim of the station was to maintain an outside supply under all conditions, and the author considered that nothing but a hand-operated switch could be relied on to pull a machine out of circuit, in the event of a failure of the machine itself. With the present system of earthing, no trouble was experienced with the A.C. motors driving the centrifugal pumps. As regarded sub-station efficiency, the average of the synchronous sub-stations was 73·5 per cent., and of the induction sub-stations 82 1 per cent., but this did not necessarily indicate the comparative efficiencies of the two types of plant. There was nothing like one-third spare plant in the sub-stations, which frequently operated on their overload capacity.

In reply to several speakers who drew attention to the heavier energy consumption per car-mile of the L.C.C. cars as compared with other cities, notably Glasgow, he pointed out that if allowances were made for the greater weight and higher speed of the London cars, and the frequent traffic stoppages, it would be found that there was no great difference between the energy consumptions in the two cases.

Institution of Electrical Engineers (Manchester Section).

The opening meeting of the session of the above Section was held on Friday evening, the 22nd ult., when the chairman, Mr. S. J. Watson, delivered his inaugural address.

Referring first to the steps recently taken by the Council to acquire the Medical Examination Hall on the Victoria Embankment as a permanent home for the Institution, Mr. Watson expressed the opinion that such a centre could not fail to be of immense advantage to the Institution, and that a grave error in judgment would have been made if full advantage had not been taken of the opportunity when it arose. He regretted that during the last few years there had at times been a difficulty in obtaining suitable papers for Institution meetings. It was necessary in some cases for members to obtain permission from their employers before offering a paper, and permisssion was, he was afraid, sometimes withheld on the grounds that the information given might be used to the prejudice of such employers. While there were doubtless some trade secrets that could be maintained absolutely inviolable, he did not think there was very much electrical manufacturing work carried out that might be classified under this heading. Most electrical manufacturers had received benefits in one way or another from the work carried on by the Institution, and in return they should do what they could to encourage their employés to join the Institution and contribute to its success.

He had also found that members who were engaged on the manufacture of special apparatus did not care to offer papers on the subject they were most intimately acquainted with because they were afraid competitors might consider they were trying to obtain a cheap advertisement. Such a feeling could be carried too far. Most of them had to specialise in one direction or another, and those whose everyday work was in one direction were just the men most capable of giving information in regard thereto.

Dealing with the development of electric supply undertakings during the past 15 years, he could not help being impressed with the remarkable growth that had taken place during a comparatively short period of time. He had prepared a table giving a summary of the records contained in issues of *Lightning* and the *Electrical Times* in 1894, 1899, 1904 and 1909, so that they would see the improvements which had taken place during three periods each of five years.

Records of Supply Undertakings.

	1894.	1899.	1904.	1909.
No. of undertakings	30	100	225	290
Cap. expenditure, £	4,472,925	11,895,993	38,284,458	57,818,142
Plant installed, KW.	32,108	112,631	454,565	795,036
Inc. in capital, £ ...	...	7,423,068	26,388,465	19,533,684
Inc. in plant, KW. ...	...	80,523	341,934	340,471
Cap. outlay per KW.	£139	£105	£84	£72
Cost per add. KW. ...	...	£92	£77	£57
Maximum load, KW.	...	78,866	269,680	501,941
% to plant installed	...	70	59	63
Units sold	15,231,181	76,432,250	349,003,935	824,819,503
Increase in output...	...	61,201,069	272,571,685	475,815,568
% increase	...	401	357	156
Units sold per £1 expended ...	3·4	6·4	9·1	14·2
Units per add. £1 expended ...	...	8·2	10·3	24·4
Revenue	£392,077	£1,556,262	£4,763,111	£7,528,321
% to capital ...	8·7	13·1	12·4	12 8
Inc. in revenue, £...	...	1,164,185	3,206,849	2,665,210
Revenue per unit ...	6·16d.	4·89d.	3·27d.	2·16d.
Rev. per add. unit	...	4·55d.	2·82d.	1·34d.
Working expenses, £	243,021	786,115	2,334,088	3,681,504
% to revenue ...	62	51	49	49
Cost per unit ...	3·82d.	2 47d.	1·60d.	1·07d
Cost of add. units, £	...	543,094	1,547,973	1,347,416
Cost per add. unit	...	2·13d.	1·36d.	·68d.
Gross profit, £ ...	149,056	770,147	2,429,028	3,846 817
% to capital ...	3·3	6·4	6·3	6·6
Inc. in gross profit, £	...	621,091	1,658,876	1,417,794
% to add. capital ...	...	8·3	6·3	7·2
Load factor, total output	...	11·0	14·7	18·7
Load factor, add. output	...	...	16·3	23·3

The amount of capital invested had increased from four to nearly sixty millions of money in fifteen years.

Ascertaining the cost of the extra units sold from year to year, and the extra capital charges incurred in supplying the extra units, gave some very valuable assistance when working out the price to be charged to cover the cost of supplying large consumers. Applying this method to the past seven years' records of the undertaking with which he was connected, during which time the output had increased nearly tenfold and large extensions had been carried out to plant and mains, he found that the extra generating costs amounted to ·203d. per unit, the extra capital charges on plant to ·154d. per unit, the extra distributing costs—*i.e.*, repair and capital charges on mains, &c., to ·234d. per unit, and the extra management charges to ·087d. per unit, so that the total additional cost of supplying the extra units amounted to ·768d. per unit. The load factor of the increased output had been 23·2 per cent. The capital cost per KW. of plant and mains installed had decreased from £139 in 1894 to £72 in 1909; the number of units sold per £1 of capital invested had increased from 3·4 to 14·2; the average price charged had been reduced from 6·16d. to 2·16d. per unit, and the gross profit had gone up from 3·3 per cent. to 6·6 per cent. Whereas the cost of the plant and mains added during the period 1894 to 1899 was £92 per KW., the cost of the additions during the period 1904 to 1909 was only £57 per KW., and the additional working expenses for the increase in the output between 1894 and 1899 was 2·13d. per unit, whereas the cost for the increase in output between 1904 and 1909 was only ·68d. per unit. There was a difference of 293,095 KW. between the total capacity of the plant installed and the maximum load recorded; that is to say, no less than 37 per cent. of the total plant was provided as spare. This represented a capital expenditure of over six millions, which was entirely unproductive, inasmuch as it did not earn one penny of income.

Within a distance of 8 or 10 miles of the Manchester Town Hall there were some 20 public generating stations, having between them a total capacity of 100,000 KW., which had probably cost over two million pounds. To construct a system of mains partly above and partly below ground, so as to interconnect these generating stations, would cost about £150,000, but by so doing it would be possible to reduce the quantity of spare plant from 37 per cent. to, say, 12 per cent., and enable the existing stations to supply an increase in load of 25,000 KW. without any further expenditure, thus making use of existing plant having a value of about £500,000 at a cost of £150,000 on mains. Some additional expenditure would be necessary to provide converters at some of the existing works, but against this might be put the saving in working expenses through running the plant at higher efficiencies.

Bearing in mind the rapidity with which power stations were constructed one after the other about 1894, it might be said that with the knowledge and experience then available the majority of the work was carried out on lines that had very well withstood the test of time. It appeared to him that only one serious mistake was made, which had only become apparent as one extension after another had had to be carried out—the common practice originally adopted of erecting the generating stations in thickly-populated districts, in order to keep down the expenditure on mains, without taking into consideration either the facilities provided for obtaining delivery of fuel, the provision of an adequate supply of water for condensing purposes or providing ample room for extensions. The growth which would take place was very much underestimated, and in consequence of this want of foresight it had been necessary in many cases to construct new generating stations on more suitable sites, or to make good the deficiencies of the existing sites at considerable expense.

The reduction in the average cost per unit between 1894 and 1909 had been brought about principally through the increase in the output and the better load-factor conditions, but these influences did not appear to be sufficient to account for the reduction which had taken place in the fuel cost; speaking broadly, there had not been any considerable change in the design or arrangement of generating plants to account for this reduction.

At the present time equally good results were apparently being obtained from both the impulse and the reaction type of turbine, but it would appear that the impulse machine was being used to an increasing extent in the large sizes. The tendency of turbine construction was to increase the clearances, reduce the number of stages and to shorten the length between bearings, and progress along these lines was likely to be more successful with the impulse than with the reaction machine.

The question of some importance to supply undertakings was to what extent the costs could be reduced by the employment of exhaust steam turbines.

In order to illustrate the effect of installing exhaust turbines in an existing generating station, he assumed a case where 4,000 KW. of reciprocating plant was installed, and worked out the costs.

His conclusion was that for public generating stations, the circumstances would have to be exceptional to result in any ultimate advantage from installing exhaust or mixed-pressure turbines, as compared with high-pressure turbines of equal capacity. A very wide field, however, existed for the application of exhaust turbines for other purposes, such as collieries, rolling mills, ship yards, and other industries particularly where large non-condensing engines were used. In many such cases the output could be increased 100 per cent with the same consumption of fuel, and electric motors supplied from the generator connected to the exhaust turbine could be substituted for the many small non-condensing engines usually required for other duties, so effecting a still further saving in the fuel consumption. Inasmuch as the load factor was slowly but surely improving, it was not unlikely that in the near future it would be found economical to install gas engines to deal with at least that portion of the load having the highest load factor.

For a direct-current station situated in a good position for obtaining coal supplies, a combination of gas engines as the prime movers with large storage battery capacity, appeared to be an excellent arrangement. The combination would not much exceed in cost the steam plant capable of dealing with the same maximum demand, and as the working load factor of the gas engine would probably reach, if not exceed, 60 per cent., there was little doubt that the fuel costs and the working expenses generally would be lower than for the steam station.

Power station engineers were evidently appreciating the many advantages incidental to the use of storage batteries on a comprehensive scale. During the last few years batteries many sizes larger than previously contemplated had been put into use, and the ideal conditions of supply of gas and water undertakings in regard to storage might even be realised in the near future.

The best results were now obtained from large plants, although they sometimes had to be worked on light loads; small sets had to be replaced by large ones, and those responsible for the management should use every opportunity to provide funds, whether under the heading of reserve or depreciation to enable the value of such obsolescent plant to be entirely written off from to time, so that the net capital expenditure should only represent the value of the plant capable of being usefully and economically employed under modern conditions.

There was no doubt that many manufacturers appreciated, and had taken full advantage of, the improved results obtained by using direct-current motors with efficient long range speed regulating devices, and would not have a constant-speed motor, even if it were given to them. Two textile manufacturers in Bury had installed a few direct-current motors with shunt regulators to drive a portion of their premises; these worked very well, and he was subsequently approached in regard to the driving of the remainder of the mills. In each case, on pointing out how much better it would be to use constant-speed A.C. motors with no brush or commutator troubles, he was told that they did not want constant speed, as they had found it exceedingly convenient to alter the speed slightly to suit the work they might happen to be engaged on, and they had not experienced any commutator troubles.

The development of our public supply undertakings had been very materially assisted by the hiring-out of different kinds of apparatus, particularly of motors, and Mr. Watson pointed out that inasmuch as Parliament had granted powers both to municipalities and to companies to establish and to work electrical supply undertakings, the same treatment should be meted out to both alike. If an undertaking established by a company in one district was allowed to supply its consumers direct with hired apparatus, it would be very unfair to debar a similar undertaking established by a local authority in a neighbouring district from doing the same thing. The majority of municipal undertakings were directed and managed at least as well as those financed by private enterprise.

It was probably less difficult to ascertain the amount to be charged to individual consumers on account of the working expenses of the generating plant than to arrive at a fair figure for the cost of distribution. Apart from other factors, an appreciable difference in price should be quoted to a consumer who only necessitated an expenditure £100 on mains as compared with another at a distance on whose behalf £5,000 had to be spent.

The cost of meter reading and repairs, office expenses in making out and collecting accounts, depended entirely on the number of consumers supplied and was independent of the consumption of each consumer. Assuming that 500 consumers were supplied using between them 1,000,000 units a year and that the cost of the above items came to £500 a year, equal to £1 per consumer per annum, or an average cost of ·12d. per unit on the total consumption, if one additional large consumer were connected using another 1,000,000 units a year, which at a power rate of a halfpenny per unit would give an income of rather more than £2,000 a year, the extra cost of the items mentioned would only be £1 per annum instead of another £500, and it would be grossly unfair to reduce the charges to the other 500 consumers by ·06d. per unit and to charge the larger consumer ·56d. instead of ·5d. per unit when the actual cost of supplying him was quite an insignificant sum. Moreover, the difference between the price of ·56d. and ·50d. per unit on the output supplied to the large consumer was 12 per cent., and represented in cash nearly £250 a year, no small matter in these days of competition.

He mentioned these two aspects of the problem to illustrate the difference which must be made in the charges as between one consumer and another if the business was to be carried out on sound commercial lines, and how unjustified was the contention so often put forward by those insufficiently acquainted with the subject that all consumers should be charged alike, without taking into consideration all the circumstances of the case.

He had heard the remark made time after time, that if any great progress was to be made in the application of motor power supply from public mains, the price would have to be brought down to about ·30d. per unit, because that was the total inclusive price (usually stated as rather on the high side) it was costing large consumers to work their own plant. If there was one fact more than another which stood out prominently in connection with most of the supply undertakings in Lancashire, it was the tremendous growth in the demand for power supply during the last few years.

He felt quite sure that it was unnecessary to quote so low a figure nowadays. Many large manufacturing concerns had found it remunerative in the long run to purchase from outside sources at prices varying between ·75d. and ·50d. per unit, depending on the conditions, but unfortunately it was difficult to get those who had made the change to come forward and give facts and figures to show what electrical driving had done for them. There was not the slightest doubt also that a price between ·75d. and ·50d. per unit was quite sufficient to enable most of the larger undertakings to maintain and even improve their financial positions, as their accounts showed, that with the access of the power load at these low prices the working expenses per unit had been very largely reduced and improved financial results attained. These prices were only intended to refer to mills or workshops using the supply during ordinary factory hours, and where fuel could be obtained at about 8s. per ton. For longer hours the price could be appreciably reduced.

During the past 15 years the price of all standard electrical apparatus had been reduced 50 per cent. to 75 per cent.

The only matter for regret was that many of the old-established manufacturing concerns who had contributed so largely to the success of the industry, had not themselves received the financial reward their services deserved. He could hardly believe that the small increase in price necessary to re-establish the majority of manufacturers in a strong financial position would have any appreciable effect on the demand, and unless greater financial stability could be secured in one way or another, it would be difficult, if not impossible, to maintain our position in the vanguard of the army of progress.

It seemed more than probable that, when a future address or paper was written dealing with a similar period to that covered by this address, less changes and improvements would have taken place than had occurred during the past period.

A New Steam-Electric Locomotive.

At the opening meeting of the Glasgow University Engineering Society, held in Glasgow on Friday, October 29th, Mr. Hugh Reid, deputy-chairman and chief managing director of the North British Locomotive Co., delivered his inaugural address as honorary president. The subject was "The First Steam Turbine Electric Locomotive," and Mr. Reid described a new type of engine at present under construction on the Reid-Ramsay system at his firm's works. Mr. Reid explained that various proposals had been made to electrify existing steam railways, but the anticipated cost for conversion and of prospective and subsequent maintenance had hitherto prevented progress. Attempts had been made to introduce independent self-generating electric units that might operate over existing railway systems without necessitating any electrical equipment on the railways themselves. The Heilmann steam-electric locomotive, built in 1894, was the most notable of these attempts, and the Reid-Ramsay locomotive was a development of that idea, but on a different and more practical basis. Proceeding, Mr. Reid gave the following description of the new engine:—Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, and the coal and water supplies are carried in the side bunkers and side water tanks at both sides of the boiler. The steam from the boiler is led to a turbine of the impulse type, running at a speed of 3,000 R.P.M., to which is directly coupled a continuous-current, variable-voltage dynamo or generator. The dynamo supplies electrical energy at from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser, and is, together with the circulating condensing water, delivered eventually to the hot well. As the water of condensation is free from oil, it is returned from the hot well direct to the boiler by means of a feed pump, and the supply of water carried in the tanks is actually circulating water for condensation purposes. It is circulated by by means of small centrifugal pumps driven by auxiliary steam turbines placed alongside the main turbine and dynamo. The cooler is situated in front of the locomotive, where the full benefit of the blast of air caused by the movement of the locomotive, aided by a fan, is utilised. As the condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast, in the experimental locomotive, forced draught is provided by means of a small turbine-driven fan, placed within the cooler, so that it will deliver hot air to the boiler fire, and at the same time assist the current of air through the cooler. The small switchboard and the instruments required, the controller for grouping the four motors in series, series-parallel and parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electrical circuit, and consequently the speed of the train, are all placed on the driver's platform within easy reach. The whole is mounted upon a strong under-frame, which is carried upon two eight-wheeled compound bogies so constructed that they will easily negotiate curves. Each bogie carries two of the four motors. The arrangement is the outcome of much thought and some experiment over a period of several years, and is being carried out on a large scale, and at heavy cost. As the engine is intended for express passenger main-line work, it is hoped to obtain comparisons from its actual working with the performances of the reciprocating steam locomotives, especially as regards the relative consumption of fuel and water, and as to the efficiency of transforming the energy of steam into draw bar or train pull, and also the relative rapidity of acceleration under the old and new systems.

Most of the component parts of this steam turbine electric locomotive have already proved themselves effective and efficient in other applications, and the novelty lies in the combination of the different elements of which the locomotive is composed. The expected results in this case should not therefore be so problematical as in an invention where the novelty is in the details, and it is the question of the cost of the locomotive which most troubles the patentees or raises any doubt as to its free adoption. A steam locomotive can now be produced at a very moderate first cost in up-to-date establishments with modern machinery and scientific organisation in comparison with any arrangement involving the use of expensive electrical apparatus.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GUATEMALA.—It is necessary that the exact net and gross weight in kg. should be marked on each package, and specified on invoices, bills of lading, and certificates of origin. The net weight of each class of goods included in a package should be stated, and the origin of the goods must be declared on all documents. Invoices must be made out in quadruplicate on special forms, and must be signed by the Consul for Guatemala. Invoices and sworn declarations must be signed by an authorised member of the exporter's firm, and in no case by irresponsible clerks, brokers, or shipping agents. Strict compliance with the regulations is required.

The following fees are payable:—

When the amount of the invoice is under £20 ...	£0	14	0
" " " from £20 to £100	1	0	0
" " " from £100 to £200	1	8	0
" " " from £200 to £600	1	12	0
" " " from £600 to £1,200	2	0	0
and for each additional £200, or part thereof	0	4	0

Forms of invoices may be obtained from the Consuls for the Republic of Guatemala.

50 per cent. of the amount of duty leviable must be paid in American gold (*i.e.*, peso = 4s. 2d.); the remainder may be paid at the currency rate of exchange.

Kg. = 2·204 lb.

The following goods are admitted free of duty:—Asbestos in fibre or plates in natural state; articles imported for the State or the Municipalities, for the public service or the service of charitable institutions; lights for lighthouses, or harbour lights; galvanic batteries; electrical machinery and batteries not charged, destined to a public service.

The following duties are payable:—

	Pesos per kg.
Axles and axle boxes, iron or steel, of all kinds... ...	·10
Iron lamps, complete or in parts	·30
" gilt, silvered or nickeled	·50
Machines for various industrial purposes	·10
" worked by water or steam power	·02
Machines or motors, steam or wind	·02
Iron pulleys for transmission belts...	·02
Iron wheels for cars, &c.	·10
Tubes or pipes of iron	·02
" coated with brass, copper, &c.	·05
Chandeliers of copper	·60
" " gilt, silvered or nickeled... ...	1
Articles not specified in the Tariff, of copper	2
Bells of copper	·60
Candelabra of copper, gilt or silvered, with or without foot of other material, weighing up to 10 kg. each ...	1·50
Ditto, weighing more than 10 kg. each	·75
Lead tubing	·05
Lamps of copper	·60
Ditto, gilt, silvered or nickeled	1
Transmission belting of leather when not forming any part of any particular machine...	·30
Manufactures of glass or crystal not specified in the Tariff	1
" porcelain, faience or earthenware not specified in the Tariff	·75
Ditto, ornamented with silk, metal, &c.	3
Candelabra of crystal or glass	·50
Lamps of crystal or glass with or without accessories of metal	·60
Ditto, of faience or porcelain...	·60
Articles of aluminium not specified in the Tariff	4
" gutta-percha or celluloid	1
Wire of iron, galvanised, or of copper insulated for the transmission of electricity	·01½
Electrical apparatus	·02
Pumps of iron or bronze	·02
Globes, glass, for incandescent electric lights	·02
Locomotives, carriages, tools and materials for railways...	·02
Lightning rods	·02
Lamp-shades of all kinds not specified, with or without their metal frames	4

GUERNSEY.—All goods imported into the island of Guernsey pay a tax of 1s. 8d. per ton of 2,000 lb. gross, with a few unimportant exceptions.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,802. "Improvements in audible electric signalling devices and the like." T. S. Rogers. October 18th.

23,808. "Improvements in portable electric lamps." G. N. Vitanoff. October 18th. (Complete.)

23,814. "Improvements in and relating to the manufacture of electric incandescent metal-filament lamps." H. Hirst and The Wolfram (Tungsten) Metal Filament Lamps, Ltd. (Date applied for under Rule 13, January 4th, 1909. An invention comprised in application No. 142, dated January 4th, 1909.) October 19th. (Complete.)

23,819. "Improvements in apparatus for cooking and like operations by means of electricity." G. G. Bell and J. St. V. Pletts. October 18th.

23,821. "Improvements in clamping and supporting devices for electrical condensers." Siemens Bros. & Co., Ltd., and C. R. Riber. October 18th. (Complete.)

23,834. "Improvements in or relating to telephonic apparatus." E. A. Graham. October 18th. (Complete.)

23,863. "Improved method of and means for charging electrical accumulators or secondary batteries." J. Schmeltz. October 18th. (Complete.)

23,937. "Distributing box for cables with multiple electrical conductors." R. Monnier. (Application for Patent of Addition to No. 13,129, 1909. Date applied for under Sec. 91 of the Act, October 19th, 1908, being date of application in France.) October 18th. (Complete.)

23,938. "Improvements in electrical transformers." C. Le G. Fortescue. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in United States.) October 19th. (Complete.)

23,980. "Improved means for supporting electric lamps." H. S. Harrison. October 19th.

24,016. "Improvements in current collectors for electrically driven vehicles." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 19th.

24,017. "Improvements in and relating to signal systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 19th.

24,023. "Improvements in and relating to dynamo-electric machines." E. K. Scott. October 19th.

24,028. "New and improved adhesive Morse slip and automatic damper for use with telegraph recording apparatus and the like." C. T. Pounsforn and F. T. Love. October 20th.

24,076. "Improvements in or relating to electric burglar alarms and the like apparatus." A. Bloch. October 20th.

24,079. "Improvements in suspension chains for electroliers, electric lamps and like electric lighting apparatus." R. Peyton. October 20th.

24,109. "Improvements in electric switches." H. J. Carrigan. October 20th. (Complete.)

24,126. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 20th.

24,127. "Improvements in and relating to the regulation of the voltage of alternating-current machines." Hon. C. A. Parsons and A. H. Law. October 20th.

24,130. "Electric pocket igniter." F. Deimel. October 20th. (Complete.)

24,134. "Improvements in apparatus for the production of continuously-maintained and sustained oscillations of electricity." H. Manders. October 20th.

24,137. "Improvements in dynamo-electric machinery." Bruce Peebles and Co., Ltd., and P. D. de la Cour. October 21st.

24,185. "Improvements in electric signalling installations." Siemens and Halske, Akt. Ges. (Date applied for under Sec. 91 of the Act, October 21st, 1908, being date of application in Norway.) October 21st. (Complete.)

24,187. "Aerial resonator for receiving apparatus of electrical wireless systems." C. Bardeloni. October 21st. (Complete.)

24,190. "Improvements in electric signs." L. Miller. October 21st. (Complete.)

24,208. "Improvements relating to apparatus for controlling electric motors." H. E. Dey. October 21st. (Complete.)

24,269. "Improvements in or relating to the driving and operation of electric frequency transformers having commutators." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) October 22nd. (Complete.)

24,275. "Improvements in or relating to means for receiving and recording telephonic messages or communications." N. P. Jasper. October 22nd.

24,276. "Improvements in dynamo brush holders." O. Höhme. October 22nd. (Complete.)

24,294. "Improved device for supporting the filaments of incandescent electric lamps." A. C. Hyde. October 22nd.

24,306. "Improvements in and relating to continuous-current motor-generators or transformers." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, October 22nd, 1908, being date of application in Germany.) October 22nd. (Complete.)

24,236. "Improvements in and relating to fittings for electric candle lamps." J. S. Highfield. October 22nd.

24,372. "Improvements in or in connection with electric motors and other electrical apparatus." W. Alnerson and J. H. Holmes. October 23rd.

24,373. "Improvements in electrical switches." N. Collins. October 23rd.

24,388. "Improvements in apparatus for receiving messages by wireless telegraphy or telephony." British Radio Telegraph & Telephone Co., Ltd., and J. G. Balsillie. October 23rd.

24,389. "Improvements in thermo-electric devices for indicating the temperature of steam on a steam locomotive." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 23rd. (Complete.)

PUBLISHED SPECIFICATIONS.

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1908.

Electric Wireless Signalling. R. A. Fessenden. 13,865. June 30th. (Date applied for under International Convention, July 1st, 1907.)

Electric Switches and Switch Arrangements. H. J. Fisher, F. Coates, H. W. Clothier and A. Reyrolle & Co. 20,590. September 30th.

Process for Fastening the Filaments of Electric Incandescent Lamps to their Electrodes. T. McKenna. (Gluhlampenwerk Anker-Ges. 20,915 October 3rd.

THE
ELECTRICAL REVIEW.

VOL. LXV. NOVEMBER 12, 1909. No. 1,668.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.— New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE JAPAN-BRITISH EXHIBITION.

ON Friday last week, the then Lord Mayor of London (Sir G. Wyatt Truscott) presided at the last of the Mansion House functions which have signalised his civic reign, and we may be pardoned if we look upon it as the most important, in view of the far-reaching effects it ought to produce upon the commerce of this country, especially in so far as it applies to our engineering and industrial undertakings. The occasion was a luncheon, to which a distinguished company numbering some 140 well-known gentlemen had been invited to meet Prince Arthur of Connaught, the Honorary President of the Japan-British Exhibition to be held next year at Shepherd's Bush; with what took place we deal in another column.

Exhibitions of various kinds have been held in practically every country of importance on the face of the globe from the time of King Ahasuerus to the present day, but we shall only concern ourselves with a few of these, commencing with the first great International Exhibition held in London in 1851, by the Society of Arts, under the Presidency of the late Prince Consort. Previous to this, such displays had been confined to the products of the country in which they took place. All nations were invited to compete in 1851, and the Exhibition remained open for 5½ months. The total number of exhibitors was 13,937, of whom 6,861 were contributed by Great Britain, 520 by the British Colonies, and the remaining 6,556 by foreign countries.

Others followed in New York and Dublin in 1853, Melbourne and Munich in 1854, and Paris in 1855, but the next great world's fair was held in London in 1862; still, none of the International Exhibitions between 1857 and 1873 had attracted as many as 7,000,000 visitors, probably because of the want of education amongst the masses and the lack of facilities for locomotion. The greater facilities, however, brought about by the extensions of railway systems in every part of the civilised world, together with an ever-growing population, considerably increased the attendances at subsequent shows, and at the Centennial Exhibition, held in Philadelphia in 1876, to celebrate the one-hundredth anniversary of American independence, the number of visitors totalled nearly 10 millions, of whom over 8 millions paid for admission. In Paris, too, in the year 1878, the number of paying visitors amounted to 13 millions; and in 1889, to the then unprecedented number of over 25 millions; but in 1900, 39 million persons paid for admission, and the Exhibition was largely visited by foreigners. A new plan of classifying exhibits was here adopted, all being displayed according to their nature and not according to their country of origin, as had been the system at previous Exhibitions. One half the space in each group was allotted to France, so that the exhibitors of that nation were enabled to overwhelm their rivals by the number and the magnitude of the objects displayed by them, there being no exclusively British and no exclusively German Court. The United Kingdom was well, but not largely, represented, both in Fine Arts and Manufactures, the administration of the section being in the hands of a Royal Commission, presided over by the Prince of Wales, now King Edward VII. For the first time since the war of 1870, Germany took part in a French International Exhibition, and showed the great industrial progress which had been made since the foundation of the Empire in the above-mentioned year.

France maintained her superiority in all the objects in which good taste was the first consideration, but the more utilitarian exhibits were remarkable for their number rather than their quality, except those connected with electrical work and display, automobiles, and ironwork. The number of exhibitors in the Industrial Section from the British Empire, including India and the Colonies, was 1,250.

There is no need further to labour the story of bygone exhibitions, so we will return to our muttons and express the hope that history will repeat itself, and that the Japan-British Exhibition will achieve as colossal a success under the honorary presidency of Prince Arthur, as did the International Exhibition of 1851 under the wise guidance and large-minded views of his illustrious grandfather.

The idea was Prince Albert's own, but he had to work for its realisation against an extraordinary outburst of angry expostulations. In these days of enlightenment it is difficult to believe that every stage of his project was combated; that in the Upper House, Lord Brougham denied the right of the Crown to hold the Exhibition in Hyde Park; and that in the House of Commons Colonel Sibthorp prophesied that England would be overrun with foreign rogues and revolutionists, who would filch our trade secrets from us, he being apparently oblivious of the fact that our own countrymen would have equal chances of learning—we will not say filching—the trade secrets of their Continental competitors. Every post brought the Prince, as President of the Exhibition Commission, abusive letters, accusing him, as a foreigner, of being intent on the corruption of England. But he was not the man to be influenced by threats or charges of this kind, and he quietly persevered, with the result we know so well, for he had a profound belief that the manufacturing power of Great Britain would be quickened and stimulated by the bringing together of foreign manufactures and products in addition to our own. It may be interesting to add that the surplus of £150,000, after all expenses had been paid, was spent on establishing and endowing the Museum at South Kensington and on the purchase of land in the neighbourhood.

The interest of His Majesty the King—the sanest monarch, as a *Westminster Gazette* correspondent happily expressed it the other day, who ever adorned a throne—in the forthcoming Exhibition is well known; the Prince of Wales for several years has been striving to wake up England, and now Prince Arthur has shown that he is a worthy worker in the same good cause, the cause, as the Lord Mayor aptly termed it, of calling the British manufacturer to arms, so as to increase our already great trade with a nation ready and willing to be our customers.

Will the British manufacturers accept this call to arms, and show that the belief of Prince Arthur that they realise the importance of the occasion, the belief which animated the Prince Consort in 1851, is justified, by coming forward with one accord as in the Great Exhibition of 58 years ago, and making the Japan-British Exhibition worthy of themselves and of the marvellous Eastern race with which we are to be associated in the arts of peace? Or will they allow our ever alert, industrious, and sober allies, whose preparations have been made on the most elaborate scale and are now in a very advanced state, outvie the old country even in those industries in which we have hitherto prided ourselves as standing pre-eminent?

We have not forgotten the Milan Exhibition of 1906, in which we were personally interested, and it may be well to repeat some of the strictures we made on the apathy of the British manufacturer towards that exhibition, indubitably one of the greatest of modern times. In a retrospect published in an issue of January 11th, 1907, we said:—

> It is somewhat the fashion to sneer at and disparage exhibitions among those who pose as the elect of the markets of the world, and who act as if there were no such contingency as the dissipation of business and its gradual extinction in the hands of those who take competition lying down. It is all very well, they say, for firms who are on the make to exhibit, and for nations who are struggling for share in the general trade of the earth to participate; we who have an established reputation among faithful clients, and who have more orders on our books than we can execute, have no necessity to show, and it is money in our pockets to keep away. Thereupon they do keep away, and with them many minor firms refrain from exhibiting who possess no such spacious excuse for absenting themselves, and Great Britain makes herself once more chiefly conspicuous by her absence.

But the lapse of three years has brought with it half depleted workshops with few fresh orders coming in to keep the machinery running, while dividends have become smaller and beautifully less; we have no longer, therefore, the excuse above mentioned to make us refrain from taking part in exhibitions, but every reason to once more assert ourselves in the way of other nations.

In our conversations with manufacturers at various times, one has said: "I know the Germans are keen and practical business people, they are serving many of the customers I used to serve, and they exhibit extensively, but it is useless pretending I hold with exhibitions, for I don't believe it pays to exhibit." Another will argue: "What is the use of exhibiting in a country protected up to the hilt, you haven't a chance of pushing your goods there if you do show, for the duties kill them. Yes! I know that Protection hits others besides us, and that our goods pay the same as those of our competitors; but I don't hold with trying to do business in Protectionist countries."

These were some of the reasons given for holding aloof from the Milan Exhibition, and it was a matter for considerable regret that our leading electrical firms should have abstained from exhibiting to the extent that they did, as it gave a wholly false impression of the position we occupy in the electrical industries in the world—all the more so considering the enormous demands which were being made for new industrial installations in Italy on all the electrical houses in that country as well as in Switzerland, Germany, and France in which our own makers should have participated. The same thing may be said in the case of manufacturers of railway stock and locomotives. Here the supply offering for several years to come from Italian sources was ridiculously short of the demand, and the Italian Government would have been influenced to a large extent in placing their orders with us had our leading houses exhibited, as they were repeatedly asked to do. As it was, they had to content themselves with limiting their custom in this country to a few second-hand locomotives purchased from the Midland and Metropolitan Railways for immediate delivery, while Belgian and German firms, who made expensive and beautiful displays of rolling stock, almost entirely monopolised the orders for future delivery.

Milan did not appeal to anything like the extent that it should have done to British manufacturers and traders, owing partly to a mistaken idea of its importance, partly to a misapprehension of the effect of the Italian Protectionist policy on the opportunities for trade in that country, partly to a disinclination to exhibit, largely engendered by self-sufficient complacency in our commercial position in the markets of the world—and partly to the lazy habit produced by over-prosperity in the past which prevents many from exerting themselves, even when face to face with loss of business, and makes them inclined to cry "Kismet" when it is actually gone.

It is abundantly clear that our somewhat halting participation had nothing whatever to justify it, and was a regrettable mistake from many points of view which it would not pay our manufacturers to repeat.

Now the Japan-British Exhibition stands on an entirely different footing, but what should we gain by exhibiting? What our reward? we can imagine the British manufacturer exclaiming.

That is difficult to answer in £ s. d., but even so long ago as the 1878 French Exhibition, it was stated at the time that, in addition to the impetus given to the trade of France, the revenue of the Republic and of the city of Paris from Customs and octroi duties was increased by nearly three millions sterling as compared with the previous year. And, as we remarked close upon three years ago :—

> No one can estimate the specific benefits conferred on the individual exhibitor or on the trade of the country to which he belonged through having participated at a great exhibition like Milan. Neither is it possible to estimate the benefits conferred on the country and the city where the exhibition is held. A balance-sheet of profit and loss would be almost as difficult to frame in the one case as in the other. But apart from individual profit, it is unquestionable that the fact of this show having taken place has led to the establishment of fresh and more extensive relations between manufacturers and consumers, not in Italy alone, but in several of the neighbouring States as well, and in others connected by close ties of relationship and interest with Italy. These relations have embraced more or less all those who have exhibited at Milan, and have certainly not left British exhibitors out in the cold.
>
> *Noblesse oblige* is a trite saying; yet its application to exhibitions among many other international matters is too often forgotten. The political standing of a nation in the comity of nations often compels it to take upon itself duties of a general character which are far from, or the reverse of, remunerative, and yet it dare not decline to do so, lest it should lose reputation, which is more valuable than money; indeed, the loss of which could not be measured in millions sterling. Even so there are certain classes of exhibits which nations in the foremost rank may not with impunity neglect to make; exhibits that under no conceivable circumstances can be made to yield any direct profit. These are in the fields of social economy, of public hygiene and of public education. The world at large expects a nation to show the best it produces in these fields of human energy; the foremost results and greatest achievements have to be placed at the disposal of, and demonstrated to, humanity at large on all suitable occasions. International exhibitions are among the most suitable of these occasions, and a nation which does not avail itself thereof loses caste, as it were, among other nations. We did not exactly lose caste at Milan in these respects, but we went perilously close to doing so.

It is useless to disguise the fact that English manufacturers have had serious misgivings as to the manner in which the exhibitions at the "White City" have been engineered; at the same time it must be confessed that the Anglo-French display of last year was in many ways a success. We are personally aware that for the forthcoming show the Exhibition authorities are leaving nothing undone to secure the best available chairmen, vice-chairmen, and members of committee for the various sections; gentlemen whose names will command the respect of Industrial England, and whose reputations are unsullied and beyond reproach.

Therefore we would urge that whatever circumstances may have arisen in the past to make exhibitors chary of participating in the world's fairs at Shepherd's Bush, all fears should now, like physic, be thrown to the dogs, and that we all combine to make English manufactures, English engineering, English art, science and literature, English everything, appear at its best, and show not only our Japanese friends and allies, but the whole world, that we can still hold our own against all comers.

Only last week we alluded to the fact that the British Government had not officially recognised the Exhibition although individual members of the Government were keenly interested in its success. Now that Parliamentary discussions seem to have completely lost their old-time dignity, now that both political parties are filling the air with "terminological inexactitudes" and "frigid calculated lies," and the Budget has changed old and tried friends into deadly foes, what a relief it would be if Mr. Balfour, with that charm of manner which Mr. Balfour alone possesses, would move in the House of Commons that the Government should officially take cognizance of the Japan-British Exhibition of 1910, and lend its support to the project. This would give that confidence to would-be British exhibitors which is now lacking and put the final touch, the official seal as it were, upon the genuine character of the Japan-British hyphen, which the Lord Mayor claimed as the happiest part of the title.

But even as it is, the refreshingly frank, boyish enthusiasm of Prince Arthur, the more matured experience of the Duke of Norfolk, whose interest in the domain of engineering and science we have long known, the co-operation of the City of London and of the leading City Guilds, combined with the support of the numerous influential commercial and technical gentlemen, some 200 or more, whose names appear in connection with the Exhibition, should make for complete success.

That there will be any want of enthusiasm on our part we are loth to believe, when we have the assurance of the Japanese Ambassador that the Emperor, his Government and the people of his country had been doing their best to make their exhibits worthy of the occasion; it rests, therefore, with ourselves whether or not we take advantage of the opportunity of a lifetime, and reap the benefit of an increased demand for British products, such as His Excellency foresees.

The Electrical Industry.

The opening of the new Session of the Institution of Electrical Engineers has let loose upon us a flood of retrospects, it being a deeply-rooted belief in many quarters that it is the duty of a chairman to devote his inaugural address to a review of the past history of the industry with which his hearers are connected. Useful lessons, can often be derived from such reviews, provided that they are not merely statistical compilations, but thoughtful and stimulating commentaries as well, for there is no better index to the future of an industry than a searching examination of its past.

Two of the inaugural addresses delivered in the provinces this year are of special interest. The first was read at Manchester by Mr. S. J. Watson, and besides giving an interesting table of statistics, showing the changes that have taken place in electricity supply during the last 15 years, embodies much useful information bearing upon commercial electricity supply. The second, on the other hand, by Mr. R. K. Morcom, who is not actually engaged in electrical engineering, but, as he aptly puts it, is direct-coupled to it, is a review of the manufacturing side of the industry, and presents the matter in a style so novel and illuminating that we have thought it well to reproduce the address in full. Mr. Morcom occupies a position which, while it brings him into close contact with electrical manufacturing, enables him to view the situation from an impartial standpoint, and his remarks are worthy of serious consideration.

It is satisfactory to note that Mr. Morcom regards British machines as "the finest in the world;" he goes on to say "at prices far below their true value," and we cordially endorse his opinion, which agrees with reports from other sources. He comments on the tendency of the large engineering factories to take up the manufacture of accessories, which he regards as a mistaken policy; in this he does not stand alone, and some instructive lessons might be derived from a comparative study of the results obtained by judicious specialisation, and by indiscriminate plunging into diversified manufacture.

"If all our works were full, the demands of our home and export trade would not be enough to take their output." Over-expansion, with the consequent increased severity of competition and lowered prices, has brought the industry into a depressed condition; but it has compelled reorganisation, and thus has resulted in increased efficiency, which should have its effect when conditions improve. The obvious need of our manufacturers is an increased export trade to take their output. We are doing all we can to stimulate their efforts in this direction, and we are assured that the opportunities are there, if they will only bestir themselves and take advantage of them. The protective tariffs of non-manufacturing countries are no greater bar to us than to our competitors, and our goods, once introduced, will bring repeat orders. Our export tables, unlike the data which Mr. Morcom quotes, indicate a steady and continuous rise in exports of electrical machinery, and we have full confidence in the future prosperity of the industry.

GAS POWER v. STEAM POWER FOR CENTRAL ELECTRIC GENERATING STATIONS.

By HORACE ALLEN.

When the London underground railways were electrified, in 1905, the power was supplied from a central station in Lot's Road, and necessarily the capacity required rendered the station one in which large units could be employed with advantage.

The electric generators were provided with steam-driven turbines of the double-flow impulse and reaction type.

Although it is only four years since this plant was installed, it is stated that, owing to the high consumption of steam, the original turbines are to be replaced by others of the standard Parsons type, which will, it is claimed, reduce the steam consumption by from 6 to 7 lb. per KW.-hour, thereby reducing the fuel cost by £30,000 per annum.

Seeing that economy in fuel consumption, by the employment of an improved class of turbine, is of sufficient importance to warrant the discarding of the original engines in such a short period as four years, it naturally occurs to engineers that the higher fuel economy of gas power would, in this special case, have promised such a further reduction in fuel cost as to render its application advisable.

If the new turbines, of the standard Parsons type, are capable of producing full-load current at a consumption of steam of 13·4 lb. per KW.-hour, the original machines must have been requiring about 20 lb., which, at an evaporation factor of 8 to 1, represents 2½ lb. of coal per KW.-hour.

Under the same conditions gas engines would have reduced the consumption by 1½ lb. of coal, and the saving would have been £55,000, as against £30,000 by the new turbines, or £25,000 more than will result from the replacing of the original turbines by more modern economical ones.

For an installation of 10,000-KW. capacity, with 1,450-KW. gas-driven units, the extra expenditure per B.H.P. has been estimated at about 31s. per B.H.P.[*] more than that of steam plant with turbines of high economy, and, with coal at 12s. per ton, the percentage of profit on the extra capital outlay is calculated to be over 35 per cent.

The higher cost of a gas power installation is due to the comparatively small units considered as available at the present time when compared with steam-driven units, and the resulting increased area of ground occupied by the gas engines and gas treatment plant. However, for such a large power installation it is probable that gas engines of about 4,000 H.P., which can now be obtained, would have been adopted, in which case the relative capital expenditure would not be so high as stated; as, for a 10,000-KW. plant, the extra cost of a gas-driven plant is considered to be only 19 per cent.

The relative coal consumptions taken as a basis are obviously those to be obtained under full load, without including accessories, but they are only employed to arrive at comparative economies; however, it has been estimated in a comparison between gas power and steam power, in the case of an installation of 10,000 KW. working under a 21 per cent. load factor, that with gas the cost of fuel was 21 per cent. of the total running costs, while for steam it was over 18 per cent.[*]

Taking into consideration the situation of the station on the banks of the Thames, where coal is expensive, and any variety could be obtained to suit the requirements of bituminous producers without increase in price, there should be no difficulty in regard to satisfactory generation of a suitable quality of gas; while the capacity of the station would allow of full advantage being taken of the economies due to the recovery of by-products and their market value.

In this connection, Mr. G. L. Addenbrooke[†] has said: "The economy of using the gas engine will, of course, be much greater in districts such as London and on the banks of the Thames, and in other similar places where much power is used, and where the price of coal is much higher than in the industrial districts near the coalfields."

Mr. Addenbrooke, while drawing attention to the greatest advantages of gas engines being obtained at or near full load, and proposing a combined gas and steam installation, owing to the latter being better able to deal with large variations in load, does not draw attention to the fact that gas engines, of even the largest sizes, are capable of being started from cold to full load in a fraction of the time possible by steam, while the standby costs are much lower.

It is therefore within the range of possibility that within another short lapse of years, a further change may be made at the Lot's Road station, and before the new turbines have fulfilled their allowance for depreciation.

---

[*] "The Use of Large Gas Engines for Generating Electric Power," by Leonard Andrews and Reginald Porter, Institution of Electrical Engineers, 1909.

[†] Royal Society of Arts, Cantor Lecture.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Oven.

I would be much obliged if any of your correspondents could tell me the name of the maker of a small oven for cooking sample biscuits. Such an oven does not require to be of large size, but it should be strong and capable of being washed without falling to pieces and without damage to its elements.

C. Turnbull.

Electricity Works, N. Shields,
November 8th, 1909.

A Question on Load Factor.

Very many thanks to "Return" for kindly answering my query on the above matter, but I am still uncertain how to arrive at a conclusion, as the battery is charged up only three times each week, being twice brought up to gasing point and the third time gased for one hour.

The battery is never out of service during the day's run, and it is always necessary to run one engine for a portion of each day, and the second engine occasionally.

Ratio.

The Coefficient of Self-Induction.

I have to thank Messrs. Cramp and Smith for recommending a few quotations from some of my letters "to the earnest consideration of practical engineers and designers." I hope they will do some good in this connection, but they were primarily intended for the serious consideration of writers of books on the "Theory of Alternating Currents."

It is possible that some of your readers may be ignorant of certain well-known electrical theorems. The quotations also being couched in scientific language, and, therefore, not being easily understood by those unfamiliar with the subject, some may be led to infer that Messrs. Cramp and Smith are demonstrating that your reviewer has been talking nonsense, or, at least, that he has been continually contradicting himself. Of course this is not their intention. I am well content with all their quotations with the exception of No. 5. In this case, doubtless owing to their anxiety to do me justice, they have amended what I wrote so as to give it a meaning which I never intended. May I be permitted, Sir, to expound a little more fully some of the scientific theorems which the authors very properly commend.

Before doing this, I should like to state that, in my opinion, an appeal to Reason is ever preferable to an appeal to Authority. I find that Thompson, Steinmetz, Kapp and Russell are arrayed against me by the authors. As I am thus challenged, I am forced to state that there is much that is crude, there is much that is badly expressed, there is much even that is illogical and wrong in some of the authorities quoted. But this does not make the notion that self-inductance can be represented by a complex variable less ludicrous.

Many designers of alternating-current apparatus, and your reviewer has the honour to number several amongst his personal friends, read through certain incantations from the treatises on which Messrs. Cramp and Smith rely before going through the preliminary cabalistic operations in connection with self-induction, which they think an essential part of their computations. Naturally, they have not much faith in the results, and check them from their own practical data. Their self-induction calculations are, in fact, a "botching piece of work," and they are grateful to anyone who will throw light on the subject.

Let us now consider quotation No. 7: "If the wire of a coil be infinitely thin, the inductance is infinitely great whatever may be the shape of the coil." Why is this quoted? Do Messrs. Cramp and Smith mean the reader to infer that it is wrong? Let me try and convince them. The self-inductance of two equal parallel wires is universally believed to be given by—

$$l\left(4\log_{\epsilon}\frac{d}{a}+1\right),$$

where l is the length of the wires, d the distance between their axes, and a the radius of either wire. This formula will be found in the standard text-books. Now let them put a equal to zero in the above formula; noticing that d/a becomes infinite in this case, and that the logarithm of an infinite number is itself infinite, they will see that the self-inductance is infinite. This is not an isolated case. Your reviewer is prepared to quote dozens of other formulæ to prove that self-inductance becomes infinite when the wire is infinitely thin, and that when the wire is thin, the self-inductance varies enormously with the diameter of the wire. In fact, he cannot see that it could possibly do anything else.

But this does not agree with the notions of the multitude? Then who is to blame? Who has blinded them? Who is telling them to shut their eyes lest they see the truth and so forsake the Temples and cease to bring tribute to the High Priests who minister therein?

No. 6. "The idea of equivalent sine waves was exploded some years ago." Your reviewer remembers pricking the bubble in your columns several years ago when criticising another book, but he may as well prick it again. The definition (Steinmetz) of equivalent sine waves only takes into account the effective values and the phase differences of the two waves. There is, therefore, an infinite number of pairs of waves which can be represented by the same two "equivalent" sine waves. They cannot, therefore, take into account the area and the maximum amplitude of the applied potential difference wave.

Now it is known that the magnetic flux in the core of a transformer varies as the area of the applied potential difference wave, and that the stress on the insulation of its windings varies as its maximum amplitude. The "equivalent" sine waves do not take into account the areas and the maximum heights of the original waves, and, therefore, they are very far from being equivalent to them.

But they are practically equivalent? No, they are not. Prof. Roessler proved experimentally, 14 or 15 years ago, that the magnetising current, the core losses, the magnetic leakage, the voltage drop and many other characteristics of a transformer varied very appreciably with the area of the applied wave, although the effective value of the applied potential difference was maintained constant. Messrs. Taylor, Beeton and Barr proved this also in their Institution paper read in 1896. It is necessary to dwell on these points, otherwise practical men will lose faith in theory if hasty and ill-considered artifices are forced on them which are incapable of explaining the observed facts.

Why do the authors quote the statement that the flux is a "double valued function of the current," and write (*sic*) after it? Is it gibberish to them, or do they mean to deny it? The flux varies with the current, and for a given value of the current it has in general two determinate values, one when the current is increasing, and one when it is diminishing. This is obvious from an inspection of Ewing's hysteresis loop. The function is, therefore, double valued—a phrase which will be found in advanced physical and mathematical treatises.

Although I regret that Messrs. Cramp and Smith do not intend to continue this correspondence, yet I hope that they, or some of your readers, will be tempted to discuss the subject further. In my opinion, the self-induction theory of circuits with iron in them is dead, and little, if anything, is to be gained by trying to galvanise it into life. Recent attempts in this direction have only led to a hopeless jumble of definitions of "inductance," "self-inductance" and "coefficient of self-induction," none of which are scientifically accurate.

Your Reviewer.

L.C.C. Motor-Generator Contract.

With reference to your leader in to-day's issue, "Common-sense Contracting," *re* the order for the 500-KW. motor-generator, which has just been placed by the L.C.C., we think that it should be stated, in justice to the unsuccessful tenderers, that this specification, which was advertised in the ordinary way as a specification for a 500-KW. motor-generator, specified the exact sizes to which everything had to be made, the windings, the details of the insulation, and, in fact, the whole of the particulars of the machines. In our case, and no doubt in the case of other tenders also, these dimensions did not fit in at all with our standard sizes, and hence we quoted for our standard machines, which we guaranteed to be satisfactory in operation.

We think that the L.C.C., when calling for tenders for a particular class of machine, with all the dimensions specified (presumably to be interchangeable with machines they already have), should state this in the advertisement, so that firms who were not willing to make special machines for them would not apply for the specification.

The Lancashire Dynamo and Motor Co., Ltd.,
A. P. Wood, *General Manager and Director.*

Manchester, *November 5th*, 1909.

Voltage for Country House Installations.

I think "H. C. P." is making a mistake in advocating high voltages for country house lighting. We have followed the false scent of high voltages all too long; it very soon got us into difficulties with our arc lighting. We could not burn arcs singly without a wasteful resistance. Manufacturers of heating and cooking apparatus prefer 100 volts to anything higher. Fire insurance companies cordially dislike high voltage, and have commenced to make war on it; and now it has left us floundering in a slough of despond because we cannot make satisfactory use of the metallic lamps, which would have done so much to help us to success.

The difficulties connected with low-voltage lighting are not anything like so great as those which have been overcome with high voltage. There is a plating workshop in London which is lit by current from the electro-plating dynamo at 4 or 6 volts. Our offices and showroom are lit at 10 volts, our workshops at 16 volts, and our small lighting sets on test are made to drive the machinery in the shop by means of a 16-volt motor. We have a private house lit at 12 volts, and the bells, telephones, fans, &c., are run from the same supply as the lamps and at the same voltage.

Two of our 25-volt installations are houses changed from 100 volts—in these two instances we did expect some difficulties, as we had to deal with long mains—and we had water boilers to provide in two cases, and an arc lamp for a magic lantern. One of these installations has 200 lamps, and it is proposed to add 60 more—and from the success we have had I would not alter the voltage if 600 more were added.

To obtain satisfactory results, all that is required is plenty of copper in our conductors and good connections in our switches, fuses, &c. We provide 14 cells only in the battery room, and one cell in the house with a special switch, which gives 26, 28 and 30 volts.

I am advising this extra low voltage lighting for villages, garden cities and small towns, going as low as 8 volts, 6 volts, and even to 4 volts for very small houses. There is nothing very wonderful about this when it is remembered that lamps of 8 C.P. can be had at 4 volts, 12 C.P. at 6 volts, and 16 C.P. at 8 volts, and I do not expect to find any difficulties to surmount so great as the opposition of electrical engineers who are not used to the idea of low voltages.

"H. C. P." fails to see any reasons for recommending 25-volt lamps. I can assure him there are some. They are cheaper, more economical, less fragile, more durable, smaller, more suitable for standards and brackets than the 100-volt ones; they are preferred by rich men who like brackets and candelabra with a number of small lights, and by poor men, who do not care to pay for 16 C.P. for their stairs, landings, passages, lavatories, bath rooms, &c., where 5 C.P. is sufficient for all their requirements.

If electric lighting is to become universal, it must provide a man with the light he wants, not with what some of us imagine he ought to have.

J. Jackson.

London, N.W., *November 8th*, 1909.

British Magnetos.

We have noted some correspondence in your columns with reference to the absence of an efficient British made magneto, and should like to add a few remarks on the subject.

Your first correspondent cannot have been aware of the exceedingly keen competition now going on between ourselves and the manufacturers of various foreign magnetos. We may say that at the present moment we are employing 350-400 men solely upon the manufacture of Simms British magnetos and sparking plugs, and we have a weekly minimum output of 300 magnetos. A number of the largest English motor and motor-car manufacturers have, after very exhaustive tests of our machines, decided to adopt them for the coming season as a standard.

We may also add that not only has the Simms British magneto become a recognised fact in this country, but we have also opened our own branches in New York and Paris, and have agents in Canada, South America, Australia, New Zealand, Belgium, Holland, Italy, Switzerland, &c., and have secured contracts with several large Continental and American firms for the next season's cars.

In order to assist the British magneto industry, prospective car purchasers should specify that a British magneto be fitted to their new cars, and to prove our capacity for turning out not only a British magneto but a first-class machine, our works are open to inspection.

The Simms Magneto Co., Ltd.
T. Savage,
Assistant Manager.

London, N.W., *November 3rd*, 1909.

The Electrical Vehicle in the States.—At a meeting of the Electric Vehicle and Central Station Association, held at Boston, U.S.A., on October 13th, President Stone briefly referred to the progress of the electrical vehicle in Boston within the past 21 months. He said it was estimated that there had been an annual increase of 231,000 units for commercial vehicle service and 95,000 units for pleasure vehicle use; this at 4 cents for commercial and 7 cents for pleasure purposes represented $15,876 additional revenue per year. In all New England the year's increase in revenue on vehicle account amounted to $28,000. Boston had now six electric garage and 88 charging stations. In emphasising the value of this business to the central stations, Mr. Stone showed that the energy consumption of a light commercial vehicle over a year was equal to seven 550-watt arcs (burning four hours per day), 320 50-watt incandescents (burning one hour), and 61 500-watt flat-irons (working 156 hours per year). A heavy commercial car on the same basis was equivalent to 18 arcs, 800 incandescents and 153 flat-irons. A paper dealing with the New York Edison Co.'s vehicle service was read, from which it appears that 65 cars are in service, equipped generally with 40 to 44 Exide cells, and used by the officials also as lamp wagons, emergency cars, for general delivery purposes, and for hauling arc lamps, signs, cable, &c. Among other particulars given, it was mentioned that 23 general delivery wagons, each of one ton capacity, run 35 miles on one charge, the positive plates having a life of 390 days and 8,635 miles, and the negatives 670 days and 11,814 miles. Five five-ton cable trucks, running 15 miles a day on one charge, are equipped with 48 cells each, the positive plates having a life of 395 days on 3,733 miles, and the negative of 461 days on 9,630 miles running. The tire life on the older cars amounted to 10,000 miles; the company assembles its own batteries, a hydraulic lift enabling them to be changed in 12 minutes.

TESTS OF THE FREUND BRAKES.

An interesting demonstration of tramcar brakes which have been designed by Mr. Edwin Freund took place on Thursday last week, at Liversedge, before the members of the Yorkshire Tramway Managers' Association. There was a representative attendance, only three members being absent. After luncheon at the Railway Hotel, Dewsbury, a special car conveyed the members to the Frost Hill depôt of the Yorkshire (W.D.) Tramways, Liversedge, where two cars had been fitted up for the purposes of the demonstration.

The first car taken out was No. 47, a car of the ordinary type which had been fitted with the self-winding spring brake, described in our issue of September 11th, 1908. A section of the car floor had been taken up, and the whole of the mechanical part of the brake was exposed to view. The first test consisted of an exhibition of the brake in descending Frost Hill from the depôt. The rails were in a very greasy state, and it was doubtful whether the wooden shoes with which the car was fitted would be more satisfactory on the track than iron shoes. However, the spring brake performed its duty easily and efficiently on the descent, which was accomplished at a speed of about 10 miles per hour, and the winding of the spring was done with perfect regularity. The brake is a substantial piece of mechanism in which the springs are wound by the momentum of the car; when fully wound the winding pawl or catch is automatically disengaged. A feature of the brake is that even though the winding may only just have been commenced when the car is started, the brake may be put into immediate use. The ascent of Huddersfield Road was commenced at a moderate speed, and when the car reached the steepest gradient—about one in nine—current was switched off, and the car was held by the brake, there being not the slightest suggestion of the car running back. In test No. 3 the car was taken to the top of the hill. Starting from rest, it descended the top part of the hill, which is about 1 in 12, and immediately it entered upon the second part, which is about 1 in 14, at a speed of 18 miles per hour, the track brake was put on, and the car stopped in 32 yd., neither sand nor wheel brake being used. In the next test the car started from rest and was allowed to attain a speed of 22 miles, when both brakes were applied, the car pulling up in the short space of 14 yd. It was pointed out by Mr. Goldston, the engineer who was superintending the demonstration, that the brake could be applied at any strength desired, the mere pulling of a hand lever bringing the brake into service. A very interesting feature was illustrated in the next test, when the car, which was travelling at about 16 miles per hour, was brought to a stop by the application of the brake from the back platform. The application of the self-winding spring brake from the front or the back is one in which each application is of service to the other; but in many of the ordinary tramcar brakes at present in use the application of the brake from one platform neutralises that from the other platform. This is looked upon as a decided improvement, and the ease with which the car was pulled up was apparent. One of the members desiring to see the effect of the brake on an unsanded portion of the track, the car was taken to the steepest gradient previously mentioned, and, having reached a speed of 12 miles, the brake was applied. The speed, of course, was not very high, but the brake pulled up the car in a very short distance (not measured) in a most satisfactory manner.

The second part of the demonstration took place upon car No. 7. The brake fitted to this car was a magnetic brake fitted with a mechanical attachment for putting it on by hand—really an ordinary mechanical track brake which could be used with a variable drag action so as to increase the power. Mr. Freund, who is the designer of this brake also, has styled it the Tumbler brake (self-tightening). The principle, briefly, is that a depression plate is fitted with cup-shaped housings for the shoulders of the tumbler, the latter resting on spherical pivots on the top of the brake shoes. Immediately the lever on the platform is pulled the tumbler tilts, allowing the shoe to drag. Another touch of the lever releases the brake. The shoes fitted to this brake provide for a certain amount of side play, and it is, therefore, claimed that the brake block finds its best possible "hold." The brake fitted to car No. 7 had been regulated to give four "notches" of drag—that is, four different degrees of the drag action—and in the first test the brake was applied notch by notch, so as to show the effect of the various amounts of drag. This test was watched with considerable interest, and the easy manner in which the brake was manipulated, and the faultless way in which notch succeeded notch without any appreciable jerk, were highly praised. In the next test, the speed was not much higher, but the brake was used as an emergency brake and the drag action went right over. It should be mentioned that this car was fitted with new iron shoes, and the opinion was expressed that quicker and better stops would doubtless be obtained if wooden shoes were used. In consequence of this, a wooden shoe was inserted—the process only taking about two minutes—and travelling at about the same speed, with one iron shoe and one wooden one, a quicker stop was obtained; the effect was a gentle and gradual pull up, and was not at all "uneasy." The general utility of the brake was admirably shown in a coast down the hill, and the smooth manipulation of it, coupled with its simplicity and the ease with which it was released, appeared to make a favourable impression upon the managers present. Mr. Goldston explained that, in adopting the "tumbler brake," the driver had, in reality, a double brake. The drag action was intended for coasting purposes, as well as for use as an emergency brake, and the mechanical action could take place before or after the magnetic. It had often been shown that the magnetic brake was apt to fail unexpectedly, and this difficulty was entirely overcome by using the "tumbler," inasmuch as the driver could apply the magnetic brake by hand, and he could intensify the mechanical effect by means of the drag.

Those tests in which the speeds were not indicated were taken at a speed of from 16 to 23 miles per hour, and the gradients on the portion of track where the majority of the trials took place were 1 in 12, 1 in 14, and down to 1 in 17.

Mr. Goldston appeared to be very well pleased with the excellent manner in which the brakes had worked under the circumstances, and was highly satisfied with the demonstration. In the course of a short chat with our local representative, he said he particularly wished it to be understood that car No. 7 had not been fitted up for the purpose of exhibiting quick stoppages. It had been fitted up simply and solely to show what the "Tumbler" brake could and would do. He was particularly well pleased with the "Tumbler" brake, and said that there were three advantages which appealed to him very much. The first was that the brake was an ordinary mechanical track brake, with equal power to those which they had on their cars and to those in general use all over the country. Secondly, the apparatus gave them the drag action, viz., the extra weight of the car on the blocks. Thirdly, the brake could be applied as an ordinary magnetic brake.

The managers who witnessed the demonstration also appeared to be favourably impressed. Several complimentary references were made to the brakes, especially with regard to the "Tumbler," and coming as they did from managers who, for the most part, are engaged in the West Riding of Yorkshire, where hills are the rule rather than the exception, they should prove of value to other tramway managers in the country. During the demonstration there was practically no criticism of an adverse character, and the general opinion appeared to be that the brake was sound in principle, and one which could be relied upon.

The managers were afterwards entertained at tea by the managing director of the company, and in the evening a private discussion took place upon the demonstration, and upon other tramway matters.

ELECTRIC LIGHT INSTALLATION ON THE STANNOS WIRING SYSTEM.

On Saturday last the students attending Mr. E. Kilburn Scott's lectures on Electrical Engineering Quantities and Estimates at the Northampton Institute visited the new factory and laboratory of Messrs. J. Fletcher-Fletcher & Co., Seven Sisters Road, to see the electric light installation and lift, &c. Mr. Rawlings, who had carried out the electric installation, was present to describe the details of the work and explain the many advantages of the Stannos wiring, which he has used. The installation is unique in that it illustrates the OS system of wiring for:—

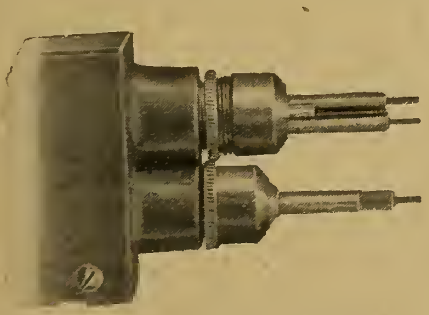


Fig. 1.—Box Fitted with Two Adapters, Taking One and Three Stannos Wires Respectively.

1. A two-wire system.
2. A surface concentric system.
3. A water-tight concentric system with Kalkos fittings.
4. A combination of 2 and 3 in buried work.

Stannos wire is insulated with pure and vulcanised rubber, taped, and then wrapped round twice with a closely compressed sheet of tinned copper. On an earthed concentric system the outer copper carries the return current, and it has only about one-third of the resistance of No. 18 S.W.G. wire.

The supply for the lighting is taken from the Islington Corporation at 100 volts (or 200 if desired) alternating, single-phase, 50 cycles.

The mains, consisting of twin-armoured cable, pass from the Corporation fuses through an ironclad D.P. switch and fuse to the first floor, terminating at a Foster double-wound transformer giving 100 volts on the lamp side and 100 or 200 volts as desired on the supply side. The object of using a separately wound transformer is to isolate the installation so as to enable an earth return system to be used, besides affording facilities to alter the voltage. In conjunction with the transformer there is a Burston automatic switch to disconnect the primary circuit when no lamps are in use. Distribution from this point is made from a four-way board, one pole of which is connected to a bus-bar, forming the return of an earthed concentric system. From this point single cables drawn into Kalkos tubes are carried to four distributing boards, the tubes being connected to the earthed bus-bar. From the fuseboards, the OS system of wiring has been employed, using Stannos wire and fittings, together with the special continuity fixtures provided for concentric work. On the top floor, and a portion of the ground floor, the system has been made water-tight by soldering the Stannos wires into Kalkos boxes.

Fig. 2.—Grip for Stannos Wires.

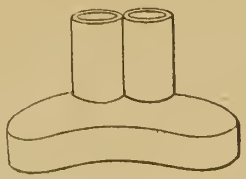


Fig. 3.—S K 2 Adapter.

In addition to the before-mentioned "earthed" system two pilot lights have been installed on the ground floor, two Stannos wires being used in the ordinary way without the intervention of the transformer.

The number of points installed is 180, with 121 switches, and the following material has been used:—1,800 yards Stannos single 1/18 and 3/20; 50 yards main cables; 2,500 OS clips; 300 continuity fixtures; fittings for Kalkos boxes and Kalkos tubes, &c.

In addition to the lighting, there is a system of electric fire and burglar alarms worked from the 100-volt accumulators, which are used for the lift control. The wires leading from the accumulators run through fuses to the whole of the bells, terminating at a relay. This portion of the wiring is carried out with Stannos wire, the wiring between the relay and the whole of the fire and burglar alarm points being carried out with ordinary high-class bell wire.

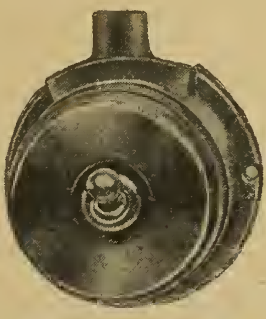


Fig. 4.—Kalkos Box and Switch, with S K 2 Adapter.

The bells which are used for timing (rung three times daily), together with the relay, batteries, &c., are the same as are used for the burglar and fire alarm system, thus ensuring their maintenance in good working condition.

The electric lift has been supplied by Messrs. Childs & Co., and is of special interest because, although the motor is single-phase, the control gear is worked by direct current from a Hart battery. In order to charge this battery an aluminium rectifier is employed. The push button for stopping has two contacts, the first putting the brake on through a resistance and the second putting it on direct. In this way the lift is brought to rest without any jerk.

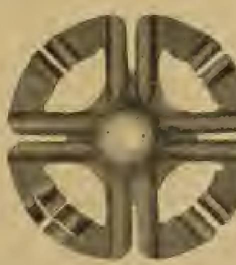


Fig. 5.—S E 2 Side Entry Continuity Fixture.

As various improvements have been made in the OS wiring system since we first described it, the following particulars will probably be of interest to our readers. The ideal before the manufacturers (Messrs. Siemens Bros. & Co., Ltd.) has been to provide a system of wiring which shall be inexpensive, but efficient and durable, unobtrusive when used for surface wiring, but suitable also for concealed wiring, and possessing an electrically continuous earthed sheathing, which can be used also as the return conductor of a concentric system.

The Stannos wires can now be had insulated not only with vulcanised rubber, but also with a special dielectric called "Unvul," which contains no sulphur; they are subjected to a test of 1,000 volts pressure, and both classes can be supplied with aluminium taping under the sheathing, a type especially recommended for concentric wiring. It is interesting to note that the current-carrying capacity of the Stannos wires on the concentric system is greater than on the ordinary two-wire system, owing to the small pressure drop in the sheathing; thus a 3/20 wire carrying 6·4 amperes has a drop of 11·3 volts per 100 yards on the two-wire system, but only 7·7 volts on the concentric system, while, of course, the latter costs little more than half as much as the former system. The importance of these points, especially in connection with low-voltage metallic-filament lamp installations fed from transformers, is obvious.

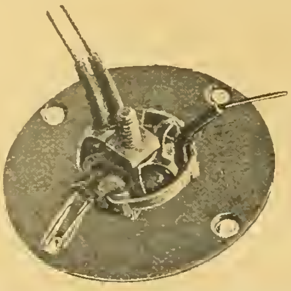


Fig. 6.—Continuity Fixture for Back Entry of Wires.

A variety of new accessories has been evolved for use with the O S system. Fig. 1, p. 767, shows two new adapters employed when Stannos wires are run into steel junction or fuse boxes; they are of brass, and are provided with metal grips such as that shown in fig. 2, which is so constructed as to prevent rotation of the wires. Fig. 3 shows the S K 2 adapter for running Stannos wires into Kalkos boxes, the joints being soldered water-tight, and fig. 4 shows a Kalkos box and switch fitted with one of these adapters. Continuity fixtures are illustrated in figs. 5 and 6, the former for side entry and the latter for back entry; in each case a back plate is used, with a screwed stud for the attachment of the earthing clamp. Special screw-clamps are provided for the concentric system. Fig. 7 shows a frog clamp for flush work, where the Stannos wires are sunk into the plaster, and it is desired to have the wood block for the switch flush with the surface; a temporary cap is placed over the wires after they have been fixed as shown, to preserve them from damage while the plastering is completed. A continuity bus-bar for a fuseboard is illustrated in fig. 8; such bus-bars are made in various sizes. Lastly, fig. 9 shows a water-tight T joint-box for concentric work, with the component parts displayed and the jointed wires in position; these boxes are used where the ordinary continuity fixtures with steel covers would be too large or unsightly, and where it is desired to have the whole system water-tight. The wires are jointed with the aid of small channels of soft metal, which are soldered together and to the wires: the joint, with two porcelain linings, is then laid in the soft-metal base, and the cover is soldered to the latter and to the outer sheathing of the wires. A hole is left in the cover to permit the air to escape when heated in the act of soldering, and is afterwards filled up with a screw, as shown.

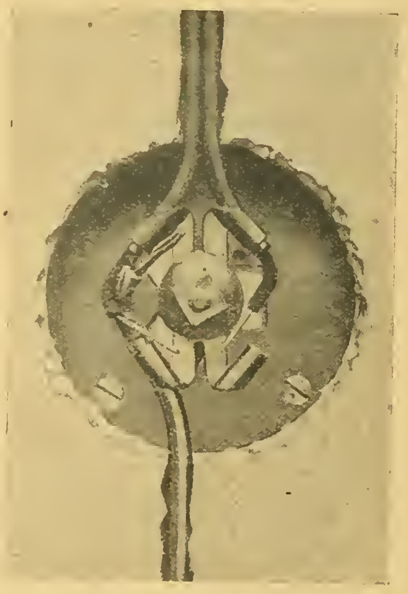


Fig. 7.—Frog Clamp for Flush Work, Wires shown sunk in Plaster.

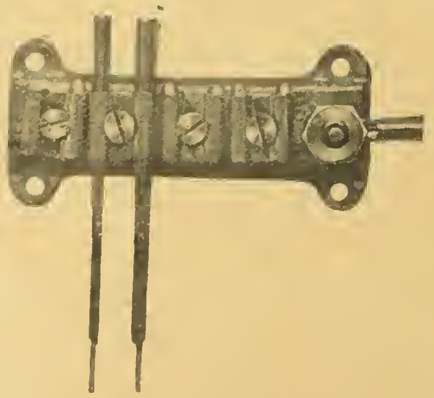


Fig. 8.—Continuity Bus-bar (Type B.B.B.) with 1/18 and 3/20 Stannos Wires.

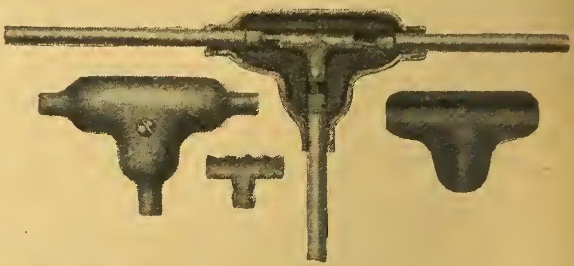


Fig. 9.—T Joint Box for Concentric Work, showing Parts and Method of Jointing Single Wire Circuit.

Full particulars of these and other details, special tools, &c., are given in a recent catalogue (No. 517, Section I) issued by Messrs. Siemens Bros., which also contains instructions for the erection of the "Metacase" (Kuhlos and Stannos) conductors.

LEGAL.

Alleged False Trade Description.

The Proceedings Against the Welsbach Co.

(*Continued from page* 736.)

At Clerkenwell Police Court on Saturday, Mr. Bros heard further evidence on the adjourned summonses against the Welsbach Incandescent Gas Light Co., Ltd.

James Fletcher Young, manager of the electric light department of the General Electric Co., Ltd., said his firm acted as agents in this country for the Auer Gesellschaft Co., of Berlin. The first metal-filament lamps they had to deal with were the osmium lamps which were sent to them by the Auer Co. The metal-filament of these lamps was made of osmium. Then they had lamps the filament of which was made of tungsten or wolfram. Afterwards they imported the Osram lamps from the Auer Co. They first began to receive these at the end of 1906. Some of these still came from Germany, although some were manufactured in this country in a factory, which was erected after the passing of the new Patents Act. The General Electric Co. was the only firm selling Osram lamps in this country, and their sale had assumed very large proportions. When the Osram lamps were first introduced, they bore the name of the Auer Gesellschaft Co. The osmium lamp was invented by Baron von Welsbach, and as far as he knew no other metal-filament lamp was invented by him.

A copy of an advertisement of the defendants' lamps was placed in the witness's hands, and Mr. Rufus Isaacs asked him what effect it would have on his mind. Witness: I should consider that the lamps offered were the invention of Baron von Welsbach, or the output of the Auer Co.

Mr. Isaacs: Do you know of any electric lamp invented by Baron von Welsbach sold with the trade mark "Aur" upon it?—No.

What would be the effect of stamping these lamps with the words "Aur" and "Welsbach"?—It would lead people to believe that they were the product of the Auer Co., or, as it is sometimes known in this country, the German Welsbach Co.

So far as you know, had Baron von Welsbach, or the Auer Co., anything to do with that lamp?—No. Nothing whatever.

Mr. Walter: You know there are three Welsbach companies in Europe, the German, the Austrian and the English?—I believe so.

Are you aware that 98 per cent. of the shares of the Austrian company are the property of the English company?—No.

Are you aware that the policy of the Welsbach companies has been not to use the words "Welsbach" and "Aur" in the territories of the others?—No.

Are you aware that the trade marks "Auroslamp" and "Auerosmi" were applied for by the German company for their lamp?—No.

Are you aware that the Austrian company, at the instigation of the English company, objected to that registration?—No. I am not aware of it.

In reply to further questions, Witness said he believed the German company undertook for a certain period not to use the word "Auer" in connection with incandescent gas mantles, but he believed that period had now expired. The registered trade mark of the German company for incandescent gas mantles was "Dagea." The word "Auergesellschaft" had formed part of the name of the German company as long as he had known it, which was two and a half years.

Mr. Walter: During the last two and a half years has a single advertisement been issued by your company in which the word "Auergesellschaft" appears?—Not by our company.

With the exception of the one circular in evidence, have your company ever advertised the word "Auer" in connection with the lamps?—No.

Baron von Welsbach has nothing to do either as manufacturer or inventor with the Osram lamp?—Not as far as I know.

A certified copy of the Patents Register was handed to the witness, and he said he saw by that that since January, 1899, the defendant company had had the trade mark "Aur" registered for goods in class 13. He was not aware that the trade mark "Aur" had been used upon all the goods sold by the Welsbach Co. for many years.

Mr. Walter: Are you aware that the word "Aur" upon goods in this country commonly means that they are the goods of the Welsbach Co?—I am not prepared to deny it.

Is the word "Welsbach" largely used upon the merchandise of the Welsbach Co.?—I do not know.

Are you prepared to deny that the word "Welsbach" upon goods in this country commonly means the merchandise of the Welsbach Co.?—On electric goods I should deny it.

Witness said the osmium lamps were not capable of being made for use on high voltage circuits, and they were not so successful commercially as the Osram lamps.

Mr. Walter: Has the word "Welsbach" ever been used in an advertisement in connection with the Osram lamp?—Yes. In reprints from the *Standard* and *Daily Telegraph*.

Mr. Walter read extracts from these reprints, in which it was stated that Dr. Auer, of Welsbach, who invented the first incandescent gas mantle, also invented the first metal-filament lamp. He asked the witness if the word "Auer" had appeared in any of his advertisements of Osram lamps. Witness: No, not in trade advertisements.

Re-examined by Mr. Rufus Isaacs, Witness said there was a reference to the Auergesellschaft Co. on the printed wrapper in which the osmium lamps were sold.

The case was adjourned until November 20th.

WOOLF *v.* LONDON UNITED TRAMWAYS CO.

In the King's Bench Division on Monday and Tuesday, November 8th and 9th, before Mr. Justice Bucknill and a common jury, an action was tried in which Mrs. Nina Woolf, a dressmaker, of Stoke Newington, sued the London United Tramways, Ltd., for damage for personal injuries alleged to have been sustained in consequence of the defendant company's negligence in failing to keep the roadway along which the line runs in a fit and proper and safe condition for vehicular traffic.

Mr. Ralph Bankes was counsel for the plaintiff, and Mr. Roskill, K.C., and Mr. Glasgow appeared for the defendant company.

It appeared that defendant was one of a party who on Whit-Monday of last year were proceeding by a four-horse brake from Stoke Newington to Hurst Park to witness the races, when, opposite Christchnrch schools in the High Road, Chiswick, the brake collapsed, and its occupants were thrown out into the road, plaintiff being somewhat seriously injured. She alleged that the accident was due to the wheel of the brake dropping into a hole in the roadway and thus being wrenched off; and the defence was that, on the contrary, it was caused by the rotten condition of the vehicle itself. Evidence on either side was called, and his Lordship, in summing up, instructed the jury that the onus of proof rested upon the plaintiff. Parliament had laid upon the tram company the obligation to keep the highway in a fit and proper state to enable it to be used by the public with safety, and she had to prove that they had failed to fulfil this obligation and that it was in consequence of such negligence that the accident occurred. Of course, as men of the world, the jury would say the company were not bound to keep the road as level as a billiard table; and they must be satisfied that at the particular spot where the accident occurred, the state of the tramway was dangerous for the public passing over. If they thonght the brake was in a rotten condition, it would be a matter for their grave consideration and judgment whether there was a hole in the roadway into which if the wheel dropped it would have broken it off, even if it was sound.

The jury found a verdict for the defendant company; and, upon his Lordship's suggestion, approved by the jury, they did not ask for costs; and judgment was entered for them without costs.

BRISTOL GAS CO. *v.* THE BRISTOL TRAMWAY AND CARRIAGE CO., LTD.

In the Court of Appeal on Tuesday, Lord Justice Buckley, Lord Justice Kennedy, and Mr. Justice Swinfen Eady had before them the case of the Bristol Gas Co. *v.* the Bristol Tramway and Carriage Co., Ltd., which was an appeal by the defendants from a decision of Mr. Justice Phillimore, affirming the award of the arbitrator, Mr. Allen C. Edwards, appointed under the Tramways Act, 1870, to settle a dispute which had arisen between the Bristol Gas Co., and the Bristol Tramway Co., Ltd., in regard to Sec. 32 of the Act. That section provides that the construction of a tramway shall not interfere with the rights of local and road authorities or gas, water or electric light companies to deal with the roads for the purpose of repairing, laying down or removing mains, pipes, &c., giving notice of their intention to do so when the contemplated work will interfere with the traffic or affect the tramway, and sub-Sec. 5 provides that any extra expense in doing such work caused by the existence of the tramway shall be borne by the tramway company. In the present case the gas company alleged that by reason of the tramlines having been laid over the gas mains, the company had incurred additional expense in obtaining access to and altering their service pipes; such additional expense for the period between February 16th, 1905, and December 26th, 1906, amounting to £115 8s. The tramway company having refused to pay this demand, the gas company applied to the Board of Trade under Sec. 33 to appoint an arbitrator. Mr. Edwards was selected, and he undertook the reference without prejudice to the contention of the tramway company that no such "difference" had arisen as was contemplated by Sec. 33. Detailed particulars of the claim were furnished, and for the purpose of his award the arbitrator divided them into three classes. (1) Laying down a new service pipe and connecting it for the first time since the construction of the tramway with a main laid before the construction, amounting altogether to £63 19s. 8d. (2) Repairing, altering or removing a service pipe laid since the construction of the tramway; the main having been laid before such construction, £14 1s. 8d. (3) Repairing, altering or removing a service pipe or main laid before the tramway was constructed, £37 16s. 8d. The arbitrator held that with regard to the first class, the gas company was not entitled to the extra expense of laying the new service, but to one-third of the amount claimed; this being the agreed proportion of the total applicable to connecting with the old main as distinguished from laying the new pipe. He therefore awarded them £21 6s. 6d. With regard to the second class, he held that the gas company were not entitled to the amount claimed. As to the third class, the gas company were entitled to the £37 16s. 8d., and he directed the tramway company to pay the costs of the arbitration. It was contended by the gas company that they were entitled to the whole amount claimed. On behalf of the tramway company, it was contended that the only work for which expenditure could be claimed, was that which caused an interruption of the tramway traffic, and that the arbitrator was wrong in holding that any trifling delay shown to have taken place was such an interruption of traffic, as was contemplated by the section, and that no such claim by the gas company for additional expense was founded. Mr. Justice Phillimore confirmed the arbitrator's award and dismissed the appeal, but without costs. Hence the present appeal of the tramway company.

Mr. Balfour Browne, K.C., Mr. Simon, K.C., and Mr. Murphy, appeared for the tramway company; and Sir A. Cripps, K.C., Mr. Bethune, and Mr. Weatherley for the gas company.

Mr. Balfour Browne, for the tramway company, said the question raised was as to the proper construction of Sec. 32 of the Act of 1870. Before that Act was passed, various private Acts had been passed allowing water companies, gas companies, and electric light companies to use the streets or roads for the purpose of laying down their pipes or mains to supply gas, water or electricity to the public, and it was necessary when the Tramways Act was passed to see that the tramway companies did nothing to take away the rights which had been conceded by Parliament to those various bodies. Sec. 32 of the Act of 1870 dealt with the relations between those various bodies and the tramway companies. The important words upon which he relied were "such works whereby the traffic on the tramway will be interrupted." The contemplation of the Legislature was that, if the work to be done was really serious work, interrupting the passage of the cars along the tramlines, the tramway companies were to be responsible for the expense of the work. He submitted that the expenses which had been put upon the tramway company in the present case were not incurred in respect of work which interrupted the traffic on the tramway, and therefore, having regard to the construction of Sec. 32, the tramway company could not be held liable for the expense. The Legislature said, "Here are two public bodies in the road, both doing public service. If the work to be done on the road is a small matter which might have occurred whether the tramways were there or not, the gas company shall pay it. If it is a big matter which interrupts the tramways, the tramway company shall pay it." The learned counsel, proceeding, said there was no need to give the tramway company notice if the work to be done did not affect their traffic. It would only be a wasting of the time of the tramway engineer to give the tramway company notice of such matters as were set out in the gas companies' claim. If in the old days of horse-drawn cars the gas company had dug a trench between the two rails the traffic would have been stopped, because the horses could not then run over that part of the road, but nowadays with overhead traction a hole between the rails did not matter, because the cars could run over that, and there would be no interruption of traffic.

Mr Simon, K.C., who followed on the same side, said the point was of great practical importance, because the claims made here were for very small amounts and were numerous. He submitted that what was referred to in the proviso of Sub-sec. 5 of Clause 32 of the Act was a class of expenses which was limited in several ways. The pulling up of a gutter would not affect the tramways at all. The scheme of the section was that the gas water and other companies might go on doing their work on the road as before the Act was passed, but in so far as the work they wanted to do was work which would interrupt the tramway traffic they must give notice, and in so far as the work which interrupted the tramways was work which would immediately affect its stability, it had not only to be done under notice, but it had been done under superintendence. It seemed a very strange thing if the

Legislature really meant that a tramway company, which was doing useful public work, had to pay all those 2½d. charges which extended back to 1903. There were over 200 cases.

Mr. Cripps, K.C., for the gas company, said that it had been found by the arbitrator that every subject matter of the claim was in respect of works of which a proper notice had been given. He could not agree that "interruption" necessarily meant total stoppage. "Interruption" was rather a question of fact than of law. He submitted that the tramway company took an absolutely wrong view as to the construction of the Act.

Lord Justice Buckley, in giving judgment, said that in his opinion the appeal failed. The second question in the case was, "Do the facts proved in this case, which are admitted, constitute in law 'interruption' within the means of Sub-sec. 2 of Sec. 32 of the Tramways Act, 1870." After referring to the statement of facts in this case, his Lordship said it seemed to him that there had been an interruption by reason of the fact that in one instance, until the doing of the work in question, the tramway company had been in possession of two lines of tramways, and were, by the events which happened, deprived of the use of one of the lines, and obliged for the whole day to carry on the traffic on one line only. In his opinion that constituted an interruption. He further thought that there was an interruption in this that the workmen in the trenches were in a position of danger when the tramcars approached, and that the tramcars had to come to a standstill or at least to slow down to enable the workmen to get out of the trenches. In his judgment, there was interruption within the meaning of the sub-section. As to the third question in the case, he was of opinion that the notices served by the gas company were proper notices and sufficiently complied with the section. Under those circumstances it was obvious that the other questions in the case did not arise. But the arbitrator had answered the first question: "Does the proviso in Sub-sec. 5 of Sec. 32 of the Act of 1870 apply if the work claimed for does not cause an interruption of tramway traffic within the meaning of the Sub-sec. 2." The arbitrator had answered the first question in the affirmative. His Lordship would not refrain from expressing his opinion on that question. He thought "such work" in Sub-sec. 2 and Sub-sec. 5 meant work whereby the traffic on the tramway would be interrupted. In his opinion the answer to the first question should have been in the negative. He was also of opinion that the connecting of the new service pipes with the old mains was an alteration of the mains.

Lord Justice Kennedy and Mr. Justice Swinfen Eady concurred.

The appeal was accordingly dismissed with costs.

In *re* Medhurst—Morris *v.* Brewer.

In the Chancery Division on Friday last, Mr. Justice Parker had before him a motion in *re* Medhurst—Morris *v.* Brewer, by which the plaintiff asked for the appointment of receiver of the electrical engineeer's business carried on by the late Francis Hastings Medhurst, and other property.

Mr. Percy Vaughan, in support of the motion, explained that Mr. Medhurst, who was prospective Unionist candidate for Stafford and who committed suicide at Croydon on October 26th last, had mortgaged to the plaintiff his electrical engineer's business, together with a policy of insurance for £3,000. Beyond the property mortgaged to the plaintiff, the estate consisted of some securities and furniture, part of the furniture having been seized during the testator's lifetime under a distress for rent, and the remainder was now warehoused. The estate was very much embarrassed, and proceedings by creditors were pending. Under these circumstances, counsel asked that a receiver might be appointed of the property comprised in the plaintiff's mortgage on the ground that the security was in jeopardy.

Mr. Bennett said that he appeared for the two persons named in the testator's will as executors, who had been made defendants. One of them had actually signed a renunciation of probate, and the other either had renounced or was going to renounce. That being so, they had not filed any evidence in opposition to the motion, but he suggested that no receiver was necessary. The testator's assets, apart from the business and the insurance policy, consisted of some share certificates and the warehoused furniture. The share certificates were in the hands of solicitors, and were perfectly safe, and the furniture would not be dealt with.

His Lordship asked what was the value of the estate.

Mr. Bennett said about £1,000. The plaintiff's mortgage, which was dated in 1897, gave a charge on the business and the policy of insurance. The policy was in no way in jeopardy, and Mr. Brewer, who was taken into partnership by the testator in 1908, was perfectly willing to act as receiver for the purpose of getting in the book debts, &c.

Mr. Hansall said he represented a creditor for £30,000, and he suggested that the estate, which was insolvent, should be administered in bankruptcy. He understood that some of the creditors were applying for administration of the will annexed.

Mr. Justice Parker thought that the plaintiff was entitled to have a receiver of the property comprised in his security. That was all he could do at present. There being the necessary affidavits of fitness, he would appoint the gentleman named in the notice of motion with liberty to him to act at once, but the plaintiff must undertake to accept short notice of motion to discharge the appointment when a proper legal personal representative of the estate had been appointed.

Irving *v.* Bodie.

In the Courts of Justice on Thursday last week, Mr. Chas. Henry Irving, the son of a Cumberland farmer, obtained £1,000 damages against Mr. Samuel Murphy Bodie, known on the music-hall stage as "Dr. Walford Bodie, medical electrician, hypnotist, bloodless surgeon," &c. Irving had apprenticed himself to defendant to learn the cure of diseases by electricity, &c., and had paid £1,000 for his apprenticeship. After some time, however, he came to the conclusion that defendant had misrepresented to him his powers, and he came before Mr. Justice Darling and a common jury in the King's Bench Division, asking for the return of his money. During the hearing some remarkable evidence was given from an electrical point of view. Among other things, Bodie claimed to have the power of withstanding enormous currents of electricity through his body, amounting, as he told his Lordship, to "millions of volts." "My treatment," said Bodie in the box "is electricity, which reanimates and brings back fresh life to the muscles."

Mr. Powell, K.C. (for the defence): Is it a fact that you sustain a current of many thousands of volts?—Defendant: As many as you like—millions if you like.

His Lordship: Do you say million or millions?—Defendant: I am prepared to sustain millions to-day to save my honour.

His Lordship: Is this a special property of yours, or is it common to most people?—Defendant: It is quite common; the higher voltage diminishes the danger. I am speaking of high-frequency current. Defendant added that he had sustained 60,000 volts of intermittent current—a quantity no one else had ever come near sustaining except the plaintiff.

His Lordship: How many amperes are you using?—Defendant said he had had as much as 20 amperes.

Mr. Powell: Have you studied electricity and obtained a knowledge of it?—Defendant: A little.

Defending counsel applied to his Lordship for permission to allow "Dr." Bodie to give a demonstration of his powers in one of the private rooms in the Courts, and this request Mr. Justice Darling acceded to, on terms that a qualified electrician appointed by himself should be present to give his opinion afterwards in the witness box.

After the demonstration had taken place, Mr. Arthur Strich, of the Sanitas Electric Co., went into the box, and stated that defendant had a 12-volt accumulator from which he obtained his current, and by means of a transformer and coil, changed it to a higher voltage. The coil was made to give a 12-in. spark, but as a matter of fact, it only gave a 6-in. spark. Defendant took about 30,000 volts intermittent current. Witness could have done it himself if he had trained himself at all to take large quantities of electricity. There was no risk of life in the amount of current defendant sustained.

Other evidence was given with reference to a "Cage of Death." Defendant, on the stage, got inside a large wire cage which was electrified, and holding iron bars in his hands touched the sides of the cage, causing a great deal of sparking. Evidence for plaintiff was given to show that here again a high-frequency machine was used, which rendered the "Cage of Death" quite safe, and a member of Messrs. Cox Bros., the medical electrical apparatus makers, gave evidence of supplying defendant with some of his "plant."

BUSINESS NOTES.

Book Notices.—*Gas Works Directory and Statistics.* 1909-10. London: Hazell, Watson & Viney, Ltd. 10s. 6d.—This is the thirty-second edition of this work, revised up to August, 1909. Full particulars appear in three sections of the gas undertakings in England and Wales, Scotland and Ireland respectively. The name of town, population, owner of system, capital, price per thousand, number of consumers, number of public lamps, personnel, &c., are clearly stated, and where there is an electricity supply system that fact is indicated also.

"The Physical Review," Double Number, Vol. XXIX, No. 3. September, 1909. London: McMillan & Co., Ltd.

"Science Abstracts," Sections A and B, Vol. 12, Part 10. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each part.

"Health in the Home." By J. Johnston, M.D. Manchester: John Heywood, Ltd., Deansgate. Price 6d. net.

"Electric Power Conductors." By W. A. Del Mar. London: Crosby Lockwood & Son. 1909. Price 9s. net.

"Electrical Inventions, and the Training of the Electrical Engineer." Lecture delivered before the Faculty of Engineering of University College, London, October 6th, 1909. By Prof. J. A. Fleming. London: *Engineering*.

"Motor Manual." Twelfth edition. London: Temple Press, Ltd. 1909. Price 1s. 6d. net.

Private Meeting.—Harold Downer, 110, High Street, Watford, electrical engineer.—A meeting of the creditors herein was held on November 1st, when a statement of affairs was submitted, showing liabilities amounting to £405. Of that amount £329 was due to sundry unsecured creditors, the balance of £75 being in respect of cash claims. There were preferential claims for £28, and, after providing for these, the assets were estimated to realise £548, the estate thus showing a surplus of over £140. The assets were as follows:—Stock in trade, £109; book debts estimated realise £263; work on hand, £80; cash at bank, 5s. 1d.; fixtures nd fittings, £25; household furniture, £50; and investment in uilding society, £48. It was stated that the debtor started trading or himself with little or no capital in December, 1889. He had made a net average profit of about £200 per annum, while his drawings had also been in the neighbourhood of that figure. Proceedings had been commenced against the debtor by a creditor, and cting on the advice of his solicitor, the debtor executed a deed of ssignment. The stock in trade had been valued by the debtor, nd after a lengthy discussion, it was resolved that the meeting should be adjourned for an independent investigation to be made y the nominee of the principal creditor.

Bankruptcy Proceedings.—Ernest Goodman (trad-ng as E. Goodman & Co.), electrical engineer, 30, Hertford Street, Coventry.—The receiving order in this case was made on debtor's petition, and according to the accounts filed, the unsecured liabili-ies amount to £198, and the assets are estimated at £36 net, a deficiency being shown of £162. It would appear that the debtor started business in March, 1908, with about £400 capital at the above address. A meeting of creditors was held last September, when the statement of affairs presented showed a deficiency of £127. A composition of 10s. in the £ was offered and accepted by the creditors, subject to debtor being able to find satisfactory guarantees, but this the debtor was not able to do, and on October th he executed an assignment. Debtor ascribes his failure to bad trade and losses on contracts. The books kept appear to be debit and credit ledgers. The unsecured liabilities, with the exception of about £3 for personal expenses, appear to be trade debts. First meeting, November 15th; public examination, December 6th, both at Coventry.

Samuel Emerson Smith, electrical engineer, 271, High Street, Lincoln.—The first meeting of the creditors in this case was held last week at the Official Receiver's offices, 10, Bank Street, Lincoln, and later on the same day the debtor attended the Sessions House, Lincoln, for his public examination before Mr. Registrar Stephen. The liabilities were stated at £125, and the assets were estimated to realise £220, an estimated surplus of about £94 being shown. Debtor stated that the cause of his failure was the illegal seizure of his goods and machinery. Mr. E. E. Tweed (Lincoln) appeared for the petitioning creditor, and Mr. G. L. Hazlehurst (Lincoln) for the debtor. In reply to the Official Receiver (Mr. F. C. Brogden), debtor stated that he was now employed by "Smith's Electrical Co." He started business in 1903 under the title of A. Smith and Co., but made an assignment in November of the following year. A trustee was appointed, and to the best of his recollection his liabilities were £400 odd. He never knew or inquired what dividend was paid. He next managed the business for his wife under the style of A. C. Smith, her name being Ada Cooper Smith. He was manager and received £2 a week. Then A. C. Smith, Lincoln, Engineers, Ltd., was established, this being the same business turned into a limited liability company. He held 500 shares, practically the whole. In November last this concern got into difficulties, a receiver being appointed, and debtor did not think it was quite wound up yet. Smith's Electrical Co. and the Ados Co. followed, and in these "the usual seven" were concerned. The Ados Co. also got into difficulties, and A. C. Smith and "Ados" had been realised. Smith's Electrical Co., of which he was manager and his wife secretary, was still going on. The case stands adjourned.

W. T. Harris, electrical engineer, Commercial Road, Portsmouth.—November 22nd is the last day for receipt of proofs for intended dividend to reach the trustee, Mr. E. W. C. Whittaker, 3, Portland Street, Southampton.

C. Scott Snell, civil engineer, Westminster.—An order of discharge was applied for on July 19th. Mr. Registrar Linklater suspended the discharge for two years and six months.

Consular Notes.—Paraguay.—H.M. Consul at Asuncion reports that seven new telegraph stations were opened to the public in Paraguay during 1908, viz, at Santiago, San Cosme, Carmen del Parana, Encarnacion, Ipane, Jbapobo and San José-mi. A double wire has also been stretched between Tebicuary and Villa Florida, and between Manduvira and Concepcion. A line is, moreover, being constructed to unite Puerto Max, the most northern telegraph station at present in the Republic, with Bahia Negra, still further north.

China.—H.M. Consul at Shanghai reports that the inauguration of the electric tramways in the International and French settlements took place in the spring of 1908. The two systems, which were contracted for and laid by a British company, traverse all the principal thoroughfares of the two settlements. The new form of locomotion became at once very popular among the Chinese, and has proved an immense boon to the inhabitants of the settlements. When the two system are linked together, as is projected within the next few months, it will be possible to reach all parts of the settlement from the native city, and a large increase in earnings is certain.

Servia.—The Belgian Minister at Belgrade, in an admirable report on the conditions of the electrical trade in Servia, states that it was the Société Belge de Tramways et d'Electricité, which about 1903 initiated electrical installation work in Servia by building a large power station to serve the tramways and the public and private lighting. Since then several other towns have had recourse to electricity for public and private lighting, viz., Nisch, Schabatz, Leskovatz, Ujitze and Valjevo. At Valjevo there are two concessionaires: a German, Herr Julian Schmidt; and an Englishman, Mr. Finay. The works at Nisch are exploited by the municipality; those at Leskovatz were installed by a Servian company, as were also those at Ujitze and Schabatz. A Servian company was on the point of being formed at Tchatchak to erect electrical works there for the utilisation of the forces of the River Morava, but the project has been abandoned for the moment, owing to the lack of competent technical engineers. Besides the works named, there exist only those built by the State (for telephones and telegraphs), and some private enterprises at Belgrade which produce electricity for their own use. In the provinces electricity is used in several mines, *e.g.*, at Bor (a French company), at Segue (Government mines), at Alexinatz (a Belgian company), at Maydan Pek (a Belgian company), and at Baba (a Swedish company). The restricted use of electricity for power purposes and lighting explains the smallness of the trade in electrical appliances up to the present. The official statistics do not permit of quotation of the imports prior to 1906, as before that year they were not shown separately. Since 1906, however, the imports have risen from 438,858 fr. to 615,362 fr. in 1907 (the figures for 1908 are not yet available). Taking the various classes of goods separately, it is found that the dynamos most in demand are those of from 10 to 50 kw., the price of a 20-kw. dynamo delivered in Servia free, including Customs duties, being given at 2,200 fr., with an addition of 90 fr. for the regulator, &c. Motors and dynamos of low powers (according to the report) are best supplied by Germany, but Belgium can do a good trade in higher power machines. The duty on dynamos, alternators, and other electric motors with their accessories and detached parts is 12 fr. per 100 kg. (if weighing more than 3,000 kg.), 17 fr. per 100 kg. (if weighing from 500 to 3,000 kg.), and 22 fr. per 100 kg. (if weighing less than 500 kg.) In 1907 the total importation of dynamos was 168,677 fr., of which Germany supplied 84,145 fr., Austria 73,672 fr., and Belgium 2,800 fr. The accumulators best adapted for the market are those with a capacity of 580 ampere-hours, of which the price is quoted at 150 fr. (port dues and Customs charges included). The imports in 1907 were 46,033 fr., of which 39,217 fr. were supplied by Austria. The duty is 20 fr. per 100 kg. The supplies of wire and insulated cables are for the State and central stations, and Germany holds practically a monopoly with 151,024 fr. out of a total of 156,056 fr.; the duty is 20 fr. per 100 kg. The largest trade is in heavy wires and cables protected by metallic coverings. The imports of electrical appliances of various kinds amounted to 72,286 fr. in 1907, of which Germany supplied 28,819 fr. and Austria 31,093 fr. A duty of 60 fr. per 100 kg. is levied on telegraph and telephone apparatus, electric bell apparatus, microphones, battery elements, and a duty of 75 fr. per 100 kg. on electric meters, interrupters, rheostats, &c. The arc lamps most in demand are those for continuous current of 5 amperes, 10-11 hours, of which the price is 90 fr. (port dues and Customs charges included). In 1907, 17,831 fr. worth of lamps were imported, of which Germany supplied 9,847 fr. and Austria 7,281 fr. The duty is 60 fr. per 100 kg., and a good opening for trade exists even with this duty. Electric carbons were imported in 1907 to a value of 11,540 fr., of which Germany supplied 4,877 fr. and Austria 4,904 fr. The duty is 30 fr. per 100 kg. The class most in demand is that valued at 55 fr. per 100 metres (port dues and Customs charges included), and selling at 18 fr. per 100 pairs of 200 mm. length each. Incandescent lamps and other similar lamps were imported to a value of 26,294 fr., of which Germany supplied 11,931 fr., and Austria 8,891 fr. As to price, the lamps consuming 3·6 watts per candle are sold at 60 centimes each, and those consuming 1 watt per candle at 4 fr. each. The duty payable is 150 fr. per 100 kg. The official statistics do not give details as to heating apparatus but supplies are chiefly from Germany, except those used for heating tramcars which are supplied by America. Firing and explosion apparatus which are frequently seen on the market, ventilators, &c., were imported to a value of 7,050 fr. in 1907, Austria supplying 3,065 fr. and Germany 3,339 fr. Electric ventilators are in demand for hotels and restaurants and are subject to a duty of 150 fr. per 100 kg. Electro-therapeutic goods are sold only to Dr. Farkitch who has an establishment at Kalimegdan, and has received a concession for another establishment at Vrutse. Various houses in Servia are engaged in the installation of electric lighting in private property, and supply the necessary apparatus. The chief are Slutzki & Co., Savitch & Co., and Christitch, at La Therasia; the Maison Ristitch, rue du Prince Michel, Belgrade; S. Yovanovitch & Bros., rue du Kolaratz, Belgrade: and Viktorovitch Bros., of Belgrade. The various accessories for electric lighting, such as shades for lamps, lamp globes, fusible interrupters, safety apparatus, insulating material, &c., are dutiable at the rate of 120 fr. per 100 kg., or 75 fr. per 100 kg. The value of the imports of this class in 1907 was 58,377 fr., of which Germany supplied 34,491 fr., and Austria 21,950 fr. There is no establishment in Belgrade dealing with repairs to dynamos effectively. Such repairs are seen to by the works themselves, or by the suppliers. The foreign houses which supply electrical materials to Servia are very numerous, and the keen competition which is thus made necessary has had the effect of reducing prices, which are often lower than the prices of the same goods in the country of production. In order to obtain trade it is necessary not only to supply articles of good quality at cheap rates, but also personally to solicit orders with activity, and to offer generous terms of payment. If it is hoped to gain an advantage over German and Austrian houses, the particular needs of the market must be carefully studied by the manufacturer himself, or by his representative. It is certain that the local buyer will not be induced to trade through a catalogue merely, but when his attention is drawn to the catalogue by a reliable agent, and explanations and concessions are given, there is every reason to believe that he may become a purchaser. The Servian houses interested in the trade have already been enumerated. All of them represent foreign manufacturers, and in some cases they represent many. A useful method of introducing electrical goods would be to establish in Servia a warehouse for the exhibition of various specialities. If this warehouse prospered, a technical office could be added to study on the spot the various projects for electrical undertakings, which the development of the country is bound to produce. Up to the present, no office of this nature exists, and in the opinion of a Servian engineer, such an office would find considerable success, and might result in the establishment of works for the production of electrical materials in Servia. In accordance with a Servian law, new industrial undertakings of this nature are given many concessions in the matter of duties, &c., and a certain preference is given to the goods produced. In fact, the public departments, who are the largest buyers of electrical goods, must buy from the concessionaires of such works at standard prices. One of the essential conditions of success in business in Servia is the granting of long terms of credit. Capital is rare, and interest on money is high. It therefore becomes necessary for the purchasers to pay for the goods they buy at the time when they sell them again, and the manufacturers who have been prepared to be generous in this matter have been those who have succeeded in establishing themselves on the market. Austro-Hungarian manufacturers, in particular, grant three, six, nine and even 12 months' credit, and they have rarely suffered from the insolvency of their debtors. Their associations with the market make it possible for them to know at once the financial standing and reliability of the firms with which they deal, and they are thus enabled to carry on their trade without serious risks. The Germans, too, have appreciated the importance of the matter, and now give as long credits as those given by the Austrians, with very satisfactory results. In this respect English manufacturers are much to be blamed, since in many cases they even demand payment in advance. Care, of course, must be taken in giving credit, but if the ordinary precautions are seen to there is no reason why there should be any great risk attached to the trade. The usual credits in the electrical trade are from four to six months. The great success which the Austrians have attained is all the more extraordinary when one takes into account the fact that not being entitled to most-favoured-nation-treatment the duties leviable on their goods are in many cases 50 per cent. higher than those levied on similar goods imported from the other competing countries.

Austrian Cable Syndicate.—It is reported from Vienna that the cable-makers in Austria have concluded a price convention, and increased quotations by 10 per cent. Negotiations are still proceeding in respect of regulating the production by the fixing of tonnage allotments for each firm.

Industrial Progress in South China.—The South China Government has placed an order for a complete shoe factory in America, also a complete tannery and belt, harness and saddle factory in England, the equipment of which is being purchased through Messrs. Sanders, Rehders & Co., Ltd., London.

Catalogues and Lists.—The Langdon-Davies Motor Co., Ltd., Southwark Works, Deverell Street, London, S.E. —New set of price sheets giving revised prices and sizes of their polyphase motors of 50 periodicity, and single-phase motors of 40, 50, 60, and 80 to 100 periodicities. Since the last lists were issued several new intermediate sizes, also larger sizes, have been added.

Maschinenfabrik Augsburg - Nürnberg, A.G., Caxton House, Westminster, S.W.—Three new pamphlets containing full descriptive information, with line and half-toned illustrations, regarding the M.A.N. Diesel oil engines, and tabulated sizes, powers, speeds, &c., of single, two, three and four-cylinder engines. One of the lists contains tabulated particulars showing the numerous users of these engines on the Continent and elsewhere. It is stated that 1,600 of these engines, aggregating 145,000 b.h.p., have been supplied.

Messrs. Mackey's Electric Lamp Co., Ltd., Tulip Place, Bermondsey, S.E.—Eight-page illustrated price list of Mackey's "Metalux" metal-filament lamps with various shaped bulbs including ordinary, pear-shaped, crinkled tubular, and other fancy lamps, as well as traction, shop, dock and street lighting lamps.

Messrs. David Shanks & Co, Ltd, 58, Albert Road, Aston, Birmingham.—40-page catalogue of electric fittings. A large number of very pleasing designs of brackets, pendants, hall lamps, shade lights, counter-weight pendants, electroliers, table standards, &c., are effectively shown on art paper, prices appearing beneath each illustration. Some cast-iron water-tight fittings are shown in the closing pages.

Messrs. Thos. Broadbent & Sons, Ltd., Central Ironworks, Huddersfield.—With the title of "More Cranes," the firm has issued a 64-page catalogue of finely produced half-tone views of cranes manufactured by them, and of the works in which they are made, and of the offices at Huddersfield. A few pages of tabular matter show the principal dimensions, weights, &c., of their standard three-motor cranes, and in the other sections pictures appear of multi-motor, single-motor and miscellaneous cranes, supplied by them for electric power houses, steel foundries, engineering and other factories, rolling mills, railway shops, cable works and so forth. The miscellaneous section depicts hand-power, walking-jib, cantilever, warehouse and other cranes.

Messrs. Adams Manufacturing Co., Ltd., Bedford.—New catalogue ("B") of 40 pages, in which they illustrate and fully describe their "Igranic" ironclad pillar-type panels. Detailed prices are clearly tabulated. Many combinations are included, meeting the requirements of the Home Office and local authorities.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. —Two new catalogues dealing respectively with electric heating and electric cooking manufactures. The heating list (Section H) contains illustrations of a large number of designs of luminous radiators, and radiator lamps, also convector heaters, a number o them being of very artistic design. The cooking catalogu (Section C) shows a very interesting selection of kettles and iron The former range in price from an article in tin supplied at a ver low figure to a heavily silver-plated kettle with ebony fittings. number of this latter pattern were supplied a short time ago fo use of H.M. the King. The most popular types are a 1½ pint coppe kettle of kitchen design, loaded to 400 watts to boil in 12 minute and a rather more ornamental brass kettle, with a cane handl more suitable for afternoon tea use. Large quantities of these hav been supplied during the past year, showing that the utility o electric appliances for both kitchen and drawing room use ar appreciated. A low-priced copper shaving pot, capacity ½ pint, wi boil water in three minutes. A glance through the catalogue show a general tendency towards cheaper utensils, together with desig leaning towards the ordinary kitchen articles with which everyon is familiar. There is a useful range of saucepans of the cast-iro variety, with a thin lid, ranging from a capacity of 2 pints and rating of 500 watts, to 12 pints rated at 1,400 watts. Potat steamers, double saucepan porringers, frying pans, &c., are show Irons, of course, are an important feature. Commencing with light domestic iron for lace work, there are also several types fo the heavy side of household work. The popular "249" is 4 lb. i weight. A feature in connection with irons is the automatic stand the action of placing the iron on the stand completes the circui but when the iron is actually in use it is not in circuit. This ha been found a good arrangement for short, intermittent worl Among the lines with which the general public are not so con versant, there are hot cupboards for linen drying in the case c large wooden constructions, or for plate or food warming in th case of the smaller iron variety. The larger type of apparatu particularly adapted to restaurant use, is given considerable atten tion. First, there are large capacity water urns, ranging fro 1 gallon capacity up to four, together with combined tea, water an coffee urns, and also the regulation form of *café au lait*, adapted t electricity and fitted with regulation. On the industrial side, glu pots of various descriptions, sealing-wax heaters, and othe apparatus, are shown for medicinal and dental purposes. A nov innovation is the production of universal voltage apparatus. Man pages are devoted to the now well-known Silundum apparatu Both lists are well illustrated and very neatly arranged, pric being plainly indicated.

Messrs. Eastman & Warne, Acton Vale, W.—New leafle announcing reduced prices for their "Hot Point" electrically heated flat-iron. Also a leaflet regarding "Hot Point" electricall heated soldering irons.

The Premier Accumulator Co., Ltd., Cattle Market Roa Northampton.—Very finely illustrated pamphlet, showing number of places where Premier accumulators are used, and th work they are doing. Central station service, large private insta lations, ship and train lighting, launch propulsion, motor-ca lighting and ignition, are all represented.

Mr. Albert C. Hands, 30-32, Snow Hill, London, E.C.— number of leaflets illustrating and giving prices of various desig and finishes of their A.C.H. luminous electric radiators.

Messrs. E. Bennis & Co., Ltd., Little Hulton, Bolton.—Ne pamphlet entitled "Appareils modernes pour la manutention d Charbon et des Cendres," containing an illustrated description i French of the plant supplied by the firm for the Coventry electricit works. The pamphlet, of course, is for the use of Continent engineers or works managers, and to such, copies of the pamphle will be forwarded on application to the above address.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—New pamphl describing and giving prices of the "Eclipse" double-carbo intense flame arc lamp, which is fitted with deposit-free globe wi dioptric inner globe.

Messrs. Turners & Manville, Ltd., 5, Lloyd's Avenu London, E.C.—Small pamphlet giving particulars of their "Leak No" metallic compound and H.O. pipe joint cement, which the are just putting on the market.

Trade Announcements.—Messrs. Archibald Smit and Stevens, lift engineers, Janus Works, Queen's Road, Batte sea, S.W.—For family reasons this firm have converted their bus ness into a limited company, under the title of Smith, Major an Stevens, Ltd. No shares have been offered to the public, and th previous owners, Messrs. C. G. Major, E. C. Stevens and P. E Stevens, together with Mr. P. C. Major, become directors, with M C. G. Major as chairman.

Messrs. G. M. Boddy & Co., suppliers of "Metalik" lamps, ar extending their London premises, having taken over the buildin 15, Gray's Inn Road (lately occupied by the Electro-Motor an Dynamo Co., whose business has been taken over by Messrs. J. an H. Grevener). With the additional facilities thus afforded th firm will be able to give early deliveries for export, country an City orders.

Mr. Albert Burnstine has been appointed general agent fo the Warner Engineering Co., Ltd., in the Argentine, Uruguay an Paraguay, with an office at 425, Maipu, Buenos Ayres (cabl address, "Grantall," Buenos Ayres). The company has als opened an office at 2, Rector Street, New York, U.S.A. (cabl address, "Interamer," New York).

Rumoured Amalgamation.—A correspondent learn from semi-official sources that meetings of shareholders in tw electrical engineering companies in the Manchester district wi shortly be held to consider a scheme to be put before them wit a view to amalgamating the two concerns. Both have been fairl busy of late executing substantial orders.

Northampton Polytechnic, Clerkenwell. — The orage battery and automatic reversible booster balancer set equired in connection with the electrical equipment of this istitution, are being supplied by the D.P. Battery Co., Ltd., akewell.

Charge of Stealing.—At the Manchester Assizes st week, Edwin Arthur Wilson (32), salesman, was charged with ealing a large quantity of electric fittings the property of his mployers, Messrs. Baxendale & Co., of Thithe Street, Manchester, nd Harry Wilson (42), electrician, Wellington Road, Stockport, nd Fred. Mason (45), electrician, were charged with receiving he goods well knowing them to have been stolen. Edward Kay 44), electrician, who was also charged with receiving in connection ith the case, failed to surrender to his bail. E. A. Wilson was ent to prison for 12 months, Harry Wilson for nine months, and ay and Mason for six months, each with hard labour.

Dissolutions and Liquidations. — Solium Electrical Co, Ltd.—This company resolved on October 27th to wind p voluntarily with Mr. E. Harlow, 23, King Street, Nottingham, as iquidator. A meeting of creditors will be held on November 12th.

British Eastern Electric Power Co., Ltd.—A meeting is to e held at 57½, Old Broad Street, E.C., on December 6th, to hear n account of the winding up from the liquidator, Mr. T. F. tevens.

School Lighting.—A news correspondent writes: "Quite a score of new schools (costing from £4,000 to £12,000 each) o be built in the near future in Central and South-East Lancashire, re to be electrically lighted. Mr. R. Littler, county architect, Ribblesdale Place, Preston, is responsible for the plans of these ew educational institutions."

Plymouth.—Mr. T. N. Riley, engineering master at he technical school, has requisitioned electrical machines, easuring instruments and regulating resistances, at a cost of £225.

Imports of Electrical Goods.—In answer to Mr. Clough, the President of the Board of Trade gives in the Parliamentary Papers a summary statement showing the value of each principal group of articles included in the official trade accounts under the head of articles wholly or mainly manufactured imported into the United Kingdom from foreign countries and from British Possessions respectively during 1908. It is stated that the value of electrical goods and apparatus other than machinery and telegraph and telephone wire imported from foreign countries was £1,263,265, and from British Possessions £497.

LIGHTING and POWER NOTES.

Amble.—Mr. Cecil Esmarch has submitted to the Council a report with reference to the proposed lighting of the town by electricity. The cost of the generating station is estimated at £2,368; of the distributing system, £1,794; making a total outlay of £4,162. The annual cost of upkeep is estimated at £668, including the payment of interest and capital, and the revenue, at £765 per annum; the Council decided to take a vote on the question.

Ardsley.—The U.D.C. has asked the Yorkshire Electric Power Co. if it is contemplating introducing an electric supply into the district.

Australia.—The new electricity works at Balmain (N.S.W.) of the Electric Light and Power Supply Corporation, Ltd., have just been opened by the Mayor of Balmain. The works are situated at Iron Cove, adjoining the chemical establishment of Messrs. Elliott Bros. The site is an excellent one with a water frontage of 270 ft., and is a good central position for supplying electricity to the remaining municipalities in the New South Welsh metropolitan area. The plant of the new works, contained in a substantial steel framed building, comprises two 5,000-volt, three-phase Thomson-Houston generators, direct-coupled to two Belliss & Morcom triple-expanion engines of 1,200 h.p. These are supplied with steam from two Babcock and Wilcox water-tube boilers fitted with superheaters and automatic chain-grate stokers; in addition there is a Babcock & Wilcox boiler connected with a garbage destructor, and the latter is more than sufficient to supply the steam necessary for lighting the whole of Balmain. The supply is controlled by a switchboard supplied by the Australian General Electric Co. The plant was supplied pursuant to specifications prepared by the chief engineer and general manager, Mr. J. E. Donoghue.

Belfast.—The electrical engineer has submitted a report on the additional plant required to meet the increasing demand for lighting and power purposes. The report was recommended to the Council for confirmation. Several deputations were present to ask that the centre poles be removed from the streets at certain points, and as the result of a report from the general manager, it was decided to change the centre poles to side poles in a number of streets.

Burton-on-Trent.—The L.G.B. has sanctioned the borrowing of £4,000, to be laid out as follows:—£2,900 for mains and feeders; £650 for services; and £100 for switchgear and instruments.

Birkdale.—The U.D.C. has received from the L.G.B. sanction to a loan of £370 for arc lighting and storm-proof fittings for the protection of the tantalum lamps on tramway poles at Ainsdale.

Camberley.—The U.D.C. has decided to apply for electrical powers. It will be remembered that the Yorktown and Blackwater Gas Co. obtained electrical powers for this district some little time ago, but a provision was made that the powers should not be exercised for 12 months, in order that the Council might take the matter up if it thought it wise to do so. Hence the recent decision of that authority.

Chippenham.—The T.C. has decided to inform the B. of T. that it is unable at present to carry out the electricity order.

Clevedon.—A prov. order for electric lighting is to be applied for by Messrs. Christie. The scheme is to be on the overhead system. Mr. Christie has informed the Council that with 250 50-c.p. lamps the cost per lamp per annum would be 37s. 3d. for 1,750 lighting hours.

Continental Notes. — Italy. — La Société Anglo-Romano, which has already a large electricity generating station at Subiaco, has just started work on the establishment of a new one at Arci, 4 km. from Tivoli. Water-power is being utilised, the plant to be installed comprising two sets of 4,500-h.p. turbines and 30,000-volt alternators, which are being built by Messrs. Ganz and Co., of Budapest.

Alsace.—The municipal authorities of Mulhouse have decided on the extension of their electric lighting undertaking at an estimated cost of £100,000.

Darlington.—By ten votes to nine, the T.C. has decided to support Maidstone T.C. in promoting a Bill consisting of the wiring clauses struck out of the E.L. Acts Amendment Bill, empowering local authorities to deal in lamps, motors, and other fittings.

Dawlish.—With reference to the proposed electric light installation, Mr. Parves, consulting engineer, recently wrote to the Council that he was pleased to know that, subject to the steel poles being approved both as to design, position, and height of wires, the Council was prepared to give permission for the erection of overhead mains in the whole of the streets of the town. In the case of a town like Dawlish it was a *sine qua non* that overhead mains should be used. The Clerk read a petition received from ratepayers who begged the Council not to permit the use of overhead wires, which, in their opinion, would be detrimental to the appearance of the district, and would depreciate the value of the property. The Council, having come to a decision in the matter, allowed the communication to lie on the table. Mr. W. Leaman gave notice of motion to rescind the resolution on the books raising no objection to overhead mains for the electric light.

Dundalk.—The U.D.C. is arranging for a loan of £20,000 wherewith to carry out the proposed electric lighting and power scheme for that town. The loan is to be repayable by a sinking fund within twenty-five years.

Eastleigh and Bishopstoke.—The B. of T. has asked the U.D.C. if it can give an assurance that there is a probability of the Council being able to put the E.L. order into operation within another year, if the order be extended for that period. The Council has referred the matter to a committee.

Grays.—The U.D.C. has applied to the L.G.B. for a loan of £900 for electricity purposes.

Hants.—£846 is to be laid out for additional electric plant and a calorifier at Fareham Asylum, the total mentioned being made up as follows: 90-h.p. engine, estimated cost £376; 300-ampere dynamo, £270; calorifier, £200.

Hastings.—The Corporation is seeking new powers by promoting a new local Act, the terms of which were discussed at the last meeting of the Council. Clauses to enable the Corporation to do electrical work were strongly contested by the opponents of municipal trading. On the other hand, it was urged that in the interest of the Corporation electrical undertaking it was essential that it should have power to supply fittings, as at present people would not take the electric light in consequence of the cost of fittings. The general idea was that the Corporation should be in a position to do wiring and fitting up, and that it should be repaid by instalments. Eventually the clauses were passed to be included in the Bill.

Hertford.—At the meeting of the Metropolitan Water Board on November 5th, it was agreed that £1,410 be laid out in reconstructing the Hertford sewage works. The Works and Stores Committee were authorised to contract for the supply of electrical energy to the works.

Kingswinford.—At a meeting of the R.D.C. on Monday, the chairman stated that the arbitration between the Midland Electric Corporation and the Council with reference to the lighting of the district took place on the previous Tuesday. The result was not yet known, but he thought the Council would be satisfied with it.

Lamorbey (Kent).—The Bexley U.D.C. has sealed an agreement with the Foot's Cray Electricity Supply Co. for the provision of electricity for Lamorbey.

Berkhampsted.—The Council has sealed an agreement with the Chesham and District Electric Light and Power Co. for powers in the district.

Llandaff and Dinas Powis.—The R.D.C. has received from the L.G.B. sanction to a loan of £2,960 to cover the cost of the Whitchurch electric lighting scheme, under which energy will be taken from the South Wales Power Co.

Middleton.—The T.C. has applied to the L.G.B. for a loan of £3,000 for cables for five years.

Rhyl.—An inquiry was held by Mr. H. R. Hooper, of the L.G.B., on November 3rd in respect to the U.D.C.'s application for sanction to borrow £5,000 for the purposes of the electric light works. Evidence was given by the electrical engineer, Mr. Wright, to the effect that since he had had charge of the works, there had been considerable trouble with the mains. These were now righted, but it was felt that the plant was not up-to-date, and was too large for the town's needs. What was required was a smaller plant of an up-to-date pattern. The cost of the works was originally £27,000, but that included provision for a tramway which was never made. They would save at least £350 per annum on the works cost alone by putting in a smaller plant. The Inspector said he realised that Rhyl had been hard hit by the undertaking, but he urged that the proper course to adopt was not so much to reduce the works cost, but to develop and secure fresh customers. He suggested that the Council should borrow money for mains extension, and by careful development bring the works to making a profit.

Royton.—Messsrs. Baker & Sons, Parliamentary agents to the U.D.C., have communicated with the Council respecting the application of Oldham T.C. for permission to supply electricity in the district. They suggest that Oldham will only supply consumers who are prepared to take a quantity of electricity which will be remunerative, and that small consumers will be unable to obtain a supply because it might not be worth while for Oldham to give it. If all the remunerative customers obtained their supply from Oldham, it would not be worth while for Royton to obtain a prov. order to supply the rest. They advise the Council to obtain a prov. order, and then negotiate with Oldham for a supply of current in bulk or for the transfer of the order. The Council has appointed a sub-committee to go into the matter.

Runcorn.—The U.D.C. has decided to consent to the applications of the Castner-Kellner Alkali Co., Ltd., and Messrs. G. H. Cox and H. J. Falk, of Liverpool, for prov. orders for electric light.

St. Helens.—The Education Committee has decided to have the new Higher Grade School lit by electricity, and has asked the Electricity Committee to reduce the price of energy for education purposes from 4½d. to 3½d. per unit.

Wednesbury.—The T.C. has applied for a loan of £345 for meters and mains already provided; £1,750 for small mains, extension services and meters, for two years; and £2,000 for other main extension services and meters.

Whitchurch.—The L.G.B. has sanctioned a loan of £2,960 for the electric lighting scheme. The number of lights required to make the scheme a success was 930, and in 1907 the Llandaff District Council had 800 promises, and it is thought that there will be not the slightest doubt that the number will be made up. The electric light will be supplied by the South Wales Power Co. A similar scheme at Radyr, also within the jurisdiction of the Llandaff Council, has proved profitable, and the Whitchurch scheme will be undertaken immediately.

Whitehaven.—The Harbour Commissioners have decided to defer for a year the putting down of the proposed plant for lighting the Harbour by gas, and to continue taking electrical energy from the T.C., who will before the end of a year quote special terms for the supply. The T.C. will supply current for the next year at a minimum of £250 for the first 28,500 units, and 3d. per unit beyond.

Wingate (Co. Durham).—The parochial electors have decided to ascertain the terms of the Electric Power Co. for lighting the parish. The estimated cost of the installation is £165, and the annual cost £70.

Wolverhampton. — The report on the Council's electrical undertaking for the year ending June 30th last, shows that 1,244,612 units were sold for lighting; 4,135,169 for power; 1,471,632 for tramways, making a total of 6,851,413 units sold. The increase in power supply amounted to 2,026,697 units, but there was some falling off in the lighting and traction supply. Application has been made to the L.G.B. for sanction to the borrowing of £10,000 for mains extensions.

TRAMWAY and RAILWAY NOTES.

Blackburn.—Interesting figures are contained in th half-yearly tramway report, issued on Saturday by the Corporatio It appears that the traffic expenses were £7,358; general expense £1,618; general repairs and maintenance, £4,098; and cost c current, £5,862. The total expenditure was £18,938, the incom was £32,697, leaving a balance of £13,759 to be carried to the ne revenue account. The total income of this account was £13,788, an the expenditure for repayment of loans, sinking fund, interest, &c £10,832, showing a net surplus of £2,955 on the half-year's working

Continental Notes.—Austria.—The municipal authorities of Iglau have secured a concession for a projected electri tramway between the town and the railway station.

Switzerland.—An 80 years' concession for the construction an working of a narrow-gauge electric railway from Stalden to Saas Grund has been granted. The line, which is to be a single track o metre gauge, must be completed within three years from the commencement of work.

A decree has been granted to Mr. Alfred Hurter, of Oerlikon, o behalf of a company to be formed with head office at Saas-Fée, fc an 80 years' concession for the construction and working of funicular electric railway from Saas-Grund to Saas-Fée. The lin is to be a single track of metre gauge.—*Board of Trade Journal.*

Sweden-Denmark.—A Swedish engineer has drawn up a projec for the construction of an electric railway from Malmo to Copenhagen, passing under the Sound. The line would be about 14 miles long, with about 10 miles of tunnel. The project has bee submitted to a Special Commission appointed by the Swedis Government.—*Board of Trade Journal.*

Italy.—A comprehensive scheme of electric railway works ha recently been decided upon by the adoption by the Parliament o two Bills which project the conversion of certain existing railway to electric traction and the construction of new electric railways The former class comprises four different groups of lines, the firs representing an extension of the present system of electric railway around Milan. It is proposed to reconstruct in connection with the existing line between Milan and Gallarate, the lines leading from the latter to Laveno and from Gallarate to Arona; a simila conversion is contemplated for the line Milan-Lecco leading to the Como Lake, and for that from the Usmate station to Bergamo. The second group is that of the frontier tunnel, and comprises a extension of electrical working in the Simplon Tunnel from Iselle to Domodossola; and the favourable experience gained in the former case has also led to the decision to electrically equip the Bardonecchia-Modane section of the Mont Cenis Railway. In the case of the third group, which embodies the tunnels on the southern declivity of the Apennines to Genoa, the "galleries" near Genoa and to Sampierdarena will first be converted, then the Giovi Tunnel, and, finally, the San Guiseppe-Savona section on the direct line between Turin and Savona. The fourth group refers to the section between Naples, Pompeii and Salerno, and the branch from Torre-Annunziata to Castellamare di Stabia. Among the new railways projected the first position is occupied by two new lines over the Apennines, which would materially accelerate traffic with Rome by reducing the time of the journey by three hours. An entirely new route is proposed for the railway between Bologna and Florence, whilst the line from Sant Arcangelo di Romagna to Urbino is of special importance to tourists. The other new electric railways include the long-discussed direct line between Rome and Naples, which is at last to be realised.

Dudley.—The Tramway Co. having applied to the B. of T. to appoint an arbitrator to fix the price to be paid for energy from June 30th last, the Council is to inform the Board that it concurs in the application.

Hendon.—The Council is to visit the depôt of the Metropolitan Electric Tramways, Ltd., in response to an invitation sent by Mr. A. L. Barber. The visit is in connection with the proposal to run a service from Golder's Green tube terminus to Heudon, which would require the approval of the Council as road authority.

Ilford.—The Council has decided to separate the tramways from the electricity undertaking. A tramways manager is to be appointed to deal with the tramways alone. Mr. Woolstencroft, who for some years has been the tramways superintendent, has been given the management *pro. tem.*

Kingswinford.—The R.D.C., in consequence of the attitude of the tramway company on the question of children's fares, is urging the Staffs. Education Committee to convey students to the Dudley Schools in a special vehicle, instead of on the company's cars as at present.

London.—In June last the Metropolitan Asylums Board entered into a contract with the Tudor Accumulator Co. for the maintenance of the battery supplied by them to the Children's Infirmary for a 5-cwt. electric motor vehicle. The agreement provided for a fixed payment at the rate of £10 per year for any number of vehicles up to six, plus ¼d. per mile for 5 cwt. vans. Since the agreement was entered into a 25-cwt. van for heavy goods has been purchased, and the company offer to maintain the battery of this car at a rate of 1¼d. per mile run. The engineer-in-chief having certified that this amount is reasonable the agreement is to be entered into.

L.C.C.—The Highways Committee is recommending that the Woolwich-Eltham tramways should be constructed, using a double (positive and negative) trolley wire construction in order to get over the objections of the Greenwich Observatory authorities. The cost will be £76,000, and it is expected that there will be a loss in working for some years to come.

City.—The Bridge House Estates Committee recommended again to the City Council, last week, the construction of a new bridge, 80 ft. wide, over the Thames, having its outlet on the north at the eastern end of St. Paul's Cathedral, also the reconstruction of Southwark Bridge. The St. Paul's Bridge would carry a double line of tramways, which would pass underground at Knightrider Street and rise to the surface near Goswell Road, thus giving another link between the North and South London tramways of the L.C.C.

New Zealand.—The annual report of the Wellington Corporation Tramways and Lighting Department, of which Mr. Stuart Richardson is engineer and manager, shows that as regards the tramways, 21,679,902 passengers were carried, resulting in a traffic revenue of £129,032; street lighting and sundry consumers of energy for lighting and power added £7,247, and with minor items the total revenue amounted to £136,436. The traffic revenue on the city lines amounted to 14·12d. per car-mile, and the expenses on the whole system to 9·69d. (including power supply). Interest absorbed £20,652, sinking fund £4,934, and depreciation £13,243; the net balance being £5,934. A 750 Belliss-E.C.C. generating set is being added to the power station, bringing its capacity up to 3,000 kw., supplied by nine Lancashire boilers. During the year 590 h.p. of private consumers' plant has been added, making a total of 1,335 h.p. connected. Some 5,173,971 units were delivered from the power station at a cost of ·749d. per unit, or inclusive of depreciation (·165d.), interest and sinking fund, 1·15d. per unit; as compared with 1·09d. in the previous year. The electric lighting department sold 2,004,304 units during the year to 4,136 consumers (including 3,821 lighting, 244 power and 71 heating). The total revenue amounted to £44,321, and after meeting financial charges and depreciation (£5,466) there remained a surplus of £4,272. Owing to the indifferent character of the plant at this station, the working expenses per unit sold amounted to 2·99d., and the overall cost (including ·65d. per unit depreciation) to 4·79d. per unit. A 1,500-kw. Parsons turbine set is being added to the station, which is being extended and brought up to date so as to increase the efficiency.

Newcastle-on-Tyne.—Sir J. Baxter Ellis, in a letter to the Tramway Committee announcing his resignation of the chairmanship, remarked that the new system of working was a failure, and that it would be better to go back to the position of 18 months ago, subject to minor alterations.

Northampton.—The Tramways Committee has recommended the T.C. to apply for powers for the construction of tramways from All Saints' Church to Far Cotton. The estimated cost is over £13,000.

South Lancashire.—The South Lancs. Tramways Co. has intimated to the Little Hulton, Farnworth and Worsley Councils that it has abandoned the idea of constructing tramways in those districts for the present.

United States.—The New York, New Haven and Hartford Railway is, according to *Electric Traction Weekly*, obtaining a number of new motor-cars for its suburban service, which will be equipped to operate on both the 11,000-volt a.c. trolley and on the 600-volt d.c. third-rail system, the latter being necessary to enable the cars to run over the New York Central's lines. The cars are intended to draw two 50-ton trailers and to accelerate at a rate of ·7 mile per hour per second. The cars are equipped with four series compensated motors, each of 200 h.p.; these and the step-down auto-transformers are supplied with forced ventilation. The Pittsburg Railways Co. is installing three 5,000-kw. Westinghouse steam turbines and 11,800 h.p. of Babcock boilers, as an extension to its present 9,000 kw. plant at Brunot Island.

The Washington, Baltimore and Annapolis Railway has practically finished the work of changing over its system of working from single-phase a.c. to d.c. It is estimated that the change will lead to an annual saving of $100,000; one reason for changing was that the single-phase system prevented the company from extending its business in Washington.

The attitude of the Illinois Central Railway in shelving the electrification of its terminal lines in Chicago, is the subject of much adverse comment. The president of the company in considering the matter, estimated a loss of $600,000 yearly by conversion, but it is noted that he made no allowance for probable increase in receipts after electrification.

The New York Edison Co. has made a formal offer to supply power for the proposed new Broadway-Lexington Avenue subway, and other lines in connection therewith. The company considers that it is in an exceptional position to supply energy on advantageous terms.

Wolverhampton.—In the annual report of the Corporation Tramways Committee, the following statement is given of traffic receipts, &c., for the first six months of this financial year, ending September 30th last, as compared with the same period last year:—

Passengers.	Receipts.	R.P.C.M.
4,647,667	£21,725	10·553d.
4,814,268	£22,533	10·901d.

The reduction in the receipts is again due to the continuation of trade depression in the district generally.

TELEGRAPH and TELEPHONE NOTES.

Trunk Telephone Calls.—In reply to a question whether the duration of a trunk telephone call could be extended from three minutes to five minutes, Mr. Sydney Buxton replied that experience in nearly all countries had shown that a period of three minutes was the most convenient unit. A unit of five minutes would involve a higher charge and would reduce the useful traffic capacity of costly lines.

Italy.—The Government will shortly ask for powers to spend a million sterling on the construction of a number of telephone lines.—*Board of Trade Journal.*

Cables.—Falmouth-Bilbao repaired November 6th; La Reunion-Mauritius interrupted November 3rd; Cayenne-Salinas interrupted November 3rd.

Switzerland.—The *Journal Telegraphique* states that the telegraphic receipts of Switzerland during 1907 were 12,988,888 fr. and the expenses 12,467,453 fr. leaving a profit of 521,435 fr. The number of messages handled was 4,917,018 as against 4,918,679 in 1906. There were 2,318,960 international telegrams while 1,008,080 passed in transit. The system consisted of 5,803 km. of line and 23,327 of wire, of which 2,483 km. are underground. The telephone service consisted of 17,574 km. of line and 291,214 of wire while the subscribers totalled 291,214. The number of offices was 3,031, of which 726 were telephone stations; 4,385 employés were engaged in the joint services in 1907.

Bolivia.—The Bolivian telegraphic system in 1907-8 consisted of 5,107 km. of line and 6,087 of wire. There were 120 offices, and 590,143 telegrams were handled. The receipts of the Government system amounted to 365,373 fr. and the expenses to 789,638 fr. The value of telegraphic business done by all enterprises, Government and private was 804,237 fr.

Wireless Telegraphy.—From the *St. James' Gazette* of October 28th we learn that Signor Marconi returned from America by the *Caronia*, and at an interview declared that the Cape Breton station would not be finished until January 1st, when operations would be commenced. He did not think the working would affect the cable companies *for some time.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—A proposal is being considered to acquire a motor tower wagon for use by the Accrington Electricity and Tramways department.

Australia.—Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Melbourne.—Telegraph and telephone material, for the P.M.G. See "Official Notices" October 29th.

Melbourne. — November 29th. 1,250 opalescent arc lamp globes for the Council. See "Official Notices" to-day.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Birmingham.—November 20th. The Guardians invite tenders for the maintenance of their private telephone installation at the Workhouse, Dudley Road, for 12 months. Apply to Master of the Workhouse.

Bradford.—November 13th. General stores for the Tramways Department for a year (returnable deposit £1 1s.). Tramway offices, 7, Hall Ings, Bradford.

Chatham.—November 25th. Incandescent electric lamps, &c., for a year; Chas. Day, Borough Surveyor.

Canada.—Montreal.—Tenders are being called by the Saraguay Electric and Water Co. for turbo-generators of 2,000 kw. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4, Phillips Place.

Ottawa.—November 25th. Tenders are invited for the packing of material and supplies for points along the Yukon telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911 and 1912. See this column for October 29th.

Nelson.—The street railway by-law was carried almost unanimously. The company's plans as to initial equipment and extension comprise:—Motor-generator set, including sheds, switchboard, and necessary cable from sub-station to trolley lines, $11,000; two double-truck four-motor cars and two trailers, $12,000; car barns, machine shop, and full line of repair parts, $2,500; rotary broom, and apparatus necessary to attach same, $1,200; belt-line extension, $16,000; total, $43,700.—*The Canadian Engineer.*

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" November 5th.

December 1st.—Electric wiring and fitting of the Workhouse buildings, nursing sisters' residence, and North City Dispensaries, for the North Dublin Board of Guardians. Specifications at the office, North Brunswick Street, or from the consulting engineer, Mr. L. J. Lawless, 27, Castlewood Avenue, Rathmines, on payment of the cost of production.

Edinburgh.—The T.C. invites tenders for electrical installation at McLeod Street Police Station. Frank A. Newington, engineer, Electricity Station, Dewar Place.

Edmonton.—November 23rd. Electric light and power installation at the new infirmary. See "Official Notices" November 5th.

Farnworth.—The D.C. is in the market for 50-C.P. lamps for tramway pillars in place of incandescent lamps.

Germany.—The municipal authorities of Bietburg, Westphalia, are about to invite tenders for the establishment of a central electric lighting station in the town.

Hull.—November 17th. Unwashed slack for the electricity works for six and twelve months respectively. Mr. H. Bell, city electrical engineer.

India.—Lucknow.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th.

London.—L.C.C.—Covering with asbestos tape about $2\frac{3}{4}$ miles of lead-covered high and low-tension electric cables in manholes. See "Official Notices" November 5th.

Manchester.—November 19th. The Electricity Committee invites tenders for the work required in connection with the provision and laying of a 10-in. diameter rising main from the pumping station at Clayton Vale to the Stuart Street generating station. Forms, &c., from the Secretary, Electricity Department (two guineas deposit).

Wakefield.—November 25th. Stores for the Wakefield and District Light Railway Co. See "Official Notices" to-day.

Warrington.—November 19th. Telegraph materials for a year, for the Cheshire Lines Committee. S. Saxon Barton, Stores Superintendent, Cheshire Lines, Warrington.

York.—November 25th. E.L. fittings, lamps, &c., for the North-Eastern Railway Co.; F. H. Clark, Stores Superintendent, Gateshead.

Telegraph stores, for the North-Eastern Railway Co.; C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Cape Town.—The following tenders were received by the Corporation for the supply of wrought-iron arc lamp carriers required in connection with the Green Point and Sea Point electric lighting:—

		£	s.
Clyde Engineering Works		£99	17
Hudson & Hopkins	(accepted)	110	0
J. F. Nosworthy & Co.		113	0
Walter Donald		119	0

India.—It is now reported that the A.E.G.-Union Electrique, of Brussels, which is a subsidiary of the Berlin A.E.G., has received from the Tata Iron and Steel Works Co. an order for motors, turbines and lighting equipment.

Kilkenny Asylum.—Messrs. Mcguire & Gatchell, Ltd., of Dublin, to whom has been entrusted the electrical installation of this Asylum, have placed the order for the necessary storage battery of 120 cells with the D.P. Battery Co., Ltd., of Bakewell.

London.—The Metropolitan Asylums Board has placed orders as follows:—

J. W. Gray & Sons, re-establishing telephonic connection between Gore House and the Hospital, £56 10s.
W. J. Fryer & Co., two electric motors, with cables, switches, &c., £129 18s.

L.C.C.—The Highways Committee received the following tenders for two marine-type boilers, complete with coal elevator, machine stokers, induced draught and air-heating apparatus, required for the first extension of the tramways central car-repair depôt:—

	Stokers A type.	Stokers B type.	Stokers C type.	Stokers D type.
Davy Bros., Ltd. (accepted)	£2,858	£2,918	£2,923	£2,818
James Howden & Co., Ltd.	3,045	3,091	3,058	—
Samuel Hodge & Sons, Ltd.	3,154	3,191	3,221	—
Ditto (alternative)	3,524	3,561	3,594	—
H. & T. Danks (Netherton), Ltd.	3,190	3,250	3,190	—
John Fraser & Son	3,206	3,306	3,286	3,186
Westminster Ventilating Co.	—	3,349	3,323	—
Lindsay, Burnet & Co.	3,342	3,385	3,354	—
Clayton, Son & Co., Ltd.	3,444	3,494	3,509	3,421
Edwin Danks & Co. (Oldbury), Ltd.	3,637	3,727	3,702	-
Richardsons, Westgarth & Co., Ltd.	4,482	4,587	4,737	

Estimate of chief officer, £2,500.

Messrs. W. T. Henley's Telegraph Works Co. are to carry out certain work in connection with the underground telephone system now in use between the various sections of the Tramways Department, at about £2,200, as an extension of an existing contract.

Portsmouth.—The Tramways Committee has accepted the tender of Messrs. Steel, Peach & Tozer, Ltd., for 200 steel tramway tires, at £1 10s. 3d. per tire.

Sheffield.—The T.C. has accepted the tender of the British Insulated and Helsby Cables for two miles figure-8 copper trolley wire, at $7\frac{7}{8}$d. per lb. less $2\frac{1}{2}$ per cent.

Spain.—Messrs. Drake & Gorham, Ltd., have received an order for 50 of their new registered pattern shuntless single-enclosure lamps for the Spanish Arsenal.

Russia.—The Compagnie Union-Electrique A.E.G., of Brussels, has secured a contract for three sets of 2,500-H.P. steam turbines and alternators for the power station in connection with the electric tramway system in Odessa, as well as 100 cars, with motor equipment for the same lines.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Birmingham Section).—Friday, November 12th. At 7 for 7.15 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society of London.—Friday, November 12th (to-day). At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Meeting. Paper on "Some Further Notes on the Physiological Principles underlying the Flicker Photometer," by Mr. J. S. Dow; and other papers.

The annual exhibition will be held on Tuesday, December 14th, from 3 to 6 and from 7 to 10 p.m.

Northampton Institute Engineering Society.—Friday, November 12th. At 5.45 p.m. Paper on "The Application of the Steam Turbine to Marine Propulsion," by Mr. C. B. Dicksee.

Birmingham and District Electric Club.—Saturday, November 13th. At 7 p.m. At the Colonnade Hotel, Birmingham. Paper on "A Discourse on Power Generation and the Transmission and Distribution of Electrical Energy," by Mr. C. de Hoedt.

Glasgow Technical College Scientific Society.—Saturday, November 13th. At 7.30 p.m. Paper on "Modern Condensing Installations," by Mr. W. A. Dexter.

Electro-Harmonic Society.—Monday, November 15th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' night.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, November 16th. At 8 p.m. At 207, Bath Street, Glasgow. Inaugural address by Mr. E. G. Tidd.

Junior Institution of Engineers.—Tuesday, November 16th. At 8 p.m. At the Royal United Service Institution, Whitehall. Presidential address, on "Recent Warship Machinery," by Engineer Vice-Admiral H. J. Oram.

Institution of Civil Engineers.—Tuesday, November 16th. Discussion on three papers on "Electric Railways."

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 16th. At 7.30 p.m. At the University, Manchester. Paper on "Telephones," by Mr. L. E. Wilson.

Institution of Electrical Engineers (Students' Section).—Wednesday, November 17th. Meeting at 7.45 p.m. at 92, Victoria Street, S.W. Opening address by Mr. J. H. Rider on "The Importance of Attention to Details."

Institution of Electrical Engineers (Leeds Section).—Wednesday, November 17th. At 7.15 p.m. At the University, Sheffield. Paper on "Some Experiments on Single and Stranded Fuses," by Mr. W. T. MacCall.

Illuminating Engineering Society.—Thursday, November 18th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W. Opening meeting. Inaugural address by Prof. Silvanus P. Thompson, D.Sc., F.R.S., first President.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for next week:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 15th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, November 16th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, November 17th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, November 18th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, November 19th.—"D" Company. Technical drill, 6.30 to 7.30 p.m. Company supper at "The Feathers," at 8 p.m. Names must be given in as soon as possible, as accommodation is limited.

Saturday, November 20th.—"B" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station at 3 p.m. Tickets will be issued at the station.

(Signed) P. H. Campbell, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

School Lighting Rates in America.—An important uling in favour of the Edison Electric Illuminating Co., of Boston, has just been handed down by the Board of Gas and Electric Light Commissioners, of Massachusetts, in relation to a equest for reduced electrical rates for school houses by the Boston School Committee. The Commission holds that no grounds exist n which to order a reduction in rates, as compared with the harges applied to other customers, and that the fact that the ustomer is a municipality in nowise justifies such discrimination. The School Committee claimed that the City of Boston ought to e entitled to a lower rate than other customers; that it costs the entral station company less to serve the city, in proportion to its ther business; that the schools are large takers of electricity, and hat the demand upon the station does not come at the time of the eak load. The Commissioners find that they are asked by the Committee to discriminate in favour of the schools over all other ustomers of the company, and that such discrimination is in nowise justified by the conditions. It cannot be seriously urged that here is any material difference between the cost of serving the chools, and the cost of supplying other customers. The board ays that the two items of advertising and collection would be a raction of a farthing per kilowatt-hour, as saved in serving the chools, and would, therefore, be insignificant in their influence pon the cost of production and distribution. It maintains that ther customers are fully as desirable as the schools, on the ground f the hours in which they use electricity, and that no discrimination can fairly be applied here. It has long been the established olicy of the Massachusetts Gas and Electric Light Commission to iscountenance discrimination based solely upon the amount of electricity consumed by different customers. The schools consume a arge amount of energy in the aggregate, but the consumption of each building is relatively small. The buildings are also scattered ver many square miles of territory, and cannot usually be supplied n group, to resulting economy of investment and operation. A rivate owner of similarly located buildings would not be entitled o a reduction simply because his total electricity consumption was arge in the aggregate. Finally, the Commissioners point out that he right granted by a city or town to a company to erect wires ver or under the public streets, is not a permission given for the rivate benefit of the company, but for the general public welfare. Hence any attempt to charge for the use of the streets, either irectly in the form of a tax, or indirectly in the form of reduced ates, becomes virtually an effort to shift the burden of taxation in part from the shoulders of the taxpayer to the consumer of electricity, as such. The Commission, therefore, has refused to order ny special rates for the schools, stating, in conclusion, that if any onsumer, including the municipality, considers that the rates are n themselves excessive, the Commission has ample authority under an appeal to make any such modifications as it may deem necessary.

Boiler Explosions in Great Britain and America.—During the year ending June 30th, 1908, in the United Kingdom 35 boiler explosions proper occurred, out of a total of more than 150,000 boilers in operation, causing an aggregate of 14 deaths and 23 injuries. While it is not possible even approximately to estimate the number of stationary and portable boilers in use in the United States, it is known that during the same period there were some 470 explosions, with a death roll of 281, or about 14 times as many explosions and 12 times as many deaths on land alone as on land and water in Great Britain. In the United States there is no Federal law governing the operation and inspection of and boilers, either stationary or portable, and only five States have such laws, and not all of these furnish adequate protection to steam users; and in the majority of large cities there are not proper regulations pertaining to the installation, inspection and operation of steam boilers. While, in Great Britain, the laws are few and simple, they are enforced.—*Power.*

The Man who Didn't.—A gentleman who recently had an electric installation put down engaged a handyman to take charge of it. The plant was only a small one, requiring but a few hours' running every other day to charge the batteries. It was suggested, therefore, that the new man could fill in his ample spare time with sundry other work.

Strong opposition: "The plant required the whole of his time!" And sure enough every day, from dawn to dewy eve, the engine was to be heard thumping merrily away, running up the oil bill, with the "engineer" in close attendance. His employer perforce had to engage an extra man for the other work.

By and by somebody advised him that there must be something wrong for so small a plant to need so much running. He wrote indignantly to the contractors, and in due course their representative came down from London. The engine and its attendant were busy with their eight-hours' day when he walked unexpectedly into the engine room. A glance at the switchboard; an astonished look at the plant, and his eagle eye noted the interesting fact that the dynamo was running with the brushes held off; busy, like the man, doing nothing.

The ingenuous handyman now helps to swell the unemployment problem.

Northampton Polytechnic Institute.—The annual prize distribution will be performed on December 10th, by Sir J. Wolfe Barry.

The Light that Failed.—

The other day we got a wire
From Ponsonby de Jones, Esquire.
Said he: "Plant's broken down,
And Brown, C.E., from town
Came down, and damned the lot
As rot, upon the spot.
Send down your man to-day,
I pray, to take away
The whole. As for your bill,
I will pay simply—*nil.*"

In view of his excited tones,
We thought we'd wire to Mr. Jones.
We said: "There must be some
Misunderstanding; one
We'll easily put right,
At sight. We'll send to-night
Our foreman, Simpson, who
Will do the trick for you."
We got a note within a day
From Simpson, care of P. de J.

He wrote: "I found down here when I arrived,
A frantic crowd of sense and light deprived.
First, Mr. Brown, consulting engineer,
With two assistants and their testing gear;
The butler, chauffeur, gardener, and bands
Of servants, labourers and stablehands;
And villagers and tenants of th' estate;
All questioning the engineman and mate;
While Mr. Ponsonby de Jones, and kin,
Were there to lead the chorus of the din.
I showed myself, and with this mob around,
I took a casual walk about and found
An interesting circumstance which seemed
To me to simplify the case. I beamed
Upon the crowd, and said, 'Now mark me right!
I put this main-switch on, and lo—the light!'"

Moral.

If anything's wrong,
Heed not detractors;
Shun language that's strong,
And trust your contractors.

H. R. T.

Electro-Harmonic Society.—The next concert (ladies' night) will be held in the King's Hall, Holborn Restaurant, on Monday evening, November 15th, at 8 o'clock. The artistes on this occasion will be:—Mr. Robert Radford; The Alexandra Ladies' Quartette: Miss Nellie Dunford, Miss Beatrice Ferguson, Miss Lilian Berger, and Miss Mary Proctor; Miss Gwendolen Mason (harp soli); Master Lloyd Shakespeare (cornet soli); Mr. Stuart Debnam (humorous interludes); and Mr. Harrison Hill (humorous sketches). We are requested to draw special attention to the fact this concert is to take place on *Monday* evening, instead of the Society's usual Friday evening.

British Tungsten Filaments for America.—Mr. F. Harrison, manager of the International Filament Co., Ltd., London, together with Mr. W. Stewart, financially interested in the enterprise, have been in the United States for some time making contracts for the disposal of tungsten lamp filaments, which are manufactured in England by a secret process controlled by Mr. Harrison, and are sold throughout Great Britain and on the Continent by the Bryant Trading Syndicate, of London. These gentlemen report that they have been quite successful in placing their filaments in the States, both with the independent manufacturers and with some members of the incandescent lamp combination. The same company also makes parts of lamps and has a patented sealed package for transporting tungsten lamps, so arranged that the lamp can be tested before the seal is broken, thus limiting claims to actual breakages in transit. Messrs. Harrison and Stewart have incorporated under the laws of New York a company, named the Electrical Manufacturers' Agency, for handling their goods in the United States, which will have headquarters in New York. They also declare that if the market for their filaments turns out as satisfactory as it now promises, a factory will be established in that country in order to get the benefit of the 45 per cent. tariff tax.—*Electrical World.*

Sealed Tungsten Lamp Cartons.—A sealed tungsten lamp carton, says the *Electrical World*, is being adopted by many manufacturers abroad, in order to minimise claims made for lamps broken in transit. The lamp may be examined and tested, and even lighted while in the carton. It cannot be removed without breaking the seal, and, therefore, enables a hard and fast line to be laid down as between the seller and the buyer as to claims for breakage in transit. In case a broken lamp is returned to the sender within a reasonable period, with the seal of the carton unbroken, it is fair to assume that the breakage occurred in transit and a claim is therefore allowed. The cartons, which are of square cross-section, and thus not likely to roll off the counter or shelf, have a label including brief instructions as to test and conditions of claims. Other advantages for the cartons are that they do not need any packing when cased; the breakage in transit is considerably reduced; improper claims for breakage are prevented, and arguments between the buyer and seller are minimised.

Parliamentary.—In the House of Commons on 4th inst. the Lords' amendments to the Commons' amendments to Electric Lighting Acts (Amendment) Bill were agreed to.

Minerals of Great Britain and Ireland.—Reporting to the Home Office on the production of minerals in the United Kingdom and Ireland during 1908, Mr. R. A. S. Redmayne states that the bulk of the compounds of barium are supplied by Durham, Northumberland and Shropshire. Northumberland supplies the valuable mineral witherite, or carbonate of barium, and the produce of Durham and Shropshire is mainly heavy spar, or sulphate of barium. During the year 38,947 tons were raised, of the value of £35,221. Bauxite, sometimes called alum clay, occurs in the form of seams lying between sheets of tertiary basalt in County Antrim. The production of alumina from bauxite and the extraction of the metal in the electric furnace was started in the United Kingdom in 1896 by the British Aluminium Co., Ltd. The alumina is prepared near Larne, and then dispatched to Foyers, in Inverness-shire, and to Kinlochleven, Argyleshire, where abundant water-power enables electricity to be generated cheaply. There were 11,716 tons of bauxite of the value of £3,025 raised in the year. The output of British copper ore in 1908 showed a decrease of 1,351 tons compared with the previous year. In 1863 the production of copper ore and copper precipitate amounted to upwards of 210,000 tons, valued at over a million sterling. In 1908 the production was only 5,441 tons, valued at £25,053. The amount of copper obtained by smelting British ores is about one twenty-fifth, or 4 per cent. more than the amount calculated from the dry assay. Thus in the case of an ore containing 5 per cent. of metal by dry assay the actual yield has been taken at $5\frac{1}{5}$ per cent.

American Rubber Combine.—A Reuter telegram from America says that the amalgamation of the Continental Rubber Co. with the Inter-Continental Rubber Co. is announced under the name of the latter with a capital of $40,000,000. The new company will control a large part of the rubber industry in the Congo region.

The French Aluminium Combine.—A Paris dispatch to the *Financial News* says that the negotiations which have been proceeding for several months with a view to arriving at an understanding between aluminium works have failed, owing to the opposition to the scheme by a number of the principal firms.

Institution and Lecture Notes.—Leeds University Engineering Society.—Prof. T. W. Morgan, of Bristol University, recently brought before the Society the new "Knight" engine adopted by the Daimler Motor Co. He enumerated the difficulties which had been met with in the use of internal-combustion engines, due to heating and warping of the valves, and lubrication difficulties, and claimed that the Daimler people had now overcome these defects. The valves, which are the peculiar feature of the Knight engine, consist of two concentric sliding cylinders surrounding the piston, each having two ports at opposite sides, and the same end of the cylinder, and both having a travel of 1 in. The piston is inside the inner valve cylinder, and the outer valve cylinder is next to the fixed cylinder, which is enlarged for this purpose. Thus internal pressure does not increase the friction of the slide valves. The valve cylinders or sleeves are worked from eccentrics which revolve once for every two revolutions of the crankshaft. These sleeves may be made an easy fit on one another, the inner sleeve being the valve proper, and the outer sleeve the distributor. The inner one is made gas-tight at the explosion end by suitable metallic packing rings, so that there is no leakage during either the compression or the explosion. The explosive charge enters at one side and is exhausted at the other. It was mentioned that the cost of the valve-sleeve experiments had run into thousands of pounds. An interesting discussion followed the reading of the paper.

Röntgen Society.—The new president of the Society, Mr. C. E. S. Phillips, delivered his inaugural address on November 4th, devoting it partly to a general survey of recent developments in radiography and medical electricity, and partly to the description of a new arrangement of his own for measuring X-ray radiation, which he is to demonstrate at a subsequent meeting. Discussing, as a layman, the medical aspect of X-ray work, he said that the value of Röntgen's discovery in the field of medicine became more impressive as time went on. With the aid of the X-rays it was now possible, by watching the diaphragmatic movements with the fluoroscope, to detect tubercular conditions, and owing to the great transparency of the chest, especially during inspiration, not only could fluid be seen in the thoracic spaces, but even the ripples on its surface following a change in the position of the body could be noted. He went on to refer to the researches of Mr. C. A. Sadler upon the problem of secondary radiation, and said that in all the talk about radioactivity the share which England had in its discovery was overlooked, and all the credit given to France. Prof. Silvanus Thompson, working on different lines from those of Becquerel, discovered the phenomenon at about the same time as the French investigator. The atomic weight of radium, according to Thorpe, was 226·7, which was fairly well in accord with Mme. Curie's latest number.

Institution of Electrical Engineers (Leeds).—In the course of his inaugural address, the chairman, Mr. W. M. Rogerson, stated that ten years ago 93 municipalities had established electric generating stations, having a total capital of £5,734,938, while some 70 companies were also undertakers with a total capital of £5,261,763. At the end of 1908, the latest date up to which the returns are available, there were 541 undertakings, 338 of which belonged to local authorities and 203 to companies or private individuals, the total capital involved being £40,016,300 and £40,722,000 respectively. It will be seen, therefore, that the capital laid out both by private companies and local authorities has increased in about equal proportion. The total lamps connected, equivalent to 8 c.p., ten years ago were 4,106,727, which have now increased to 35,056,700, while the output in Board of Trade units sold both by companies and municipalities has increased in ten years from 60,125,500 to no less than 749,594,200. In 1898 only some 40 electric tramways were in existence, with a capital of approximately £24,000,000, while from the latest returns there are at present 305 undertakings in the United Kingdom, with a capital of £68,199,918, the gross receipts being £12,439,625, while the total number of passengers carried per annum amount to the large total of 2,625,532,895.

P. and O. Batti-Wallahs' Society.—The Birmingham Section of this Society held their second entertainment of this season in the Grosvenor Room, Grand Hotel, Birmingham, on Friday, November 5th, in the form of a Bohemian Concert. There were between 200 and 250 ladies and gentlemen present, including many gentlemen well known in the electrical and engineering profession. The evening was a most enjoyable one. The chairman, Mr. J. P. Kemp, in his remarks appealed to all Batti-Wallahs who were also members of the Institution of Electrical Engineers, to endeavonr to be present at the dinner of the Birmingham local section on Friday to welcome and support the chairman—Mr. R. K. Morcom—who was also a Batti-Wallah, and was present with them that evening. The next function of this local section is to be a ball at the Grand Hotel, and the probable date is Friday, December 17th.

Institution of Electrical Engineers (Birmingham).—The first meeting of the Session was held at the University of Birmingham on Wednesday last week. The retiring chairman (Dr. Kapp) stated that the Council of the Institution had agreed to extend the area of the Birmingham Local Section, to inclnde the whole district within a radius of 50 miles, with the exception of Nottingham and the Potteries. This had the effect of increasing the membership from 330 to 401. The chair was then taken by Mr. R. K. Morcom, and a vote of thanks was accorded to Dr. Kapp for the able way in which he had acted as chairman during the past two years, after which Mr. R. K. Morcom read his address (reported elsewhere in this issue).

Physical Society's Exhibition.—The date of the annual exhibition held by the Physical Society of London, which was fixed some time ago for December 10th, has been altered to Tuesday, December 14th, so that the exhibition may be open in the afternoon as well as in the evening.

Mr. Thomas Humphreys, M.I.E.E., has delivered a lecture on "A Discussion on Electrical Difficulties" to the members of the Rochdale and District Motive Power Mutual Improvement Society.

Institution of Municipal Engineers.—A meeting is to be held at Norwich to-morrow (13th) to form the District Committee for District No. 4.

Institute of Marine Engineers.—At the nineteenth annual dinner of the Institute last week, the President, Mr. James Denny, occupied the chair, and some 330 members and guests were present. A handsome presentation was made to the founder and hon. secretary, Mr. James Adamson. Replying to the toast of "Kindred Associations," Mr. W. M. Mordey, president I.E.E., recalled the fact that as long ago as 1882 he helped to put into the old *Colossus* an installation of arc lighting, which was, he thought, the very first example of electric lighting of a warship in the world. Since then the applications of electricity on board ship had extended until the lighting had become a matter of minor importance, and the question of adopting electricity even for the propulsion of the ship itself had been brought forward, great advantages being claimed for the use of electrical gearing between high-speed engines and low-speed screws. The provision of an economical heat engine was not an insoluble problem, and he believed that the end of this century would see steam disappear. The engineers of this country had always been, and still were, pioneers; the engine used by Fulton was a Watt engine, built at Soho, near Birmingham, and the work of Parsons had brought about the most profound change in marine engineering of later years. An electrical carriage was run by Davidson on the Aberdeen and Glasgow railway between 1839 and 1842.

Faraday House Old Students' Association.—A smoking concert and "At Home" will be held at Faraday House, Southampton Row, London, W.C., on Friday, December 3rd, from 8 to 11 p.m. Dr. Alexander Russell, M.A., the new Principal of Faraday House, will take the chair at the concert.

Trade in October.—The trade returns for the month of October show an increase of £1,905,477 in imports, £923,192 in exports, and £518,983 in re-exports, as compared with the same month in 1908. For the 10 months there is an increase of £15,902,148 in imports, a decrease of £7,402,496 in exports, and an increase of £10,181,804 in re-exports, over the same months in 1908.

American Competition.—At the meeting of Messrs. R. & J. Dick, Ltd., belting manufacturers, Glasgow, it was announced that the board had acquired a site in New Jersey (United States), where they would erect a belting factory of even greater capacity than the Glasgow works. The heavy tariff of 35 per cent. on their belting entering the States had forced the company to erect an American mill.

(Continued on page 786)

DR. GISBERT KAPP.

The new President of the Institution of Electrical Engineers was born at Mauer, near Vienna, in 1852. He received his technical education at the Zurich Polytechnic School under Zenner and Kohlrausch. Both this training and his first practical experience were in mechanical engineering. Coming to England in 1875, he specialised at first in the design of centrifugal pumping plant with Messrs. Gwynne & Co., subsequently travelling on the Continent for another mechanical engineering firm.

Dr. Kapp's connection with electrical engineering commenced in 1882, when Col. Crompton appointed him engineer of the Chelmsford Works. The designing of dynamos was then in a chaotic state, and Dr. Kapp soon established his reputation for original investigation in the subject. He found that the best method of acquiring critical knowledge was to prepare papers for the instruction of others. At that time the bulk of the literature available on dynamos was of an academic character, whereas the early papers by Dr. Kapp appealed at once to the practical man. The confusion over the design of dynamos was due to ignorance as to the magnetic circuit. The scientific principles were known to theorists, and had been expressed in abstruse mathematical formulæ, but the application of these principles to dynamos was not seen either by theorists or practical engineers. Dynamos were made with insufficient iron, and the iron parts, as in the Edison Jumbos, were too long and too thin. It was to Hopkinson and Kapp that the alteration in this state of things was due. Dr. Hopkinson greatly improved the magnetic circuit of the old Edison dynamo, and explained his reasons in a difficult paper read before the Royal Society, and buried in its *Transactions*. Dr. Kapp independently introduced the same improvement, and, what was more important, made quite clear to electrical engineers the essentials in the design of a magnetic circuit. The term "magnetic resistance," introduced by him, made the magnetic circuit simple to understand, and his methods of calculation were universally adopted. His earliest papers were presented to the Institution of Civil Engineers. The one on "Modern Dynamos and their Engines," in 1885, gained the Telford premium and medal; it was followed by others on the design of alternators and electrical apparatus. These showed the power of the author to grasp the fundamental principles involved, and to make his reasoning as clear to others as to himself. These papers, and Dr. Kapp's book on "Electric Transmission of Energy," published in 1886, were read with eagerness, and provided information which enabled others to design with certainty machines to fulfil given conditions. It must be remembered that this information was published at a time when the general tendency was to keep all electrical data secret. Generous frankness has characterised Dr. Kapp's professional career throughout, and he is still an emphatic Free Trader.

Photo by] [*Lafayette, Manchester.*

Gisbert Kapp.

When the number of electrical manufacturers increased and competition in prices ensued, his opinion was that the designer should meet this by the more economical use of material rather than by cutting down labour charges. The multipolar type of direct-current dynamo was introduced by him in 1889, and for some years he alone in this country defended this type when other designers were straining the possibilities of bipolar machines. The multipolar machines in the municipal electricity works at St. Pancras were the first of their type, and, in spite of cast-iron field magnets, fulfilled their guarantees. Dr. Kapp was then practising as a consulting engineer in Westminster, and was responsible for several large electrical undertakings. The Corporation Electricity Works at Bristol were designed by him as joint consulting engineer with Sir W. H. Preece.

Dr. Kapp's engineering works and publications, together with his wide knowledge of languages, kept him in close touch with engineers abroad, who frequently consulted him over questions of design. In 1894 he was invited to act as secretary of the Verband Deutscher Elektrotechniker, which was formed by the leading German engineers to assist in the standardisation of electrical practice throughout the German Empire. With the co-operation of the large manufacturing firms standards for the rating of plant, electric lamps, copper conductors, &c., were drawn up. Rules for electrical installations and for the protection of the public from overhead lines were also prepared, which have since been accepted by the majority of the German States. This avoided the confusion which would have arisen had each State acted independently in the preparation of local regulations. More than technical skill is required from the secretary of such a society to accomplish work of this nature, which is wrecked if professional jealousy is aroused. Dr. Kapp's tact and personal influence, coupled with the fact that he was independent of any of the large German firms, carried this work to a successful issue. These regulations and machinery ratings are now accepted in most of the European countries.

While acting as secretary of the Verband, Dr. Kapp was also free to practise as a consulting engineer, and here again his expert advice was widely sought, both as arbitrator and as designer of schemes for power, lighting and traction. The cosmopolitan nature of his practice was unique. Thus, Moscow, Trondhjem, Trieste, Leipzig, are amongst the towns he advised, and he was frequently called to Switzerland and Italy. When the electrification of the Underground Railways in London was under consideration, he gave evidence as to the possibilities of the Ganz system, and his support in 1901 of a high-tension system for railway working has been justified by subsequent developments.

Again, he was consulted as to the transmission of power from the Zambesi Falls to the Rand Gold Fields, and advocated the continuous-current series system at 100,000 volts as most suitable for the purpose; but the commercial possibilities of such a scheme depend on the price of coal on the Rand.

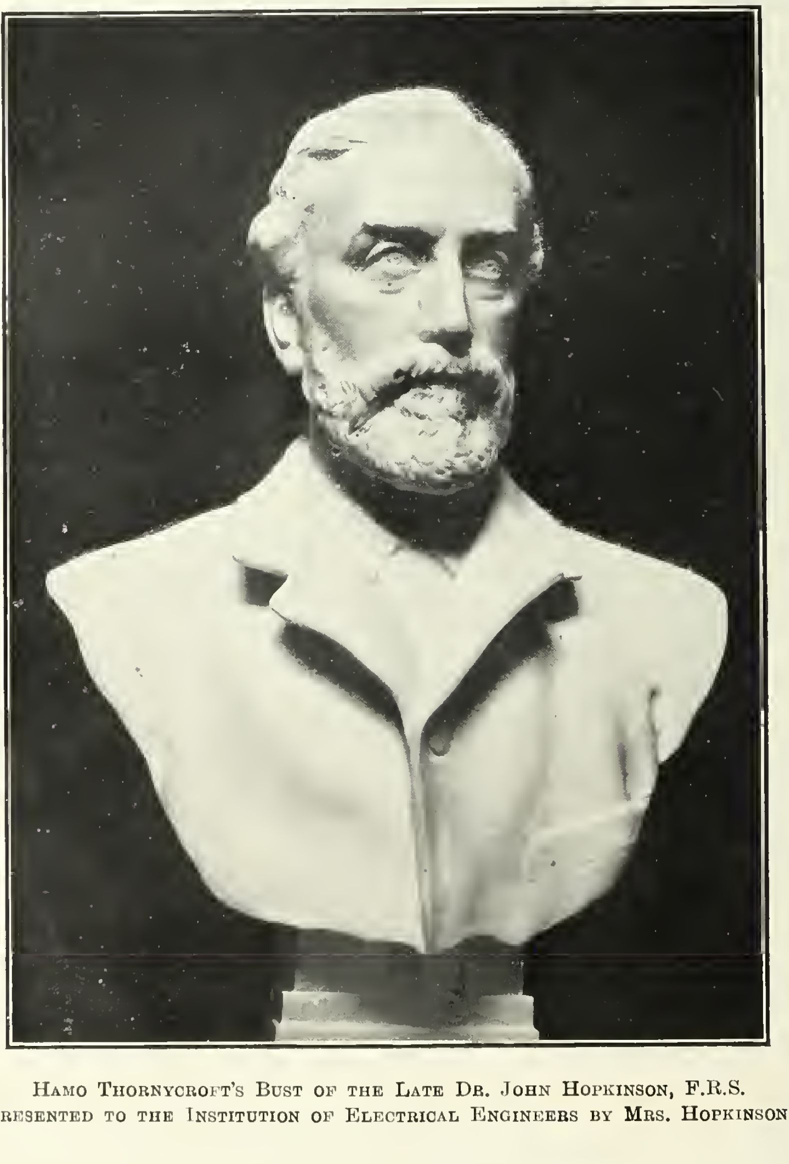
While living in Berlin Dr. Kapp lectured on the subject of electrical design at the Technical High School, Charlottenburg, where the practical nature of his instruction was highly valued. In 1905 the University of Birmingham offered him the new Professorship of Electrical Engineering, which he now holds. Before he left Germany, the Universities of Dresden and Karlsruhe each conferred on him their honorary degree of Doctor of Engineering. His welcome back to England showed the hold he possessed, and still maintains, over those who worked with him in the earlier day of electrical engineering. Dr. Kapp's genuine hospitality makes many friends, and his kindliness, combined with absence of "side," extends his list of friends to all classes. His capacity for hard work is accompanied with the power of encouraging others to exert themselves and of extracting the best efforts of all associated with him. His recreations are music and sailing.

Elected an Associate of the Institution of Electrical Engineers in 1877, and a Member in 1883, Dr. Kapp has now attained the highest honour that it is in the power of the Institution to bestow—a post which he will assuredly occupy with dignity and ability worthy of his illustrious predecessors in that office. —R. W. W.

New Electrical Showrooms.—The Brompton and Kensington Electricity Supply Co., Ltd., has opened showrooms and offices at 254, Earl's Court Road, S.W.—in a central situation in its area of supply and in close proximity to Earl's Court Station—where there are on view the latest improvements in electric lamps, fittings, and cooking and heating appliances. An electric kitchen is furnished with the latest electric cooking utensils, and demonstrations of cooking, ironing, &c., will be given as desired. The company's offices, in Richmond Road, are now closed, and all communications must be sent to the new address.

BUST OF THE LATE DR. JOHN HOPKINSON, F.R.S.

At the opening meeting of the Institution of Electrical Engineers, held at Westminster last night, members were privileged to take part in one of those interesting functions which help to keep green the memory of past leaders in the chair. There have been few greater presidents of the Institution than Dr. John Hopkinson. Twice—in 1890 and in 1896—he occupied that exalted office. Not only was he eminent in research and discovery and in inventions of enormous practical service in the development of the electrical engineering industries, but he was a president of charming affability and dignity, with a reputation absolutely unsullied among his contemporaries and others in the profession.



Hamo Thornycroft's Bust of the Late Dr. John Hopkinson, F.R.S. Presented to the Institution of Electrical Engineers by Mrs. Hopkinson.

Among the various services rendered by him, one remembers in such times as these the characteristic energy with which he devoted himself, at a period of some national excitement and alarm, to the organisation of trained electrical engineers for volunteer service. It is the direct result of his initiative and interest in this matter that we have the electrical engineers fully equipped to-day for defence should occasion arise.

Dr. John Hopkinson was a leader whom we could ill afford to lose, but it will be recalled how his splendid career was cut short by an event which came as a shock to all who knew him throughout the entire electrical world. The details of the holiday in Switzerland, and its untimely termination, there is no need to dwell upon here. Since 1898 Mrs. Hopkinson has made very many valuable gifts to electrical education which will perpetuate the memory of her late husband, but the bust which will now stand in the premises of the Institution is a fitting form in which to keep before the minds of those who attend the London meetings the very fine abilities and qualities that were possessed and exercised by a former noted occupant of the presidential chair.

The presentation was made by Prof. Bertram Hopkinson, of Cambridge University, on behalf of his mother.

The Electrical Review is placed under a debt of gratitude to Mr. Hamo Thornycroft, R.A., for granting facilities for photographing the marble bust as it stood in his studio at Kensington. Mr. Thornycroft's record as a sculptor is of such world-wide renown that we are sure Mrs. Hopkinson could not have made a more excellent selection of an artist for carrying out her wishes.

BROWN-BOVERI TURBINE PLANT AT BUENOS AYRES.

The new power station which the "Deutsche Ueberseeische Elektricitäts Gesellschaft" (German Trans-Atlantic Electricity Co.), of Berlin, are erecting in Buenos Ayres will, when completed, be one of the largest power stations in the world. The supply of electrical energy for the various undertakings in Buenos Ayres which are owned or leased by the above company will be effected in the future entirely from this station, which is situated on an arm of the Dock Sud immediately outside the boundaries of Buenos Ayres. Its generating capacity will eventually exceed 110,000 H.P., and some idea of its dimensions, when completed, will be gathered from the outline drawings of the engine room, &c., shown below and on page 783.

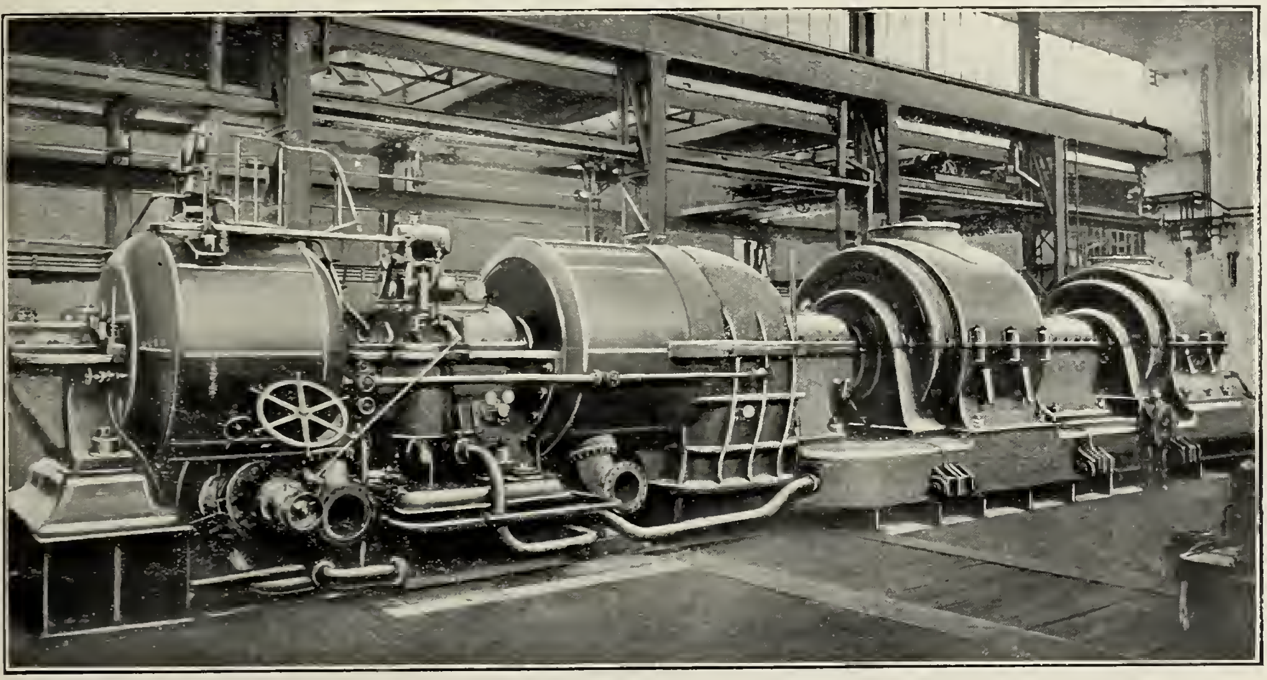


Fig. 1.—Steam Turbine of 11,000 h.p. Coupled to Two Alternators, each of 7,500 kw. at 750 r.p.m.

When complete, this station will contain ten turbo-alternator sets, each of 7,500 KW., and in addition several smaller sets, and the first instalment of this equipment, consisting of five turbo-alternators of 7,500 KW. and two turbo-dynamos each of 1,000 KW., is now being erected.

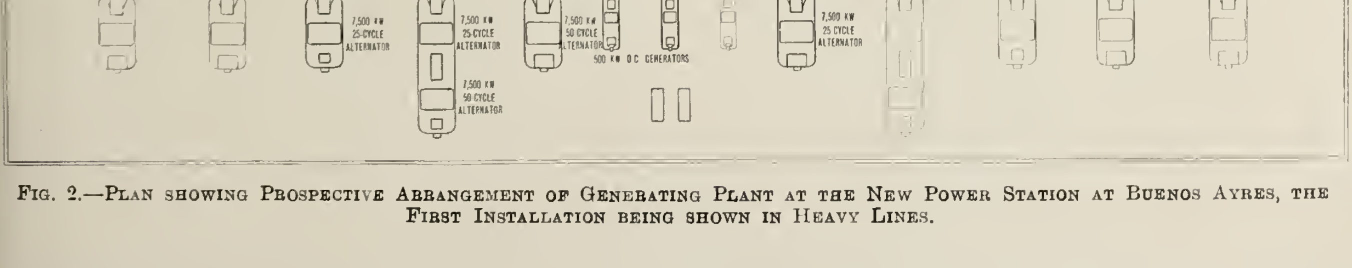

11,000 H P TURBINE SET
11,000 H P TURBINE SET
11,000 H P TURBINE SET
1,000 H P TURBINE SETS
11,000 H P TURBINE SET
7,500 KW 25-CYCLE ALTERNATOR
7,500 KW 25-CYCLE ALTERNATOR
7,500 KW 50 CYCLE ALTERNATOR
7,500 KW 50 CYCLE ALTERNATOR
500 KW D C GENERATORS
7,500 KW 25 CYCLE ALTERNATOR

Fig. 2.—Plan showing Prospective Arrangement of Generating Plant at the New Power Station at Buenos Ayres, the First Installation being shown in Heavy Lines.

The order for all the generators, which include six 7,500-KW. alternators (two 50-cycle machines and four 25-cycle machines) and four 500-KW. dynamos, was placed with Messrs. Brown, Boveri & Co. The five steam turbines are of the Brown-Boveri-Parsons type, two having been built at Messrs. Brown, Boveri & Co.'s Mannheim works, and three (to the same drawings) at the works of Messrs. Franco Tosi, of Legnano. One of the turbo-alternator sets consists of a turbine of 11,000 H.P. driving both a 25-cycle and a 50-cycle-alternator, each of 7,500-KW., which accounts for the extra alternator; a tandem arrangement for the 1,000-KW. turbo-dynamo sets was adopted on account of the D.C. supply pressure, which is 2 × 230 volts.

Fig. 1 shows the first of these large turbo-alternator sets to be completed, this particular plant having been shipped from the Mannheim works to Buenos Ayres in November last; figs. 3, 4 and 5 show one of the alternators in various stages of construction, and give a good idea of the dimensions of the parts. As will be seen from the illustrations, the alternators embody in their construction (for instance, with regard to the method of ventilation and of field-magnet construction) the features of design which were originally introduced by Brown, Boveri & Co. about 1902, and which have now become almost standard practice with every maker. The machines are totally enclosed, with the exception of chimney-shaped openings at the top and bottom of the armature casing, and of an air-trunk at each end. Cool, clean and dry air is drawn up these trunks for ventilating purposes, which, after circulating through every part of the armature and field system, is expelled from one or other of the discharge openings—in this case the upper one, the lower opening being closed up. This nearly total enclosure (taken in conjunction with the perfect and permanent balance readily obtainable with the Brown, Boveri cylindrical construction of the field magnets) enables the machines to work with a negligible amount of noise, as the warm air can get away without any throttling through the single large opening provided for the purpose.

The core of the cylindrical field system is formed of steel plates—separated from one another by distance pieces to allow of free ventilation between them—built upon a hollow hub of forged steel (machined inside and out), into the ends of which the shaft-ends are shrunk. The winding consists of former-wound coils composed of copper strip, wound edgewise, which are placed in slots machined in the core for their reception, the coils being held in these slots by means of metal wedges in such a way that radial movement due to centrifugal force or expansion is an impossibility. The ends of the windings projecting over the field magnet core are secured in position by caps of non-magnetic metal, to which are attached the impellers for forcing cooling air through the machine, as above referred to. These impellers, which, in conjunction with the casing, constitute a proper fan system at each end of the alternator, are so dimensioned and arranged that an ample supply of ventilating air (drawn up through the air trunks from the engine-room basement or from outside) is forced through the field and armature cores, and through the end windings, the air being made to travel along well defined paths before it is discharged to the atmosphere, and in fig. 4 will be noticed the baffle plates and air channels in the armature casing, which partly serve for this purpose. The complete field system of one of these alternators, together with one of the hubs, is shown in fig. 3.

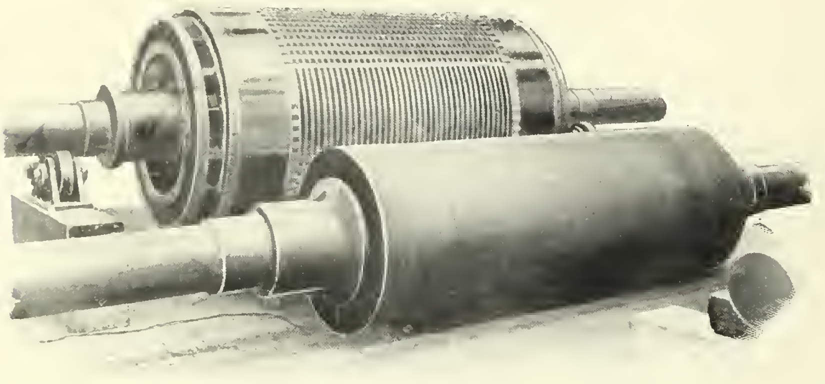


Fig. 3.—Complete Field-Magnet System for 7,500-kw. Alternator, showing (in Foreground) the Steel Hub and Shaft on which the Field Core is Built up.

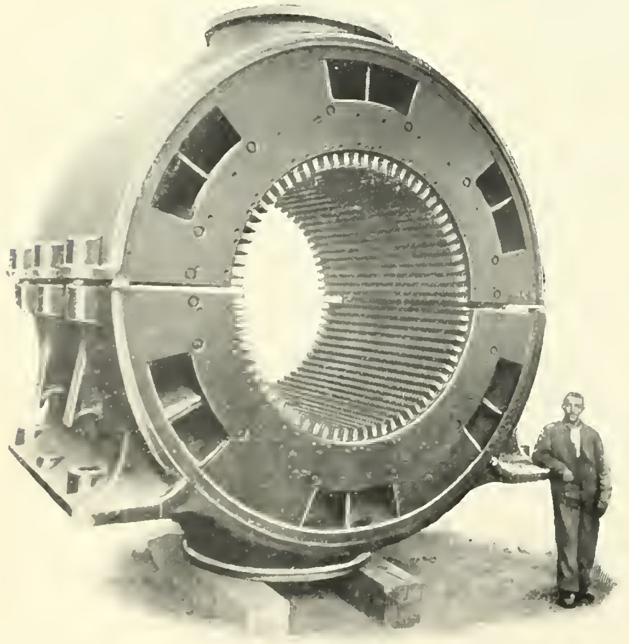


Fig. 4.—Armature Casing and Core for 7,500-kw. Alternator, Ready to Receive Windings.

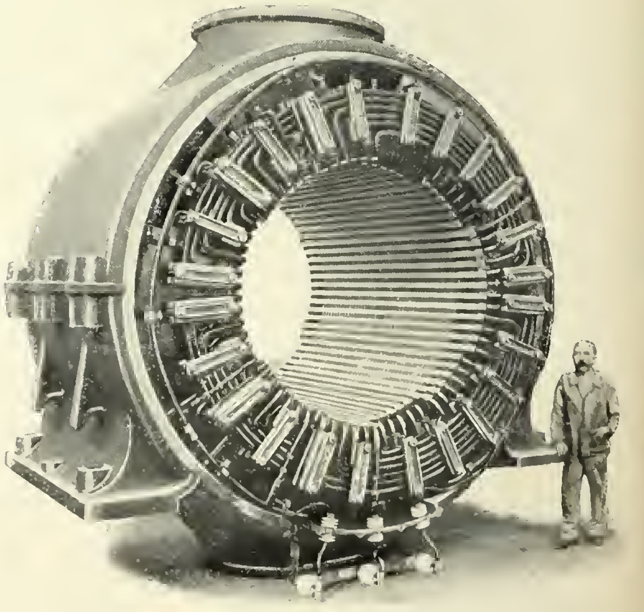


Fig. 5.—Complete Armature System, with End Covers Removed, of 7,500-kw. Alternator.

The armature core is built up between heavy end plates in the casing, a large annular space existing between core and casing, which forms one of the principal airways through the machine, and a great number of radial ventilating ducts being provided throughout the entire length of the core. Slots with parallel sides are provided along the internal periphery of the core for the reception of the windings, which consist of former wound rectangular coils, built up on the "solid system" in accordance with the maker's usual practice with this class of work. The coils are held firmly in position in the slots by means of hardwood wedges, which run the entire length of the armature core along grooves left in the teeth for the purpose. As will be observed from fig. 5, very great care is taken with regard to the clamping of the coil ends of these armatures; heavy gun-metal clamps are used for this purpose which, together with their bolts, are thoroughly insulated from the windings by blocks and tubes of compressed insulation.

The slip rings are of steel, faced with copper, and are provided with carbon brushes. In accordance with Messrs. Brown, Boveri & Co.'s usual practice, they are placed one at each end of the field system; very great care is taken with the connections from the field coils to the rings, these connections being of heavily insulated stranded conductor positively held throughout their length.

The normal rating of these alternators is 7,500 kw. at a power factor of 0·8—0·9 when running at a pressure of 12,000—13,000 volts and a speed of 750 r.p.m. At this rating the temperature rise is 40—45° C. after a long continuous run. The weight of a single generator complete, but without bedplate or bearings, is 73·5 tons, the armature weighing about 48 tons, and the field system about 25·5 tons.

In the case of the two alternators in tandem, separate bedplates are provided for each, these being fitted and bolted together, as shown in fig. 1.

The steam turbines, driving the alternators described above, are constructed for a continuous output of 11,200 h.p. at a speed of 750 r.p.m., and are capable of giving an output of 14,200 h.p. for at least two hours under normal steam conditions, that is, with a steam pressure at the stop-valve of 180 lb. per sq. in. and a steam temperature of 572° F. The turbines, which are all of the Brown, Boveri-Parsons type, have two cylinders—high and low pressure—with a bearing between them. This arrangement has been adopted by the designers with a view to obtaining greater economy in steam consumption and to allow a greater number of blade rows to be fitted, and with it all shaft troubles, even with widely varying temperatures, disappear.

The turbine rotor consists in each case of a forged steel drum, into the extremities of which the shaft ends are shrunk and locked by means of bayonet keys. Heating channels are provided at the steam inlet end of the drum, so that uniform heating of the entire rotor is obtained, while the high temperatures are confined to the comparatively short high-pressure cylinder, so that the expansion effects due to these high temperatures are reduced to a minimum. To balance the thrust, dummy pistons with labyrinth packing are provided. The piston which balances the thrust of the low-pressure expansion (and which in the earlier type of Parsons' turbines was very large) is built on the low-pressure end of the rotor, in accordance with Fullagar's patent. The two rotors are coupled together by a flexible coupling, a small intermediate thrust bearing being provided.

The relay for the double-beat controlling valve is operated by means of oil under pressure instead of steam, this being a special feature lately introduced by Messrs. Brown, Boveri & Co. in their large turbines. The oil for this purpose is supplied from the general lubrication system, and one of the advantages of this method of governing is that, should the lubrication fail, the turbine will be automatically stopped.

The centrifugal governor working on the relay is driven by helical gear from the vertical shaft from which one of the oil pumps is also driven, and on this same shaft there is an emergency governor, set to act when the speed increases above the normal by 15 per cent., in which case the double-seated inlet valve would be closed in the usual manner.

On the other side, and symmetrical with this shaft, is a second oil pump, driven by the same helical wheel. This second oil pump works in parallel with the first pump, and supplies oil for general lubrication at a pressure of 22 lb. per sq. in. The normal steam consumption of these turbines when working at a load of 7,500 KW. has been guaranteed not to exceed 6·3 kg. (13·9 lb.) per KW.-hour, the vacuum being 28·5 in. with the barometer at 30 in.

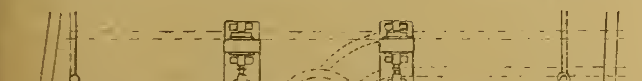


Fig. 7.—Plan showing Arrangement of Condensing Plant for Two Turbine Units, Buenos Ayres Power Plant.

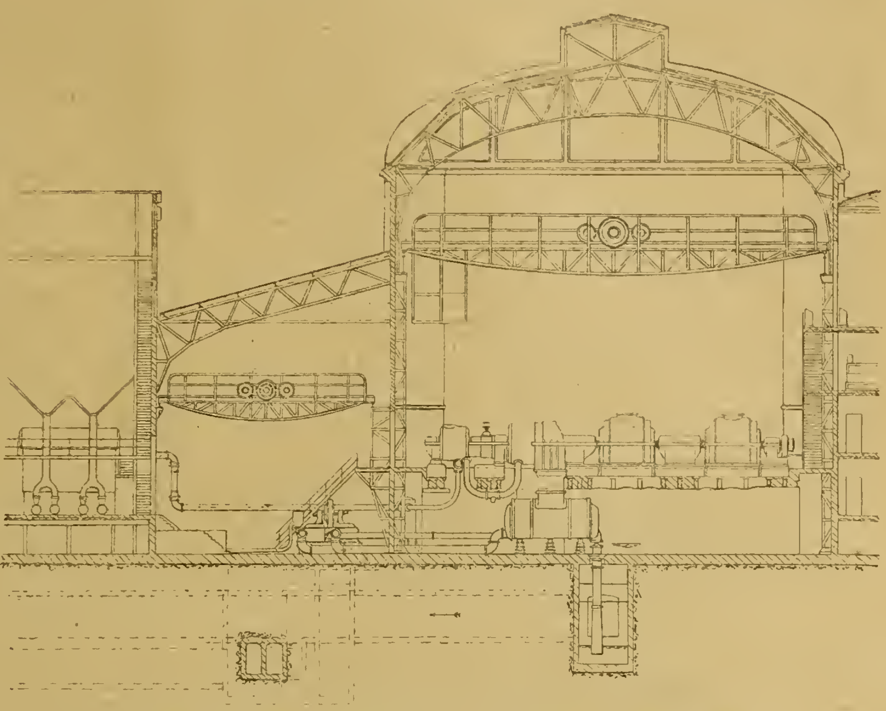


Fig. 6.—Section through Engine Room, Buenos Ayres Power Plant, showing Brown, Boveri Turbine.

Each surface condenser has a cooling surface of 1,300 sq. m. (13,993 sq. ft.), and, when supplied with sufficient cooling water at 60° F., is capable of producing the above-mentioned vacuum when condensing 50,000 kg. (110,200 lb.) of steam per hour, while a vacuum of 27·2 in. will be maintained under these conditions when the condenser is supplied with cooling water at 77° F.

ELECTRIC DRIVING OF TEXTILE FACTORIES.

The following important communication came to hand after our "Correspondence" columns were closed. It will be seen that Mr. Woodhouse, who possesses experience probably unique in this subject, corroborates the views expressed in our "Note" on page 704 :—

The report issued by the Bradford Engineering Society on "The Electrical Driving of Textile Factories," appears to have been accepted in some quarters as being an authoritative pronouncement based on exhaustive tests, and backed up by the whole of the Committee. As this is certainly not the case, I venture, as the reader of the paper which was to some extent the cause of the formation of the Committee, but more particularly as a member of the Committee, to offer some explanation of the actual facts.

1. The Committee were not unanimous, and although I, myself, dissented from the form of the report, the Society have not thought fit to publish this fact.

2. The report is *not* conclusive, nor are many of the so styled "conclusions" based on any tests made by the Committee.

The report speaks of exhaustive tests, but it does not make it clear that the only comparative tests made were those of speed variation, and that of the two tests mentioned —at Dock Ing and Leigh Mills respectively—the latter (which is electrically-driven) showed the smaller speed variation.

The statement that (in the mechanically-driven mill) "the amount of cyclical variation was not so great as had been anticipated," is an example of the misleading way in which the report is worded. It suggests that the Committee were unscientific enough to form a previous opinion on the matter, which was certainly not the case. The majority of the Committee had never seen the mill, and the anticipations referred to were of unknown amount and existed in the mind of some unknown person. I submit that a vague statement of this kind should have no place in such a report.

No figures were presented to the Committee on the relative output of mechanically and electrically-driven machines, but to say that "no evidence of increased output from electrically-driven machines *can* be supplied," is incorrect, and that "the Committee have been unable to obtain any proof based on actual experience" is more—it is misleading. Evidence of increased output due to electrical driving is available from all parts of the world, and I am sure that the statement to the contrary made above has never been formally agreed on by the members of the Bradford Committee, nor would it be by any unbiased person with a knowledge of the results of electrical driving.

Several of the other conclusions are worded in the same curious manner. I will take as example those which state "Where power is generated on the site the mechanical losses are less than the electrical" and "mechanical losses are excessive if the friction load exceeds 30 per cent." These are generalisations which have not even a single test to support them.

If the writer were disposed to generalise from the very large number of tests which he had made in woollen mills, he might with justice disagree with both of the above conclusions, but it is perhaps sufficient to point out that on such vital points as these the report furnishes conclusions without data—bricks without straw.

For the reasons given above I disassociated myself with the report, and I much regret that it should have been issued without fuller consideration.

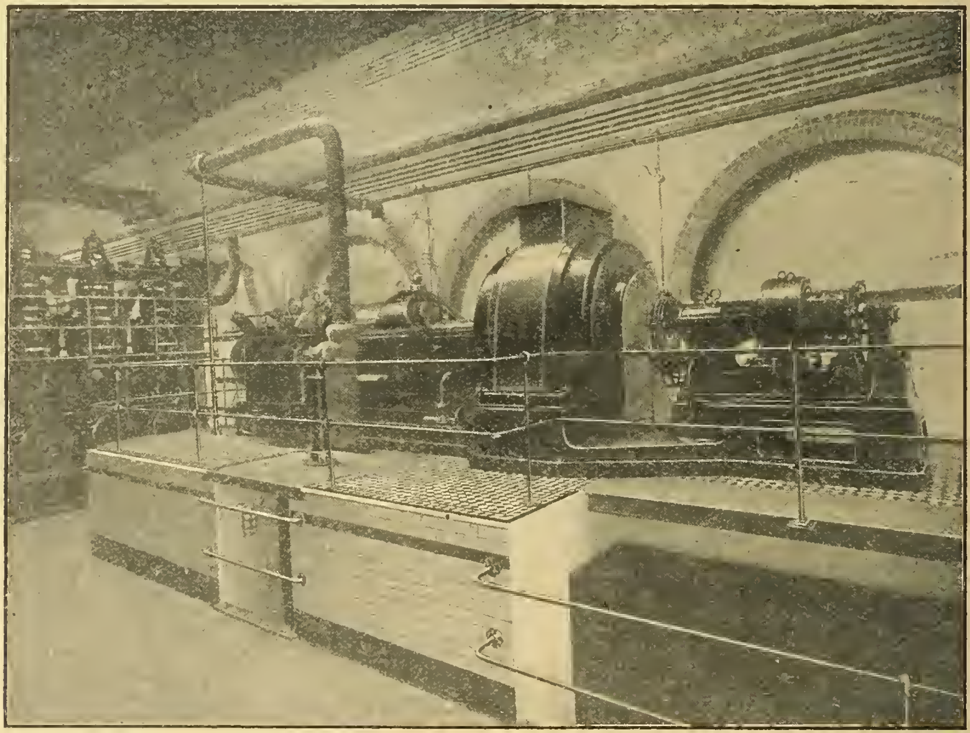
W. B. Woodhouse.

Thornhill, *November 9th*, 1909.

Copper.—The surprising fact about copper is that, in the face of huge visible supplies, the price continues to hold up. The total given in Messrs. Merton's circular for October 31st is 99,357 tons, an increase of 2,754 tons over the mid-monthly return, which increase is principally in the stocks of standard copper at Liverpool and Swansea, and the quantity afloat from Australia. In the supplies columns, America is up to recent average, though not up to average for the year. Spain is average, Chile slightly low, Australia fully average. A re-shipment of 75 tons from England to the States is noticeable.

TUNBRIDGE WELLS EXTENSIONS.

Descriptions of new generating plant, which formed an important feature of the technical papers a few years ago, have now become somewhat rare, particularly with regard to those undertakings which deal principally with a lighting load. There are signs, however, that the winter peaks will shortly show their familiar upward tendency again, and it may be safely assumed that when the lighting load really increases, due to new business obtained with the metallic lamp, the rate of growth will be far more rapid than in the past, for such business will come from those users of light who are obliged to consider the immediate and obvious cost of their necessities, and their number is in most towns enormously greater than that of the present domestic users of electricity—in spite of the great increase in the use of electricity during recent years. The proportion of dwelling houses taking the supply is generally found to be between 5 and 10 per cent. of the total in an average provincial town, a figure which shows the great possibilities of the future and the magnitude of the engineering problems involved, from the point of view of distribution at least.



500-kw. Westinghouse Turbo-Generator, recently installed at Tunbridge Wells.

The borough of Tunbridge Wells has had a flourishing electric light department for the last 14 years, and the use of the supply has become very general in the district, which is almost exclusively residential, and for the most part of a prosperous character. The works, which were originated by Mr. H. P. Boot, at present consulting engineer, are interesting in many respects; they contain some early examples of electric lighting machinery, and are evidence of the excellent plant which was made in England more than a decade ago, in spite of the limitations of experience and material then available.

Although much of the machinery must in the natural course of events be replaced by more modern types, it is of interest to note that none of it has become unusable, or has so far been replaced on account of failure.

A new plant, recently installed, consists of a 500-kw. Westinghouse-Parsons turbo-generator designed for 2,000 volts single-phase supply, and working at 150 lb. pressure with superheated steam. This machine is fitted with a high-pressure by-pass, allowing it to be loaded up to 750 kw. for short periods; its performance under tests carried out after erection was extremely good for a machine of this size, the principal figures, after corrections, being as follows, in lb. of steam per kw.-hour: pressure, 150 lb.; superheat, 100° F.; vacuum, 27½ in.:—

	Guaranteed.	*Obtained.*
¼ load	30·2	23·67
½ "	23·3	22·48
¾ "	20·8	19·58
Full load	19·6	18·81

The generator is of the revolving field type with radial collectors, the exciter also being fitted with the Westinghouse radial commutator and carbon brushes, which appear to be giving satisfaction at this relatively high speed (2,225 R.P.M.).

The condensing plant was supplied by Messrs. J. and P. Hall, and consists of a centrifugal circulating pump and air pump of the Edwards type, driven directly by a 30-H.P. single-phase Fuller motor. The whole plant is compactly arranged on concrete work and finished with vitrified tiles. The pipe work, carried out by Messrs. Spencer & Co., is arranged to permit of the reciprocating sets in the station, and the turbine being worked either with the electrically-driven condensing plant or the original steam equipment.

The steam-raising plant, consisting of water-tube and Lancashire boilers, is being modernised, and underfeed stokers and Hotchkiss circulators are about to be installed. At the present time hand firing with high-grade steam coal is practised, and there appears to be room for considerable economies in fuel costs, which will, no doubt, result from the use of the turbine and other improvements.

The mains system is, owing to the scattered character of the district, a very extensive one; armoured concentric cables are used throughout, the nature of the soil and light character of the local traffic rendering cable work comparatively inexpensive. Transformers are accommodated in underground chambers and pillars in the more recent work. At the present time several extensions are in progress, and the department is beginning to feel the benefit of the great cheapening of cost which has resulted from the extensive use of the metal-filament lamp. The Corporation does not exercise any trading powers, and the installation work is in the hands of local contractors, who, although not numerous, appear to be thoroughly alive to the possibilities of the district, and find ample reward for their efforts at the local rate of supply, 4½d. per unit. This figure compares with 2s. 8d. per 1,000 ft. for gas, and is distinctly in favour of electric lighting, and with the high-efficiency lamp opens out a great possible market for electric heating and cooking apparatus amongst the consumers, who are now finding their accounts reduced by many pounds per annum.

The supply of power, although small, constitutes quite a large proportion of the total in the district, several printing and photographic establishments being driven by electric motors, whilst tradesmen and the usual employers of small machinery help to form a day load on the station plant.

Public lighting by electricity has been carried out in this borough for many years, and recently great extensions have taken place—some 15 miles of streets being illuminated with Osram lamps and arc lamps; amongst the latter are a number of rectified lamps and other early types which are being gradually superseded by modern flame lamps.

On the occasion of completing the turbine extension, the chairman of the Lighting Committee, Mr. B. M. Woollan, J.P., invited the Council and a number of local residents to inspect the works.

The engineer prepared a booklet describing the undertaking and containing a quantity of illustrated advertising matter, and arranged with the local contractors to display lamps and fittings, heating stoves, cooking utensils and a "Tricity" cooker in operation, which were much appreciated by the visitors. Amongst the exhibits a new form of electrolytic rectifier calls for some attention; it is designed and made by Mr. Avery, of Fulmen Works, who is, so far as we are aware, the only electrical manufacturer in the district. The apparatus, which works on the principle of the Nodon valve, is combined with a voltage-reducing transformer, and has water-cooled elements; an efficiency of 80 to 90 per cent. is claimed, which should make the apparatus of interest to those who wish to charge accumulators off an alternating supply without the use of running machines.

Unfortunately, owing to indisposition, the chairman was unable to be present, and the guests were received by the Mayor, Councillor Caley, J.P., and the vice-chairman, Councillor Tylor. These gentlemen made a feeling reference to the valuable services which Mr. Boot had given to the undertaking during such a long period of years, and showed clearly how much it was to the interests of the town to develop the business, and the great extension in the use of electricity which might be anticipated as the result of recent improvements and the comparatively low rate charged for the supply.

Our thanks are due to the resident engineer, Mr. J. W. Beauchamp, for details of the undertaking, and the photograph reproduced herewith.

A CURIOUS INCIDENT IN CENTRAL STATION LIFE.

Curious Motoring Incident.

[Extract from *The Motor* of October 19th].

Motorists who have occasion to travel at night in country districts are familiar with the sight of the wild rabbit disporting itself in the glare of the headlights, oftentimes with disastrous result to itself; and in this connection a curious incident is reported from Cumberland.

On Wednesday night, September 29th, about nine o'clock, while Dr. C. Crawford Aitken, of Carlisle, was motoring in the vicinity of Cotchill, some six miles out from Carlisle, a well-grown rabbit ran in front of the car, a 15-H.P. Humber, and disappeared from view, apparently run over. On search being made no signs of it were to be found, and it was assumed that it had managed to make its way to the hedge.

Next morning, on lifting the bonnet of the car preparatory to starting, the chauffeur was astonished to find the animal seated on the top of the carburetter alive and well. It had evidently jumped in through the small space between the radiator and number plate notwithstanding that the car was moving at nearly 20 miles an hour and it had maintained its position amid the operating levers of the carburetter and synchroniser during the whole run of six miles into Carlisle. It appeared to be perfectly unhurt, though a quantity of fur adhering to the under surface of the radiator and to the governor spindle and electrical connections showed it to have sustained a rough passage inside the bonnet. It was later in the day set at liberty.

Fact.

Shift engineers who have occasion to sit up late at night watching the wheels go round, frequently are in the habit of causing the long night hours to pass more pleasantly by indulging in the companionship of the station cat, and in this connection one of the engineers of the Hammerlebone Urban District Council's station in London has an interesting story to tell.

Some six months ago—to be precise, on Wednesday night April 19th—while Mr. Busbar Thompkyns was going his rounds about 11 p.m., preparatory to turning in on top of one of the boilers, he noticed the station cat playing with a large mouse, which, after several efforts at escape, finally bolted through the boiler house door, and fell into the hot well, while pussy, in hot pursuit, was unable to stop her headlong career, and was also precipitated into the same watery abyss.

Mr. B. Thompkyns exhausted himself and every form of fireman's implement (including a garden rake) in the endeavour to save his feline friend, but after prolonged efforts was obliged to desist and return to his duty (in the boiler house).

A remarkable sequel to the story has recently developed during the overhaul of the Hammerlebone steam turbines preparatory to the heavy winter and Christmas loads.

Mr. Busbar Thompkyns was on dayshift, and in charge of this work, and was standing by No. 2 turbine, while the cover was being lifted. Imagine his amazement after the cover had been raised some little distance, when he observed pussy sitting up contentedly in the space just in front of the low-pressure blades, cleaning her face with her paws and ministering to the wants of a family of seven kittens.

Pussy appeared to be quite unhurt, though a quantity of fur adhering to the high-pressure blades (and also further quantities subsequently found in the boiler-feed pump and superheater) showed her to have sustained a rough passage from hot well to turbine.

The kittens were all in excellent health, but pussy herself (who, we understand, had been found eating boiler composition on previous occasions), though in good health, appeared rather thinner than usual. Mr. Thompkyns is inclined to attribute this to her strict attention to family duties, and to the great heat of the past summer: in fact, he points out that there are distinct evidences that she spent the earlier part of her sojourn in the turbine under the double-beat steam admission valve, but was forced to move further down the turbine as the summer heat increased.—X.

NOTES.

(Concluded from page 778.)

Olympia Motor Exhibition.—Although the eighth International Motor Exhibition, which opens at Olympia to-day and closes on November 20th, does not, so far as one can see, present any particular novelty in electric cars, there is every promise of a fine display of petrol cars and a sprinkling of novelties in the shape of valveless and piston valve engines, transmission apparatus, &c. As usual, the galleries will be devoted to accessories, including ignition apparatus *ad lib.*, electric lamps, sparking plugs, accumulators, electric horns, speed indicators, ball bearings, chains, and the thousand and one details which have been evolved for the convenience of the motorist. One feature which appears to be more pronounced this year is the display of electric generating apparatus for car lighting, and, generally speaking, the Exhibition contains a good deal which will interest engineers and electricians.

What is an Electrician?—The following little incident, witnessed by a correspondent a few days ago, might, he says, be a practical solution of the never-ending inquiry, "What is an electrician?" He was in an auction mart in a well-known seaport in South Wales. The auctioneer was a very smart and witty man, and kept the audience in a good humour with his jokes. The main object of his witticisms was the showman, whose duty it was to take the goods round and show them before they were put up for auction. This showman went by the name of Smelter. The mart was very brilliantly lighted, and in the midst of proceedings all the lights went out except one small row at the back of the place. The auctioneer explained to the audience that the volts had become too high and so burnt the fuse; but Smelter would soon put it right; he was a very handy man, Smelter was. Smelter in the meantime was fiddling with the distribution board, when, bang! a huge report, and all the remaining lights went out. "There you are," exclaimed the auctioneer; "I told you so. Smelter is an electrician now; he puts the blooming lot out!"

Birthday Honours.—The list of Birthday Honours published this week is practically devoid of interest from our point of view. The new Privy Councillors include Sir Edgar Speyer, Bart., of financial renown and underground electric railway experience, and Sir Henry Roscoe, F.R.S., the celebrated chemist. Mr. W. J. Crossley, M.P., chairman of the well-known firm of Crossley Bros., Ltd., gas engine builders, &c., of Manchester, becomes a baronet, and Sir William has the hearty congratulations of the Electrical Review upon the honour thus conferred. A knighthood raises the director and superintendent of ordnance of Vickers, Sons & Maxim, Ltd., to the title of Sir Arthur Trevor Dawson, to whom also we offer congratulations, and a similar honour changes the description of a well-known motor-car manufacturer to Sir Charles Friswell. Prof. W. A. Tilden, D.Sc., F.R.S., the eminent chemist, also becomes a knight. A C.B. is granted to Mr. G. R. Askwith, K.C., the Comptroller-General of the Commercial Department of the Board of Trade.

The Bodie Case.—The difficulty—we fear, the impossibility—of destroying the popular belief in "animal magnetism" as a curative agent, is well exemplified in the recent case in which "Dr." Bodie was compelled to refund £1,000 paid by a credulous youth for initiation into the mysteries of his so-called art. It is greatly to be regretted that the scientific evidence adduced was utterly inadequate, and, indeed, instead of constituting the principal feature of the case, was feeble and ineffective in the extreme. We do not wish to cast the slightest imputation upon the technical ability of the expert appointed by the judge, but the evidence that he furnished was of trifling value. A technical witness more experienced in the art of giving evidence could have shown with ease that the performances of the defendant were mere child's play; his claim to possess exceptional powers could have been torn to shreds, and the peculiarities of the phenomena observed with high-frequency currents could have been explained. The only satisfactory feature of the case was the intelligent decision arrived at by the jury, who rightly assessed the value of the defendant's claims, and thus exposed the fallacy of his demonstrations.

New Association.—We have received particulars of the British Association of Medical and Electro-Medical Instrument Manufacturers, which has just been formed. A number of the leading firms are connected with it already. Particulars can be obtained from the hon. secretary, Mr. Geoffrey Pearce, "Nairn," Avondale Avenue, Woodside Park, N.

Appointments Vacant.—Assistant electrical engineer (35s.) and switchboard attendant, for Fareham U.D.C. Junior lecture assistant in the Electrical Engineering Department at the Northampton Institute. See our advertisement pages.

Tramway Trolley Standards.—It will be remembered that a fatal accident occurred on May 21st on the Wolverhampton District Electric Tramways, when a man was found dead on the top deck of a car with his feet (on which were nailed boots) resting on the base of the trolley standard and the upper part of his body against the handrail. The Board of Trade has now issued a circular letter to tramway authorities, stating that its electrical adviser, Mr. A. P. Trotter, in the course of his inspection of the car, found signs of a considerable arc on the brass bolt by which the main cable was attached to the trolley head: arcing had taken place between this bolt and the trolley boom at a distance of only about ½ in. from the extreme end of the boom, at a place where it was not likely that there had been any mechanical abrasion of the insulation. Mr. Trotter was of opinion that the defect was probably due to a chip of metal in the taping with which the brass bolt was insulated. In addition to this defect, there was a failure of the red lamp warning, due to a discontinuity in the wiring of the lamps. On the car being stripped, the wire was found to be open-circuited behind one of the corner pillars.

Owing to the drawbacks attached to the red lamp warning, the Board of Trade has previously expressed preference for an audible signal; and as a result of the accident the Birmingham and Midland Tramways Joint Committee, which works the line, has decided to make a daily test to see that the trolley standards are properly insulated, and to equip all cars with a magnetic blow-out fuse giving a distinctly audible signal. Pending the adoption of an audible signal, the lamps should be bridged with a suitable fuse, and the signal device should be tested at least once a week; and authorities are requested to give the matter their careful consideration.

Non-Magnetic Wire.—In an article in the *E.T.Z.*, by R. Gans, a description is given of measurements which show that the enamel used by the A.E.G. for insulating wire has a magnetic susceptibility less than $29{\cdot}5 \times 10^{-6}$ in absolute measure. Wire insulated with this enamel can, therefore, be regarded as non-magnetic, even when employed in measurements of high precision.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Tramway Officials.—Mr. H. H. Lancaster, assistant manager of the Blackpool tramways, who has secured an appointment at West Ham with the Metropolitan Tramways Co., has been presented by the staff with an oak book-case bureau.

General.—Mr. G. W. Farrall, who has been for the last 22 years a member of the staff of the Electric Construction Co. at Bushbury, near Wolverhampton, and who has resigned his position in order to take up another appointment with the Midland Electric Power Co., was on Saturday evening the recipient of a gold watch and gold ring, as a mark of appreciation and goodwill from his old comrades. The presentation was made by Mr. W. Bullock, manager of the Electric Construction Co., at a complimentary dinner, followed by a smoking concert.

Mr. H. Herbert Cassé has resigned his position as director of the Bradford Electrical Co., Ltd., and has joined the firm of Mr. Charles Bell, The Ironworks, Bath Street, Leeds Road, Bradford, where he will have charge of the electrical department.

NEW COMPANIES REGISTERED.

Smith, Major & Stevens, Ltd. (105.693).—This company was registered on November 1st, with a capital of £50.000 in £1 shares (60 founders), to take over the business carried on at Janus Works, Queen's Road, Battersea, and elsewhere, as "Archibald Smith & Stevens," to adopt an agreement with C. G. Major, E. C. Stevens and P. H. Stevens, and to carry on the business of mechanical and electrical engineers, ironfounders, lift, machinery and boiler makers, &c. The subscribers (with one share each) are:—C. G. Major, 156, Bedford Hill, Balham, S.W., engineer; E. C. Stevens, Rivermead, Twickenham Road, Teddington; P. H. Stevens, 12, Holroyd Road, Putney, S.W., engineer; P. C. Major, 24, Regent Street, Coventry, engineer; W. Spyer, 65, London Wall, E.C., solicitor; Miss B. K. Stevens, 12, Holroyd Road, Putney, S.W.; C. D. Bishop, 123, Lavender Hill, S.W., medical practitioner. Minimum cash subscription, £100. The number of directors is not to be less than three or more than five; the first are C. G. Major, E. C. Stevens, P. H. Stevens and P. C. Major; remuneration of C. G. Major, £750 per annum; of E. C. Stevens and P. H. Stevens, £375 each per annum; of P. C. Major nil, until C. G. Major vacates office (afterwards, £375 per annum).

Feld Bros. & Co., Ltd. (105,577).—This company was registered on October 25th, with a capital of £5,000 in £1 shares, to acquire the business carried on at 432-433, Mansion Hoose Chambers, E.C., as Feld Bros., and to adopt an agreement with F. W. Sichtermann and A. Feld, and to carry on the bnsiness of manufacturers of and dealers in electrical appliances, lamps, burners, fittings, radiators, batteries, cables, wires, accumulators, meters and engines, &c. The snbscribers (with one share each) are:—F. W. Sichtermann, 17, Delaware Road, W., electrical engineer; A. Feld, 7, Ivanhoe House, Kenton Street, W.C., electrical engineer. Private company. The first directors are F. W. Sichtermann and A. Feld with £250 each per annum as remuneration. Registered office, 432 and 433, Mansion House Chambers, Qneen Victoria Street, E.C.

Marbro, Ltd. (105,619).—This company was registered on October 27th, with a capital of £2,000 in £1 shares (1,500 preference) to carry on the business of mannfacturers of electrical goods of all kinds, general merchants, &c. The subscribers (with one share each) are:—Mrs. L. Markt, Belmont, Stanhope Avenue, Finchley, N.; C. A. Sampson, 28, Rundell Road, Paddington, W., clerk. Private company. C. Markt is permanent director and manager, with remnneration as director, £27 6s., and as manager, £365 per annum. Table "A" mainly applies. Registered office, 22, Belsham Street, Morning Lane, Hackney, N.

Perth Traction and Development Co., Ltd. (105,787).—This company was registered on November 5th, with a capital of £10,000 in £1 shares, to acquire concessions, rights and privileges for the construction and laying down of tramways in Western Australia, and to carry on the business of tramway, railway, omnibus, traction, engine and van proprietors, manufactorers of and dealers in carriages, trncks, locomotives, accumulators and dynamos, &c. The subscribers (with one share each) are:—E. W. Lyons, 73, Florence Road, Strond Green, N., F.C.I.S.; R. B. Holmes, 6, Binfield Road, Clapbam, S.W., clerk; G. E. Bance, Ballencrieff, East Molesey, clerk; W. J. Rontledge, 1, Thorold Road, Ilford, chartered accountant; H. P. Jones, 15, Crewdson Road, S.W., clerk; G. Kerr, Lochnago, Greenham Road, Muswell Hill, N., secretary; F. A. Holyfield, Heathercroft, Waustead Park, secretary. Minimnm cash subscription, 10 per cent. of the shares offered to the public. The first directors are A. H. P. Stoneham, O. Wethered, R. Popkiss and C. Wren. Registered office, 30-31, St. Swithin's Lane, E.C.

Silico-Bitumen Co., Ltd. (105,790).—This company was registered on November 5th, with a capital of £4,000 in £1 shares (2,000 6 per cent. cumulative preference), to carry on the business of bitumen manufacturers and merchants, contractors and agents, electric insulating compound manufacturers, electric fittings and accessory makers, asphalt and tar macadam, binder makers, &c. The subscribers are: J. Rickman, Blakemere, Weybridge, civil engineer, 10 preference shares; J. P. Rickman, 13, Walbrook, E.C., civil engineer, 100 preference shares. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; qualification, £100 shares or stock; remuneration, 50 guineas each per annum. Registered office, 13, Walbrook, E.C.

Brown & Murray, Ltd. (105,707).—This company was registered on November 2nd, with a capital of £1,000 in 900 preferred ordinary and 100 foonders' shares of £1 each, to take over the business of manufacturers of telegraph machines, general machinists and engineers, &c., carried on by S. G. Brown and D. Murray, at Mildmay Park Works, Islington, as the "Telegraph Machinery Manufactory." The subscribers are: S. G. Brown, 4, Great Winchester Street, E.C., engineer, 1 pref. ordinary share; D. Murray, 3, Lombard Court, E.C., engineer, 1 pref. ordinary share. Private company. The first directors are S. G. Brown and D. Murray (both permanent managing directors); qnalifications of ordinary directors £10; registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Vactite Wire Co., Ltd. (105,696).—This company was registered on November 1st, with a capital of £450 in £1 shares, to take over the business of a manufactnrer and supplier of accessories to the incandes-electric lamp industry at 50, Uxbridge Road, Ealing, as the Vactite Wire Co. The subscribers (with one share each) are:—L. J. Yeoman, 805-9, Salisbury House, E.C., chartered acconntant; F. J. Hubble, 806, Salisbury House, E.C., clerk. Private company. The provisional directors are L. J. Yeoman and F. J. Hubble; qualification, one share. Registered office, 805-6-9, Salisbury Honse, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

La Capital Tramways Co., Ltd. (49,597).—Memoranda of satisfaction in full on September 17th, 1909, (*a*) of mortgage dated November 23rd, 1896, securing £120,000, of which £110,600 was outstanding on July 1st, 1908, and (*b*) of mortgage dated November 25th, 1898, securing £150,000, of which £142,100 was outstanding on July 1st, 1908, have been filed.

La Capital Traction and Electric Co., Buenos Aires, Ltd. (62,311).—A memorandum of satisfaction in full on September 17th, 1909, of mortgage dated December 21st, 1900, securing £800,000, has been filed.

Cunnington & Harris, Ltd. (104,932).—Debenture dated October 1st, 1909, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Susannah L. Attrill, 23, Villiers Street, Strand, W.C.

Lepel Wireless Syndicate, Ltd. (101,881).—A memorandum of satisfaction in full, on October 18th, of a charge dated August 18th, 1909, securing £200, has been filed.

CITY NOTES.

Berlin Electricity Works.

The report for 1908-9 of the Berliner Elektricitätswerke, which have a practical monopoly of lighting and power supply in the German capital, states that many difficulties were encountered during the year. Political concern for a time assumed an acute character and accentuated the crisis in trade and industry, which caused consumers to be reserved in the use of current, whilst the decline in building operations produced by the dearness of money in recent years restricted the number of new connections. The introduction of the 8 o'clock closing hour for shops diminished the lighting requirements in business establishments, and the energy economising metallic-filament lamps also prejudiced the consumption of current, and in consequence of the control exercised over the drivers by the Grand Berlin Tramways Co., there was a reduction of 580,000 kw.-hours in the use of power for working the tramways. The town of Rixdorf has availed itself of its right to give notice, and proposed to take over on October 8th, 1911, the distributing network used for the supply of this Berlin suburb, together with the house connections, meters and accessories, by virtue of the terms of the contract. It was intended to counteract the deficiency by the connection of large establishments for which an advantageous tariff had been worked out on the basis of the number of hours of use, and by the extension of sales in the further environs of Berlin where the possibility of cheap power would be offered to the growing industries in those localities. The number of consumers increased from 22,244 in 1907-8, to 24,786 in 1908-9, the connections advanced by 17,104 kw., to 164,364 kw., and including the quantity used by the works themselves, the total useful sales rose from 155,115,135 kw.-hours, to 157,887,625 kw.-hours in 1908 9. As a consequence of the displacement of the conditions between the sale of current for lighting and power purposes, the average sale price realised experienced a slight advance from 15·97 pfennigs in 1907·8, to 15 98 pfennigs per kw.-hour last year. The accounts show the following figures for the two years:—

	1908-9.	1907-8.
Ordinary share capital	£2,205,000	£1,575,000
Preference shares (4½ per cent.)	1,000,000	1,000,000
Loan capital	2,422,900	2,446,150
Gross profits	829,000	727,800
Depreciation provision	201,200	167,300
Net profits	409,800	369,400
Profit share of Berlin Municipality	124,500	132,500
Dividend on ordinary shares of £1,575,000 ..	11 %	11 %
Dividend on ordinary shares of £630,000 ..	4 %	—

It should be explained that the gross profits for 1908-9 include the sum of £54,600 derived from interest, but nothing was obtained from this source in the preceding year; and that including taxes the total payment to the city of Berlin amounts to £240,400 for the past year. Since July 1st additional connections representing 5,170 kw. have been made, and applications for a further 2,938 kw. were on hand on October 1st. The increasing consumption of current in the first three months of the new financial year, particularly for power purposes, is stated to indicate that with the disappearance of a number of disturbing factors, trade and industry have again become more actively employed, and a further favourable development of the company's business is therefore expected to take place in the present year.

Official Announcement re Companies.

The following are to be struck off the register in three months, unless cause is shown to the contrary:—

Adelaide Electric Tramways, Ltd.
Automatic Electric Co., Ltd.
Bettwsycoed Electric Lighting Co., Ltd.
Burmah Electric Works Syndicate, Ltd.
Cleminson Electric Lamp Attachment, Ltd.
Diamond Electric Lamp, Ltd.
Desrumaux's Automatic Water Softener and Purifier, Ltd.
Electric Laundry Co., Ltd.
Electric Royalties Syndicate, Ltd.
Electrical and Hardware Co., Ltd.
Electrical Bleaching Co. (1904), Ltd.
Electromotion Corporation, Ltd.
Expansion Turbine Syndicate, Ltd.
Hampstead Electric Supply Co., Ltd.
Helicoid Locknut Patents (Parent) Co., Ltd.
Hydro-Kinetic Engineering Syndicate, Ltd.
Ilford Accumulators, Ltd.
Imperial Engineering Supplies Co., Ltd.
Manchester and Liverpool Electrical Railway Syndicate, Ltd.
Medical Battery Co., Ltd. (Registered September 27th, 1989).
Midland Electrical and General Engineering Co., Ltd.
Motor Traction Co., Ltd.
Ozone Processes, Ltd.
Perth Electric Lighting Co., Ltd.
Pioneer Electric Light and Power Co. of China, Ltd.
River Po Electric and Power Syndicate, Ltd.
S. M. Van Hinden Electrical Co., Ltd.
South American Traction Co., Ltd.
Tavistock and District Electric Supply Co., Ltd.
Willoughby Destructor Syndicate, Ltd.
Wynne's Electric Closed Tube Tramways, Ltd.

Prospectuses.—*Alor Pongsu Rubber Estate, Ltd.*—This week 25,000 shares of £1 each are being offered for subscription at par.

Java Amalgamated Rubber Estates, Ltd.—This company has been offering 123,000 shares of £1 each for subscription at par.

Lendu Rubber Co., Ltd.—An issue of 45,000 shares of £1 each have been offered.

Rubber Estates of Bentota, Ltd.—28,500 shares of £1 each have been offered at par.

Stock Exchange Notices.—The Committee have appointed a special settling-day as under:—

November 17th.—Chiswick Electricity Supply Corporation.—£80,000 4½ per cent. first mortgage debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

London United Tramways.—Further issue of £318,930 4 per cent. first mortgage debenture stock.

France.—La Compagnie Générale Electrique, of Nancy, is declaring a dividend of 60 fr. per share for the last financial year.

Western Telegraph Co., Ltd.

The seventy-second ordinary general meeting was held on Wednesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., presiding.

In moving the adoption of the report (see Electrical Review, November 5th, page 746), the Chairman said that although there was a slight diminution in the message receipts and an increase in the working expenses and cost of the maintenance of the cables, he thought they would derive satisfaction from the report and statement of accounts. The message earnings showed a decrease of £1,567 compared with those of the corresponding period of 1908. The reduction in the tariff between Europe and the West Coast of South America, which was made on May 1st last, cost the company rather more than this sum, but they were compensated to some extent by increased traffic revenue from other countries. Rents, interest on investments and on money on deposit, &c., were more by £5,477, making a net increase in revenue from all sources of £3,893. The general expenses in London exceeded those of the half-year ended June, 1908, by £194. The expenses at the stations were more by £4,173. The increases occurred in salaries and wages due to annual promotions and additional staff. Pensions and expenses of training staff were slightly higher; foreign and other agencies, which had been more active in consequence of some important negotiations which had had to be carried on, had cost them more; rent and taxes due to new offices at Rio de Janeiro, repairs to buildings in consequence of structural alterations to the new offices just mentioned, postage and petty disbursements had also somewhat increased their expenses; also, he was sorry to say, medical expenses had increased, due to exceptionally heavy charges for medical attendance on account of a regrettable increase of illness amongst the staff during the half-year. Subscriptions to Consular chapels, &c., and legal expenses were also slightly higher. On the other hand, decreases were shown in the following items:—Travelling, repairs and renewals of furniture. A largely increased expenditure, amounting to £15,651 net, occurred in connection with the maintenance of cables. Considerably more cable had been used this half-year, costing over £18,000 during repairs, principally in their oldest main line section. A quarterly interim dividend, amounting to £31,189 10s. had been paid, £90,000 transferred to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund. The directors now recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which, together, would amount to £51,982, leaving a balance of £6,463 14s. 10d. to be carried forward. At the last meeting the shareholders were informed that negotiations were proceeding with the Brazilian and Argentine Governments with regard to improved telegraphic communications, and he was now glad to state that a satisfactory arrangement with the Argentine Government had been concluded, under which a new and direct cable would be laid by the company from Buenos Ayres to the Island of Ascension, where it would join the existing main line route to Europe. The cable was now being manufactured, and they hoped it would be laid and in working order during next year. Their main line cables to Brazil, as they were aware, had been laid for a considerable number of years, and in view of the age of these cables the directors thought it right to propose to the Brazilian Government to also strengthen the means of telegraphic communication by laying a direct cable from Ascension to Rio de Janeiro. Those negotiations were in progress, but were not yet concluded. It was evident that the offer which they had made was one which must be of the greatest advantage to Brazil, by putting the capital city of that great country in the same position as would be shortly secured to Buenos Ayres, the capital of Argentina. He regretted to report that Lord Richard H. Browne resigned his seat on the board in consequence of failing health, but was glad to say that they had been able to fill the vacancy by securing the services of Mr. John George Griffiths, who had been connected with this and the associated companies for a great many years and had an intimate personal knowledge of South America.

Sir John Denison-Pender, K.C.M.G., seconded the resolution.

Mr. J. Stacey Reeves asked whether the time had not come when it was unnecessary to continue piling up the reserve fund, which now amounted to more than half the capital of the company.

The Chairman said they must not ask them to diminish the reserve fund, because the commitments they were now taking in connection with Brazil and Argentina would draw very considerably upon the fund. The great *desideratum* in all cable companies was stability, so that they could undertake work on renewals and extensions without affecting a stable dividend. That they had been able to do for many years past, and he hoped they would be able to continue that policy for many years to come.

The report was then adop'ed.

Norwich Electric Tramways Co.

The annual meeting of this company was held in London on Friday, Mr. Francis Fitzgerald presiding.

The directors' report for the year ended June 30th last stated that the balance of profit derived from the working of the tramways, as shown by the revenue account, was £7,772, plus £156 interest and transfer fees received, bringing the gross profit for the year up to £7,928, or, including the balance brought forward from the previous year, to £7,958. Deducting from this amount the sum of £2,640, 4 per cent. interest on the company's mortgage bonds for the year, there remains a sum of £5,318 to be dealt with. The directors recommend that £500 be placed to reserve fund account, that a dividend of 1¾ per cent., amounting to £4,620, less income-tax, be paid on the shares of the company, for the year ended June 30th, 1909, and that the balance of £198 be carried forward. Comparing the accounts with those for the year ended June 30th, 1908, the revenue has decreased by £621, and the expenses have decreased by £2,238, showing an increase of £1,617 in the profits for the year. The directors call attention, however, to the fact that the profits have been arrived at after charging to revenue the following extraordinary expense for arbitration law costs, £909. The permanent way, rolling stock, and power station have been maintained in an efficient condition out of revenue. The number of passengers carried was 7,371,524, an increase of 181,163 on the previous year, and the number of car-miles run was 1,002,258, as against 1,049,175. The earnings per car-mile were 7·76d., and the expenses 5·72d., while the earnings per passenger were 1·02267d.

The Chairman said that since the accounts had been made up there had been an improvment in the gross income of £537, notwithstanding the fact that the returns on August Bank-holiday suffered the considerable diminution of £240. The visit of the King this week had not only rejoiced the hearts of the citizens of Norwich, but it had proved a rich source of revenue to the company, and he wished such visits were more frequent.

The report was adopted.

Eastern Telegraph Co., Ltd.

The meeting of the above company was held on Wednesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, November 5th, page 747), said that the gross revenue for the half-year under review amounted in round figures to £592,600, against, for the corresponding half-year of 1908, £568,400, or an increase of £24,200. The receipts from messages exchanged with South Africa continued to improve, and the principal increase in the revenue this half-year was from that source. Various other branches of traffic showed small increases; but there was a further decline of about £4,000 in the receipts from traffic with Egypt, to which he referred at the last meeting. The message receipts as a whole, however, showed a satisfactory increase, and he was glad to be able to state that their general revenue continued up to the present date to be fairly well maintained. During the half-year they received £6,400 more in respect of interest and dividends on reserve fund investments, but, on the other hand, interest on cash at bankers on deposit yielded £3,200 less, leaving a net increase in respect of interest of £3,200. With regard to the expenditure side of the revenue account, the total expenses amounted in round figures to £278,900, against, for the half-year to June, 1908, £261,100, or an increase of £17,800. He was pleased to state that the ordinary expenses were less by £2,000 than they were for the half-year to June, 1908, but the expenses attending maintenance of cables were unusually heavy, the total expenditure under this head, including the depreciation of spare cable, being £70,500, against £51,200 for the corresponding period of 1908. This increase was largely due to their having expended a much larger quantity of cable on the repairs of various sections of their line; this item alone accounted for £11,000 of the increase. The comparison of the expenditure under this abstract was further adversely affected in consequence of the amount received from foreign Governments and other telegraph companies for the charter of their repairing ships, being considerably less during this half-year than it was in the corresponding period of last year. During the half-year they had renewed a further 63 knots of the Aden-Bombay No. 1 cable, which was originally laid in 1870, the cost of this partial renewal amounting to £8,337 being charged, as usual, against the general reserve fund. The operation of gradually renewing this cable had extended over several half-years, and up to the date of the accounts they had renewed about 1,570 knots, at a total cost of about £260,000, the whole of which had been charged to this fund. Since the accounts were made up they had laid in a further 100 knots, leaving about 220 knots still to be renewed. The type of cable employed in the renewal of this section would give a greater carrying capacity than that of the cable which was originally laid in the year 1870. It was to meet such expenditure that the general reserve fund was provided, and when operations of this kind became necessary the importance of building up this fund became more apparent. The net result of the half-year's working was that they had £4,300 more available for distribution than in the corresponding period of 1908, and, as it was not proposed on this occasion to further augment the maintenance ships' fund, they were able to make a contribution of £10,000 more to the general reserve fund than was transferred to the fund for the corresponding half-year of 1908.

Sir J. Denison-Pender, K.C.M.G., seconded the resolution, and the report was adopted.

Allgemeine Elektricitäts Gesellschaft.—The Berlin correspondent of the *Times* states that this company has declared a dividend for the business year 1908 of 13 per cent., as against 12 per cent. in the previous year. The net profits amount to £815,000, as against £795,000 for the previous year.

Edison & Swan United Electric Light Co., Ltd.

The twenty-sixth ordinary general meeting of the above company was held at Winchester House, E.C., on November 4th, under the chairmanship of Mr. Henry Wolfenden.

In moving the adoption of the report (see Electrical Review, October 29th, page 706), the Chairman said they were again faced with a large decrease in their profits, caused by a decline in the price of the carbon lamps, which were the principal lamps they had been dealing in so far. This decline was not the result of any falling off in their quality, which had been maintained at its usual high standard of excellence, nor was the shrinkage the result of any material falling off in the turnover. Their total business in the year under review in all classes of goods taken together showed a reduction of only 1·6 per cent. in value, as compared with the previous year, and having regard to the depression in trade generally, and in the electrical branch in particular, he ventured to think that was not very unsatisfactory. On analysis, however, they found that the carbon lamp sales showed a decline of 6 per cent. in volume, but the value was reduced by 17½ per cent. It was here that they got the clue to the shrinkage of profits, viz., the lower selling price in carbon lamps without a corresponding reduction in the cost of manufacture or distribution. The smaller sales and lower prices were the result of the diminished demand for this class of lamp owing to the change to the metal-filament lamp, and they had been actively engaged in the year in pushing forward this new type of manufacture. There had been expended on capital during the year ending June 30th, a sum of £19,873, almost entirely on account of additions to buildings and plant in connection with the manufacture of metal-filament lamps. They had reduced the production of carbon lamps during the year, but they still thought there would always be a field for their use. On the other hand, they had materially increased the production of metal lamps although the accounts under review did not have the full benefit of that increase. They were turning out at the present time a large number of these lamps in a complete range of candle-powers and voltages, and confidently hoped to have a substantial increase month by month. The quality continued to be satisfactory, and was quite equal to anything on the market. The inauguration and development of this metal lamp manufacture had presented many serious difficulties, but he thought they might claim now to have succeeded in surmounting these difficulties, and their best thanks were due to the loyal and able staff at the factory for the zeal, energy, ability and courage they had displayed over a long and trying time both for them and for himself. Moreover, this new business had been established cheaply and economically. The experimental work had been carried out at their own factory, and the cost charged to revenue. In fact, the new business had been created without expenditure on capital account, except so far as was represented by tangible assets, such as buildings and plant. With reference to the cost of manufacturing carbon lamps, it was impossible to reduce it, for it was already at a minimum. They had, however, felt for some time past, that the question of the sale and distribution of their goods was one which called for careful consideration with a view to obtaining greater economy without impairing efficiency. Now that the strain in connection with the metal lamp was to some extent relaxed, this other matter was receiving, and would continue to receive, their close attention, and he might say that following the changes made in their selling department at the head office about the end of the financial year, they, in September last, appointed a commercial manager, who, under the direction of the board, was now devoting his attention to this important question with a view to securing greater economy and better results by the adoption of improved methods of selling and the reduction of costs. Steps were being taken with this end in view, but, of course, in a matter of such importance to the business, each step needed to be carefully considered beforehand. In this reduction, the board intended to participate, notwithstanding that in times such as they had to deal with, the work of the directors was more onerous. Turning to the accounts, the chairman referred to the sum allocated for depreciation, and said that it had been reduced, and for depreciation on property stood at 2 per cent. In this connection, regard must be had to the fact that they had written down their property in the last eight years by over £26,000, and of the £78,500 now standing to the debit of that account, nearly £16,000 had been expended on new buildings in the last four years. In like manner, the appropriation for depreciation on plant and tools had been reduced, but he would point out that nearly £46,000 had been written off this item in the last eight years, and of the £77,000 at which they stood in the balance-sheet, nearly £30,000 represented new plant in last five years. In the balance-sheet the material alteration was that the Investments were considerably down owing to the sale of securities to provide the necessary additions for the manufacture of the metal-filament lamps. Sundry creditors were up for the same reason. Investments were now set out for the first time at cost as a reserve fund, and about £1,400 had been applied to that account, which was derived from the profit realised on the sale of securities, together with a sum which had been previously reserved for another purpose, and which, on adjustment, was found to be in excess of the actual requirements. The market value of the investments to-day was £700 below the amount at which they stood in the balance-sheet. Stocks and work in progress were up by £4,300; the figures being £176,700 this year, against £172,400 last year. This increase was more than represented by the stock of metal-filament lamps, and the carbon lamp stock was practically stationary on the year. The figure included also the stocks of raw materials and stores at the various works and all work in progress. The net result of the year's working, was that after providing £15,701 for debenture interest and £10,713 for the reserve fund for depreciation and bad debts, they had a small sum of £421 to carry forward, which made the total carry forward £10,027. They considered that in connection with the affairs of the company much work had been done and progress made during the year, and although the effect was not reflected in the accounts under review, it would bear good fruit in the future.

Mr. E. B. Ellice Clerk seconded the motion, and the report was agreed to unanimously without discussion.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The half-yearly meeting was held at Electra House, E.C., on Tuesday, under the chairmanship of Sir John Wolfe Barry.

In moving the adoption of the report (see Electrical Review, November 5th, page 745), the Chairman said that the gross revenue was practically the same as in the corresponding period of 1908, the actual figures being £290,931 this year, against £290,295 last year. It was only right, however, to mention that the traffic receipts again showed a falling off amounting to, roundly, £8,000, due to the commercial depression that had been so severely felt in the Far East during the last few years. Fortunately they had been favourably affected by the dollar exchange conditions prevailing in China during the past half-year, and the increased revenue from this source had not only enabled them to wipe out the traffic loss, but to show a few hundred pounds increase for the past half-year. During the last month or two, there had been a little improvement in most of the traffics, which encouraged the hope that the depression was beginning to pass away. The working and other expenses amounted, in round numbers, to £157,000, against £151,000 for the corresponding period of 1908, showing an increase of £6,000. Of this, £3,300 appeared under the heading of "salaries and wages," and the balance was accounted for by their having had fewer ships' charters this year than in the corresponding period of last year, which made the expenses attending the maintenance of cables appear greater than they were last year, although in reality the maintenance expenditure was less by over £3,000. With regard to the increase of £3,300 in salaries, £1,300 of this was due to their having had to provide additional staff for the Java-Cocos cable laid last year, which had materially added to the efficiency of the service; £1,400 represented the amount of compensation granted to some of the senior staff whose engagements had to be terminated when the Tasmanian cables were recently closed, and the balance of £600 was due to automatic increases of salary. The net profit for the half-year was, roundly, £116,000, and after adding £18,000 brought forward from the previous half-year, there remained an available balance of £134,000. The usual quarterly interim dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, leaving a balance of £58,844 to be carried forward. When he last addressed them he explained that in consequence of the Australian Federal Government having laid and opened cables of their own between Victoria and Tasmania, when the company's exclusive concession expired on April 30th last, they had been obliged to close their Georgetown and Flinders stations, and intended, when a suitable opportunity occurred, to pick up the cables between Victoria and Tasmania and utilise them elsewhere. For this purpose their largest ship, the ss. *Patrol*, stationed at Singapore, was necessary, and as they had so far had no other cable work for her to carry out in Australian waters, the Tasmanian cables had not yet been picked up. Seeing, however, that the capital account had for some little time past been considerably over-expended, and that the original cost of the Tasmanian cable communication (£70,000) was included in the capital expenditure, it was considered advisable to write down the capital account by this amount and debit the general reserve fund with it. This had accordingly been done, and when the cables had been picked up and overhauled, the account could be finally adjusted by crediting the reserve fund with the estimated value of the old cables after deducting the expense of picking them up and transporting them to Singapore.

The Marquess of Tweeddale seconded the motion.

Mr. Reich pointed out that the expenses were constantly growing. Their revenue for the year would be about £230,000, and the dividend of 7 per cent. took £210,000, so that there was not much margin. He suggested also that instead of stating the investments at cost and setting aside £120,000 for investment fluctuations, it would be better to set out the investments at the market price on the day of making up the accounts.

The Chairman said it was true the expenses had grown, as the public expected so much accommodation, whilst the revenue had not been so great; but as he had said, this had been due almost entirely to stagnation of trade in the Far East, and other enterprises connected with that part of the world had suffered in like proportion. He did not want to prophesy further than he could see, but he did not think they need have any great alarm but that the dividend would be maintained, at all events for the present. The matter of the investment depreciation had been discussed, and it was felt better to set aside the £120,000 for depreciation, and to state the investments at what they actually cost the company. As a matter of fact, on the date of making up the accounts the depreciation was £137,000, which only meant a difference of £17,000 on one and a third million pounds of investments.

The report was then adopted, and a vote of thanks accorded the board and the staff.

MARKET QUOTATIONS.

Wednesday, November 10th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	„ Nitric	„	22/-	..
a	„ Oxalic	„	28/-	..
a	„ Sulphuric	„	5/6	..
a	Ammoniac, Sal	„	42/-	..
a	Ammonia, Muriate (crystal)	per ton	£29	..
a	„ „	„	£30	..
a	Bleaching powder	„	£5 10	..
a	Bisulphide of Carbon	„	£18	..
a	Borax	„	£16	..
a	Ferro-Silicon (50 %)	„	£11	..
a	Copper Sulphate	„	£18 10	..
a	Lead, Nitrate	„	£26 10	..
a	„ White Sugar	„	£23 10	..
a	„ Peroxide	„	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (75/80 %)	per ton	£20	..
a	„ Chlorate	per lb.	3½d.	..
a	„ Perchlorate	„	3¾d.	..
a	Potassium, Cyanide	„	7d.	..
a	Shellac	per cwt.	75/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	„	£6 10	..
	„ Recovered	„	£5 10	..
a	„ Lump	„	£5	..
a	Soda, Caustic (white 70 %)	„	£11	5s. inc.
a	„ Chlorate	per lb.	3⅝d.	..
a	„ Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks	per lb.	3d.	..
a	„ Cyanide (basis 100 %)	„	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£75	..
b	„ Wire, in ton lots	„	£112	..
b	„ Sheet, in ton lots	„	£120	..
p	Babbitt's metal ingots	„	£50 to £136	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c	„ Tube (brazed)	„	8¾d.	..
c	„ „ (solid drawn)	„	7¾d.	..
c	„ Wire, basis	„	6½d.	..
c	Copper Tubes (brazed)	„	8¾d.	..
c	„ „ (solid drawn	„	8¾d.	..
g	„ Bars (best selected)	per ton	£72	£2 inc.
g	„ Sheet	„	£72	£2 inc.
g	„ Rod	„	£72	£2 inc.
e	„ (Electrolytic) Bars	„	£60 10	..
e	„ „ Sheets	„	£77	..
e	„ „ Rod	„	£65 10	..
e	„ „ H.C. Wire	per lb.	7⅞d.	..
f	Ebonite Rod	„	3/3	..
f	„ Sheet	„	3/-	..
n	German Silver Wire	„	1/6	..
h	Gutta-percha, fine	„	5/6 to 6/6	..
h	India-rubber, Para fine	„	8/3	9d. dec.
i	Iron Pig (Cleveland warrants)	per ton	50/10	5d. dec.
l	„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g	Lead, English Ingot	„	£13 5 to £13 7 6	dec.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£9 17 6	inc.
d	Mica (in original cases) small	per lb.	6d. to 1s.	..
d	„ „ „ medium	„	2/6 to 4/-	..
d	„ „ „ large	„	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	„	1/- to 1/1½	..
p	„ „ rolled bars & rods	„	1/1½ to 1/3	..
p	„ „ rolled strip & sheet	„	1/2½ to 1/6	.
o	Platinum	per oz.	120/-	variable.
e	Silicium Bronze Wire	per lb.	9d.	..
r	Steel Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	„	£136 to £137	10/- inc.
n	„ Wire, Nos. 1 to 16	per lb.	1/9	..
p	White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a	G. Boor & Co.	h	Edward Till & Co.
b	The British Aluminium Co., Ltd.	i	Bolling & Lowe.
c	Thos. Bolton & Sons, Ltd.	k	Morris Ashby, Ltd.
d	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd.
e	Frederick Smith & Co.	m	W. T. Glover & Co., Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
g	James & Shakspeare,	o	Johnson, Matthey & Co., Ltd.
		p	The Phosphor Bronze Co., Ltd.
r	W. F. Dennis & Co.		

Amazon Telegraph Co., Ltd.—The directors' report for the year ended June 30th last shows a gross revenue of £77,365, and total working expenses £48,691, plus £26,984 for debenture interest and sinking funds, leaving £1,690 to the credit of the revenue account for the year, which reduces the debit balance to £49,386. The Brazilian Government has granted an extension of the present concession for 20 years from 1925 to 1945, together with an extension of the payment of the present subvention of £17,125 per annum for 20 years from 1915 to 1935, in consideration of the company duplicating its main cables. It is proposed to issue new debentures in order to provide for the cost of the duplication and for the repayment of the debentures now outstanding, and an extraordinary general meeting will be held after the ordinary general meeting on November 16th for the purpose of sanctioning £300,000 5 per cent. debentures and for making certain alterations in the articles of association, providing, *inter alia*, that whenever the reserve fund shall amount to less than £250,000 no dividend shall be paid in any year at a higher rate than 5 per cent. per annum.

STOCKS AND SHARES.

Tuesday Afternoon.

Over the Stock Exchange markets broods a general air of subdued melancholy, enlivened only by fitful gleams of cheerfulness. Money is dear, and not one of the departments in the House escapes from the effects of the burden. Brokers and dealers—ever prone to exaggerate—take a gloomy view of business prospects for the immediate future, but console themselves and each other with the reflection that all shall be well when the new year brings cheaper money and a lower Bank Rate. Some express a pious hope that the 5 per cent. minimum may be reduced before Christmas.

Home Railway stocks are all sliding back into the old rut of depression with which they are so familiar from long experience. The end of the half-year being in sight, prices should benefit from consideration of dividends to come, but not a ray of cold comfort do they derive from this. City & South London and Metropolitans are lower; so are Districts, and the seller of any Home Railway stock throughout the list finds that he is regarded as a menace instead of being welcomed as a friend. The Brighton Railway announces that its new electric service will start on the first of next month.

Here and there the prior-charge issues of the leading railway companies show an inclination to recede, but up to the present this factor has not affected the Debenture stocks of the electric traction lines, beyond a point fall in Baker Street & Waterloo, lowering the middle price to 98.

Electricity Supply descriptions are stagnant. Charing Cross and City "Lights" are each ⅛ lower. These two companies, with the County of London, are doing a little in the way of affording publicity to the attractions of electric radiators, and, considering the fine field that still exists for this form of enterprise, it is a little curious that more vigour is not displayed in bringing the matter to the notice of possible consumers. With almost every City office using electric current for lighting, and with the eagerness that is apparent amongst City men for details of radiator work, it ought not to be a difficult matter to get the articles installed into thousands of offices which are now served by other methods of heating.

The Canadian-Mexican group is steady, without sensational matter of interest. Mexico Trams reacted ½, and at 89 Rio Trams are 1 lower. British Columbia stocks are downgrading, the Deferred showing most loss with a drop of 3, followed by a fall of 1½ in the Preferred and 1 in the Preference; but the First Debentures are 2 higher. Profit-taking after the long rise, joined with the nervousness engendered by dear money, is assigned as the cause of the movement; but perhaps proprietors of these issues have been tempted to sell in order to embark in some of the newer ventures lately emanating from the Dominion.

Brisbane Electric Tramways Investment Ordinary has hardened to 6⅞, and the 5 per cent. Preference to a trifle over 5. The 4½ per cent. Debenture stands at 100½, carrying nearly five months' interest. Winnipeg Electric Railway 4½ per cent. Debenture stock has been changing hands at about 103½. Anglo-Argentine Trams 4 per cent. Debenture eased off a trifle, and Metropolitan Electric Trams 4½ per cent. Debenture declined to 95. British Electric Tractions are being picked up, with the result that the Preference shares have risen $\frac{3}{16}$, and the First Debenture at 84½ is the fraction to the good.

West India and Panama Telegraphs have been favoured on the good dividends declared by the company, and all four classes of securities have advanced. The Eastern group remains extremely quiet, the dividends and reports not affecting the quotations in any way. Anglo-Americans have weakened, the Deferred being ⅜ down, and the Preferred ¼. The Amazon Telegraph Company has done badly in its past year, making a profit of no more than £1,700, which is applied to the debit balance brought in, lowering that item to £49,400. Marconis have not recovered from their decline of last week. Telephone stocks and shares exhibit trifling changes, of which falls of ¼ in Chili Telephones and of ½ in National Telephone Deferred are the only noticeable examples.

The most satisfactory feature amongst miscellaneous varieties is a further recovery in British Westinghouse 4 per cent. Debenture, which raised the price 4½ points to 50. Even the Preference shares are ⅛ better at 10s. middle. The market being so limited, these movements are of course more or less the outcome of quite retail demand, but it is so long since Westinghouse issues have improved, until this last fortnight, that the rise certainly deserves a paragraph to itself.

Babcock and Wilcox shares are strong, and show 2s. 6d. gain at $4\frac{11}{16}$. Edison & Swan "A" have dropped to a nominal price of a few shillings, and General Electric Preference show ¼ fall.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3 — 3½	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —146	141 —146	..	..	..	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 93	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	61 — 63	61 — 63	61	..	..	5 3 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101¾—102¾	101½—102½	102½	101¾	— ¼	5 17 1
3,220,770	Do. do. do. Deferred	Stock	⅜%	1⅞%	1 %	8/-	21⅝— 21⅞	22¼— 22½	21$\frac{11}{16}$	22⅛	+ ⅛	1 16 7
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	7¾— 8⅛	7⅞	..	— ¼	4 18 6
2,481,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 89½	87½— 89½	88	..	..	4 9 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅜— 9⅛	8⅜— 9⅛	8½	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—101½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13 — 13½	13 — 13½	13⅜	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	126 —129	128	126½	..	5 8 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	83½— 85½	86	83¾	..	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102 —104	102	..	— ½	3 16 11
300,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅝— 12⅛	11⅝— 12⅛	12	11⅝	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102½	102¼	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	99	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10$\frac{7}{16}$	10$\frac{3}{16}$	..	5 8 3
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13¾	13½	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28½— 29½	28½— 29½	..	..	..	7 0 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51 — 53	51 — 53	..	..	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93½— 95	93 — 95	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	12/-	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— ⅞	¾— ⅞	17/6	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	17/6	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	107½	107¼	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	119½—121½	120½	119¾	— ½	4 18 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	10⅞	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10⅝	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅝	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	27/6	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1$\frac{1}{16}$— 1$\frac{5}{16}$	1$\frac{1}{16}$— 1$\frac{5}{16}$	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	..	..	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	8	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞— 7⅛	6$\frac{15}{16}$— 7$\frac{3}{16}$	7⅛	6$\frac{1}{16}$	+ $\frac{15}{16}$	5 10 1
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5$\frac{7}{16}$— 5$\frac{11}{16}$	5$\frac{7}{16}$— 5$\frac{11}{16}$	5⅝	..	..	4 8 4
80,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13½— 14	13¾	13½	..	5 0 0
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	103½	..	..	3 16
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	$\frac{11}{16}$— $\frac{13}{16}$	¾— ⅞	17/6	15/-	+ $\frac{1}{16}$	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9½	8⅞— 9⅜	9$\frac{5}{16}$	9$\frac{1}{16}$	+ ⅛	6 8 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8½— 9½	8¾— 9¾	9½	9⅛	+ ¼	15 7 8
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	102 —104	..	..	+ ½	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4½— 4¾	4½— 4¾	93/9	90/7½	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼— 4½	4¼— 4½	..	..	..	5 6
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	91 —92½	90½— 92	91¾	90¾	— ½	4 7 0
392,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4½— 4⅝	4⅝— 4¾	95/-	90/7½	+ ⅛	4 3 3
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1$\frac{7}{16}$— 1$\frac{9}{16}$	1$\frac{7}{16}$— 1$\frac{9}{16}$	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	..	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	97½	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	150 —155	147 —152	151	147½	—3	5 5 3
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —128	122 —126	123	122	—1½	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	108 —111	111½	108½	—1	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	102 —104	102	..	+2	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —106	103½	103	..	4 5 9
133,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝— 1	⅝— 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2⅛— 2⅝	2⅜— 2¾	52/6	48/1½	+ $\frac{3}{16}$	5 13 4
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82½— 85½	83 — 86	85½	84½	+ ½	6 16 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	58 — 62	59½	59	..	7 5 2
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7½— 7⅝	7 — 7½	7$\frac{9}{32}$	7⅛	— $\frac{3}{16}$	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	105½	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	¼— ½	⅜— ⅝	..	..	+ ⅛	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	44 — 47	48 — 52	43	..	+ 4½	7 18 10
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	$\frac{9}{16}$— $\frac{11}{16}$	$\frac{9}{16}$— $\frac{11}{16}$	..	..	..	Nil
50,000	† Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	4½%	4½— 5	4½— 5	93/9	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	95/7½	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅛— 10⅞	10⅛— 10⅞	10½	..	..	6 18 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5¾	5⅜— 5¾	5⅜	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb, Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105—107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	$\frac{3}{16}$— $\frac{7}{16}$	$\frac{3}{16}$— $\frac{7}{16}$	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2$\frac{1}{16}$— 2$\frac{3}{16}$	2$\frac{1}{16}$— 2$\frac{3}{16}$	42/6	..	..	5 19 1
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890 690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	60 — 62	60 — 62	61⅞	60½	..	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	45	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	30 — 31	29½— 30½	31	30	— ½	4 18 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From **Manchester Share List.**

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
605,000	Do. do. 6 % Cum. Pref., 1 to 605,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	5/32— 9/32	3/32— 7/32	4/-	3/6	— 1/16	34 5 8
17,139	Do. "A" shares, 01—017,139 ..	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 3/16— 1 7/16	1 3/16— 1 7/16	22/6	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	— ¼	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13½	12½— 13½	..	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¼— 16	15½— 16¼	..	..	+ ½	6 3 1
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	6 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅜— 2⅞	2⅜— 2⅞	..	..	..	13 0 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	67 — 70	67½	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	37¼— 37¾	36¾— 37¼	37½	36¾	— ½	1 6 10
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 —66	64 — 66	65	..	..	4 3 4
6,235,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	15½— 16	16	..	— ½	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32— 11/16	19/32— 11/16	..	..	..	6 10 11
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	3/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16— 13/16	11/16— 13/16	14/6	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93½— 96½	93 — 96	..	..	— ½	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½—127½	124½—127½	126	125	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	91¾	91½	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	34½	..	.	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 6
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100 —101	101	100½	..	4 19 0
2,800,000	Do. do. 4½% Bonds..	..	..	..	..	4½%	86 — 88	86 — 88	..	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	29 — 31	31 — 33	31	30½	+ 2	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	74 — 79	..	..	—1½	5 1 3

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908.	Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Highest	Lowest	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94 xd	91 — 94	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	7¼	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
686,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅞— 4⅜	3¾— 4¼	..	..	— ⅛	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4⅞	4⅜— 4⅞	78/1½	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 6 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3½— 4	..	..	..	5 12 6
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10¼— 10¾	10½	10⅜	— ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	12⅛	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 3 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	7 27/32	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	..	..	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	107½	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	99 —101 xd	99½	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅝— ⅞	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	92½	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	..	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —¹	99 —101	..	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1¾— 2⅛	1¾— 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅞— 5¼	4⅞— 5¼	5⅛	98/9	..	5 14 3
382,655	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	96/3	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	106 —109	..	..	+1	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	80½— 82½	82	81½	+ ½	6 1 8
13,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	71 — 75	73	72	..	4 13 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	103⅞	102½	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	84 — 86	85⅜	85⅛	—1	5 16 3
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	99½	99¼	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4½	4¾— 5¼	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 16¼	12¼— 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,610	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	6⅛	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 9/16— 1 11/16	1 9/16— 1 11/16	..	..	..	4 11 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 3/32— 1 7/32	..	..	+ 1/32	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16— 3/16	9/16— 13/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 6	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	103	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜—	⅜— ⅞	9/4½	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 1
275,000	Do. do. 4½% 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½— 78½	74½— 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	15/16— 1	15/16— 1	19/3	18/6	..	5 3 11
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	8 11/16	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞— 5¼	4⅞— 5¼	..	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 28nd, 1909

THE STEAM TURBINE OF THE OERLIKON CO.

This turbine is of the pure action type, with several pressure stages in a single casing. It is distinguished from other action turbines by the fact that in it use is made of the speed of exit of the steam from the revolving disks as well as of the inlet speed.

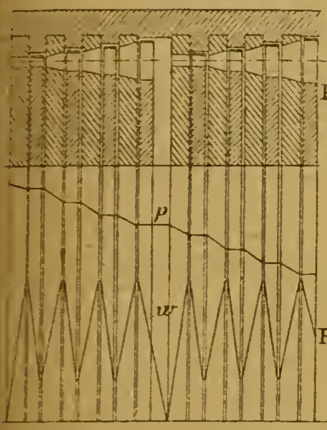


Fig 1.—Oerlikon Turbine; Steam Path, Velocity and Pressure Curves.

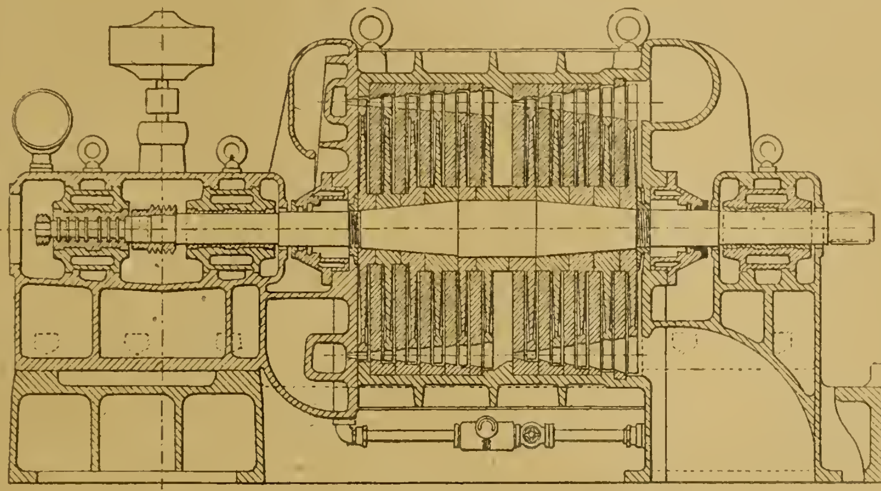


Fig. 2.—Sectional View showing Arrangement of Oerlikon Turbine.

For this purpose the turbine consists of one or more groups of pressure stages, each having an inlet arc of constant length, whilst the successive expansions of the steam are allowed for by increasing the radial length of blade from stage to stage within each group. Once the maximum practicable length of blade has been attained, the steam passes to a second group of stages, distinguised from the previous group by an increased inlet arc. This increased arc again remains constant throughout the various stages of the new group. The radial length of blade diminishes in general from the last stage of one group to the first stage of the next, and then increases again gradually from stage to stage.

In this way, the turbine makes use in each stage of the exit speed of the steam from the previous stage, except in the case of the last stage of each group. Fig. 1 shows diagrammatically the steam path in an Oerlikon turbine, having two groups of pressure stages. The length of blade in the first group increases step by step as shown, from 8 mm. to 51 mm. The second group commences with blades 15 mm. long, and ends with 48 mm. blades. The inlet arc forms 16 per cent. of the periphery in the first group, whilst in the second it forms 90 per cent. The manner in which the pressure falls from stage to stage is shown by the curve *p*. The initial pressure might be 144 lb. per sq. in., and the final pressure about $^{1}_{1}$-th part of this, or 1½ lb. per sq. in. From this pressure curve *p*, and the peripheral speeds of the revolving blades, the curve *w* for the speed of the steam within the turbine can be deduced.

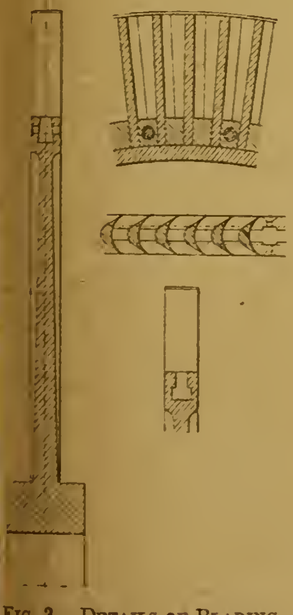


Fig. 3.—Details of Blading.

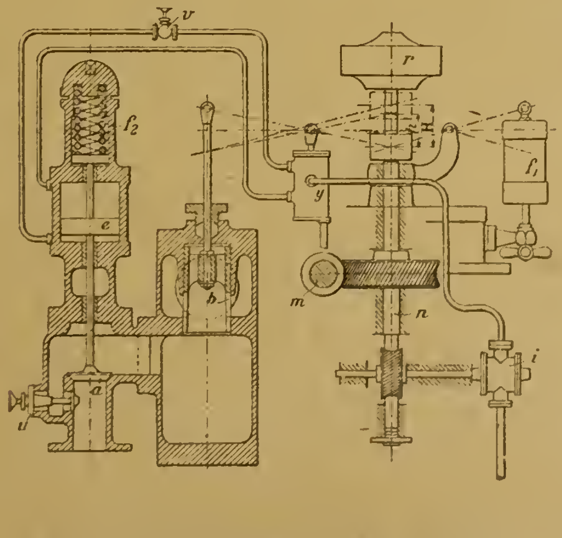


Fig. 4.—Governor Details, Oerlikon Turbine.

As compared with some of the older action turbines, this turbine has the advantage of an absence of pressure difference between the two sides of each revolving blade wheel. The tendency to leakage is therefore reduced, and this is made use of by the Oerlikon Co. to increase the clearances everywhere, and so minimise the risk of breakdown. In place of clearances of a few tenths of a millimetre, the Oerlikon Co. use gaps of at least 1 mm. in the smallest sizes, and this is increased to about 2½ mm. in the larger sizes.

The effect of variations of speed and variations of steam pressure on the consumption of these turbines is shown in the following table. These results refer to the first 1,000-kw. 3,000-revolution turbine made, and improved results have since been obtained. In this turbine the radial clearance between the boss of the revolving wheel and the fixed wheel was 1¼ mm., between the revolving wheel and the outer cylindrical casing 4 mm., and the axial clearance between the revolving and fixed wheels was 3 to 5 mm.

Steam admission pressure. Lb. per sq. in.	Admission temperature. Deg. C.	Steam outlet pressure. Lb. per sq. in.	kw. output at generator terminals.	R.P.M.	Hourly steam consumption in lb.	Steam consumption per kw.-hour.
90	280·5	1·35	526	3,000	11,100	20·9
90	276	1·17	548	2,677	11,200	20·4
90	276	1·17	465	1,700	11,400	24·5
52	258	·82	304·7	3,000	7,200	23·7
74	253	·79	499	3,005	10,200	20·3
106	257·5	·98	765	3,010	14,600	19·2
136	271	1·21	1,004	3,000	18,400	18·3
166	280	1·48	1,243	3,000	22,200	17·9

Fig. 2 shows a diagrammatic sectional view of an Oerlikon turbine. The rotor is carried in two bearings, one of which is arranged to take the end thrust which, as in all action turbines, cannot be entirely eliminated. Forced lubrication is employed and, in the larger sizes, provision is made for water cooling. All bearings are completely isolated from the steam. Labyrinth packings are arranged where the spindle enters the steam chest. The spindle is amply dimensioned and tapers from the centre outwards, so as to facilitate the mounting of the disks.

The stationary blade wheels are carefully fitted into the interior of the cylindrical casing, are in two pieces, and are made of forged iron. The fixed blades are machined out of the solid steel. They are given the exact theoretical shape, and are polished, so as to reduce the steam friction.

The revolving blade wheels, fig. 3, are shaped exactly symmetrical, and have a factor of safety of from 5 to 7. They are cut out of sheets of cast Siemens-Martin steel of the best quality. The blades and distance pieces are dovetailed into the rim of the wheel as shown, and are riveted at intervals. Each wheel is tested separately, before assembly, up to a speed 50 per cent. in excess of the normal, although the governor employed with these turbines limits the speed increase to 10 per cent. or 15 per cent. The revolving blades are carefully made in nickel steel. A steel ribbon riveted to all the blades limits the radial depth of the steam space. Turbines up to 20,000 h.p. are built on this plan, with a single cylindrical casing.

The governor employed is shown in fig. 4, and the way in which it is operated in starting up the turbine is as follows:—

By means of a by-pass *u*, steam is gradually admitted to the turbine by hand, and the turbine starts up. As it approaches the normal speed, the governor *r*, driven through worm gear from the turbine spindle *m*, takes over the regulation, and if the three-way cock *v* is open, the oil pump *i* is able to force oil under the valve piston e, and this opens the stop valve a, and keeps it open against the action of the spring f_2. Should the speed exceed the normal by more than 15 per cent. however, the valve is automatically closed, and also should the supply of oil cease from any cause, the valve a is again automatically closed by the spring f_2. b is the regulating valve, y is an oil distributing chamber, and f_1 is an auxiliary spring, by the hand regulation of which the speed can be varied ± 5 per cent. The oil pump i supplies the whole of the forced lubrication as well as operating the valves as described. In order to shut the turbine down it is only necessary to turn the three-way cock v through 90: thus admitting oil to the top instead of the bottom of the cylinder c. An indicator is fitted to show whether the stop valve is open or closed at any time.

For overloads (or for normal load without condensation) live steam can be admitted direct to the second or third group of blades instead of to the first. The greater area of steam passages thus attained admits a greater quantity of steam.

The condensed steam from these turbines is found to be entirely free from oil.

A flexible coupling is provided between the turbine and its electric generator.—*Le Génie Civil.*

THE JAPAN-BRITISH EXHIBITION.

The erstwhile Lord Mayor (Alderman Sir George W. Truscott) entertained a large party to luncheon on Friday last at the Mansion House, to meet Prince Arthur of Connaught (hon. president of the Japan-British Exhibition 1910).

In proposing the toasts of "His Majesty King Edward VII." and of "His Imperial Majesty the Emperor of Japan," the Lord Mayor commented on the active interest which both Sovereigns were taking in the coming Exhibition.

The Lord Mayor, in afterwards proposing "Success to the Japan-British Exhibition," said he thought the company would agree with him that the happiest part of that title was the hyphen, which represented the alliance they all rejoiced in between the two great Empires of Japan and Britain. Proceeding, his Lordship said the project, which was to take shape at Shepherd's Bush next year, must prove to be one of the most interesting of modern Exhibitions. What they now desired was to call British manufacturers to arms, in order that they might show what they could do in the arts of peace. The Government and the people of Japan were ready and willing, as they had already demonstrated, to be the customers of England. It now only remained for the British manufacturer to enable them to be so. The foreign trade of Japan with the British Empire amounted to-day to something like £24,000,000, or 29 per cent. of her foreign trade taken altogether. It was surely worth our while to maintain that splendid commerce, and, if possible, to increase it. It had been suggested that possibly the Corporation of the City of London might see its way to take part in the British section, and that the leading City guilds might possibly arrange historical exhibits of the trades they represented, to add to the importance of that section.

Prince Arthur of Connaught, in replying, said: It gives me very great pleasure to reply to this toast, which you, my Lord Mayor, have so eloquently proposed. I feel I could not do better than quote the words of my revered grandfather, the Prince Consort, speaking at the Mansion House on a similar occasion in connection with the Exhibition of 1851. "No one," he said, thoughtfully considering the particular features of that Early Victorian era, "could doubt for a moment that it was an age of wonderful transition—an age tending rapidly to accomplish the end towards which all history pointed—namely, the unity of mankind. That unity," continued his Royal Highness, "was not one which broke down the limits and levelled the peculiar characteristics of nations, but one which drew them together with one great object—the mutual understanding and the general good of the human race." As commercial men, those here gathered together to-day are perhaps more fitted than the rest of the community to judge how much this material progress has helped towards realising that peace which the Prince Consort had so much at heart. What the Franco-British Exhibition has done in this direction is well known, and it promises well for the future to see so many gentlemen of standing and position in British commerce assembled together for the purpose of carrying out the organisation of yet another vast enterprise, which will help to draw the ends of the earth together, strengthen the bonds of political and commercial union between us and our gallant allies, increase the prosperity of both countries, and make for the advantage of each of our great Empires. That would have been the thought animating the great Prince whose words I have quoted: that, I venture to hope, will be the thought animating all present here to-day in connection with the Japan-British Exhibition. The co-operation of the City of London will be most valnable to the Exhibition; while the Lord Mayor's idea of the City Companies participating, in the manner he has suggested, would create a new departure in the history of exhibitions which I am sure our Japanese friends would greatly appreciate. The Japanese Exhibition, being of such a singularly interesting character, is bound to attract universal attention; and there is no doubt that thousands will come from all parts of the world to avail themselves of this splendid opportunity of seeing the treasures of the East spread out before them. I feel confident that our British manufacturers and merchants, fully realising the great importance of this Exhibition, will lend their strongest support by sending exhibits which will be worthy of so unique an occasion.

His Excellency the Japanese Ambassador, who also responded to the toast, said that the Government and people of his country had been doing their best to make their exhibits worthy of the occasion. According to accounts he had from home, the preparations were on an elaborate scale and in a very advanced state. The ambition of his countrymen would be to show to their allies their past achievements and prospects in the path of peaceful progress and development, and thereby bind more closely those important ties which happily united the two countries, politically and commercially. Those of his countrymen who would come over to England next year in considerable numbers would derive benefit from the examination of the splendid array of British exhibits which would no doubt be displayed at the Exhibition, and he hoped that would result in an increased demand for British products.

The Lord Mayor subsequently telegraphed to Prince Fushimi in Tokio sending hearty greetings from those present, and assuring the Prince that everything that can be done should be done to make the Japan-British Exhibition at Shepherd's Bush an unprecedented success, and the following reply has been received by the Lord Mayor-elect (Sir John Knill) from Prince Sadanaru Fushimi, who will visit the Anglo-Japanese Exhibition in London next year:—

Japanese Government, Tokio.

I am grateful to receive your hearty greetings, and appreciate your earnest desires for Anglo-Japanese Exhibition. Please convey my sincere thanks and earnest wishes for the complete success of the Exhibition to all the members.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers (Birmingham Section).

Inaugural Address of the Chairman,
Mr. R. K. Morcom, M.I.E.E.

I have to thank you for the honour you do me in choosing me as your chairman for the coming session. In a way I feel that an apology is due. I am not actually myself engaged in electrical engineering, though I think I may say I am direct coupled to it. There appears to be no doubt that at present the electrical industry is passing through difficult times. There is a great deal of severe competition both home and foreign, and the market itself is not expanding as satisfactorily as in the past. I think that having, as I have, a keen interest in the progress of electricity, but being, as it were, on its borderland, I may be able to survey the position from a somewhat special point of view. More particularly I wish to consider the state of the primary branch of the industry—namely, large electrical engineering—which will be referred to as "the industry" in many places. With the object of getting into closer touch with internal opinion I referred to the reports of annual meetings and to the balance-sheets of the leading companies, and was surprised to note that at least one or two companies in every year since the beginning of the century complained of general industrial depression, although in the same years others might state that trade was satisfactory. Opinions being so conflicting I thought it advisable to analyse figures to discover to what extent depression or the reverse existed, by an examination of figures published or otherwise obtainable for the past few years.

In some respects the state of the electrical industry is difficult to analyse. Its development depends upon the development of a practically new science, and its progress is affected not only by the general progress of trade, but also by the success of its competition with older methods of attaining particular ends. If electricity were unknown, oil and gas could still give light and heat; ropes, belts, and shafting would transmit our power, and locomotives or horses propel our trains and trams. But the convenience of the electrical method is such as to make comparatively rapid headway in these fields.

In studying the period from 1900 to the present day from available statistics, it at once becomes apparent that immediately the disturbance caused by the South African War had subsided, the trend of trade was upwards on a very steep curve, except that 1904 and 1908 were noticeably periods of depression. So far as the Board of Trade returns for total imports and exports are concerned, the 1904 depression is masked by the demands of the Russo-Japanese War, whereas that of 1908 is obvious. To find the signs of the former depression we must go to other figures. Among the chief users of electrical power are the textile, the iron and steel, engineering, shipbuilding, chemical, and mining industries. A study of the Board of Trade returns for these industries reveals the signs of depression not in the textile industry, which shows a steady increase up to 1907, but in the others. In the iron and steel industry there was a decided falling off in exports during 1904. The chemical exports instead of increasing were almost steady, the machinery exports showed an increase less than that shown in either 1903 or 1905. Also there was a falling off in shipbuilding in 1903-4 for vessels for our mercantile marine. There was likewise a fall in the rates of increase of coal and pig-iron production.

The depression of 1908 is much more marked, and statistics show a retrograde movement all round—a very serious one in the textile trade, and actual decreases in all the other above-mentioned industries. As further indicating that these were years of depression, the returns of unemployment show a peak in both. It is to be hoped that the coming winter will show some alleviation of the unemployed position compared to last year, when it assumed such serious proportions.

Another important consideration bearing on the progress of the industry is to be found in the expansion of public supply, my authority for which I take from the latest edition of Garcke's Manual. The figures show that whereas there was an increase from 1906 to 1907 of 197 million units, the increases from 1907 to 1908 was only 104 million units. The increase of plant installed for supply undertakings have likewise fallen off considerably in the last year or two.

The traction figures for municipal trams extended but slowly during 1908 The expenditure of tramway companies was very considerable, but Mr. Garcke points out that the rate of growth of increase is not maintained, and a considerable portion was accounted for by railway companies' electrical expenditure. The Board of Trade returns treating of the electrical industry itself are incomplete and unsatisfactory. Roughly, they reveal that whereas our imports of electrical machinery have since 1903 maintained a fairly constant level of, say, £600,000, our exports have risen from just under half a million to about one and one-third million. Figures of electrical exports and imports, including machinery, have been subject to various adjustments and classifications which obscure them, but the position may be summed up by saying that the imports have shown an almost steady rise, while exports fell severely in 1904 and again in 1908. The exact value of our home market for electrical machinery is one that is difficult to estimate. The census of production figures for the industry are not available, and unlike some of our foreign competitors, we do not seem anxious to publish particulars of our sales. Occasionally some indication is offered in prospectuses, but incomplete and sometimes over-optimistic. I endeavoured to get at it in a round-about way as follows: I obtained, after considerable inquiry, particulars of the number of employés of leading firms. I also got from some of them the proportion existing between the export and home trade in a sufficient number of cases to suggest an average figure. The average was taken, the percentage from each firm being properly weighted by multiplying it by the number of employés. As the figures given were confidential I can only give my results as follows: This rate for 1908 works out at 31½ per cent. foreign and 68½ per cent. home. The figures are necessarily approximate only, but indicate that our home consumption is in the neighbourhood of £3,000,000, our exports one and one-third million, and imports half a million. In comparison with previous years our exports appear to have increased faster than the home consumption.

Another noticeable point has been the falling off in the ratio, in our home consumption, between work for public service to that for private service. A recent estimate of the municipal demand was about 1½ million per annum. To-day's figure is probably a good bit less than this. Estimates of the output of other branches of the industry, which I glean from evidence collected in the Tariff Commission's report, are that the home consumption of electrical fittings is between £300,000 and £400,000 per annum, of which about half is imported. For lamps the home consumption is about 20 million lamps, of which about 7 millions are imported.

So far the analysis has been chiefly confined to the consideration of the market for finished goods. The prices of raw materials will next be taken. The most noticeable feature of the century was the rise in price of copper in 1906-7 to a value double that prevailing in 1894-5. This rise, it will be seen, occurred on a falling market for electrical machinery, and was a factor in producing considerable distress to manufacturing concerns. The price of pig-iron from a very low figure in 1901 has risen steadily, and was in 1908 nearly 70 per cent. above the former figure. Under these conditions of output and prices of raw materials, what has been the progress of selling prices? As an indication I propose to take instances which represent the general trend, selecting the branch for which the figures are most easily accessible to me—namely, generating sets for coupling to high-speed engines. I propose to give the price per kilowatt of alternating and direct-current machines of about 250 KW. and about 1,000 KW. The averages thus obtained for 1901-2 were £3·6, £3·4, £2·6, £3·0 per kilowatt. These started at once to fall, first slowly, then rapidly in 1904, and then again gradually, till to-day the corresponding figures are £1·9, £1·85, £1·5, £1·55. The trend of prices has been similar in practically all branches of the trade, and in the allied industries of stationary engine building and steam turbine building. The increased price of raw materials in 1906-7 made no difference to the rate of fall.

The causes assigned for the fall are three-fold. Some put it down to foreign competition either real or feared, others to over-productiveness in the industry, others, again, to depression of general trade. A satisfactory feature is that up-to-date machines are better designed and more reliable than the older; they are better manufactured and much better standardised. A few years ago to meet the cut prices, some machinery was turned out of inferior design, but the mistake of such a policy has been clearly shown, and my own experience is that our manufacturers now turn out the finest machines in the world at prices far below their true value.

Year.	Large engineering.	Cables.	Lamps, fitting and wiring.	Traction accessories.	Instruments and accumulators.	Foreign agencies.
1896	1,700,000	1,400,000	830,000	—	450 000	130,000
1902	5,000,000	2.500.000	2,200,000	600.000	950 000	500,000
1908	9,000.000	3,200,000	4,300.000	500.000	1,400,000	500,000

A further point that needs consideration is the distribution of capital in the industry. The figures for this capitalisation are given in Garcke's Manual, but, unfortunately, they are very disguised by the inclusion of a large number of companies whose staple product is not electrical, or who are merely agents for foreign manufacturers. I have taken out revised figures which will, I think, put the position more clearly. Mr. Garcke states that from 1896 to 1906 the capitalisation grew from £6,500,000 to £40,000,000. I have attempted a closer analysis of the figures for the three years 1896, 1902 and 1908, which I tabulate as in the preceding column.

It will be seen that much the largest rise in capital has been in the industry I am specially considering, and this branch is the one which accordingly will suffer most from internal competition. The stress in other branches is more likely to occur from foreign competition or that due to the large engineering factories taking up accessories as a sort of by-product.

The tendency nowadays is towards wholesale manufacture and the accumulation of subsidiary manufactures into the hands of large firms whose business is of such a nature as to be akin to the particular subsidiary. It is generally a mistake to endeavour to link up two industries which requires staffs of absolutely different training. For instance, engine-building pursued by electrical firms has not on the whole been a great success, and probably always leads to waste in staff expenses. The heavy capitalisation which has been noted in the engineering section is one particularly worth note, and its effect may be usefully illustrated by a wider review than has been hitherto adopted.

In a way it is a young industry, but past its infancy. In its infancy it suffered from one very bad slump in the early and middle eighties, similar to that which recently hit the infant motor-car industry. This slump was undoubtedly due to the great rush of capital into an industry, based on a mistaken idea as to its immediate future. In the year 1882 alone nearly £9,000,000 of capital was raised for electrical enterprises. As a result, competition was so keen as to reduce profits to vanishing point. Improved methods of manufacture and gradual realisation of the over-eager anticipations of the companies gradually steadied the industry into one of increasing prosperity.

The progress of electric lighting, which came with the improved design and cheapness of lamps, continued steadily. Electric traction found more and more application, and up-to-date manufacturers, by adopting electric drive because of its convenience, cleanliness and economy, all brought grist to the mill, and a remunerative business was done during the closing years of the last century by a number of concerns whose names are household words with us.

The beginning of the twentieth century seems to have heralded harder times. The older companies, led on by their excellent trade, increased their capital, and new enterprise was tempted in by the evident prosperity of the business, till to-day we are again in the position that if all our works were full, the demands of our home and export trade would not be enough to take their output.

I find that, generally speaking, the summary of figures which I have so far given throws considerable light on the published remarks made at the various company meetings, which, as I previously mentioned, I had found somewhat conflicting. It is obvious that the sore straits in which some of them found themselves blinded them to the actual course of events, but, on the whole, they are so instructive and illustrative that I should like to abstract a few of them. In 1901-2 there was a great bustle in the industry, large factories were built, big extensions were made, and manufacturers were evidently starting on a big campaign of development. In 1903 there were general reports of improving trade and growing business, but here and there a complaint of small profits due to the inauguration of new factories. In 1904, apparently, foreign competition was severely felt, and a heavy fall of prices occurred. The report of Crompton & Co.'s meeting is so instructive that I will abstract it somewhat fully. The chairman stated that results did not compare favourably with recent years in consequence of general trade depression and continued competition, though there were signs of improvement. Prices were dropping fast, lists of standard goods falling as much as from 10 to 25 per cent. in a month. Public tendering was so keen that in one case there were 60 tenderers. Although they turned out more goods than in 1903, the money value was less.

In 1905 the general report was that competition was increasing in intensity, though the volume of business was improving. In 1906 came a rise in the price of raw material, in spite of which no corresponding rise occurred in prices. An interesting summary was given at the Electric Construction Co.'s meeting, the chairman reporting an increased output from the factory, but no increase in profits, in spite of careful organisation. They were not alone in this unfortunate position, which did not arise from lack of demand or foreign competition, but was solely caused by excessive expansion of production in this country. Three or four years before great preparations had been made for an increased supply of electrical machinery, which was only partially justified, the demand not being sufficient to provide employment for all. Average prices had been reduced by more than 30 per cent. in three years, in face of an advance in prices of raw material.

The evidence all points to considerable increase in the volume of trade in 1906 and 1907, in spite of a marked reduction in the increases of municipal expenditure. Reports show that improvements in organisation and design were having their effect in coping with the reduced scale of prices, but towards the end of 1907 the cheerful tone disappeared and a severe depression set in, the reasons for which, as well as its character, will be quite clear from what has been said about the very obvious slump of 1908.

It is certain that had it not been for increased productivity, the first seven years of this century, excepting 1904, would have been progressively profitable. In fact, 1906-7 were remarkably good years. The introduction of the metallic-filament lamp has undoubtedly reduced the requirements in machinery, and it remains for the increased cheapness and efficiency of electric light to stimulate the demand to a pitch when plant requirements shall again assume an upward grade. Cheap electrical power is encouraging further industrial application, and if experience of heavy traction, at present on its trial, is satisfactory, it is only a matter of time before this application is extended. Tramway work is bound to extend with increasing urban population.

In shipbuilding more and more work is being done electrically, and the electrical requirements of the ships are growing, while at present the air is full of rumours of the close approach of electro-marine propulsion. All these things give hope that, as the capitalisation which caused the slump in the early 80's was justified in the 90's, that of the first decade of this century may be justified in the second.

But to cause such a demand, capital and enterprise are required. I use the word capital in the usually understood sense of capital in bulk. While freedom of capital may not so much affect the sale of an article which can be bought in penny lots, when it comes to an industry whose output comprises units costing hundreds or thousands, free capital is its life blood. Without it, we must look to great restriction of our home market, which is at present our chief one, with the likelihood of foreign competition such as occurred in 1904. The other great markets of the world are practically closed to us. Our Colonial industries, though growing rapidly, are not yet large enough to make up the deficit, and the same may be said of various non-manufacturing countries. The industry is so large and important that in foreign countries it receives special support from their Governments, and it is estimated that in Germany the number of employés increased from 1904 to 1906 from 72,500 to 95,000. According to Garcke, the comparative British figures for 1907 would be 45,000. It is estimated that the whole of the electrical industry in this country employs 300,000 persons, so that its prosperity may seriously affect the question of unemployment. In the large engineering branch capital must play a great part. Contracts are severe, and payments for the finished article are often held up for long periods. All the while the wages of labour must be promptly and fully paid. Capital is the fly-wheel of industry, which keeps things going steadily under the fluctuating impulses of demand, and enables the machinery to grind out at an even rate the current of wages. It is, therefore, the business of capital to keep wages secure. But it cannot perform this function rightly unless it is secure itself. Such security requires a large enough market. It is serious to note in Garcke's Manual that almost £7,000,000 of capital in the industry earns no dividend at all, and to observe the serious fall which has occurred in the Stock Exchange quotations for electrical securities. In an industry so specialised, and which requires a great amount of brain work, a great deal of expensive machinery, and large purchases of raw material, the capitalisation must be high. I find from figures of numbers of employés, and of the capital of a number of our leading companies, that on the average £300 of capital must be found to provide workshop, tools, security, and trade for every single workman.

The average capital expended on buildings and plant is nearly £200 per man employed. Careful organisation, with increasing trade, will enable this figure to be reduced. The staff expenses for technical and clerical work are necessarily very high, and add considerably to the dead charges. In many instances their total is as high as the wages bill; while, taking an average for the clerical staff of a number of the large firms, it will be found that one clerk is required for every three to four workmen. The importance of this clerical element is often overlooked when discussing the relation of capital to labour. I would like to enlarge upon the internal relations of manufacturing, but the information is very hard to obtain. In this connection the annual report of the American G.E.C. is most interesting. From the 1907 report I glean the following:—Area, 4,770,000 sq. ft.; employés, 28,000; cost, $1·12 per sq. ft.; orders, $60,000,000; capital, $64,000,000.

I have touched a little upon the great subject of the relations between capital and labour, but will refrain from discussing it at all in its political aspect, as I have refrained from remarking upon the tariff controversy. We are not a political institution, but one thing upon which we all are intent is to do our bit for the welfare of our great industry, and thus for our country. Our bit is for the manufacturer, designer, and consultant to see that our products, designs, and schemes for 1910 are so superior to what we have done before that our older works will be discarded, and their substitution bring in such a crop of orders as to give plenty of business and full employment to our engineers and factories alike. But not only must our 1910 goods be better than our previous ones, they must be better than any one else's 1910 goods.

We are now so well equipped with fine technical schools and universities, and they have such splendid men on their staff as professors, that we may rest assured that engineers are being turned out, equipped with the highest training, and able to hold their own in any competition. This, above all, will ensure our industry showing progressive improvement, which will keep the market alive.

A noticeable feature in the addresses of chairmen of local sections of late years has been the stress laid on the education problem, and very rightly, but we must see that the thing is done properly and not overdone. Education can narrow as well as broaden.

That a man in his time must play many parts has never applied to any one, I think, as much as to the modern engineer. It has been pointed out that he may have to be a physicist, mechanic, accountant, salesman, organiser of labour, and judge, and you cannot be educated to all that. All that our teachers can do is to lay the right foundation of knowledge and leave experience to do the rest. So much has been said and written by able men on this point that I can but refer you to their writings and words for guidance in forming your own opinions, but there is one point on which I feel strongly, and that is, that there is rather a tendency to discourage pure in favour of applied science. The value of mathematics in particular, as a training, should never be overlooked. Given zeal, I believe that mathematics, and plenty of it, will take a man further than any other training. It will give him that most valuable commodity, a well-ordered mind. A common experience is that if a student experienced difficulty in, say, advanced arithmetic, he would go back to it as child's play after a bout with algebra, and when algebra begins to get vague a dose of differential will send him back to scoff at the former difficulty, and so on into higher fields. A sound mathematician can always more readily specialise on a physical subject than another man—he is trained to reason.

Too many engineering text-books are now written which make a boast of their non-mathematical nature. It certainly makes the book fatter and more expensive, but mathematics are labour-saving appliances, and should be used. Those who cannot use them should take the results they produce for granted, like a labourer with a complicated automatic.

The number of successful barristers whose training has been mathematical is large, and any of us who have been in contact with a barrister on a technical subject must have been surprised at the great command of that subject which he can acquire at short notice. Take a mathematician, give him a workshop training, and let him read the technical papers instead of the sporting columns of the daily Press, and he will make an engineer. If he also has the gift of common sense and zeal for his profession he will make a good engineer. An engineer whose knowledge of mathematics and pure science is rudimentary is to his truly educated *confrère* much what a pianola player is to a pianist.

And this brings me to my conclusion on a point at which manufacturers, educationalists, and this Institution are on common ground. For it is only by keeping in the forefront of scientific production that we can hope to secure for ourselves a prosperous industry and a respected profession.

Physical Society of London.

At the meeting held on October 22nd, 1909, **Mr. F. E. Smith** read a paper entitled "On Cadmium Amalgams and the Weston Normal Cell." Cadmium amalgams may be solid, liquid, or a mixture of solid and liquid phases, the percentage composition of the phases depending on the temperature. When a completely liquid amalgam is cooled below the lower transition temperature, the centre of the resulting solid is of high cadmium concentration, and the outer skin of low cadmium concentration. Diffusion tends to produce uniformity, and in consequence the E.M.F. of a cell containing the amalgam is unstable for a considerable length of time. When the amalgam is slowly cooled to a temperature a little below the lower transition temperature, the difference of concentration between the inner and outer parts of the amalgam need be only small to enable the outer skin to be a two-phase system. The diffusion process will be slow and the E.M.F. may remain constant for a very long time. Amalgams which were of uniform cadmium concentration throughout were obtained by chilling completely liquid amalgams to a temperature of about —50° C.; although not initially stable, rapid diffusion processes resulted in these amalgams becoming approximately uniform throughout after a few days, and their electromotive properties were markedly different from those of slowly cooled amalgams. If, however, the temperature of such an amalgam is raised until two phases exist, subsequent cooling will not restore the uniform condition, and an unstable amalgam results. The experiments indicate that a 12·5 per cent. amalgam may be safely used at all temperatures between 12° and 60° C., and a 10 per cent. amalgam at all temperatures between 0° and 51° C. Experiments were made on the temperature coefficients of the anode and cathode limbs of the Weston normal cell, and show that if a difference of temperature of 1° C. exists, an error of about three parts in 10,000 is introduced.

A paper entitled "Production of Radium from Uranium" was read by **Mr. Soddy**. Measurements on the growth of radium in the three uranium solutions purified by Mr. T. D. Mackenzie between three and four years ago have shown that in all the growth of radium is proceeding at a rate proportional to the square of the time, within the error of measurement. The methods of testing have been improved, and the ordinary error is not greater than 10^{-12} gramme of radium. This result indicates the existence of only one long-lived intermediate product in the series between uranium and radium.

Mr. Soddy next read a paper entitled "The Rays and Product of Uranium X." Experiments have been made with the uranium X preparations separated with the help of Mr. A. S. Russell from 50 kilogrammes of pure uranylnitrate. It is concluded that the parent of radium cannot be the direct product of uranium X. The experiments, taken in conjunction with those given in the preceding paper, indicate that it is not a product of uranium X at all, but the subsequent history of the uranium X preparations must be awaited before this can be decided.

A third paper, entitled "The production of Helium from Uranium and Thorium," was also by **Mr. Soddy**. Helium has been detected in four experiments with uranium, in three with thorium, and in one with pitchblende solutions carried out according to the methods already published.

DIFFICULTIES IN SUB-STATION PRACTICE.

[COMMUNICATED.]

Owing to the introduction of alternating current for power and lighting distribution, the areas of electricity supply have within recent years become very greatly increased, and as a result the method of distributing power at extra high pressure and reducing it by means of static or rotary transformers has become increasingly prevalent. This has led to the development of an entirely new set of conditions as regards electrical operation, which, in practice, differ from ordinary generating station procedure. Up to the present not very much has been made of the special difficulties to which the attendants in electricity supply sub-stations are subjected, and it may, therefore, be worth while detailing in the following paragraphs typical instances of the difficulties which have been encountered, and the way in which they have been overcome.

Owing to considerations of rental values and the necessity of economising in ground space, it has become the practice in recent years to locate the sub-station either in the basement of one of the buildings in the supply area, or even under the street. This is more especially the case in the large centres of population, such as the metropolis. This introduces certain difficulties with regard to lighting and ventilation, which are ably foreseen and planned for by the architects having charge of the scheme. There are, however, incidental dangers with regard to the working of the supply which are not always predetermined. For example, in one sub-station, which was converted from an old steam plant engine room, located under a theatre, and from which the whole of the supply to the theatre was fed, the whole room was sunk under the level of the roadway, although contained within the building area of the theatre. In the reconstruction, a trap to a sewer 4 ft. above the floor level of the sub-station was left unnoticed, and remained unguarded by any protective device when the station was reconstructed. During a period of heavy load it happened, unfortunately, that a torrential rainfall flooded the sewer, and the sub-station floor became covered with water from the trap to a level of 3 ft., with the result that part of the high-tension switchgear was submerged. This, of course, partially interrupted the supply, and a considerable amount of confusion was caused in the area affected. The trouble was, however, diminished to a large extent by the prompt action of the switchboard attendants, who borrowed a fire engine and pumped out the water from the sub-station almost as quickly as it entered. The only device which was permanently put out of action was a small high-tension transformer on the high-tension board, which had to be removed and dried, and the oil renewed. After the station was cleaned out the trap to the drain was stopped, in order to prevent any recurrence of the trouble.

Another evil which can also be traced, in many cases, to the situation of the sub-station is the excessive amount of dampness in the atmosphere, and in this connection it may be urged that sub-station buildings placed below the level of the ground should be protected by double walling and sheets of damp-proof material between the two walls. In very marshy ground it is not too much to specify that concrete shall be freely used, and, at the lower levels at any rate, cavities should be left so that bitumen or pitch may be run in, in a continuous sheet, to form a protective course. If means are not taken to prevent the percolation of water there should, at any rate, be a provision for warming and drying the sub-station chamber. This can be partly done by the heat developed in the transformers, which undoubtedly has a drying effect upon the atmosphere, and may be assisted by providing a gentle circulation of air by means of a fan. If such precautions are neglected, serious accidents may occur upon the high-tension apparatus due to the deposition of moisture upon the insulators. In one sub-station the high-tension current is conducted along a path near the wall by means of separate rubber-insulated cables, cleated with porcelain insulators to the wall. When a damp cloth touched the glazed brick wall and the outside of either cable, as was almost inevitable when cleaning down the walls of the sub-station in the usual way, a number of crackling sparks were emitted, about $\frac{1}{16}$ in. long. Such disruptive discharges might very easily, in course of time, penetrate the insulation of the cable and cause a serious breakdown. The remedy adopted was to keep the walls near the cables quite dry by means of heat and fanning, as above described.

In many cases the switching arrangements of a transformer sub-station are very carelessly designed. So far as possible the rule which has become general in the generating station, that is to say, that each switchboard should be its own wiring diagram, should be followed in the sub-station, but owing to restricted space and the consequent crowding of apparatus, this rule is not followed so strictly as it might otherwise be. This has its effect in many instances upon the operation of the sub-station, as will be evidenced by the following incident. In one of the main transformer sub-stations on a widely-extended supply system it is the practice, after the load of the day has come down to a minimum value at about 1 o'clock a.m., to shut down all the transformers but one on each phase, in order to avoid the iron losses due to superfluous transformers. The switchboard attendant in this sub-station was not particularly careful to observe that the high-tension and low-tension switches which he handled corresponded in every case, and the result was that he left the low-tension side of one transformer connected to the network of the distributing area, opening all the other low-tension circuits, while he left the high-tension side of another transformer connected to the feeders. The result was that, as this particular sub-station was left completely isolated from the remainder of the low-tension system at night time, the load was cut off the whole of the area fed by this station. It was not noticed immediately, as the sub-station lighting was fed from a separate small transformer, and it was not until reports of the extinction of lighting were received that the mistake could be rectified.

Probably the majority of the difficulties occurring in static transformer sub-stations are due in some way or another to the transformers themselves. They are of the type of apparatus which causes trouble by being apparently so simple as to require no supervision, and in large-sized sub-stations the units are generally so bulky as to prohibit very frequent or thorough overhauling. For this reason supply and distribution by means of static transformers is not, perhaps, quite so simple a matter as it would appear at first sight. Quite apart from initial difficulties due to carelessness on the part of erectors—such as, for example, a case which actually occurred in which a transformer was completely burned out because it was connected up the wrong way about; that is to say, with the high-tension feeders connected to the low-tension terminals of the transformer—a good many unfortunate occurrences may take place during the course of running. In one sub-station of this nature three transformers of 50 KW. each, converting from 3,000 to 200 volts, failed one after another within 18 months of their installation. The trouble was at first attributed to defective design, and, on this being rebutted, all sorts of fantastic theories as to voltage surges along the high-tension cable breaking down the insulation were advanced. As a matter of fact, however, it was probably simply due to defective drying of the transformers, as, owing to some amount of urgency when the transformer sub-station was first put into commission, the transformers were not dried out at all in the sub-station before the oil was put in. They were never loaded beyond 75 per cent. of their full-load capacity, and, owing to a slowly increasing demand in the area, they had during this period plenty of time for rest. That this explanation seems to be the correct one is supported by the fact that upon the transformers being reinsulated they were run for a long period with full-load current through the coils, both before and after the oil was put into the transformer chambers, and this measure obviated any further trouble from this cause.

An experience with transformers due to a faulty coil in one of the windings may be of interest to engineers engaged in sub-station practice. One of the transformers suddenly broke down on night load, and refused to take up its share of the load. Curiously enough, the secondary coils appeared quite in order when a continuity test was applied to them. Moreover, the low-tension voltage was correct when high-tension current was switched in on no load. The curious feature was that when the transformer was put on to its ordinary working load, it refused to take more than from 20 to 30 amperes on the primary, when it should have taken about 130 amperes. There was nothing for it but to return the whole transformer to the makers for repairs.

With the increasing use of oil-insulated, high-tension switchgear for sub-station practice, a note may be made concerning trouble which occurred in connection with one of these switches. It is not intended in any way to minimise the advantages of this type of switch, as it is undoubtedly the best form of construction for such an occasion, but it may be noted that care should be taken to guard against danger due to the expansion of hot oil in the switch chambers. In one such sub-station, high-tension switches were installed which worked in tanks of oil. On the top of the tank a hole was provided, about 1 in. in diameter, which served as an outlet for the oil in case of expansion. On one occasion, when a jointer was working over one of these switches, the oil shot out from the hole with considerable force, owing to sudden expansion and insufficient outlet, and completely spoiled the man's clothes. It is quite easily conceivable that such an occurrence might have much more serious consequences, as the oil was hot, and only a happy chance prevented the man's face from being in the way of the discharge. Since this occurrence, small zinc shields have been made and placed as baffle plates over the holes, so that any oil which is ejected from the switch chamber is diverted away from any person in front of the switch at the time.

The above notes do not profess to be any connected account in sequence of the difficulties which may arise in static transformer sub-station practice; they are merely given as examples derived from practical working experience which may serve as guides to correct items of practice as found at present, and having merit because they are derived directly from practical handling of the plant described.

NOTES ON TRADE ABROAD.

(*Concluded from page* 715.)

Traders Asking Questions.

From statistics quoted in the recently issued report of the Advisory Committee on Commercial Intelligence, it appears that the Commercial Intelligence Branch of the Board of Trade is being made greater use of every year. Personally, we have always found the Department courteously willing to assist us as editors, and the more the trading members of the community recognise this willingness and also the ability of the Department to furnish information of real value, the greater will be their desire to avail themselves of its resources. In the year 1906 the number of inquiries totalled only 5,544 (an increase of 25 per cent. on 1905), but in 1907 they were nearly doubled, being 9,231. The rate of increase in 1908 was not so large, the total being 11,267, of which 6,764 were written inquiries, and 4,503 personal. For the first half of the current year the inquiries made were at the rate of 12,558 per annum, but as the rate is continuously increasing the total for 1909 when ended will go a good deal beyond that figure.

For the benefit of trading readers who have never yet turned to the Department for assistance in times of difficulty, we may indicate briefly the nature of the matters covered in inquiries received from firms desirous of opening up or of developing foreign trade in specified countries:—

> Commercial statistics; names of firms abroad engaged in particular trades or industries; import, excise, and consumption duties; port, harbour and tonnage dues and other charges on shipping; Customs regulations; foreign and colonial contracts open to tender; sources of supply and prices of commercial products; foreign patent, trade marks and merchandise marks legislation; regulations concerning commercial travellers; trading licences; Consular fees; certificates of origin; and methods of packing and means of transport.

The classified lists of possible buyers of British goods in foreign countries and British Colonies are revised from time to time, and specialised lists are supplied to British traders who make application for them. The report says that there is evidence that these lists are greatly appreciated.

Circulating Information.

For several years past the Department has reserved for British manufacturers and merchants only in the first instance, reports regarding possible openings for trade, &c. The circulation of this information to the various Chambers of Commerce enabled members of those bodies to have a reasonable start of foreign competitors who might later see the reports. But this favoured members of these Chambers to the exclusion of British firms who were not members but for whose benefit a Government Department exists quite as much as for anybody else. The present Committee in 1907 introduced an extension of the principle by establishing a list of British firms who desired to be kept directly posted in such matters by the Department. At June, 1909, there were on the list 1,321 firms, but we venture to believe that that number will be largely increased before long. Electrical firms would do well to avail themselves of this opportunity, and see what benefit there is to be derived from it. When we ask for Governmental assistance in the extension of our national trades, we should see that full advantage is taken of the privileges that are ours for the asking. It occurs to us that the Department may experience difficulty in confining its information to purely British firms, but no doubt it has a fixed line upon which it conducts searching investigations as to whether a firm desiring to go on the list is purely British, or is an importer with a British title. Otherwise we are simply helping the foreigner to supplement the information prepared for him by his own Government Consuls. After all, the foreigner in his own country, if he be better served with Consular information, as frequently appears to be the case, is already more favourably placed than is his British rival, and he may not need to take advantage of our Consular suggestions. Our advantage lies in the reports being specially prepared for British eyes and for British manufacturers or exploiters, and they are of special value only when they are prepared by men who know something about what they are reporting upon. Our feeling has long been that a Consul who is looking after the possibilities of doing trade in cotton or pigs cannot give specialised or valuable information regarding electrical openings. He may tell us that an electric lighting or traction plant exists which means continuous demand for its cognate supplies, or that a scheme is on foot in such a place, but unless he has been associated somehow or other with electrical business or engineering, he is likely to overlook important possibilities, or to send information which, while being too meagre on important points, is almost extravagant in its detail regarding unnecessary matters. For the present, as we have said before, we have to accept what we can get as a general guide, and by despatching our own electrical representatives, who possess aptitude for searching out electrical possibilities, get really to the bottom of things, each for himself. It is a costly procedure, no doubt, so many of us covering the same ground, but there is so much to be done if we get "right there" straight away, that we may each well repay our own expenditure in the connections that we establish for the future, as well as by laying up for ourselves a knowledge of the market, gained from a close intimacy with it—knowledge that never entirely loses its value, though it might require refreshing every few years.

Through British Spectacles.

Ocular Demonstration for Trade Reporters.

As bearing upon the foregoing, we may say that it is very satisfactory to learn from the report of the Committee that newly appointed Consular officers, before proceeding to their posts, are now attached for a short period of service to the Commercial Intelligence Branch, and arrangements have also been made by the Foreign Office whereby H.M. Commercial Attachés, and occasionally H.M. Consular officers, visit the chief manufacturing and commercial centres of the United Kingdom from time to time, in order to become better acquainted with the kind of information which it is desirable should be furnished for the benefit of British trade. A little local acquaintance is better than none at all, of course, and if such visits are going to make Consular officials more efficient instruments in helping us in the commercial fight abroad, by all means let them take place. We fear, however, that any visitor, knowing no one branch of industry better than others, and only having a general idea of all, would be likely to end with copious notes covering practically every class of industry, with everything electrical, everything engineering, everything textile, and so on; but much of this knowledge he could get without going. His Department, no doubt, arms him with all sorts of commercial reference books, but beyond all these is there not a further need? Does it not seem that reports or statements expressly prepared by a specialist in each of the various trade departments would be likely to bring out in permanent form for reference detailed particulars of just what the manufacturers and traders want to sell abroad, or the kind of things which by adaptation they can make? For example, let a man who knows, or is capable of intelligently ascertaining, all about the electrical engineering capabilities of the country, specialise on what electrical firms can do, or want to do, indicating, after conference with the representative electrical firms in different sub-sections of our industry, with what kind of information the Consuls can best aid them. Let specialists in the textile trades, in textile engineering, in railway engineering, prepare similar statements for these departments, and so on throughout the whole of the kingdom and through the whole length and breadth of our industries. Then place such information as this in the hands of the Government agent who is going abroad. A full mastery of its contents should form part of a man's training and equipment if he goes to represent British industrial interests. Would such material not be a safer guide for him than what he would be likely to pick up in a run through a score of commercial or manufacturing districts? If it be desirable, let the commercial expeditions of these *attachés* and Consular agents tour through the highways of our industries for the purpose of being profoundly impressed with their variety, their magnitude and their capabilities, and getting a pronounced local touch, but let them also carry back abroad the most complete specialised information in the form of the reports we have proposed. They will thus be doubly armed, and will be able to furnish us with just that kind of useful information for which we are all athirst.

Special Missions Abroad.

The report in its second section states that the policy of sending special commercial missions to various foreign countries and British possessions has been continued, such markets as Australia and New Zealand, Canada and Newfoundland, and Asiatic Turkey (Mesopotamia and Syria and Palestine) having been visited. In Section III it goes into the question of permanent trade representation in India and the Colonies, with a view to ensuring that a service of commercial intelligence, similar to that already afforded by H.M. Consular officers in foreign countries shall be maintained. The Crown Colonies and certain of the self-governing Colonies nominated 48 officers to answer inquiries, either from the Commercial Intelligence Branch, or from individual firms. Four special Trade Commissioners were appointed in 1908 to visit Canada, Australia, New Zealand and South Africa, these being Messrs. Richard Grigg, C. Hamilton Wickes, G. H. F. Rolleston and R. Sothern Holland, and the whole time of these gentlemen is devoted to the investigation of the trade conditions and requirements of the respective Colonies, with a view to watching the movement of foreign competition and to reporting on all matters which may tend to the promotion of new or increased trade between the Mother Country and other portions of the Empire. By means of the co-operation of these special commissioners, the correspondents already mentioned, and a number of local correspondents in Canada, Newfoundland, Australia, New Zealand and South Africa appointed by the Home Government, it is expected that our traders will derive considerable benefit in the promotion of business in the over-seas dominions.

Other Points.

Arrangements have further been made for the exchange of information between the Commercial Intelligence Branch and the Director-General of Commercial Intelligence in India. The Government of India has sanctioned a system of telegraphic communication with the Commercial Intelligence Branch, under which information required by firms in the United Kingdom may be obtained for them by the C.I. Branch on deposit of a sum sufficient to cover the cost of inquiry and reply.

Other points touched upon in this important report include the steps taken by the Branch to ascertain the probable effect of proposed changes in the tariffs of foreign countries likely to affect British trade. Further on, in alluding to the taxes imposed on commercial travellers in British Colonies, the report says that inquiries have shown that these taxes, though irritating and vexatious, particularly when levied in British Colonies on travellers from the United Kingdom, do not operate to any large extent in restraint of British trade, except in one or two instances in which the amount of the tax is very high. It does not appear that the British commercial travellers are under any greater disability in regard to these taxes than travellers of other nationalities. Therefore it is not proposed to take any action in regard to the matter. Those who decide to study this report *in extenso*, will find references to certificates of value for goods exported to the U.S.A., and to a proposed international conference on the laws relating to bills of exchange.

The Most "Live" Government Department.

We welcome the report as showing that the C.I. Branch of the Board of Trade is now year by year rendering more valuable assistance to the cause of British trade abroad. We profoundly hope that Department will be the most "live" of all the Government offices, that it will redouble its efforts in bringing its organisation legitimately to the assistance of our exporters, and that the electrical firms who are in need of such aid as it can give, will keep the Department well occupied with a continuous stream of intelligent inquiries.

The Workmen's Compensation Act.—Statistics have recently been published by the Home Office in connection with the Workmen's Compensation Act. Figures are generally dull reading, but these reveal some interesting facts with regard to accidents and industrial diseases. Particulars were required by the order of the Secretary of State to be furnished by certain industries, viz., mines, quarries, railways, factories, harbours, docks, &c., constructional work and shipping. These particulars were to include (*inter alia*) the number of fatal cases, the number of disablement cases, and the duration of the disablement. Particulars in relation to industrial diseases were to be given separately from other causes of death or disablement, and the nature of the disease was to be specified. The gross total of compensation paid to workmen in the above industries during the year 1908 was no less than £2,080,672. This represented 3,473 cases of death and 325,484 cases of disablement. It is clear from the statistics that of all workmen who have been affected by the Act, the miner should be the most grateful. One-third of the fatal cases during 1908 occurred in mines, while nearly one-half of the men who were disabled in the industries above mentioned are miners. Again, of the 2,260 persons who suffered from industrial disease, no fewer than 1,550 were miners. Of these 386 were cases of nystagmus, 6 of ankylostomiasis, 459 of beat hand, 537 of beat knee, 67 of beat elbow, and 87 of inflammation of the synovial lining of the wrist joint and tendon sheaths. It is noteworthy that none of the disease cases at mines had a fatal termination; there were, however, 1,689 disablement cases, in respect of which £13,382 was paid during the year; of these 139 (£2,490) were continued from the previous year. Of the remaining disease cases lead poisoning accounts for 421, anthrax for 23, arsenic poisoning for 15, chrome poisoning for 20, compressed-air illness for 10.

Sec. 8 of the Act requires that before a claim can be made in respect of disablement caused by an industrial disease, the workman must either have been certified by a certifying or other appointed surgeon to be suffering from and disabled by the disease, or have been suspended from his employment under special rules or regulations made under the Factory Act on account of having contracted the disease.

Returns which have been obtained from the certifying and other appointed surgeons of the certificates issued by them show that 1,562 certificates were issued, 66 certificates of refusal to certify disablement, 89 certificates of suspension, 7 certificates of refusal to suspend and 6 supplementary certificates under Regulation 5. Of the certificates of disablement, 3 related to ankylostomiasis, 319 to nystagmus, 1 to compressed-air illness, 312 to beat hand, 488 to beat knee, 67 to beat elbow, and 63 to inflammation of the synovial lining of the wrist joint and tendon sheaths All of the above occurred in mines, except two cases of beat hand in factories, one case of beat knee in domestic service, and one case each of beat elbow and inflammation of the wrist joint in factories. The figures may be compared with the figures of cases in which compensation was paid during the year.

The latter considerably exceed the number of certificates of disablement or suspension issued by the surgeons. It is understood that in some cases the employer does not require a formal certificate of suspension from the certifying surgeon before admitting the workman's claim; and also that in some cases the certificate of the "works" doctor is accepted by the employer as sufficient.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

HAITI.—Invoices for goods sent to Haiti must state the marks, countermarks and numbers on and quantity of the packages, the detailed contents of each, the price of the goods, the freight, expenses, and port of shipment, and must be a literal reproduction of the consignor's books. If the goods are to order, the words "to order" must be inserted in lieu of the consignee's name. Invoices must be submitted to a Consul of the Republic for certification and must contain at the foot the following declaration to be signed before a Commissioner or other duly authorised person: "I affirm that this invoice is the faithful and true expression of the truth, that it agrees with my books in every particular; that no alteration has been made in the usual description in the weight, quality, or quantity of the articles therein specified." Invoices must be presented in triplicate and should state the exact net and gross weights. The net weight of each class of goods in one package should be stated and the origin of the goods should be declared on all invoices. The value on which *ad valorem* duty is calculated is the cost price of the goods at the place of production converted into legal currency with an additional 10 per cent. for expenses.

Surtaxes of 50 per cent. and $33\frac{1}{3}$ per cent., in all $83\frac{1}{3}$ per cent. are levied in addition to the duties named below. Duties are calculated in American gold, *i.e.*, piastre = 4s. 2d.

The following goods are admitted free of duty: Machines of all kinds and their accessories for industry, and also machines for the purposes of working the soil or preparing produce of the country; hydraulic presses, hydraulic wheels.

The following duties are payable:—

	Piastres.
Iron boilers...	·50 per 100 lb.
Small bells	·50 per doz.
Axles, wrought or cast-iron	1 per 100 lb.
Wire, brass or iron	·05 per lb.
Lamps, complete, standing or hanging and so-called bracket lamps, fine	2 each.
Do. do. ordinary	1 "
Do. do. common, standing ...	·50 "
Do. do. medium	2 per doz.
Do. do. small	1 "
Chandeliers	20 % ad val.
Earthenware	·12 per 12 pieces.
Pipes, wrought or cast-iron	·50 per 100 lb.
Porcelain opaque	6 per hogshead.
" fine and common	·03 each.
Goods which can in no way be assimulated to any entry of the tariff pay a duty of ...	20 % ad val.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,431. "Improvements in dynamo-electric machines." F. W. Carter. October 25th.

24,437. "Process of manufacturing material for metallic files of electric incandescent lamps." E. Ruhstrat. October 25th.

34,444. "Improvements in boosters, balancers, and motor-generators for use on direct and alternating current circuits." A. M. Taylor. October 25th.

21,453. "Improvements in circuit closers for automatic electric burglar alarms." H. B. Collier. (Date applied for under Rule 13, November 26th, 1908. An invention comprised in application No. 25,525 dated November 26th, 1908). October 25th.

24,498. "Method of utilising the gases resulting from reduction operations carried out in electric furnaces and electric furnaces for carrying out the same." A. Helfenstein. October 25th. (Complete.)

24,500. "Improved electric gas-igniter." F. Deimel. October 25th. (Complete.)

24,561. "Improvements in electrical conduits and accessories." L. Milne. October 26th.

24,565. "Improvements in or relating to electric arc lamps of the inverted or flame type." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H. Germany). October 26th. (Complete.)

21,566. "Improvements in electric arc lamps." H. Hirst and A. E. Angold. October 26th.

24,583. "Improvements in or relating to telephone receivers." B. D. Willis. (Date applied for under Sec 91 of the Act, October 28th, 1908, being date of application in United States.) October 26th. (Complete.)

21,602. "Improvements in and relating to arrangements of circuits for magneto ignition purposes." J. L. Milton. (Date applied for under Rule 13, October 20th, 1908. An invention comprised in application No. 22,271, dated October 20th. October 26th. (Complete.)

21,615. "Improvements in and relating to a telephone exchange system." E. E. Clement. (Date applied for under Rule 13, December 14th, 1908. An invention comprised in application No. 27,139, dated December 14th, 1908.) October 26th. (Complete.)

24,616. "Improvements in and relating to a telephone exchange system." E. E. Clement. (Date applied for under Rule 13, December 14th, 1908. An invention comprised in application No, 27,139, dated December 14th 1908.) October 26th. (Complete.)

21,681. Process for utilising the spongy zinc obtained electrolytically." October 26th. (Complete.)

21,632. "Electrically reset gravity escapement." W. D. Walden. October 27th. (Complete.)

24,671. "Improvements in reversing switches and the arrangement of the electric circuit connections therewith for the purpose of reversing electric motors." D. R. Lloyd. October 27th.

24,683. "Improvements in and relating to the sheathing of insulated electrical conductors." Siemens Bros. & Co., Ltd., H. W. Handcock, A. H. Dykes and J. J. Rawlings. October 27th.

24,687. "Improvements in electric exploders actuated by archimedean screws." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 27th. (Complete.)

24,697. "Improvements in or relating to electrodes for electric furnaces." L. Ruthenburg. October 27th.

24,704. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 27th. (Complete.)

24,716. "Improvements in electrolytic apparatus for the production of pure oxygen and hydrogen." R. Eycken, C. Le Roy and R. Moritz. (Date applled applied for under Sec. 91 of the Act, December 9th, 1908, being date of application in France.) October 27th. (Complete.)

24,733. "New or improved system of wiring for and connecting electric meters for office buildings, hotels, tenement houses, flats, and the like." T. F. Tate. October 28th.

24,735. "Improvements in electro-deposition apparatus." A. F. Harris. October 28th.

24,745. "An apparatus by means of which high voltage electric currents can be modified, measured and used for medical and other purposes." G. W. Chapman. October 28th.

24,769. "Improvements in ceiling roses for electric lamps." L. M. Waterhouse. October 28th. (Complete.)

24,770. "Improvements in electrical fittings, such as ceiling roses, fuseboxes, switch and the like." L. M. Waterhouse. October 28th. (Complete.)

24,771. "Improved combination coupling for electric conductors." L. M. Waterhouse. October 28th. (Complete.)

24,784. "Electric hydraulic press." Maschinenfabrik Oerlikon. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in Germany.) October 28th. (Complete.)

24,796. "Improvements in sound intensifiers for use in telephones and suchlike instruments." E. T. Hincks. October 28th.

24,812. "Improvements in automatic telephone exchanges." Siemens Bros. and Co. (Siemens & Halske Akt.-Ges., Germany.) October 28th. (Complete.)

24,813. "Improvements in or relating to electrical heating apparatus." A. F. Berry. October 28th.

24,829. "Improvements in or relating to electric heating apparatus." A. Tepreau. October 28th. (Complete.)

24,843. "Improvements in and relating to the electric driving of vehicles." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, December 18th, 1908, being date of application in Germany.) October 28th. (Complete.)

24,892. "Improvements in conduit fittings for electrical and other purposes, and in the manufacture of same." A. Brampton and F. Osborne. (Date applied for under Rule 13, April 10th, 1909; an invention comprised in Application No. 8,601, dated April 10th, 1909.) October 29th. (Complete.)

24,901. "Improved device for securing electric ceiling roses to ceiling-rose boxes." E. S. Bradburn and Drake & Gorham, Ltd. October 29th.

24,950. "Appliances or means for mounting incandescent electric lamps." A. W. Beuttell. October 29th.

24,958. "Improvements in electric welding." S. Jevons. October 29th.

24,992. "Improvements in devices for prevention of retardation in electric cables." W. E. Hitch. October 30th.

25,022. "Improvements in common battery telephone systems." W. Fairweather. (Aktiebolaget L. M. Ericsson & Co., Sweden.) October 30th. Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Telephone Systems. D. Sinclair and W. Aitken. 20,968. October 5th.

Electric Switches for Surface-contact Electric Traction Systems. W. M. Mordey. 21,089. October 6th.

Control of Dynamo-Electric Power Systems. Akt.-Ges., Brown, Boveri et Cie. 21,580. October 12th. (Date applied for under International Convention, October 14th, 1907.)

Portable Magnetic Compasses. L. W. P. Chetwynd, Kelvin & James White, Ltd., and F. W. Clark. 21,634. October 13th. (Cognate application, 4,338, 1909.)

Switch for Controlling Electrical Circuits. T. J. Rorke and E. Rorke. 21,674. October 13th. (Dated October 13th, 1908.)

Fluid-Pressure Governors especially applicable in Connection with Electrically-driven Air Compressors. British Thomson-Houston Co. General Electric Co. 21,765. October 14th.

Starting Switches for Electric Motors. E. Garside. 22,228. October 20th.

Insulators for Electric Wires or Cables. W. Copeland. 23,703. November 5th.

Signalling Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co., U.S.) 23,727. November 5th. (Application for Patent of Addition to No. 20,542, of 1906. Date applied for under Rule 13, October 14th, 1908.)

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1909.

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Electrical Process for Removing the Grease and Yolk from Wool and Apparatus Therefor. R. Vandatte and B. Lagye. 5,859. March 11th.

Multiple Switch Starters. H. W. Lake. (Cutler-Hammer Manufacturing Co.) 5,909. March 11th.

THE
ELECTRICAL REVIEW.

Vol. LXV. NOVEMBER 19, 1909. No. 1,669.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

INSTITUTION PROCEEDINGS.

A LETTER from an Associate Member of the Institution of Civil Engineers, published elsewhere in this issue, draws attention once more to a grievance long endured by the members, not only of that Institution, but also of most of our leading technical societies. We have so often ventilated our views upon this subject, that we return to it with some diffidence, lest our readers should be wearied; but reforms are rarely accomplished without long-continued perseverance and reiteration—the parable of the unjust judge holds good to-day as ever—and as in all probability a very large proportion of our readers belong to one or other of these societies, they are directly interested in the matter.

The present practice is to summon a meeting for the purpose of hearing and discussing a paper on some technical or economic question. The paper is read, usually *in extenso*, and if the author is the reader, as generally happens, with rare exceptions his elocution is defective, the reading tedious, and the audience bored. The situation is saved by the fact that practically every member of the "audience" is really engaged in reading the paper himself, a copy having been thoughtfully placed in his hand on his arrival for that purpose.

Seeing the paper now for the first time, a member who is conversant with the subject and desires to take part in the discussion has no opportunity to co-ordinate his thoughts, to reason out difficulties, or to prepare statistical or other data. The natural consequence is that his extempore utterances are undigested and often clumsily expressed; he is at a serious disadvantage; and his difficulties are shared by his hearers. It often happens that he puts forward arguments relating to one portion of the paper which are fully covered, or, perhaps, refuted by another portion of it. More often still—and this is, to our mind, the most deplorable feature of the whole procedure—the time available for discussion after the paper has been read is but half an hour or less, and the discussion, instead of being the most interesting and illuminating portion of the evening's transactions, is restricted to some two or three members more or less acquainted with the subject, while others are requested to forward their remarks to the secretary, for interment in the Society's *Journal.* Could anything be more futile?

One of the worst features of the system is that complained of by our correspondent—that members who travel long distances in order to be present are prevented from joining in the discussion; their time and trouble are wasted, to say nothing of the expense and inconvenience to which they are subjected unnecessarily, and their fellow-members are deprived of the pleasure and advantage of hearing the views of experts specially interested in the subject of the paper.

The fact that copies of the paper can usually be obtained in advance by those who apply for them caps the absurdity of this procedure. If some, why not all? It cannot be alleged that the expense is exorbitant; the paper is printed in any case, and the cost of the additional copies, postage, &c., would be insignificant compared with the enormous increase in the efficiency and usefulness of the discussion. In this respect some of the American Societies set an example well worthy of the compliment of imitation by our own. The American Society of Civil Engineers, for instance, issues copies of papers months in advance of the meetings at which they are discussed. If they can do this, why not we?

The question, in our opinion—and we do not stand alone—is one of urgent and pressing importance, and we commend it to the earnest consideration of those in charge of the procedure of our technical Institutions.

More Retrospects.

While, perhaps, Dr. Kapp's Presidential address to the I.E.E. is retrospective within narrower limits than those which are still coming to hand from the Local Sections, it partakes of that character to a considerable extent. Constituting as it does a summary of more or less recent practice in electrotechnics, its substance is not so amenable as usual to editorial comment; we, therefore, publish a brief abstract of it elsewhere in this issue, and shall confine our present remarks within small compass.

It was, perhaps, only to be expected that Dr. Kapp's references to publications containing more detailed descriptions of the systems and apparatus mentioned in his address should be drawn mainly from foreign journals (there are 21 such references, all but three in the German language, and 10 to English or American publications, only two of which are, strictly speaking, technical journals, the rest being proceedings of societies); but, unfortunately, the restricted field of his researches has apparently prevented him from doing himself justice. His address consists largely of brief descriptions of systems and apparatus with which the readers of the English technical Press and of the *Journal* I.E.E. can hardly fail to be familiar—if so, it is their own fault; we find little discussion of broad principles, or guidance for future progress — the dominant note is technical detail. Is it possible that Dr. Kapp's long residence abroad has imbued him with that love of detail said to be characteristic of the German nation, while broad and far-seeing views, such as those on which we commented last week, are wanting? The inclusion of two folding plates to illustrate a single point is a typical instance of this tendency. Where principles are touched upon, on the other hand, there is a tendency to verge upon platitude. Precisely why, in the appendixes, lists and statistics of the electric power companies are given, we have been unable to guess; what purpose do they serve? We can only suppose, as is no doubt the case, that Dr. Kapp has been too busy to devote much time to the preparation of his inaugural address.

Architects and Electrical Engineering.

We have from time to time pointed out in our columns the tendency for architects to usurp the position of the consulting engineer, and have given several specific instances showing that, in these matters, the architect is entirely in the hands of the contractor, no attempt being made either to draw up a specification or to supervise the carrying out of the work, both duties being entirely beyond either the scope or the ability of the architect who has had no electrotechnical training. In a paper read on November 10th by Mr. W. Woodward, F.R.I.B.A., before the Quantity Surveyors' Association, the author referred to the necessity for surveyors to keep abreast of the times in order to be able to prepare a proper bill of quantities for purposes of modern tendering, and he proceeded to point out that large provisional sums were sometimes inserted in contracts to cover special items (such for instance, we suppose, as electric lighting and power work, electric lifts, and so on), and these sums frequently formed a considerable portion of the total contract price. The author was of opinion that instead of providing these provisional sums to cover outside work, the quantity surveyor should be in a position to include the quantities in his bill, so that the value of electrical work could be included in the payments to the main building contractor, and both the quantity surveyor and the architect would draw commission thereon. In the subsequent discussion which took place several speakers endorsed the author's view that all sub-contractors on the job were a nuisance, and that the main contractor had no authority over them. One speaker, a builder, thought that quantity surveyors could, to some extent, stop the practice of calling in specialists if they suggested to the architects that they were just as competent as an electrical engineer to measure up electric wiring installations. We presume by this remark that the speaker was of opinion that it was just as easy to measure up electric wiring as to measure up gas piping, and this reflects the general ignorance among the building trade of the nature of electrical work.

We have frequent opportunities of seeing architects' specifications, and are familiar with the methods adopted in their preparation. In the case of, say, a new factory, heating arrangements, electric light, electric bells and the like are required, so a contractor is called in to look at the plans of the building and give an outline specification and a covering price for what he considers to be necessary. Some such paragraphs as the following are thereupon inserted: "*Heating:* A sum of £500 to be included in the contract sum for payment to Messrs. Jones for heating pipes and apparatus." "*Electric Light:* A sum of £500 to be included for payment to Messrs. Brown for electric light installation." "*Electric Lifts:* A sum of £500 to be included in the contract sum for payment to Messrs. Robinson for electric lifts." There is no competition in the matter, the orders going, as a matter of course, to Messrs. Jones, Brown and Robinson at the figures mentioned. The architect, of course, gets his usual 5 per cent. from the client, and in many cases, we regret to record, the amount paid to the contractor is the usual 5 per cent. less than the amount inserted in the specification. What becomes of this we need not say, except that the quantity surveyor does not appear to have any claim on it, as the quantities were not in his bill. The proposal of Mr. Woodward would, therefore, seem to recognise this, and the effect of adopting his suggestion means an extra 2½ per cent. from the client's pocket, without any additional guarantee that he is getting what he is paying for. We have discussed with architects this question of trade commissions, and there appears to be a widespread feeling among them that if they specify the name of a contractor or manufacturer, they are morally entitled to a commission from him. It is largely because of this feeling that many consulting engineers decline to insert any names in their specifications if it can be avoided. We do not suppose that all consulting engineers are above reproach, but, generally speaking, they know their business and are not dependent on a quantity surveyor to keep them right; their chief failing is in specifying too minutely what they want rather than specifying provisional sums to cover the work of Messrs. Jones, Brown or Robinson. There is nothing to prevent the quantity surveyor from becoming in the future sufficiently expert to take out electrical quantities of simple lighting installations, but it will probably be more to his advantage to keep abreast of the times in the matter of building construction, so that he will be able, say, to make out a bill of quantities for a ferro-concrete building. He has not been too successful in this direction hitherto.

MERCURY MOTOR AND OTHER METERS.

By E. P. AUSTIN.

The accurate registration of electrical energy is a subject of considerable interest to both the engineer and the general public. The consumer of electrical energy naturally regards the meter that is fixed on his premises in the same light as the scales used by his butcher and grocer, but with this difference: he understands the ordinary weight scale, and can check its measurements, but the electricity meter is beyond his understanding, and consequently an object of suspicion. His dubious attitude towards the registrations made by his meter is aggravated when he is told that supply authorities are allowed to run the meter 2½ per cent. fast or slow, and a learned discourse on the difficulties to be overcome in making a perfectly accurate instrument leaves the consumer rather more doubtful than ever. The idea of the scales, and the weights and measures inspector, still remains with him.

With the keen competition that exists in the business of the public supply of light and power, the confidence of the business public is, perhaps, the most valuable asset an electrical undertaking can possess, and one that can be largely influenced by the behaviour of the apparatus that is used to supply the figures that appear on the quarterly bill.

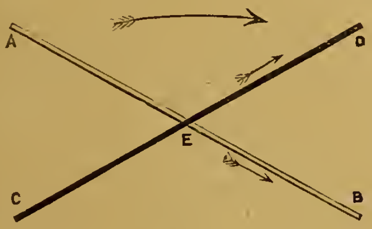


Fig. 1.

There are numerous and excellent makes of service meters on the market, but the most popular instrument for direct-current working is undoubtedly the mercury motor meter. Its simplicity of design, and the consequent ease with which it can be tested and adjusted, reflects considerable credit on the designers of the various types.

The principles of action depend on the physical properties possessed by two conductors, each carrying a current, and placed in such relative positions that when one is fixed, the other if free to move will rotate until both become coincident. This action is illustrated in fig. 1, where A B is the fixed conductor and C D is free to rotate in a clockwise direction about an axis E.

In all types as now manufactured for the measurement of ampere hours, a magnetic field is supplied by means of a permanent magnet, which field is concentrated on a copper disk armature immersed in a mercury bath. The mercury serves to conduct the current to be metered, from the fixed connections to the disk.

It is obvious that the rate of rotation of the disk will have to be proportional to the current passing across the disk, and since the torque is proportional to the product of the field strength and current strength, a retarding effort that is proportional to the speed must be exerted. This retarding effort is obtained by means of the Foucault brake, eddy currents being generated either in a separate disk mounted on the armature spindle or in the disk armature itself.

Theoretically, this device provides a meter that is absolutely accurate on all loads, but in practice certain errors due partly to friction in the bearings, but principally caused by fluid friction in the mercury bath, have to be compensated for. The fluid friction varies as the square of the speed, and, therefore, causes a slowing-up of the meter on high loads. Compensation for error is effected by means of an electromagnet connected in series with the armature, and so arranged as to weaken the magnetic field that produces the braking effort, without weakening the permanent magnet.

In the development of the meter under consideration, inventors have alternated between the use of one disk or cylinder on which both the driving and braking efforts are exerted, and the use of two disks each performing a separate duty. (A brief history of the mercury motor meter, by Rankin Kennedy, appeared in the ELECTRICAL REVIEW of June 18th, 1909, to which the reader is referred for further information on the subject.) In the latest type of all makes the one-disk meter is manufactured, and a brief consideration of the two types will reveal the advantages attending the use of one disk.

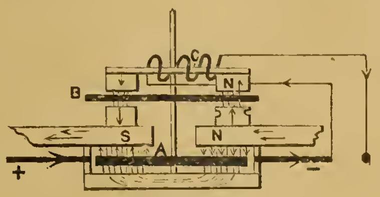


Fig. 2.

In figs. 2 and 3 diagrams of the essential parts of the two types are given, showing the magnetic and electric circuits. Referring to fig. 2 we see that the lines of force pass through the driving disk A twice, so that a maximum torque is exerted. A certain proportion of the lines of force pass upwards by means of pole-pieces, through the brake disk B, in which the eddy currents are generated. To compensate for friction, a few turns of wire are wound round the bridge piece C and connected in such a manner that the field they produce opposes the permanent magnet field through the brake disk, thus decreasing the braking effort as the load increases. A ready means of adjustment is provided by varying the height of the upper pole-pieces, although any alteration of the magnetic system affects the error curve of the meter.

Considering now the diagram in fig. 3, we see that more efficient use is made of the permanent magnet. There is only one magnetic circuit and one air gap. The field is, therefore, stronger, giving a higher torque, and also greater braking effort, since the opposing forces are produced by the one stronger field. The result is a flattened error curve, as, with increased forces acting on the moving part, there will be less disturbance from friction. Reference to the curves in fig. 4 makes this point clear. Correction is made by means of the electromagnet C, which presents a south-seeking pole to the north-seeking pole of the permanent magnet, thus diverting a number of the lines of force, but in no way weakening the permanent magnet.

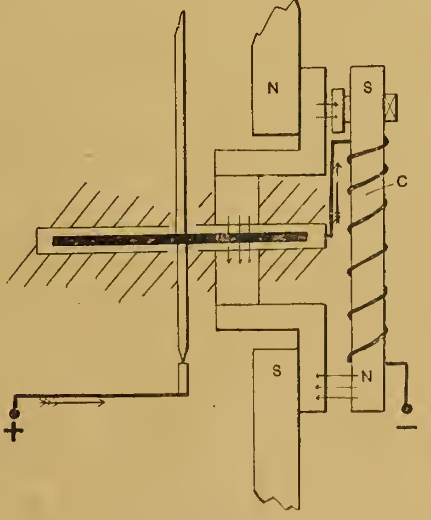


Fig. 3.

It would appear that the correcting coil would weaken the driving effort to the same extent as the braking effort; but this is not the case, as the driving torque is proportional to the field strength, and the eddy currents generated are proportional to the square of the field strength. Compensation is, therefore, effected by weakening the braking effort relatively to the driving effort.

The advantages of the one-disk type can be briefly summed up in the following manner:—simplicity, lightness of the moving part, increased torque, compactness, and greater reliability in long service.

The use of shunts in connection with house service meters is a practice that does not commend itself. Meters so made are subject to temperature errors in addition to errors that arise from defective contacts or changes in the mercury bath. A meter of this type is now on the market, and has met with a good reception in some quarters. It possesses many good points, principally in its compactness and small number of parts. Ease of access to the working parts is a particularly good feature in its design. By the use of the shunts previously mentioned the meter is kept at one uniform size for different ratings, and the current actually passing through the bath does not exceed 5 amperes in any size of meter.

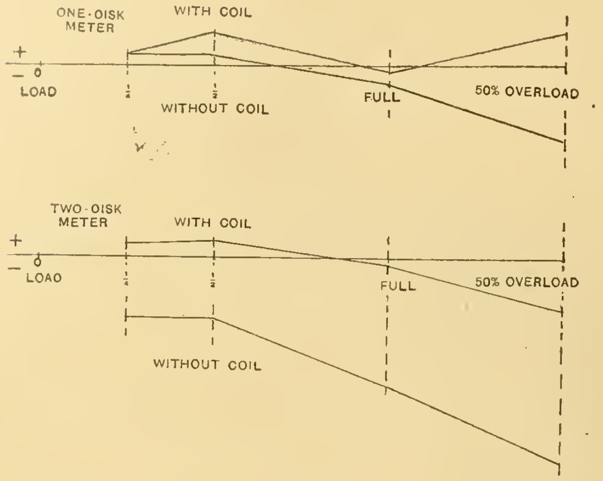


Fig. 4.

It is of the cylinder type, and does not use a separate brake disk, nor is a compensating coil employed, the makers claiming that by a correct design of the mercury chamber and running at one correct full-load speed no correction is necessary. Adjustment of speed is easily made by changing the shunt, as the makers provide interchangeable shunts for all sizes, giving a guaranteed variation of 1 per cent.

Reference to the table of tests shows what excellent results are obtained by the different makers. Improvement in the low-load performances is hopefully looked for in the small sizes, as such meters are frequently used on installations that use one lamp only at a time, and that lamp will generally be of the metallic-filament type.

Table of Tests.

Rating in amps.	Starting current.	Per cent. error on load.				Remarks.
		$\frac{1}{20}$	¼	½	full	
1·5	·03	3 −	1·4 −	95 −	·47 −	One-disk
3·0	·03	3 −	1·1 −	1 1 −	·9 +	" "
5·0	·05	1·2 −	2·2 −	·4 +	·2 −	" "
5 0	·05	2·0 −	1·0 +	1·5 +	1 0 −	Shunt
10·0	·06	2·8 −	1·0 +	O K	9 −	One-disk
10 0	·06	3·0 −	1·9 −	·7 −	1·7 +	Two-disk
25 0	·06	2·6 −	1·3 +	O K	2 0 −	" "

+ means fast. − means slow.

All tests made on meters after continued service and random selection.

The figures in the table relating to starting currents reveal one or two points of interest; we have meters rated at 1·5-ampere capacity starting on ·03 ampere—that is, one-fiftieth of full load, and those rated at 5 amperes starting on ·05 ampere, or one-hundredth of full-load current. The 10 and 25-ampere instruments are well up to the standard of one-hundredth full-load starting current, but are obviously not so suitable for low loads as the smaller sizes. This point is sometimes disputed, but these tests show the advisability of suiting the meter to the class of installation it has to work on, instead of standardising on one or two sizes.

The testing and inspecting of meters on receipt from the makers is a matter of considerable importance. Although due care is taken by the suppliers to ensure the accuracy of all meters on leaving the factory, a certain number require adjustment before being put into service. The first test to make is for insulation resistance; if the result is good, the starting current may be measured. This test will reveal any mechanical defects in the armature and the counter, if they exist, as the disk will refuse to rotate at all, or else will stick at some particular point in each revolution. Having proved the meter to be in good order, further tests for accuracy may be applied on different loads. It is sufficient to make these tests on four loads only, preferably on $\frac{1}{20}$, $\frac{1}{4}$, $\frac{1}{2}$ and full loads. Accuracy on the low loads is important, and the writer has found that if the half-load test is made first, and adjustment, if necessary, made to bring the meter correct on that load, the instrument is accurate within 2 per cent. limits on the other loads. The lowest test for sizes of 5 amperes and under need only be on the $\frac{1}{10}$th full load.

Conflicting claims are made by the different makers relative to the action of the mercury on the disk and chamber. The buyer has to decide between such diametrically opposite statements as the following :—

(*a*) "Mercury, however pure, attacks copper, therefore the disk armature is protected by means of fibre, except at the contact-making parts."

(*b*) "When a copper cylinder or disk is properly amalgamated, mercury has no further action on it. Therefore, it is unnecessary to cover the armature."

(*a*) "It is almost impossible and quite unnecessary to make the mercury perfectly pure, and a mechanical method of cleansing it is quite sufficient."

(*b*) "Mercury should be distilled and rendered chemically pure before using in meters."

(*a* and *b*) "A roughened surface on the mercury chamber and disk helps air bubbles, if formed, to readily escape."

(*c*) "Air bubbles, if formed, can only escape if all the surfaces are smooth, and we enamel our disks to achieve this end."

An explanation from an outside source will be helpful to the buyers of meters, as such points as the action of mercury on metals belong to the realm of the chemist rather than the supply engineer.

Perhaps the most attractive method of ampere-hour measurement is by means of some form of electrolytic apparatus. The absolute accuracy of this class of meter has led to the invention of a variety of instruments based on distinctly different principles. In the practical application of electrolytic actions to the uses of a service meter, numerous difficulties have had to be overcome, and the defects that developed in the earlier types made supply engineers look askance at the later inventions. The Schattner meter possessed, perhaps, most of the faults that belonged to electrolytic meters. It had a bath containing a strong corrosive acid, a shunt circuit, a scale that had to be manipulated by the meter reader, and a resistance that usually burnt out in time, and possessed a considerable temperature coefficient. The terminals used to corrode and cause errors of registration. In addition, it possessed the inherent defect common to all such instruments, inasmuch as all record of its performance was lost each time it was reset. The above-mentioned defects are emphasised in order to indicate the lines on which improvements have been made, and new departures taken to produce the excellent modern devices now on the market.

A type of instrument that is having a ready sale registers the ampere-hours by the quantity of water decomposed. It consists essentially of two electrodes situated in the bottom of a long glass vessel containing a solution of caustic soda, and covered with a layer of oil to prevent evaporation. The water only is decomposed, and its height in the vessel is read off on a vertical scale calibrated in B. of T. units according to the voltage of the circuit it is to be used on. The whole of the current passes through the solution, no shunt being used. The complete instrument is contained in a strong cast-iron case, and is fitted with substantial terminals embedded in ebonite. In the earlier types considerable trouble was caused by the electrodes becoming detached from the leading-in rods at the bottom of the vessel, causing a failure of supply, but this defect has been overcome in the new types; the mechanical construction of the entire apparatus has also been greatly improved since its rst appearance. Its accuracy is the same on all loads, since o current, however small, can fail to produce a proportionate ffect on the electrolyte. Inaccuracy, however, develops fter a meter has been in use for any length of time, especially f it has been used on full-load rating, and several cases of urious behaviour on the part of apparently "good" meters hat had been in use for about 18 months, led the writer to make some tests to discover the cause of the trouble.

Careful observation revealed the fact that the bubbles of gas, passing from the water through the oil, carried a considerable amount of water with them, which evaporated and condensed on the metal cover of the containing vessel, and on the case and fittings of the meter. The meter reaches a temperature of 100° F. on full load, with atmosphere at 55° F., and this is sufficient to cause the evaporation of the oil and water that is carried by the bubbles of gas. The resultant inaccuracy is not appreciable at any part of the scale when a meter is newly set up, but the loss of oil with continued use causes a meter to read fast when the electrolyte approaches the bottom of the scale, and is consequently hotter. There is a fall of potential across the meter of 2·4 volts on full load, principally due to the back E.M.F. caused by the accumulation of gas on the surface of the electrodes. This, however, is not a serious defect when metallic-filament lamps are used, and the meter is eminently suitable for small installations using this class of lamp.

An electrolytic meter having an entirely different action consists of a glass vessel in the form of a narrow vertical tube marked off to a scale of Board of Trade units, and having a bulb at the top containing mercury, which is kept in position by means of an annular trough or else platinum gauze. The mercury forms the anode of the electrolytic cell, and a cathode is provided below the mercury and directly over the mouth of the narrow tube. The cell is filled with an electrolyte and hermetically sealed, the leading-in wires being fused into the glass. A current passing through the cell causes the mercury to travel towards the platinum cathode, with which it does not combine, but drops in tiny particles down the tube. The height of the mercury in the tube is read off in Board of Trade units on the scale. The complete apparatus consists of the electrolytic cell connected in series with a compensating resistance, the combination being shunted across a low resistance which carries the main current and allows only a small fraction to pass through the cell. The whole is mounted in a substantial cast-iron case suitably fastened at the door, and proper means are taken to exclude moisture. The compensating resistance is so arranged that temperature errors are corrected, the total resistance of the cell and the compensater remaining unaltered on all loads. Errors due to back E.M.F. are reduced by the automatic circulation of the electrolyte, produced by the disposition of the electrodes. The denser liquid formed around the anode displaces that in the immediate neighbourhood of the cathode, and thus causes an automatic circulation when the meter is in action.

This circulation is also useful in other respects. The crystallisation that takes place in the copper voltameter is usually absent in the meter under consideration, as concentration of the solution around the electrodes is prevented by the circulation described above.

Notwithstanding, the only trouble the writer has observed in the working of the meter has been the crystallisation, which occurs sometimes around the cathode only, ometimes in the tube also.

Some meters that have been in continual use for two years have not shown any signs of crystallisation wherever; others have developed the trouble in less than 12 months.

The nature of the load appears to affect them, as crystallisation takes place when the load is either small or when the apparatus is used infrequently, but is absent altogether or else takes longer to develop when the load approaches the full-load rating of the meter, and it is in continual use. This apparently points to the need of continual circulation of the electrolyte.

The makers introduced a meter having a new solution with the object of overcoming the crystallisation trouble. A good deal of success rewarded their efforts, but time alone can show whether the defect has entirely disappeared or not.

All troubles due to corrosion of terminals have been avoided in the meter, and it is only fair to add that the shunt circuits have given no trouble at all. It still possesses the defects of the scale and loss of record after resetting, and in common with other electrolytic meters is most suitable for small loads on this account.

Much could be written on this interesting subject, but the writer has confined his remarks to meters which have been under his observation for some years in actual service.

RAILWAY ELECTRIFICATION IN CHILE.

By C. A. SMITH, A.Am.I.E.E., Santiago de Chile.

For some time past the Chilian authorities have been concerned about the commercial inefficiency and the inadequate service of the State Railways, and they are seeking to reduce the abnormal working expenses and to improve the traffic. Particular attention is being given to the main trunk route, known as the "First Section," which connects Santiago, the capital, with Valparaiso, the chief port.

Two years ago they appointed their technical advisor, Mr. James McKerlie, A.M.I.E.E., A.M.I.Mech.E., to report upon the matter, and to study the advisability of electrifying the central portion of the above section, between Tiltil and Llai-Llai, a distance of 43 km.; also the branch line from Llai-Llai to Los Andes, which is 49 km.

The chief difficulty, and the part which presents the greatest obstacles to the successful working of the traffic, lies in the main line portion, where the sharpest curves and the heaviest gradients are met with—the one approaching 180 metres radius, the other rising to a maximum of 2·25 per cent. in reaching the summit of the Tabon, which is 804·60 metres above sea level.

With the present practice of keeping additional standby locomotives under steam, to haul the trains over this torturous piece of mountain track of 22 km., together with the inherent inefficiency of steam traction under such unfavourable conditions, the whole main line service is greatly impaired.

From available statistics, it appears that the number of trains per day on both lines is 46, while the maximum number moving simultaneously is 6, corresponding to 5,556 train-kilometres per day, or 68 per cent. of total traffic in the first section.

Mr. McKerlie points out that the working expenses for these two short sections, of only about 92 km., amounted to about £129,000 per annum, and the freight carried, which represented 64 per cent. of total traffic, reached only 8,000 tons per day, whereas, if the lines were electrified, and employing steam-driven plant, the costs would probably not exceed £90,600 per annum, while the freight handled would increase, perhaps, to 24,000 tons daily.

As fuel is the principal costs item, especially when Australian coal is used at 27s., he explains that there would be a saving of 50 per cent. on this score alone, and still more if native coal were burnt in a modern generating station. His proposal is to erect an up-to-date steam-driven plant of 7,000 H.P. at Llai-Llai, and employ single-phase transmission direct to locomotive units of 900 and 1,500 H.P.

Since the Chilian rivers are so very erratic in stream flow, and are frequently subjected to floods and prolonged droughts, Mr. McKerlie prefers to follow the British practice of security in using steam for such an important object, without prejudice to the adoption of a water-power plant later on, in which case the steam plant would act as a reserve.

Recently the Italian Westinghouse Co. submitted to the Government a more extensive proposal, with plans and estimates, to electrify the entire route between Santiago and Valparaiso, of 187 km., together with the Los Andes branch, on the same lines as they did the Valtellina Railway, Italy, using three-phase current throughout. Most of the Chilian railways are single track, wide gauge with 85 lb. rails.

A brief outline of their scheme is to utilise the water power of the Rio Aconcagua at a point between Rio Blanco and Guardia Vieja, where there is a fall of 260 metres, about 85 km. from Llai-Llai. The estimated power is about 15,000 KW.

They propose to erect two 35,000-volt, three-phase transmission lines, one to Las Vegas, and the other to Montenegro, situated one on either side of the above-mentioned town. From these two points the transmission lines will branch off into 15 transformer stations distributed *en route*. The trolley lines will receive three-phase current at 3,000 volts.

They propose to use 50 locomotives of the Westinghouse improved type, and with these they estimate for a 50 per cent. increase in traffic over that carried by the 159 steam locomotives now in use.

A reserve of 2,750 KW. is set aside for shunting and lighting at the various stations.

It is interesting to observe that the company calculate on a saving in working of 3 million pesos (18d.) and 100,000 tons of coal per annum, by the change.

The tendering company offer to contract on the following terms :—

(*a*) To deposit in the name of the Chilian Government a guarantee of £50,000.

(*b*) To maintain the service for one year after completion of the work.

(*c*) They ask for payment of 1 or 2 per cent. as a cumulative sinking fund and 5 per cent. interest on money invested in the undertaking.

A local Commission of Chilian engineers is at present studying the matter.

NOTES FROM INDIA.

One of our special correspondents in India writes as follows regarding several electrical schemes and openings in that country :—

Mussoorie.—This hydro-electric long-distance transmission scheme is now in working condition, and although it cost considerably more than was anticipated, it has, on the whole, given satisfaction. There has been one interruption of supply since its inauguration, due to abnormal floods washing away some of the main pipe line, and causing a landslip which resulted in one of the transformer sub-stations collapsing. The damage was, however, soon repaired. The Municipality were ill-advised as regards house wiring at the commencement. They undertook to wire installations at cost price in order to encourage consumers, but it was soon found that such municipal trading had its disadvantages; this cheap wiring scheme has now been abandoned. Very few contractors have up to the present found it worth while to seek or carry out work in Mussoorie, because this initial mistake of the municipality has given consumers wrong ideas as to costs of wiring and accessories. There is, however, plenty of scope for electrical enterprise of a sound nature, as the only firm of any importance now doing electrical work is the local general and provision merchant.

Lucknow.—The Municipal Commissioners invite companies and financiers interested in electrical enterprises to formulate a scheme and apply for a licence to supply electrical energy within municipal limits for traction, lighting and power purposes generally. All reasonable terms, consistent with the rules laid down in the Indian Electricity Act of 1909, will be granted. There should be good scope for investment here, as the area covered is not very extensive, and the population is dense, and Lucknow, being the fourth important city in India, is a centre of very active industry. The Military Cantonments alone should give a good return. Capitalists would do well, however, to make close inquiry into the cause of the slow development and growth of electrical enterprise in Cawnpore before venturing on a similar scheme in Lucknow.

Mourbang.—This State, which is about 200 miles from Calcutta, is in communication with the Government regarding the utilisation of the vast water-power available, and now running to waste. A scheme for direct transmission of electrical energy in bulk to Calcutta was once mooted, but the Calcutta Electric Supply Co. have such a firm grip of requirements in that city, that the chances of success, even of a hydro-electric scheme at lower rates to consumers, are not very rosy. The State, however, is rich in minerals, and given cheap energy, it might not be outside the range of possibility to successfully exploit its resources. The Maharajah is an enlightened man of modern ideas, and would probably give earnest consideration to suitable and *bona fide* schemes, which would mutually benefit the Mourbang exchequer, and any enterprising company or capitalist willing to take risks.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cost of Living in the Federated Malay States.

"One Who has Lived There," who writes in your issue of August 20th, 1909, must have lived there some time ago. For a start, it is four or five years since the dollar was fixed at 2s. 4d., and it took some time to get up to that figure from the 1s. 11d. and 2s. at which it used to stand. In old days, though luxuries certainly cost more, ordinary everyday things were cheaper; and, as far as wages are concerned, a dollar has been a dollar all through, no matter what the exchange value.

To take the points in order—*Outfit.* The new-comer will do well to buy umbrella and goggles where he sees them worn. In Singapore, they mark the tourist. Up country, a miner needs both his hands and all his eyes. (It isn't only supervising—unless he has a wonderful set of native assistants; he must put his hand to the plough sometimes, especially in electrical work.) Two pairs of shoes and six singlets. "Double three thousand and then treble that." Say six and a dozen of each as a start. After a garment has once touched the skin it should be washed. Prickly heat is not nice—and one cannot help sweating. But India-gauze singlets only under the fan in a Singapore office. Up country—a thick woollen singlet, low in the neck, no collar, short sleeves; a pith tope coming well down behind, and trousers of a Chinese cotton cloth "kain-asap," which is not so chilly on the skin as drill when wet. Socks, &c., in like proportion. Remember, thick wool keeps out the sun and absorbs perspiration. Sun and chills are the two prime causes of ill-health (thirst excepted).

Knowledge of ordinary Malay speech is essential. The Malays are coming to the fore again. They are the best launch hands, pumps men, locomotor and winding engine drivers, and coal coolies (not as miners). This sounds odd, but the writer has tried it, and so has the manager of a neighbouring mine. Except in the towns, where office hours are easy, work generally starts at 6.30 or 7 till 11, and 1 till 5 or 6, according to conditions.

I do not think that a table such as described can now be kept under $50 a month. The prices given total up to, say, $40. Water carrier is usually provided by company or estate; if not, $10 should be added. It is usually necessary, though, to keep him about the house all day. Shops about a mining village are not up to much, and if the boy has to cook and go some miles to market, he will not have much time to clean the house and wash and mend clothes. In the F.M.S., where roads are good, the motor-cycle is ousting the pony and syce. Honesty is the rule, provided that one has nothing in the house worth stealing. A good boy will see that *no one else* cheats his master if he can help it. Yet the writer, a guest, and his servants and dogs, have been drugged by soporific smoke, blown into the mosquito net, and the wardrobes gone through, without their being any the wiser till next day. This was an exception—the work of experts. Last year, the tin mines being in a bad way, and many Chinese coolies out of work, there were too many gang robberies reported up the F.M.S.—better class Chinese and some Europeans being the victims. This is exceptional though, and it is worth remembering that the Malay has a fair amount of pluck, and will always back up the white man, in work and in everything.

It is possible that the prices given might be almost kept too, right up country or by the sea coast. In the latter case, fish and rice would have to form rather a large part of the diet. But it is not good to live too simple a life out here; you must go out and see your friends, and entertain them a bit in return; and that can't be done on $82 a month. Other things may be up, but beer is a bit cheaper, thank goodness.

I am tempted to think, Mr. Editor, that your contributor must have been the lucky possessor of a very excellent "sleeping dictionary," with the aid of which his marketing was done, his cook's bills kept in order, his clothes made and mended, and so on. I am informed that these things, though rare, are not impossible. But, in that case, some proportion of the cost of upkeep of the "dictionary" should be added to the monthly bills.

One Who Lives There Now.

Singapore, *October 7th*, 1909.

Universal Domestic Motor.

It would be a great acquisition in houses where the electric light is installed to have a small movable electric motor, to which different kinds of wheels could be attached for cleaning knives, polishing plate, &c., and also a fan.

I am quite sure there would be a great demand if they could be obtained at a reasonable price. I presume they would vary in price according to the voltage, which in Willesden is 240.

per **Henry Urquhart.**
William Huting.

London, E.C., *November 11th*, 1909.

[An "Electric Servant" on these lines has been developed by Mr. R. Borlase Matthews, and was mentioned in our review of his book "Electricity for Everybody." The idea is certainly a very promising one.—Eds. E.R.]

Is Electricity Ponderable?

I have recently been engaged on some experiments on electrification which appear to show that a positively electrified body is slightly heavier than the same body negatively electrified. The effect is about one-thousandth of a milligramme for 30 electrostatic units of electricity.

Should the effect prove to be a purely gravitational one, it will be regarded, I think, as the first observed departure from the ordinary gravitational laws. Further experiments are contemplated.

L. Southerns.

Cambridge, *November 11th*, 1909.

Gyroscopic Action of Turbine on Locomotive.

With reference to your article on Mr. Hugh Reid's inaugural address at the opening meeting of the Glasgow University Engineering Society, on "The First Steam Turbine Electric Locomotive," nothing is mentioned as to the effect of gyroscopic action of the turbine and generator running at 3,000 r.p.m.

It would be interesting to know what will be the extent of this effect when the engine runs round sharp curves at a fair speed, assuming that the turbine has its shaft horizontal and at right angles to the axles of the wheels.

J. G. Smith.

London, S.W., *November 12th*, 1909.

[If any trouble is experienced from this cause, a vertical-shaft turbine can be used; but we do not anticipate any difficulty with the horizontal type.—Eds. E.R.]

Voltage for Country House Installations.

Mr. J. Jackson is quite correct in his condemnation of high voltage for country house lighting; he does, however, overstep the mark by advocating 25 volts as a suitable pressure for distributing centres supplying 200, plus his proposed 600, lamps.

On the other hand, I would point out to "H. C. P." that the saving in capital outlay of a 25-volt plant over a 110-volt plant is very considerable, and the advantages gained are in most cases not sufficient to justify the adoption of the higher pressure. True, the unsteady light on a 25-volt circuit is, at times of very great fluctuations, a source of annoyance, but with a battery of ample capacity, and the proper handling of the battery-regulating switch by an able attendant, the trouble may be considerably minimised.

The adoption of a three-wire system for these small installations appears to me to be entirely out of place, chiefly for the very reason that "H. C. P." is complaining about, namely, the fluctuating, and, therefore, unequally balanced load, not to speak of the augmented cost.

A far better scheme is to install a double set of accumulators and to switch the two sets in parallel at times of extra heavy load. In the latter instance it is usual to charge one battery while the other is discharging.

Now to return to Mr. Jackson's 800-lamp installation, which must of necessity cover a fairly large area, a brief consideration should convince him of the error of his views.

I will assume 800 8-c.p. lamps, with an average consumption of 2 watts per candle-power, which, with the latest types of Osram and metal-filament lamps, may appear somewhat high, but is counterbalanced by the fact that owners of country houses are not always satisfied with 8-c.p.

Ignoring the losses in the conductors, which, without details of his scheme, it is, of course, impossible to determine, the power consumption of the 800 lamps is 12·8 kw.; at 25 volts pressure $C = 512$ amperes. Now let Mr. Jackson look up the required sizes of the distributing mains, branch lines, switchboard equipment, and the capacity of his battery, all of which necessary evils, and some consideration for the pockets of his prospective clients, should induce him to raise the voltage for his 800-lamp scheme. Mr. Jackson would save the wasteful resistance of the single arcs, and then get Peter to pay Paul the interest on the expensive copper mains.

I fail to see why it should be necessary to burn arcs singly! Moreover, I fear the adoption of the charming variety of 4, 6, 10, 12, 16-volt installations would only increase the already existing confusion in that branch of electrical engineering.

The need for a standard is apparent, and most of our leading firms have adopted 25 volts as a low-pressure standard for a maximum consumption of power of, say, 3 kw. and short lines only. I may mention that a description of Messrs. Siemens Bros. & Co.'s country mansion installation for a similar output appeared about five years ago in the columns of several electrical journals. The next step up the ladder of recognised standards for larger distributing centres —viz., small villages or large hotels, &c., is as near as possible 65 volts, and from the above deductions that pressure is evidently more suitable for the supply of 800 lamps than 25 volts. We then pass on to the more familiar pressures of 110 volts and higher of our central stations. It is neither prejudice nor conservatism which prevents engineers from adopting a low voltage as a universal standard, but one has to steer between Scylla and Charybdis, and the right course is dictated simply by experience, Ohm's law, judgment, and economical considerations.

P. W. Doell.

Beeston, Notts., *November 15th*.

With reference to the above, I am pleased to find a correspondent in your last issue championing the cause of low-voltage lighting.

It has occurred to my mind for some time past that the only way to compete in the lighting of the smaller country houses, and similar isolated places, is in the use of these very low-voltage plants to replace the acetylene and other gas-making apparatus, which have sprung up of late.

No doubt the large conductors required will not appeal to the high-voltage engineer, but, on the other hand, I imagine, some considerable advantage might be gained in the case of even so low voltages as 16 volts, or, perhaps, 10 volts for the very small houses, by the compactness of the plant, and the great reduction in the number of cells, resulting in a saving in space and attendance, the general utility of the same for the use of bells and telephones, and the comparative immunity from dangers of shock, and, to a certain extent, fire also.

In short, if electricity is to become universal, we must be prepared to supply a man with the plant best suited to his needs and convenience.

S.

Institution Proceedings.

A full house listened from 8 until 9.20 p.m. on Tuesday night to the secretary and his assistant reading in a most capable way three papers.

Amongst the audience were railway men who had journeyed from Newcastle, Heysham and Liverpool, and the writer ventures to think that their reason for coming to London was to hear a discussion on those papers, which everybody really interested had already read, but nothing transpired but the reading.

The Institution supplies to every member who asks for it a copy in advance, and to the personal knowledge of the writer each of the gentlemen referred to had read the paper before coming to the meeting.

Is there any reason for continuing a practice of reading more than the barest outline of papers which have been before the members privately in advance of the public meeting?

Would it not meet with general approval if papers were laid on the table and the discussion commenced forthwith?

If your columns are open to ventilation of this suggested economy of time, the writer believes you will benefit a large number of your readers.

Assoc.M.Inst.C.E.

November 11th, 1909.

[We refer to this matter in our leading columns.—Eds. E.R.]

British-made Magnetos.

I was surprised to read Messrs. Jno. C. Fuller & Son's letter in your valuable paper of October 29th, in which they write as if representing the British magneto manufacturers at large, and then immediately go on to advertise their self-starting machine. They also mention the amount of money spent on experimenting. All this is scarcely an answer to "Widnes," who wished to know why British-made machines are inferior to foreign articles. If they have experimented and spent thousands of pounds in developing their magneto, which is, by the way, a low-tension with a separate induction (transformer) coil, an article very simple and cheap to construct, this is their own misfortune. It is not improbable that thousands of users of their make are quite satisfied, but that many English car manufacturers have signed an agreement with foreign makers is not without a reason, though Messrs. Fuller, as indicated, have brought their magnetos to a final design and perfection. These two expressions I ascribe to their *naïveté* and poor judgment of existing conditions.

If the two or three actual magneto manufacturers will experiment less with obsolete designs which have been discarded long ago by their rivals, and merely copy and improve later ones, they will surely arrive at a successful stage; otherwise they will remain where they are, or where the large makers on the Continent, &c., were at their beginning period.

As far as the writer is acquainted with this trade, there is an increasing demand both in the automobile and other trades for first-class, good and not freakish-designed magnetos, at home and abroad, and if one follows German and French practice and literature, there is no reason to take such a dark view of existing conditions.

H. Armature.

November 1st, 1909.

East India Tramways Co.—The directors report for the year ended July 31st that the total amount at the credit of revenue account was £1,655. The full dividend of 5 per cent. per annum on the cumulative preference shares is recommended, also a dividend equivalent to 3¼ per cent. per annum on the ordinary shares. £121 is to be carried forward.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

The Redemption of Bonds and Increases of Capital.

The custom of raising loan capital in various European countries by the issue of obligations or bonds, which may or may not have a mortgage charge, and are consequently not always equivalent to debenture bonds, sometimes places the holders of drawn bonds in an awkward situation. A certain number of bonds is usually drawn for repayment every year, and the payment of interest on these bonds automatically comes to an end. Apparently no necessity exists on the part of the issuers of the bonds—whether a State, city or company—to advise the owners of drawn bonds that the time for redemption has arrived, and unless the holders discover the fact they may continue to cause their coupons to be regularly presented for payment, and receive payment of what they consider is the interest, but which, they ultimately find out, is merely the gradual return of capital. If the operation continue for a number of years, the issuers have the capital at command without the payment of interest, whilst the holders of the drawn bonds eventually become aware that they have accepted as interest payments of a large percentage of their original capital, which they believed was still intact. It is regrettable to note the name of one electrical company which is charged with the offence of paying coupons after bonds had been drawn for redemption, and the circumstances suggest that the obligation should generally be imposed of notifying holders or their bankers, as occasion may arise, of the fact that the bonds have ceased to bear interest by having been drawn for redemption.

The Westinghouse Electricity Co. has been registered in Berlin with a share capital of £5,000. Its object is to continue the business of the company of the same name which is to be dissolved, and which originally had a share capital of £50,000, which was subsequently reduced to £15,000, owing to losses. The business management of the new company also is said to be in the hands of Herr J. Hessenberg, of Charlottenburg, and Mr. Walter Phillips, of London.

Among new emissions of capital in Germany, may be mentioned the decision of the Rheydt Cable Works Co. to increase the share capital in the first instance from £187,500 to £250,000 by the issue of new shares at the price of 104 per cent.; and, secondly, by a further issue of £25,000 in shares, so as to permit the whole of the capital to be introduced on the Berlin Stock Exchange. The Elektrizitäts Gesellschaft (late H. Poge), of Chemnitz, has also resolved to make a fresh issue of shares to the amount of £50,000, most of which will be offered to existing proprietors at 114½ per cent.; whilst the capital of the Regina Bogenlampen Fabrik, of Cologne-Sülz, is to be advanced from £9,570 to £50,000, for the purpose of providing funds for meeting the demand for the company's manufactures, including arc lamps.

The Belgian mannfacturing firm, the Ateliers de Constructions Electriques, of Charleroi, has just offered for subscription 10,000 new priority shares of £20 each, which will increase the share capital from £200,000 to £400,000; and the Tramways Electriques de la Province de Salerne (Italy), which is also a Belgian enterprise, has invited subscriptions for 10,000 £4 shares and 2,000 bonds of £20 each. Another undertaking referring to Italy is that of the Società Elettrica della Sicilia Orientale, of Catania, which proposes to raise £80,000 by the emission of 5 per cent. bonds.

German Works.

The directors of Brown, Boveri & Co., of Mannheim, state in their report for 1908-9 that the trade suffered more than in the preceding year from the weak demand and depressed prices caused by severe competition. Prices are neither in harmony with the cost of materials nor with wages, for although iron and manufactures thereof are cheaper than a year ago, copper and its alloys have scarcely receded, and wages have remained the same. In the endeavour to provide sufficient employment for the shops also during a declining period of prosperity, various firms had unfortunately quoted prices which must be regarded as directly causing a loss. Notwithstanding these unfavourable general conditions, to which was added a strike which stopped work for seven weeks, the year's results were not substantially different from those of the previous year. This was due, in the first place, to the reputation of the company's manufactures, which rendered it possible in many cases to secure orders without going down to the lowest prices, and secondly, to the continued efforts to perfect the methods of working and increase the output. The accounts show the following figures:—

	1908-9.	1907-8.
Capital paid up	£300,000	£300,000
Bond capital	225,000	225,000
Depreciation provision	18,590	22,710
Net profits	26,250	25,980
Dividend	18,000	18,000
„ per cent.	6	6

A large portion of the contracts received for steam turbines again represented repeat orders. During recent years the company had effected special improvements in the electrical operation of paper mills, and the total equipment for three of the largest mills was already partly in operation. The method proposed for driving paper-making machinery by separate motors had now been protected by patent. The experience gained with single-phase motors for the regulation of the speed permitted their use for large outputs, particularly for traction purposes, and several orders had been received for electric locomotives for full gauge railways.

The turnover of the Kabelwerk Rheydt, of Rheydt, is stated in the directors' report for 1908-9 to have been 25 per cent. greater than in the preceding year. The prices of conductors were depressed almost throughout the year, whilst those for other manufactures, particularly during the period when the cable syndicate collapsed, were at times subject to heavy fluctuations. After appropriating £11,100 for depreciation, as contrasted with £13,700 in 1907-8, the accounts exhibit net profits of £17,590, as against £191 in 1907-8. It is proposed to pay a dividend of 8 per cent. on the share capital of £187,500, this comparing with no distribution in the preceding year. The works are at present normally employed, and satisfactory results are hoped for in the future. It is intended to make a fresh issue of shares to the extent of £87,500, for the purpose of extinguishing the bank debt and for other objects.

The accounts of the Deutsche Elektrizitätswerke Garbe, Lahmeyer and Co., of Aix-la-Chapelle, show for 1908-9 an allocation of £8,050 to the purpose of depreciation, as compared with £8,310 in the previous year; £7,500 to the dividend equalisation fund, as against £5,000 in 1907-8, and £5,000 to the reserve funds. After making these appropriations, the net profits allow of the payment of a dividend of 5 per cent. on the share capital of £150,000, being the same rate as in the preceding year, and the sum of £3,750 has been carried forward, as contrasted with £2,920 in 1907-8.

The Gesellschaft für Elektrische Industrie, of Carlsruhe, which was formed in 1897 for the construction of electrical equipment, machinery and apparatus, and the establishment of lighting and power installations, proposes to go into liquidation in consequence of the lack of working capital. With an original capital of £100,000, the company was only able to pay a dividend in one year, the rate being 4 per cent. in 1898-9, and the finances were subsequently reorganised. The accounts for 1907-8 show a loss of £29,500, and since then the central stations at Mosbach and Niederbronn-Reichshofen have been sold at a book loss of £7,500. The share capital consists of £30,000 in ordinary shares and £40,000 in preference shares, together with a loan debt which reached £48,000 at the end of June, 1908.

Swiss and Other Works.

The report for 1908-9 of the Maschinenfabrik Oerlikon states that sufficient orders have been received at better prices than at the end of the financial year, although prices have since fallen away more than those for materials. As gross profits, the accounts exhibit the sum of £96,500, as compared with £100,200 in 1907-8, and net profits of £17,860, as against £17,890. After making allocation to the reserve fund, the balance has allowed of the payment of 4 per cent. on the share capital of £320,000, this being the same rate as in the preceding year. The directors mention that the electrical working on the railway section Seebach-Wettingen, which was started on December 1st, 1907, and had to be continued by the company for one year, was maintained until July 3rd, 1909, at the request of the Swiss Federal Railway Administration. It was hoped that, as a result of the clearing up of the question of the system from the trials on that railway, from the selection of the method by the Berne Alpine Railway Co., and from the decision to adopt the same system on various foreign railways, the period had been brought closer when electrical working would be introduced on Swiss main-line sections. The company had specially advanced the construction of single-phase motors for traction purposes by the building of types up to 1,000 H.P., and had extended the application of the electrical distribution of power to the operation of textile machinery. It was not possible to maintain the sales, of which a large portion represent export orders, on the same level as in the previous year, although the degree of activity, with one exception, was wholly satisfactory. At the date of the report the workshops were somewhat less briskly employed, but nevertheless the amount of work was still adequate.

The directors of Escher, Wyss & Co., whose shares are almost entirely held by the Felten & Guilleaume-Lahmeyer Works, state that the considerable extensions at the Zurich works were entirely finished during the year 1908-9, and those at Ravensburg were almost completed. By this means, and apart from the materially more favourable conditions of manufacturing, the productive capacity had experienced a large increase, although this could not always be fully utilised during the year, owing to the industrial decline. Notwithstanding this circumstance, the sales were approximately the same as in the previous year, but keen competition largely depressed prices, particularly for steam turbines. The Zoelly turbine had opened up a further field of activity. The gross profits reached £123,700, as contrasted with £116,400 in 1907-8, and the net profits were £15,740, as against £18,430 in the same years respectively. A dividend at the rate of 7 per cent. has been declared on the ordinary share capital of £200,000, being the same rate as in 1907-8. The early months of the new financial year have witnessed a slight improvement, and the arrival of new orders and those in hand can be regarded as satisfactory.

The United Electricity Co. (Vereinigte Elektrizitäts Gesellschaft), of Vienna, realised net profits of 599,100 crowns in 1908-9, as compared with 590,030 crowns in the previous 12 months. It has been decided to pay a dividend at the rate of 6 per cent., as in the preceding year. The directors state that competition was unusually severe throughout the year, causing a heavy fall in prices, which was only equalised by materially increasing the turnover. Of the Hungarian undertakings closely associated with the company, the United Glow Lamp and Electricity Co. had been able to distribute 9 per cent., and the United Electricity and Machine Works Co. 6 per cent.; and the former, which manufactures the Wolfram lamp, has now been compelled to extend its plant.

The Russian Schuckert Co., of St. Petersburg, realised net profits of £10,274 in 1908-9, as compared with £9,875 in the previous year. After making provision for depreciation, the balance has permitted of the payment of a dividend of 3 per cent. on the share capital of £200,000, or the same rate as in 1907-8. It has been decided to liquidate the concession obtained for the establishment of tramways on the outskirts of Moscow, in consequence of the totally changed conditions, as the exercise of the rights in a profitable manner would appear to be out of the question within a conceivable period.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

H.P. Cable-Hanger.

The cable-hanger shown herewith, known as the "H.P. Rustless Cable-Hanger," is stamped out of sheet zinc, and, being complete in one piece, has no parts to become detached or iron hooks to rust out, thereby allowing the cable to sag or fall. Being of zinc, it is durable, and affords a good metallic connection of the messenger wire with the lead sheath on the cable. This feature localises damage by lightning and high-tension crosses, thereby greatly reducing reconstruction costs. The hanger binds tightly on the cable and, being flat, does not interfere with the cable-car riding readily over the messenger wire after it has been applied. It packs closely in small boxes, 500 in each, of convenient size for carrying under the arm. The hanger is attached as follows:—Hold the circular end against the cable and wind the free end twice around and once over the messenger wire as shown in the cut. The cable-hanger described is made by H. P. Copeland, 127, Franklin Street, New York City.—*Electrical World.*

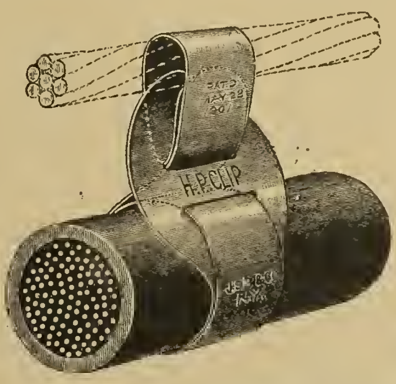


Fig. 1.—H.P. Rustless Cable Hanger.

The "DG" Continuity Clip.

The clause in the official Wiring Regulations which requires that every system of metal conduits shall be electrically and mechanically continuous has a very important bearing upon the large number of installations that have been erected on the "slip-joint" system, and in many cases has led to their condemnation, and replacement by screwed conduit work, although the wiring may have been in good condition.

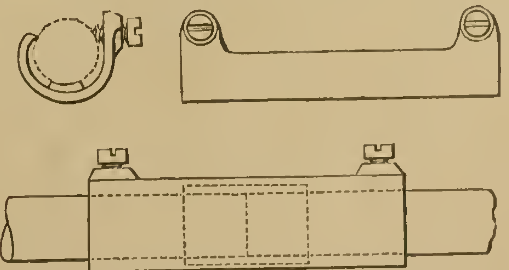


Fig. 2.—Details of the DG Continuity Clip.

To avoid the necessity of incurring the expense and inconvenience of rewiring such systems, Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., have introduced the "DG" continuity clip, which is illustrated herewith. It consists of a metal clip which is slipped over the tubing, without necessitating its removal from the wall. The clip makes contact with the tubes on two opposite points, which are slightly beyond the centre; one is a fixed point forming part of the clip, and the other is obtained by the end of a screw, which is forced well home. Two clips and a copper connector are used at bends.

It is found in practice that it is quite unnecessary with this clip to scrape away the enamel, and tests made by the Westminster Testing Laboratories showed that the resistance between two pieces of tube clipped together by this method was somewhat less than ·002 ohm. Further, as much as 75 amperes was passed through a ⅞-in. tube for an hour without its becoming more than warm.

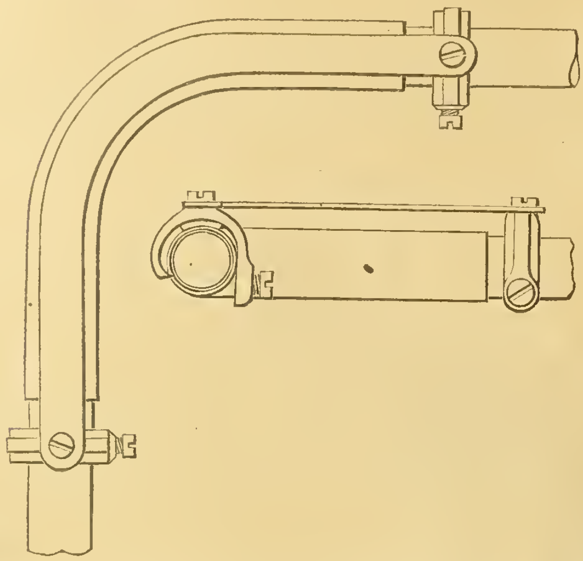
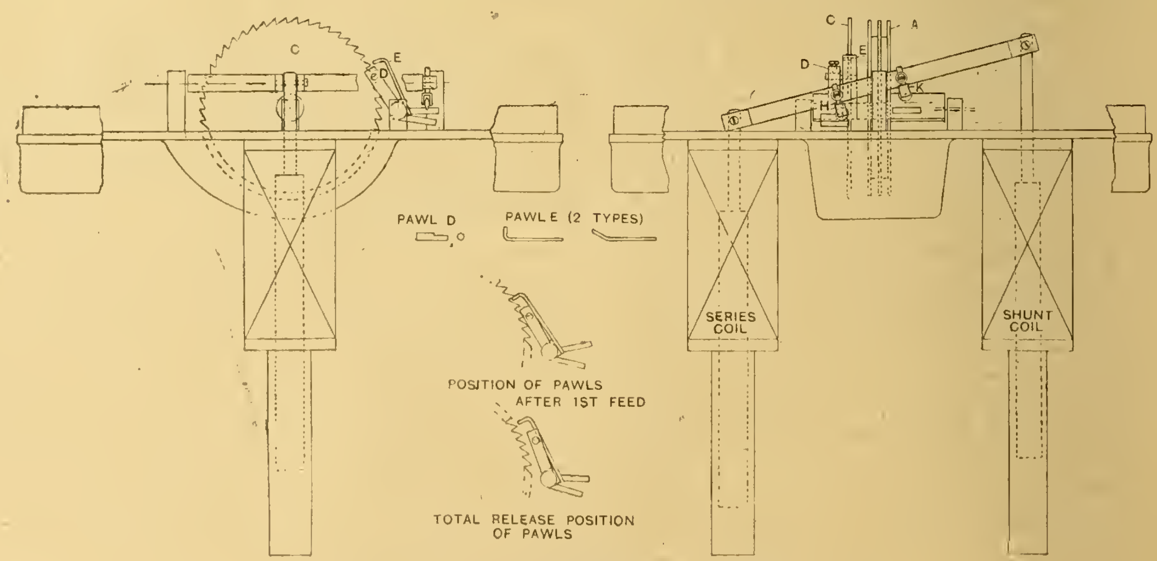


Fig. 3. — Arrangement of Clips and Connector at a Bend.

It is not proposed that new work should be carried out on these lines, as contractors naturally now use some of the grip systems which are already developed, but in factories and other places where slip-socket tubing has been used, considerable expense may be saved by making an existing installation comply with the Rules, which would otherwise have to be removed.

The "Beacon" Flame Arc Lamp.

There is no standing-still in arc-lamp manufacture, a trade in which competition is keen and persistent; it was quite natural, therefore, that the Gilbert Arc Lamp Co, Ltd., of Chingford, should bring out a new flame lamp, which we inspected last week. The lamp is of the converging carbon type, and as will be seen from fig. 4, it possesses a pleasing external appearance, which distinguishes it from the ordinary run of arc lamps. An important feature of the new lamp is the situation of the whole of the mechanism, except the carbon holders, within a separate compartment at the very top of the lamp, isolated as far as possible by a diaphragm from the rest of the interior, so that the access of fumes to the working parts is rendered practically impossible. The carbon holders are suspended from a double drum by chains which pass through small holes in the diaphragm, and slide freely on sloping guides, one of which is fixed, while the other is capable of moving sufficiently to strike the arc. The holders are of the spring-grip type, and the chains are so connected to the drum that the carbons move equally and simultaneously, the slack chains being wound up for trimming by a coiled spring. A weak blow magnet is provided


C
E
PAWL D
PAWL E (2 TYPES)
POSITION OF PAWLS AFTER 1ST FEED
TOTAL RELEASE POSITION OF PAWLS
C
A
D
E
H
K
SERIES COIL
SHUNT COIL
Fig. 5 —Details of Mechanism of the "Beacon" Lamp.

The details of the regulating mechanism are novel and interesting. The general principle is that of a gravity feed, with a double-pawl and ratchet step-by-step escapement, which is controlled by a rocking beam subject to the differential pull of shunt and series solenoids. This is well seen in fig. 5, which gives front and side views of the mechanism. The coils, it will be noticed, although projecting below the diaphragm, are enclosed together with the plungers in pockets having no communication with the lower part of the lamp case. On the same arbor as the double-grooved chain drum A is carried a steel ratchet wheel C of large diameter, with which two pawls D and E engage. The pawls are actuated alternately by small friction wheels carried by the rocking beam, as shown at H and K. When the lamp is out the carbons are together, and the left-hand (series) end of the beam is down, depressing the tail of pawl D by means of H so far that pawl D is not only removed from contact with the ratchet wheel, but also lifts off pawl E (as shown in the lowermost detail view). On closing the circuit, the series coil rocks the beam, allowing the pawls to come into gear with the wheel; the motion of the beam also strikes the arc by moving the lower end of one of the carbons outwards, through the agency of a link and bell-crank acting on a guide-plate at the bottom of the lamp. The wheel is then held by pawl D alone. As the arc lengthens, the left-hand (series) end of the beam falls, without, however, feeding the carbons until striker H lifts pawl D, when the ratchet wheel advances part of one tooth, being stopped by pawl E. Thus feeding proceeds by the alternate release of the pawls. When the circuit is opened, the beam tilts so far that pawl D is lifted off and holds pawl E out of gear also, so that the carbons run down, while at the same time the lower end of the movable carbon is brought inwards and the carbons meet. The design is such that when the arc is burning and feeding normally, the radial distance between the carbon tips is practically unaffected by the movement of the beam in feeding. Every care is taken to reduce friction; the rocking beam is carried on knife-edges, and, as shown, actuates the pawls through friction wheels. When not actually moving the pawls, the beam is perfectly free, except that it is restrained by a dash-pot from sudden and violent movements. As far as possible, too, the working parts are given plenty of play, so that sticking is unlikely to occur

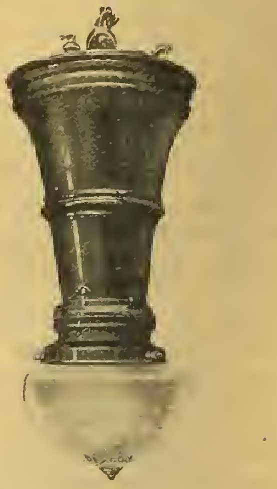


Fig. 4.—Gilbert "Beacon" Flame Arc Lamp.

For convenience in trimming, a catch is provided, which retains the carbon-holders in their highest position; to ensure the release of this catch, it is arranged so that the globe cannot be put on until this has been done. Ample space is available for the cut-out and the substitutional resistance, which is mounted inside the body of the lamp. With suitable modifications the lamp can be used on either D C or A C, and burns five in series on 230 volts D.C. A 10 ampere lamp burns for 12 hours, with metal-cored carbons.

The simplicity of the mechanism, its protection from fumes, and the experience and foresight which have been exercised to provide against all possible causes of failure, all help to ensure the successful working of this lamp, which, we understand, has been in commercial operation for some months on an extended scale, and is giving complete satisfaction to the users, including customers who are already using the best foreign-made flame lamps. Fig. 6 shows an installation of Beacon lamps at a skating rink—one of many rinks in English towns where they have been adopted; they are also extensively used for shop and works lighting. The lamp is British-made and of British design, with no clockwork in its construction, and its graceful shape is not the least attractive of its meritorious features.

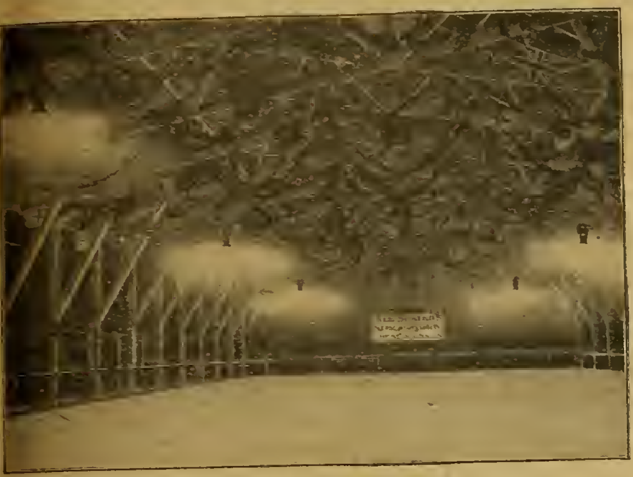


Fig. 6.—Rink Lighted with "Beacon" Lamps.

Portable Electric Saws.

A portable electrically-driven saw for cutting timber, which presents several interesting points, is being placed on the market by **Messrs. Feld Bros. & Co., Ltd**, of 25, Budge Row, E.C. The apparatus consists of an angle-iron carriage mounted on a couple of wheels, and supporting an electric motor belted on to a circular saw. The electric motor and starter are fixed inside the machine, and coupled up to the electric supply by means of a length of flexible cable and pin-plug.

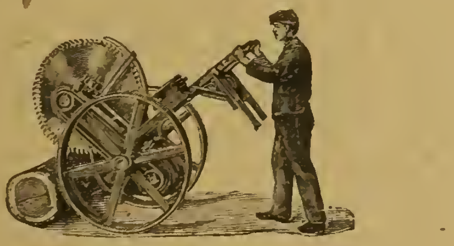


Fig. 7.—Portable Electric Saw.

The H P. of the motor varies from 2 to 8, according to the class of work intended; the higher powers being for the type C machine, which is designed for cutting felled trees, logs, &c., up to 16 in. diameter, and is illustrated in use herewith. The type A machine is provided with a table-top for cutting boards and planks in the usual way; and type B, for cutting logs, beams, &c., is also designed to carry the material, the saw having a movement distinct from the carriage.

LEGAL.

Johnson & Phillips, Ltd, v. Paterson.

In the Chancery Division of the High Court of Justice on Friday, November 12th, **Mr. Micklem**, K.C., moved, on behalf of the plaintiff company in the action of Johnson & Phillips, Ltd., electrical engineers, against Paterson, to restrain the defendant, until judgment or the further order of the Court, from granting any licence to work, or assigning any mortgages charging, or purporting to charge, an alleged share in certain letters patent, or in any way dealing with them, contrary to the terms of an agreement dated February 25th last. The defendant, counsel explained, was until quite recently the manager of the plaintiff company, being employed at the large salary of £1,000 a year and certain commissions. The agreement of February 25th last put an end to his connection with the company. He left the company, and all matters between them were settled upon the terms of that agreement. There was, amongst other things, a provision that defendant should assign to the company all letters patent in his name, or in his name jointly with some other person connected with the firm. There were two questions which his Lordship would have to determine. One was whether the agreement of February 25th last was a final agreement come to between the parties, and the second was whether the defendant had any interest in these letters patent at all, because the company claimed them as their letters patent. It seemed to him that his Lordship might have a difficulty in coming to a final determination on interlocutory proceedings, and he should have thought the most convenient course would be to leave matters *in statu quo* until the trial.

Mr Frank Russell, K.C., who represented the defendant, said he did not think there was much dispute as to the facts; it was a question as to the meaning of the document itself. As he read the evidence, the question was whether the company had shown any title in these matters. Unless the plaintiff company could upset it, defendant had a clear title. He would be perfectly willing to keep an account, until the trial, of anything he made, and, if necessary, earmark it and put it aside.

Mr. Micklem, K.C.: That won't do. If our case is right, the defendant has no right to these letters patent at all. We say that having regard to the agreement, he clearly cannot deal with them now. The suggestion is that defendant is entitled to a half. The case made out by him is that the document which he signed was an offer, and not an acceptance; but I think the evidence is conclusive that what he did was to accept the offer made to him by the company.

Mr. Russell: The difficulty I feel is that I am afraid, supposing I am right in the trial, my remedy against the company on an undertaking for damages is not worth much. Mr. Blackwell is a director, and there are one or two other directors who have made affidavits, and if these gentlemen will give their personal guarantee I will agree.

Mr. Micklem said this was a grave allegation against a company carrying on a large business, which had large funds, and which had been employing the defendant at £1,000 a year. It was absurd to suggest that the company would not be able to pay damages if it proved to be wrong in the trial.

His Lordship: If that is so, I should have thought the directors would not mind giving their guarantee.

Mr. Micklem said he had no doubt the directors would give their undertaking, but he was not able to consult them all.

Mr. Russell intimated that defendant would be satisfied with the personal guarantee of Mr. Blackwell alone.

Subsequently **Mr. Micklem** said Mr. Blackwell declined to give the undertaking without the other directors gave the same undertaking. He very much resented the suggested insolvency of the company. There was not the least foundation for the suggestion. They could not get at all the directors, one or two of them being abroad, and he therefore asked that the motion should stand over for a week.

His Lordship concurred.

Taylor v. L.C.C.

In the King's Bench Division on Tuesday and Wednesday, November 9th and 10th, before Mr. Justice Bucknill and a common jury, the action was tried in which Mrs. Louisa Alice Taylor, formerly of Rotherhithe New Road, and now of 62½, Old Broad Street, sought to recover damages from the London County Council for injuries which she alleged she had suffered owing to the negligence of the defendants' servants. Defendants admitted liability and paid £125 into Court, which they submitted was ample to cover any damages the plaintiff had suffered. Plaintiff was a passenger on one of the defendant Council's electric tramcars on June 7th last year, and was about to alight at the canal bridge, Rotherhithe, when the car moved on with a sudden jerk and caused her to fall heavily on the tramcar and injure herself. Having heard evidence as to the amount of damages sustained, the jury assessed them at £100, and judgment was therefore entered for the defendant Council, this being less than the sum already paid into Court.

Arbitration Proceedings: Lascelles v. Yates.

Mr. Pollock, one of the High Court Official Referees, on Saturday gave judgment, following an award by arbitrators, in an action in which a London firm of builders and decorators, Messrs. W. H. Lascelles & Co., Ltd, had sued Mr. William Yates, of Weir Cottage, Shepperton-on-Thames, to recover money alleged to be due in respect of alterations in the interior of that residence. During the hearing it was stated that part of the work included electric light installation, it having been alleged that the estimate therefor was based upon a statement made by the defendant that the wiring was comparatively new, and had been properly tested. The plaintiffs had alleged that in the course of work, during the defendant's absence abroad, it was found that the whole of the existing electric wires were useless and would require renewal, but those points the defendant disputed. Messrs. Blomfield and Lomax were appointed as arbitrators to ascertain the general cost of the whole of the work done and the materials charged. They had awarded a sum of £4,269, but as a sum of £3,720 (which the defendant had paid before the action was brought) had to be deducted, a balance of £549 was left in the plaintiffs' favour. The Official Referee gave judgment for that amount, and awarded plaintiffs the costs of the action and of valuation and reference, and of an order of November 26th, 1908, but not the costs of an order of February 2nd, 1909, under which the plaintiffs had had to disclose particulars as to expenditure in approximate estimates.

General Electric Co., Ltd., *v.* J. E. Wakelin & Co.

In the King's Bench Division on Saturday, Mr. Justice Sutton sanctioned a claim by plaintiff company against defendant firm, electrical engineers, of Tottenham Court Road.

Mr. Trickett, appearing on behalf of the plaintiffs, said the action was brought to recover £22 6s. 1d. in respect of goods sold and delivered; and the defence, so far as it was foreshadowed in an affidavit by Mr. Wakelin, was a suggestion that certain of the goods were defective, and that this would give the defendants a substantial counterclaim for damages.

There was no appearance on the part of the defendants.

Robert M. Truman, clerk to the plaintiffs' solicitor, proved the service of the writ. He saw Mr. Wakelin for that purpose (he said) at the defendants' place of business in Tottenham Court Road. He asked the witness if the General Electric Co. would allow him time, and suggested that they might give him until October 7th. Mr. Wakelin said he had been interested in two or three limited companies, and was only temporarily embarrassed. He also suggested taking the witness out to dinner if he (Truman) took the writ away.

His Lordship gave judgment for the plaintiffs for the amount claimed, with costs on the High Court scale.

New Ignition Syndicate, Ltd.

In the debenture-holder's action of Wild Blundell *v.* the New Ignition Syndicate, Ltd., which on Monday last came before Mr. Justice Parker on motion for judgment, his Lordship pronounced the usual debenture decree directing the usual accounts and inquiries upon the production of an affidavit proving that the principal moneys were due.

There was no opposition.

British Aluminium Co., Ltd.

Petitions by Dick, Kerr & Co., Ltd., and A. Schonfield & Co., Ltd., for the winding up of the British Aluminium Co, Ltd., were before Mr. Justice Neville in the Companies' Winding-up Court this week.

Mr. Younger, K.C., representing the company, said that he had to apply that the petitions might stand over in order that a scheme of arrangement might be formulated. The matter had been before the Court on several previous occasions, and there was considerable opposition to a winding up, by the unsecured creditors. Those creditors thought it desirable that a scheme of arrangement should be formulated, and he therefore applied on behalf of the company that the petition might stand over until the first petition day in next sittings. He understood that there was no serious objection to that course being adopted, as all parties desired that there should be time for the necessary negotiations to formulate a scheme. Mr. Stewart Smith, K.C., for certain of the creditors, had stipulated that any scheme that might be formulated should be submitted to him as early as possible, in order that he should have ample time to consider it, and, of course, that should be done.

Mr. Stewart Smith said that he did not object to an adjournment, but he suggested that there was no reason why the matter should be thrown over until next year. He asked that the adjournment should be until the last day of the present sittings.

Mr. Younger thought that would not give sufficient time.

Mr. Smith said that the matter could be then mentioned again.

Mr. Martelli, K.C., said that he represented the petitioners on the first petition, and supported the adjournment. The adjournment over the Christmas vacation would hurt no one, and the additional time would be of great assistance to the receiver in preparing the scheme.

Mr. Hamilton, K.C., for unsecured creditors to the amount of £123,000, supported the proposed adjournment.

His Lordship said the preparation of the scheme must take some time, and adjourned both petitions until next sittings.

Electro-Peat Coal Co. Litigation.

The case of J. C. Barker *v.* the Right Hon. the Earl of Mayo and others came before the Master of the Rolls and Lords Justices Fletcher Moulton and Farwell this week, upon an appeal by the defendant, George Darlington Simpson, from a judgment of Mr. Justice Lawrence on the finding of a special jury by which he was held liable in respect of certain alleged misrepresentations in connection with the flotation of the Electro-Peat Coal Co., Ltd. The action was brought by Mr. J. C. Barker, of Ilkley, Yorkshire, against the Earl of Mayo, Mr. H. Howard Allen, Mr. Macgregor, Col. St. Quintin, Sir Leslie Falkiner and Mr. J. D. Simpson, and by it the plaintiff claimed damages for alleged fraudulent misrepresentation, upon the faith of which he alleged he was induced to subscribe for 2,000 shares in the Electro-Peat Coal Co., Ltd. All the directors other than Mr. Simpson were sued as directors of the company, Mr. Simpson being sued as the promoter. The defendants denied that any untrue statements were made to their knowledge, and that the plaintiff was induced to enter into his contract to take shares upon any misrepresentation made by them. The jury found in favour of all the defendants except Mr. Simpson, against whom on the finding of the jury the learned Judge entered judgment for £910 and costs. Mr. Simpson now asked for judgment or a new trial.

Mr. Cozens Hardy, who appeared in support of the appeal, said that the case had had a somewhat chequered history. Though it had been before the other branch of the Court of Appeal on two occasions and had been adjourned, he was now unable to find an opponent. On an application to fix a day for the hearing of the appeal, the Court had directed that notice should be given to the plaintiff and his solicitor, but so far as he (counsel) knew, there was no one present to oppose him. The Court of Appeal had, however, taken the view that under the circumstances the merits of the case must be dealt with. It was a very serious case, and took 17 days to argue in the Court below. The action was a common law action for deceit based on a prospectus. For reasons best known to himself, Mr. Simpson in the Court below unfortunately appeared in person. In the first place, the action was brought against eight defendants, all of whom, with the exception of Mr. Simpson, were directors of the company, and all were represented by counsel of great eminence. Mr. Simpson not only appeared in person, but put in his defence himself, and still more unfortunately, became ill during the course of the trial, and was away on a doctor's certificate. The result was perfectly clear; because of his absence the right questions were not submitted to the jury. Points in the defendants' favour were not brought out, and he (counsel) thought that it was perfectly clear that if at the close of the plaintiff's case, an application had been made that the plaintiff should be non-suited, that application would have been granted on the ground that there was no evidence to go to the jury on the material issues of the case.

Lord Justice Moulton pointed out that that would not help Mr. Simpson now.

Mr. Cozens-Hardy said it was so. All the other defendants, however, except his client, had judgment given for them, while his client had judgment given against him. It was not so much the mere monetary claim that Mr. Simpson cared so much about—that was only £910—but it was the costs that were really a serious thing. They amounted in this case to between £7,000 and £8,000. Judgment was only given against Mr. Simpson on the first prospectus. On the second, judgment was given in his favour. Their Lordships would see that one-half the questions left to the jury were immaterial. The action was based upon the issue of a certain prospectus which, it was alleged, contained fraudulently misleading statements, which statements were the cause of the plaintiff underwriting a number of shares in the Electro-Peat Coal Co. The plaintiff was not an ordinary innocent person subscribing for shares on the faith of a prospectus. He was an astute underwriter, who, after he got these shares, pooled them, and then took shares in the promoting syndicate. The case made was that, by a document dated January 25th, 1904, which he might call the 13th proof prospectus, and which, by the defendants' authorisation, were shown to the plaintiff, the plaintiff was induced to take shares. On February 10th, the plaintiff sent an underwriting letter to Mr. Simpson, and on March 24th the underwriting letter was accepted by the promoting syndicate. The application for shares was not in the Peat Coal Co., which was not incorporated until April, 1904, but in the promoting syndicate. The plaintiff was relieved of a portion of his underwriting, and was allotted 1,000 shares, for which he received 11½ per cent., 5 per cent. from the promoting syndicate, 2½ per cent. from the company, and a secret commission of 4 per cent. Though the company was not insolvent, he did not think that the shares were of very substantial value. It was suggested that the invention which the company was formed to exploit was a very valuable one. The plaintiff paid £1,000 for his shares, less £90 received by way of commission, and judgment was therefore given against the defendant for £910. His submission was that there was no evidence to support the findings of the jury.

In answer to the Court, Mr. Cozens-Hardy said that he was instructed to conduct the appeal by Mr. C. D. Simpson.

The Master of the Rolls said that having regard to other proceedings, Mr. Simpson had no *locus standi*, as his trustee was not a party to the appeal.

Mr. Cozens-Hardy said that the verdict against which he was appealing was a very serious one for Mr. Simpson.

The Master of the Rolls: But we are in the position of having neither the appellant nor respondent before us.

Mr. Cozens-Hardy asked for leave to amend.

Lord Justice Moulton said that they could give him nothing as he had no right to be there, and the appeal was accordingly dismissed.

Mr. Cozens-Hardy applied on Wednesday that the appeal in the case might be restored to the list for hearing. He stated that when the case was before their Lordships on the previous day he was under a misapprehension as to the exact position of the appellant (Mr. Simpson) and the plaintiff.

Their Lordships said that the appeal would be restored and would appear in the next day's list as part heard.

PROCEEDINGS OF INSTITUTIONS.

Electric Railway Working.

At the ordinary meeting of the Institution of Civil Engineers on Tuesday, November 9th, the papers read were "The Single-phase Electrification of the Heysham, Morecambe and Lancaster Branch of the Midland Railway," by Messrs. J. Dalziel and J. Sayers; "The Equipment and Working Results of the Mersey Railway under Steam and under Electric Traction," by Mr. J. Shaw, M.Inst.C.E., and "The Effect of Electrical Operation on the Permanent-Way Maintenance of Railways, as Illustrated on the Tynemouth Branches of the North-Eastern Railway," by Mr. C. A. Harrison, D.Sc., M.Inst.C.E. The following are abstracts of these papers:—

The authors of the first paper state the reasons for the electrification of the Heysham-Morecambe-Lancaster section of the Midland Railway on the single-phase system, showing why the railway company adopted this system as being more probably applicable to their future requirements than the direct-current system hitherto used in this country. They explain that the choice of this particular section of the line for a more or less experimental electrification was partly due to the fact that it could be worked from an existing power station at Heysham. Though the traffic is light, it is long-hour throughout the year, and consequently, is expensive to work by steam, so that there was scope for saving in working expenses; also, the summer traffic is heavy and liable to congestion, two of the stations being terminals, and there being a considerable local traffic between Morecambe and the third station, Lancaster, which tends to congest the main-line trains. A description is then given, more or less in detail, of the principal parts of the overhead equipment and machinery installed for traction purposes in the power station and of the rolling stock. [The installation was fully described in our issues of June 12th and 19th, 1908.]

In the Appendix are given diagrams and figures taken from the motors while at work on the line; it is shown that the motor-cars are required to work very similarly to locomotives, and take over daily from steam locomotives, trains totalling up to a weight of 190 tons, which is 125 per cent. over the loading specified to the contractors. The paper goes on to set out the disabilities under which it has been variously alleged single-phase apparatus labours—particularly in respect to its asserted unsuitability for high-schedule-speed, frequent-stop, suburban and interurban traffic, necessitating high accelerations—and to prove, from the results of special tests, made with a view to ascertaining the accelerating capabilities of the Heysham equipments, that single-phase apparatus is not only as capable of working such services as direct-current apparatus, but that the weight of the single-phase trains is only a very small percentage greater than that of corresponding direct-current trains, and that the energy consumption is appreciably less.

The author of the second paper presents a comparison of the equipment and working results of the Mersey Railway when worked by steam and by electricity. The railway runs under the River Mersey and joins Liverpool with Birkenhead on the opposite bank. It was opened for traffic as a steam railway in 1886. The working expenses were always very heavy, and as the difficulty of maintaining efficient ventilation made the railway very unpopular with the travelling public, the revenue was insufficient to make a commercial success of the undertaking. In 1900 the company obtained Parliamentary powers to substitute electricity for steam, and the electric service was inaugurated in May, 1903. [An illustrated description of the electrification was given in our issue of May 22nd, 1903.] The final change was accomplished in a single night, no mixed passenger service being run.

The traffic conditions call for a train service of 19½ hours per day, with a peak load for a few hours in the morning to Liverpool, and another peak load for a few hours in the evening in the reverse direction. During steam working the peak was met by increasing the number of trains in service, and, under electric working, the peaks are met by increasing the number of cars per train, keeping the interval between the trains constant throughout the day.

The special feature about the electric rolling stock is the Westinghouse system of electro-pneumatic control. For dealing with the heavy traffic the trains consist of four or five car trains with a motor-car at each end. After the heavy service is over, the trains are divided about the centre, one motor-car and one trailer only being used for each train-unit.

In order to make a comparison between the working results of the railway when operated by steam and electricity, three years' working results under both systems have been analysed, and for each system an average year of steam and of electricity has been arrived at. The working results are compared on the basis of total cost per annum, cost per train-mile, per ton-mile, and per seat-mile.

The costs have been divided under various headings which make up the total cost of the locomotive and engineering departments. The departments of a railway which are most directly affected by the substitution of electricity for steam are the locomotive and carriage departments, and the tabulated results show that under electric working these costs have been reduced from 0·117d. to 0·089d. per ton-mile. With electric traction 1 lb. of fuel, costing 8s. 9d. per ton, moves 1 ton of load 2·29 miles at an average speed of 22¼ miles per hour; whereas, with steam, the same weight of fuel, costing 16s. per ton, moved the same load 2·21 miles at an average speed of 17¾ miles per hour.

The effect of electric traction on the maintenance of the permanent way has been to reduce the cost of maintenance per ton-mile from 0·0208d. to 0·0089d., or by 0·012d. per ton-mile.

As regards the life of the rails under the two systems, the average rolling load over the track before the rails require renewal is increased from 32 million tons to 47½ million tons.

The substitution of electrically-driven pumps for the working of the hydraulic lifts has decreased the cost per lift-mile from 85·2d. to 30·1d., a decrease of 55·1d. per lift-mile.

The effect of electric working on the working results has been to decrease the cost per ton-mile, as follows:—

1. Total cost of working and maintaining the whole of the locomotive and engineering departments from 0·238d. to 0·152d., a decrease of 0·086d.

2. Total costs of the railway, including general charges, &c. (but exclusive of interest on additional capital for electrification), from 0·344d. to 0·24d., a decrease of 0·104d.

Summarised comparative results of the change upon the working and finances of the railway are given in three tables, which show, among other things, that the average speed, including stops, has been increased from 15·6 to 19·9 miles per hour, and the number of ton-miles per annum from 43 to 67 millions, while the total expenses per ton-mile, after allowing interest on additional capital for electric works, have been reduced from 0·344d. to 0·2928d. In the half-year ending June 30th, 1908, the number of passengers carried was more than twice as many as in the last half-year of steam working (ending December 31st, 1902), and more than two-and-a-half times as many season-tickets were issued; the seat-miles run per passenger showed a decrease of 30 per cent.; and the passenger receipts per seat-mile an increase of 26·5 per cent; while the ratio of expenses to receipts decreased from 95·3 per cent., to 69·8 per cent.

Just before electric working commenced, the Corporation of Birkenhead opened an extensive system of electric tramways which had the effect of reducing the railway's receipts considerably each half-year, as the tramways, being owned by the same Corporation who worked the ferry service, were specially laid out to feed that service, by giving extra facilities to passengers to reach the ferries from any part of the town.

Since the electric service commenced the number of passengers using the railway has increased steadily each half-year.

The third paper deals with certain branches of the North-Eastern Railway, which the company decided in 1903 to work by electric traction. They are known as the "Tynemouth Branches," *i.e.*, from Newcastle to Tynemouth direct and by the Riverside line, and also from Newcastle to Tynemouth *via* Benton and Whitley Bay. The line as electrified was brought into use on July 1st, 1904. It is, therefore, possible to form some idea of the effect of electric traction and the cost of maintenance.

The total length of electrified line, including sidings, is 75 miles, and the average distance between the station stops is 1¼ miles. The current, at a pressure of 600 volts, is taken direct from the conductor rail by shoes fixed on the electric cars, the return current passing through the track rails, which are bonded similarly to the conductor rail.

The paper describes the contact shoe, bonding, anchorage for preventing the "creep" of the rails, and the track cable terminals. It also compares the train service under steam and electrical working respectively. Although the train-mileage has nearly doubled, the car-mileage and ton-mileage are slightly less under the new conditions.

The amount of wear on permanent way, although greater under electric traction at points and crossings than with steam train working, is only slightly increased on the ordinary running line, either on the straight or on curves.

Mention is made of the methods of inspection of insulators, bonds, and electrical connections, and also the difficulties encountered owing to the presence of snow or ice on the conductor rail, which are overcome by the use of special ice scrapers fixed on the car. Although the pressure is 600 volts, there has not been a fatal accident due to electric shock to any of the company's employés, and serious injury due to shock has been very exceptional, the men being provided with insulated tools, rubber gloves and mats for their protection. Fatal accidents through shock which have occurred on the electrified lines have, in all cases, been due to trespass.

The electric cars are of the open corridor type, lighted and heated by electricity, and ample space is provided for the comfort of the passengers. Trains can be made up of two, three, four, or any convenient number of coaches as may be required, up to a length of 550 ft., which is of great advantage. Three electric parcel vans are used for dealing with the fish traffic between Tynemouth and Newcastle, and also work a service of parcel trains. These vans are also fitted with end buffers so as to haul ordinary horse boxes, fish wagons, carriages, &c., if required.

The electric trains enable much more work to be done at the platforms at the Central Station, Newcastle, than could be accomplished by steam trains, the work being facilitated by the fact that there are no engines to be attached and detached. They can be discharged and reloaded for a return journey in 2 minutes, and are all dealt with from three platforms. The economising of platform accommodation is one of the most satisfactory features of electric train working. Another great advantage is that the signal movements are reduced by one-half. With the steam trains there are four platforms and eight signal operations, but with the electric trains there are only two platforms and four signal operations.

Another important feature, especially for a service of frequent stops, is the high acceleration possible with electric trains. A saving of time is effected without increasing the maximum speed, as will be seen from the following:—

1. Time occupied in running round trip from the Central Station to Manors North Station with steam train—68 minutes.

Ditto, with electric trains—58 minutes (stopping at all stations).

2. Time occupied in running from the Central Station to Tynemouth station *via* the Riverside line with steam trains—35 minutes.

Ditto, with electric trains—29 minutes (stopping at all stations).

3. Time occupied in running by express steam train from the Central Station to Monkseaton *via* Wallsend—30 minutes.

Ditto, express electric train—25 minutes.

The paper gives an estimate of the annual cost of renewals, with a table, and concludes by showing that it would have been impossible to carry by the old steam service the number of passengers that are now being conveyed on the Tynemouth lines with the electric service.

[A description of the North-Eastern electrical lines appeared in the Electrical Review, December 23rd and 30th, 1904.]

Institution of Electrical Engineers.

On Thursday, last week, the first meeting of the present session was held at Great George Street, when Dr. Gisbert Kapp, the new President, read his inaugural address.

The business of the evening commenced with the pleasant duty of awarding the Institution premiums and prizes for papers read during the previous session. A full list of these awards was given in the Electrical Review, May 28th, 1909.

The retiring President, Mr. W. M. Mordey, then called on Prof. Bertram Hopkinson, of Cambridge University, who, on behalf of his mother, asked the Institution to accept the very fine marble bust, which we illustrated on page 780 of our last issue.

Prof. Hopkinson remarked that it was possible to conceive the personality of an artist or an actor long afterwards from his work, but this was not the case with the scientist, who remained merely in name. It was thought that it would be a good thing to have something to clothe the name of Hopkinson in the future, and it was in this hope that the bust was presented. A sculptor, who had known him well, had endeavoured to indicate something of his personality in the block of marble before them.

Mr. W. M. Mordey, in thanking the donor, said that he thought that next to Faraday, the scientific father of the industry, we owed more to Hopkinson than to any other man. He was President of the Institution twice, in 1890 and 1896, and his work embraced many other scientific matters than came under the heading of electricity. Hopkinson also initiated the original movement which resulted in the formation of the Corps of Electrical Engineers.

The retiring President then announced that it had been arranged to take possession of the new headquarters, on the Embankment, in June next, the Council considering that it was better to wait until the building was quite ready for actual use before moving.

Subsequently a vote of thanks to Mr. Mordey was moved by Mr. Alex Siemens on behalf of the members, Mr. Siemens remarking that if the new building turned out satisfactory it would be largely due to Mr. Mordey's efforts. Mr. Jas. Swinburne, in seconding, dwelt on the work which the retiring President has done on behalf of the Institution, including many papers which were all the more valuable because they hadn't agreed with them.

Inaugural Address.

Dr. Kapp devoted his address to a review of the existing state of electrical engineering, which he first compared with the conditions 10 years ago. Then, the total capital invested in the electrical industries was 106 millions sterling; this year it was 386 millions, and the membership of the Institution had grown from 3,254 to 6,117. Assuming that the membership afforded a rough indication of the number of persons engaged in the electrical industries, he deduced that each man now produced, controlled or utilised 70 per cent. more wealth than 10 years ago.

The President drew attention to the modern tendency to install very large units, rendering forced ventilation necessary to cool them, and described the turbo-driven centrifugal air and circulating pumps of the A.E.G.[*]

After touching upon exhaust steam turbines, compensated alternators, and asynchronous generators, Dr. Kapp described the "double-field generator" of Mr. E. Ziehl. In this machine the stator and rotor each carry a three-phase winding, connected in such a way that a three-phase current sent through a machine will produce fields which, in stator and rotor, revolve in opposite sense. If now the rotor be driven by power in a sense opposite to that of its own field and with a speed corresponding to twice the frequency, the field produced by the rotor currents will in magnitude and direction of motion be identical with that produced by the stator currents. Thus each of the two windings contributes one-half of the field common to both. At the same time the demagnetising action of each winding is eliminated by that of the other. The machine cannot work alone, but must be excited in the same way as a non-synchronous generator from some synchronous generator; it cannot give a wattless current, and in an installation where the power factor is less than unity the synchronous machine must supply the wattless current. As advantages Mr. E. Ziehl claims the following: Since the E.M.F. is generated in both windings only half the flux as compared to a synchronous generator is required; hence less hysteresis loss, smaller radial depth of stampings, and less copper weight, which is due partly to the small air space and partly to the shorter pole-pitch. All these tend to reduce the cost of manufacture. Since the machine can only give a watt current, a short circuit on the mains cannot damage it. The paralleling is easy; the speed need only be approximately right, and if coupled up in a wrong phase position no damage is done, since the inductance is then very great. It is only when running at exactly synchronous speed, and in correct phase position, that the mutual compensation between the two windings takes place, and if the machine is switched on when out of phase, it pulls itself quickly into phase without demanding from the bus-bars a large synchronising current. When used in connection with converter sub-stations, no separate alternating excitation is required, the converter itself acting as exciter.

Dr. Kapp next referred to the large sizes and high efficiency of transformers, up to 10,000 KW., three-phase, at 60 cycles, 100,000 volts (as made by the G.E. Co., of America, with an efficiency stated to be 99 per cent. at full load, and weighing 54 tons, or with 7,500 gallons of oil, 85 tons). The use of alloyed iron, large units, and vigorous cooling had greatly reduced the weight of transformers, the active iron in a 3,500-KW. Oerlikon transformer weighing only 2 kg. per KW.

For furnace work, the transformer should have a rather large inductive drop, to protect it against damage due to short-circuits in the furnace.

Dealing with A.C. motors and the problem of speed regulation, the author described the three-phase traction motor devised by Mr. Aichele, the chief designer of Messrs. Brown-Boveri, who have applied it in their latest Simplon locomotives. The rotor is simply a squirrel-cage, and has no slip-rings and no outside electrical connections whatever. The bars are ventilated copper tubes, and the end connections are designed to stand a temperature of 200° to 250° C., when an exceptionally large starting current is developed. At the same time, the resistance of the rotor as a whole is raised some 40 per cent., owing to the temperature coefficient of the end connections. The latter cool rapidly as soon as speed is attained, and the rotor then works with normal slip. The stator has two distinct windings, one for 16 and the other for 12 poles, and each winding can by means of a pole-changer be so grouped as to produce half its normal number of poles. There are thus four normal speeds possible, corresponding respectively to 16, 12, 8 and 6 poles, or to a train speed of from 26 to 70 km. per hour. At starting the pressure is reduced by an auto-transformer and thrown at first on to the 16-pole and then on to both the 12 and the 16-pole windings in parallel. Then the 16-pole winding and the auto-transformer are switched out and the train attains the speed of 35 km. per hour, which corresponds to the 12-pole winding acting alone at the full line pressure of 3,000 volts. To increase the speed further, the 8-pole winding is added in parallel, then the 12-pole winding is switched out, then again switched in as a 6-pole winding, and finally the 8-pole winding is switched out, leaving only the 6-pole winding at work when the maximum speed is reached. The frequency is 16 per second. Each winding is connected with the pole-changer by 6 leads—that is to say, there are 12 leads in all required for each motor. No starting resistances are required. The ends of the stator windings are protected, but the inside of the rotor is freely accessible to the air. The power of the motor at the one-hour rate is given by Mr. Schnetzler as follows:—

Poles	6	8	12	16
Horse-power	850	750	650	550
Train speed—kilometres per hour...	70	52	35	26

The Deri single-phase motor was also described; this resembles a "repulsion" motor, but (if a two-pole motor) has two pairs of brushes on the commutator. One brush of each pair is fixed in the polar axis of the stator, while the other, which is shorted on the fixed brush, can be moved so as to make any angle with the fixed brush up to 180°.

If the fixed and movable brush are in line and bearing on the same part of the commutator, no current passes through the armature. If their angular distance is 180° the armature winding acts as the shorted secondary of a transformer. In neither case is a torque exerted. If, however, the angular distance between fixed and movable brush is intermediate between 0° and 180° a torque is exerted, and if the armature is allowed to run the current decreases and the power factor increases. The effect of shifting the brushes is analogous to changing the impressed voltage on an ordinary continuous-current series motor, and thus by adjusting the brushes the torque and speed may be regulated. This property renders the Deri motor valuable in all cases where delicate speed regulation is essential. It is largely used for working passenger lifts and other hoisting machinery, and also for driving ring-spinning frames, the speed regulation in the latter case being automatic. The result of automatic speed regulation is an increased output from the ring-spinning frames. Another application is for electric railway working. An important point in these motors is their perfect commutation.

The well-known Winter-Eichberg motor as first developed for railway work had a series characteristic; recently Mr. Eichberg has altered the winding so as to give the motor a shunt characteristic, so that it runs at constant speed whatever the load within its range. The motor is started as a series machine, and when up to speed, or nearly so, it is switched over by its controller to the shunt condition. Dr. Kapp has found the inventor's claim that the power factor is very nearly unity at all loads quite borne out.

Turning to the electric transmission of power, the President remarked that the conditions obtaining in England rendered a pressure of 20,000 volts an upper limit for most cases, though on the Continent and in America pressures up to 110,000 volts were employed. The ultimate limit was set by the loss of power through dispersion of electricity through the air, for which he gave the following approximate formula, based on Mr. R. D. Mershon's experiments:—

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[*] Electrical Review, September 3rd, 1909.

$$\text{K V} = \frac{0{\cdot}115\, b}{0{\cdot}5 + r}\left(\frac{1}{1 + 0{\cdot}013\, v}\right) r \log \frac{s}{r},$$

where K V is the pressure limit in virtual kilovolts,
b the barometric pressure in mm. of mercury,
r the radius of the wire in cm.,
s the distance between two wires in cm.,
v the pressure of saturated steam in mm. of mercury at the given temperature multiplied by the relative humidity of the air.

The protection of power lines against pressure surges was, he said, a very important matter, particularly where an underground cable joined an overhead line. Mr. Semenza, of Milan, had solved this problem by employing resonant circuits between line and earth, the resonating frequencies being chosen of the order of those of lightning discharges—from 20,000 to 10 millions. If a capacity and inductance tuned to any of these frequencies are placed in series and connected to line and earth, a current of that particular frequency will flow to earth as if the connection were direct. Even if the frequency were only approximately that to which the set was tuned the reactance would not be excessive and the protection would be sufficient. A set for 1 million frequency may conveniently be formed of two Moscicki condensers in parallel, having together a capacity of 0·01 mf. and an inductance of 2·54 microhenry. The latter is obtained by two turns of 2 mm. copper wire 50 cm. in diameter. A set for 100,000 frequency would require eight condensers in parallel and a coil of 10 turns. For the ordinary working frequencies up to 50 either set has of course a practically infinite reactance, that is to say, it has no effect on the power current. The Milan translating station has been at work now for about two years with perfect success. The system not only protects against lightning discharges, but against any abnormal rise of pressure, in so far as this is caused by a high-frequency surge.

Another recent invention has for its object the prevention of the infiltration of high-pressure current into low-pressure lines. That such a device is urgently needed is shown by the lamentable accident which happened last August in Olgiate, where several persons were killed by contact with nominally low-pressure lighting circuits. Some means should always be provided to cut off the current automatically in the low-pressure circuit as soon as its potential to earth exceeds a predetermined limit. Such an instrument was perfected last year by Mr. Arcioni, of Milan, and is now being gradually taken up on the Continent. The essential parts are three electromagnets with shaded poles connected star fashion, with the centre point earthed, to the three wires of the low-pressure system. In front of the poles are the three legs of a star disk mounted on a counterweighted spindle. As long as the three wires have normal potential difference to earth the torque exerted by the shaded poles is insufficient to raise the weight, but if through infiltration of high pressure the electrical centre is displaced the torque increases, the weight is raised and makes contact in a relay circuit, which then trips the main switch. If the weight is adjusted to rise at double normal torque the apparatus also acts if one of the low-pressure wires should go to earth.

In an appendix, Dr. Kapp gave particulars of the British power companies, and he remarked that the public generally, and even some engineers, were still under the impression that a country of abundant water power offered better opportunities for electric power distribution than a country of cheap coal; but that this was in reality not so was demonstrated by the great development which power supply had reached in this country. In the country of waterfalls, industries have to be introduced in order to utilise the power made available through electric transmission, whilst in the coal country highly developed industries of different kinds are already there. As regards capital outlay, the advantage lies generally with the thermal station, quite apart from the extra cost of a steam reserve, which, for at least part of the power, in many cases is unavoidable. This drawback may be compensated by a very high load factor, such as is obtainable when the current is used in electrochemical processes, but with the load factor ruling in other industries the energy costs less in the country of cheap coal than in the country of abundant water power.

Mr. C. H. Merz had pointed out that within the area served by the North-East Coast Power Station System the gas obtained as a by-product of the coke ovens could be made to yield continuously 150,000 H.P. if burned under boilers, and 250,000 H.P. if used in internal-combustion engines. It was the merit of Mr. Merz to have recognised the enormous commercial importance of these sources of energy, and to have made a beginning with their utilisation by the establishment of what he called "waste heat stations." An essential part of this system was the linking-up of all generating stations into one common network, with feeders protected by the Merz-Price system.*

Regarding electric railway operation, the President said that the majority of practical men held that alternating current in some form or other must be the means to supply power to the motor, the only question being whether three-phase or single-phase should be chosen. The Siemens-Schuckertwerke and the A.E.G. had each supplied or on order single-phase equipments aggregating over 50,000 H.P.; in Italy, the Government had decided to electrify 337 miles of track on the three-phase system, mainly on account of the heavy nature of the service. Dr. Kapp thought that the Swiss Government would adopt the single-phase system, using the Deri motor.

Other matters dealt with in the address were winding engines and rolling mills, with brief particulars of the plant at the works of Sir Alfred Hickman, Ltd., and Messrs. Dorman, Long & Co., Ltd.;* electric steel furnaces; the fixation of nitrogen; and the use of electricity in agriculture.

An enormous field of useful work, said Dr. Kapp, was open to the electrical engineer—not only useful to himself, but even more so to the interests that employed him. How, then, came it that electrical engineering was not as prosperous as it might be? He had frequently visited Continental shops, and was convinced that British shops could turn out work equally well and generally at a slightly lower prime cost. There was certainly no justification in reproaching the makers of electrical plant with backwardness, and, moreover, it was bad business policy. If, however, the reproach was levelled against the potential users of such plant, there was some justification. There was progress, but it was not fast enough, and to accelerate it they must educate the potential users of electrical plant. The Institution could do something to accelerate the introduction of electricity into our great industries, by arranging for papers of interest to the particular industries carried on in the district of each Local Section.

TRADE STATISTICS OF ROUMANIA.

The following figures, showing the imports of electrical and similar goods into Roumania during 1907, are taken from the official statistics which have just been issued for that year. Details for 1906 are given for purposes of comparison, and notes of any increases or decreases have been added:—

Kilog. = 2·204 lb.

	1906. Kilogs.	1907. Kilogs.	Increase or decrease. Kilogs.
Electric insulators of faience and porcelain, even combined with other materials.—			
From Austria	77,701	41,004	— 36.697
„ Germany	91,159	62,130	— 29,029
„ Other countries ...	210	488	+ 278
Total ...	169,070	103,622	— 65,448
Electric incandescent lamps.—			
From Great Britain ...	—	174	+ 174
„ Austria	1,725	3,531	+ 1,806
„ Germany	5,236	6,290	+ 1,054
„ Other countries ...	1,119	1,291	+ 172
Total ...	8,080	11,286	+ 3,206
Rails for railways and tramways.—			
From Great Britain ...	130,465	85,687	— 44,778
„ Austria	8,322,708	14,703,958	+ 6,381,250
„ Belgium	752,157	6,660,990	+ 5,908,833
„ Germany	1,202,531	2,582,436	+ 1,379,905
„ Holland	2,595,732	1,608,170	— 987,562
„ Russia	—	13,495,749	+13,495,749
„ Other countries ...	124,874	189,419	+ 64,545
Total ...	13,128,467	39,326,409	+26,197,942
Boilers, &c.—			
From Great Britain ...	25,449	24,498	— 951
„ Austria	363,730	184,005	— 179,725
„ Belgium	1,420	31,746	+ 30,326
„ Germany	181,436	431,272	+ 249,836
„ Other countries ...	10,127	1,481	— 8,646
Total ...	582,162	673,002	+ 90,840
Iron wire, galvanised, &c.—			
From Great Britain ...	2,219	65,364	+ 63,145
„ Austria	79,891	56,963	— 22,928
„ Belgium	9,113	50,380	+ 41,267
„ Germany	538,383	294,778	— 243,605
„ Other countries ...	10,996	18,865	+ 7,869
Total ...	640,602	486,350	— 154,252
Hammered copper in plates more than 1 mm. thick.—			
From Great Britain ...	1,084	5,359	+ 4,275
„ Austria	108,175	55,980	— 52,195
„ France	160	11,662	+ 11,502
„ Germany	59,799	91,037	+ 31,238
„ Holland	—	36,310	+ 36,310
„ Other countries ...	24,441	20	— 24,421
Total ...	193,659	200,368	+ 6,709
Copper, &c., wire, 1 mm. or more in diameter.—			
From Great Britain ...	69	332	+ 263
„ Austria	198.788	34,082	— 164,706
„ Belgium	—	1,238	+ 1,238
„ Germany	63,178	70,627	+ 7,449
„ Other countries ...	343	542	+ 199
Total ...	262,378	106,821	— 155,557

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* Electrical Review, August 28th, 1908.

* Electrical Review, November 13th, 1908.

	1906. Kilogs.	1907. Kilogs.		Increase or decrease. Kilogs.
Copper wire less than 1 mm. diameter.—				
From Great Britain ...	9	108	+	99
„ Austria	2,186	1,790	—	396
„ Germany	3,793	8,358	+	4,565
„ Other countries ...	824	1,082	+	258
Total ...	6,812	11,338	+	4,526
Copper, &c., goods not specified.—				
From Great Britain ...	8,980	14,270	+	5,290
„ Austria	64,065	92,823	+	28,758
„ France	4,080	6,577	+	2,497
„ Germany	30,928	42,065	+	11,137
„ Other countries ...	3,176	3,287	+	111
Total ...	111,229	159,022	+	48,793
Steam engines.—				
From Great Britain ...	115,000	40,000	—	75,000
„ Austria	2,104,000	4,712,000	+	2,608,000
„ Germany	511,000	2,379,000	+	1,868,000
„ Other countries ...	108,000	676,000	+	568,000
Total ...	2,838,000	7,807,000	+	4,969,000
Petroleum engines.—				
From Great Britain ...	123,000	322,000	+	199,000
„ Austria	91,000	131,000	+	40,000
„ Germany	363,000	1,262,000	+	899,000
„ Other countries ...	15,000	86,000	+	71,000
Total ...	592,000	1,801,000	+	1,209,000
Gas, compressed air, &c., engines.—				
From Great Britain ...	23,000	24,000	+	1,000
„ Austria	39,000	25,000	—	14,000
„ Germany	172,000	106,000	—	66,000
„ Other countries ...	13,000	17,000	+	4,000
Total ...	247,000	172,000	—	75,000
Hydraulic machinery.—				
From Great Britain ...	99,000	—	—	99,000
„ Austria	146,000	3,000	—	143,000
„ Germany	552,000	—	—	552,000
„ Other countries ...	64,000	1,000	—	63,000
Total ...	861,000	4,000	—	857,000
Pumps of all kinds, and ventilators.—				
From Great Britain ...	62,000	32,000	—	30,000
„ Austria	92,000	169,000	+	77,000
„ France	4,000	22,000	+	18,000
„ Germany	224,000	299,000	+	75,000
„ Other countries ...	189,000	39,000	—	150,000
Total ...	571,000	561,000	—	10,000
Locomobiles.—				
From Great Britain ...	2,934,797	1,203,097	—	1,731,700
„ Austria	1,071,083	394,171	—	676,912
„ Germany	1,584,839	881,829	—	703,010
„ Other countries ...	2,946	21,450	+	18,404
Total ...	5,593,665	2,500,547	—	3,093,118
Dynamo-electric machines, electric motors, converters, transformers, &c.—				
From Great Britain ...	18,000	7,000	—	11,000
„ Austria	77,000	132,000	+	55,000
„ Belgium	3,000	158,000	+	155,000
„ France	20,000	16,000	—	4,000
„ Germany	383,000	816,000	+	433,000
„ Other countries ...	2,000	16,000	+	14,000
Total ...	503,000	1,145,000	+	642,000
Accessories for dynamo-electric machines.—				
From Great Britain ...	—	1,000	+	1,000
„ Austria	6,000	14,000	+	8,000
„ Germany	61,000	16,000	—	45,000
„ Other countries ...	2,000	—	—	2,000
Total ...	69,000	31,000	—	38,000
Accumulators and spare plates.—				
From Great Britain ...	2,000	—	—	2,000
„ Austria	18,000	102,000	+	84,000
„ France	3,000	1,000	—	2,000
„ Germany	10,000	14,000	+	4,000
„ Other countries ...	10,000	—	—	10,000
Total ...	43,000	117,000	+	74,000

	1906. Kilogs.	1907. Kilogs.		Increase or decrease. Kilogs.
Arc lamps.—				
From Austria	3,000	4,000	+	1,000
„ Germany	10,000	10,000		—
„ Other countries ...	—	1,000	+	1,000
Total ...	13,000	15,000	+	2,000
Electric apparatus for telegraphs and telephones.—				
From Austria	3,000	8,000	+	5,000
„ Germany	10,000	17,000	+	7,000
„ Other countries ...	5,000	5,000		—
Total ...	18,000	30,000	+	12,000
Ditto for transmission of power and light.—				
From Austria	7 000	9,000	+	2,000
„ Germany	11,000	37,000	+	26,000
„ Other countries ...	5,000	5,000		—
Total ...	23,000	51,000	+	28,000
Ditto for bells.—				
From Austria	2,000	2,000		—
„ Germany	2,000	3,000	+	1,000
„ Other countries ...	—	1,000	+	1,000
Total ...	4,000	6,000	+	2,000
Interrupters, &c.—				
From Austria	6,000	9,000	+	3,000
„ Germany	24,000	47,000	+	23,000
„ Other countries ...	2,000	1,000	—	1,000
Total ...	32,000	57,000	+	25,000
Cables for transmission of electricity and insulated wire, with iron covering.—				
From Great Britain ...	2,000	9,000	+	7,000
„ Austria	143,000	160,000	+	17,000
„ Germany	125,000	633,000	+	508,000
Total ...	270,000	802,000	+	532,000
Cables for transmission of electricity ; other.—				
From Great Britain ...	1,000	1,000		—
„ Austria	56,000	58,000	+	2,000
„ Germany	46,000	74,000	+	28,000
„ Other countries ...	7,000	—	—	7,000
Total ...	110,000	133,000	+	23,000
Tramway cars.—				
Total ...	23,223,000	11,214,000	—	12,009,000

BUSINESS NOTES.

Consular Notes.—Spain.—The Belgian Legation at Madrid reports that several causes have contributed to the development of the electrical industry in Spain. Its position as a mountainous country renders it particularly adaptable for the use of water power from the numerous falls for the production of electric energy, and this fact alone has been of considerable importance since, owing to the high price of coal and the higher price of petroleum, the use of these combustibles for the purpose is out of the question. The first works were established in 1887 and 1890, and since that time they have quickly multiplied. There are only a few of the important towns which still maintain horse tramways, such as Alicante, Valladolid, Coruna and Las Palmas (Canary Islands). In the last-named town the transformation to electric traction has already been decided upon, and will soon be effected. In 1900 the Minister of Public Works ordered the publication of electrical statistics, and the report showed that there were in all 861 works, of which 651 were for public purposes, and 210 for private industries. This state of things has continued to improve to such an extent that when, in 1906, the Minister of Finances required information as to the number of works, in order to assist him to levy the tax on electricity, it was found that there were in all 1,721 works using 2,347 dynamos. Since this date, several other works have been established. In Madrid itself current will shortly be supplied from the Tagus and the Zucar. The works existing in the town are to substitute electricity for steam power, and there will doubtless be a considerable opening for electric motors and accessories. Manufacturers are advised to confine themselves to the production of the intricate parts only of the machines, leaving to the Spaniards the work of making the armatures and heavy pieces of cast-iron or steel, which greatly increase the weight of the final product, and thus incur heavy duties. Manufacturers should arrange with Spanish works to establish mounting shops in the country, where the work of adjustment, &c., could be carried out by chosen workmen. They should also take note that Spanish and foreign houses quote their prices delivered free of duty, and at the same time give liberal credit. Supplies for the electrical industry are made by the two Spanish houses and foreign firms having branches in Spain who have entrusted their business to private persons or companies formed for the purpose. A keen competition has arisen between suppliers of electrical apparatus, and principally amongst the Germans. The Spanish industry could be considerably helped by the Customs tariff, and even if the majority of the raw materials come from abroad, it should not be lost sight of that there are in Spain considerable quantities of cast and other iron, which take an important part in the manufacture of the apparatus. Manufacturers could find a considerable opening in Spain for best quality machines, but they should strictly conform to the clauses of the specifications, the observance of which is strictly required. As regards the raw materials used by the manufacturers, the most important are copper, tin and iron ore, which are produced in Spain. Foreign manufacturers could find a good opening for electrical goods in Spain, but there is a considerable competition. One of the most important things to be arranged is the choice of an agent of reliability to recommend their goods and to give any explanations which may be necessary.

Japan.—The British Consul at Dalny reports that electric lighting was installed at Mukden towards the end of June, 1908, and the results proved satisfactory, over 1,400 lights being installed in the first three months. At Dalny, owing to insufficient power, applications for installation have had to be refused everywhere. In addition to the electric lighting, power will have to be supplied for the new electric tramways, which are to be completed in 1909, and consequently the power house is being enlarged. During the course of 1909 the Changchun railway settlement is to be lighted by electricity. Materials for the electric tramways in Dalny are being obtained from various countries, the rails and cars coming from the United Kingdom. The total length of the system will be 13 miles.

Algeria.—The British Consul at Algiers reports that the wireless telegraph station at Port de l'Eau, in Algiers Bay, is open for commercial purposes, and messages are delivered in Algiers and replies transmitted. The cost of the message is collected on shore and from the person receiving it. It appears to be somewhat high, as a message delivered recently worked out at about 10d. per word for some 200 miles.

The Vice-Consul at Bone reports that in 1908 the municipality asked for tenders for the construction and working of a line of tramways, 7½ miles long, to be run by electricity and for the erection of a central electric station. Details of the undertaking were sent to the Commercial Intelligence Branch of the Board of Trade, but no British firm came forward. Two offers have been received and are being considered. It is proposed to light the new quays by electricity, and to put up electric cranes, &c., for handling goods shipped or unshipped.

Madagascar.—The British Consul in Madagascar reports that there was an enormous decrease in the exports of rubber in 1908 of £158,678 which can be ascribed not so much to the export duty of 2d. per kg. levied on that product, as to the immense quantity of Para rubber and rubber coming from the great plantations almost all over the world, which, doubtless in a not remote period, will oust Madagascar rubber from the great European markets.

An Electric Supply Company's Showrooms.—The County of London Electric Supply Co., Ltd., in pursuance of its policy of opening local showrooms, has opened at 206, Upper Richmond Road, Putney, additional showrooms in order to afford the residents of Putney and district an opportunity of inspecting the latest improvements in lighting, heating and cooking by electricity. Residents in the district (whether consumers or non-consumers) will here be able to obtain first hand, and in a place readily accessible, full information on all matters connected with electric supply. The showrooms are in an excellent position in a busy thoroughfare, and everything inside and out has been effectively designed and thoroughly thought out, with a view to displaying the artistic possibilities of electric light. For instance, the drawing-room aspect is carried out with moulded panelling in green and white, while the dining-room aspect is in the best style of oak. The fittings in each case are in keeping with the designs, and the whole effect is pleasing to the eye. In the window facing the street various exhibits are shown, and these will be varied constantly. At present the electric radiator in every design is tastefully displayed, and later an electric dining table, &c., will be shown. Various cooking and heating appliances are on view. The latest types of metallic-filament and carbon lamps, electric radiators, irons, kettles, grillers, and everything that interests the good housewife, especially in the way of labour-saving devices, can be seen and tried. The boon to the residents of the district in being able to obtain all information concerning electricity and its uses free of all charge, will doubtless be appreciated to its full extent. The showrooms are situated in a central position, and have been designed throughout with a view to demonstrating that a tasteful installation can be put in at quite a moderate cost, by a judicious selection and under expert advice. The main object of the company is to assist consumers in obtaining the fullest information and advice in all things electrical. The districts supplied by the County of London Co. cover 54 sq. miles, and embrace all classes of users of electricity, so the company is able to advise upon installations of every kind.

Auction Sale.—On Friday, December 3rd, Messrs. Fuller, Horsey, Sons & Cassell will offer for sale by auction at 251, High Holborn, W.C., the entire contents of an engineering works, which include a large number of machine tools, steam plant, electric and other cranes, &c.

Bankruptcy Proceedings.—E. A. Brandon, trading as E. A. Brandon & Co., electrical and mechanical agents and factors, at 33, Devonshire Chambers, Bishopsgate Street, E.C.—A sitting of the London Bankruptcy Court was held on Wednesday last week for this public examination. The statement of affairs showed total liabilities £2,107 (unsecured £1,137) and net assets £8, after deducting £15 in respect of preferential claims. In the course of his evidence the debtor stated that prior to January, 1906, he was in the employ of a firm of electrical engineers, and in that month he commenced business on his own account. In addition to trading on his own behalf, he had acted as agent for the Bean (British Electrical and Mechanical Co.), Ltd., and a number of other electrical companies. Witness attributed his insolvency to bad trade, in consequence of which his net profit had been insufficient to meet his household and personal expenditure. The examination was concluded.

Harry Graham, plumber and electrician, 99, North Street, Lockwood, Huddersfield.—Receiving order made November 9th on debtor's own petition.

J. G. S. Cunnington & H. P. Alison, electrical engineers and contractors, London.—A first dividend of 4s. in the £ is payable at the offices of Josolyne, Miles & Co., 28, King Street, Cheapside, E.C.

Herbert John Burdett, electrical engineer, &c., 16, Regent Street, Rugby, and 32, Earl Street, Coventry.—The public examination of this debtor was recently resumed at the County Court, Coventry, before Mr. Registrar Kirby. The O.R. said that the cash account ordered had been filed and was quite in order. The case was ordered to be closed.

Arnold Roberts, electrical engineer, Bradford.—Second and final dividend 11½d. in the £, payable November 25th. Mr. J. H. Haley, 29, Tyrrel Street, Bradford.

Dissolutions and Liquidations.—United Engineering Co., Ltd.—A meeting is to be held at 20-21, Lawrence Lane, E.C., on December 17th, to hear an account of the winding up from the liquidator, Mr. R. D. Munro.

Victor Arc Lamp Co., Ltd.—A meeting is to be held at 8, Arthur Street West, E.C., on December 13th, to hear an account of the winding up from Mr. W. C. Penny, the liquidator.

"X" Electric Accumulator Co., Ltd.—A meeting is to be held at 18, Leadenhall Street, E.C., on December 15th, to hear an account of the winding up from the liquidator, Mr. W. J. Webb.

I.T.E. Electric Co., Ltd.—Mr. P. F. Huddleston, the liquidator, will give an account of the winding up at a meeting called for December 17th, at 9, Walbrook, E.C. This notice does not in any way relate to the I.T.E. Electric Co. (1907), Ltd.

Buenos Ayres Grand National Tramways Co., Ltd.—An account of the winding up will be given at the meeting called for December 16th.

Catalogues and Lists.—Messrs. Ferranti, Ltd., Hollinwood, Lancs.—New pamphlet giving a description, and price, with a number of clear illustrations, of their traction meters.

The Reason Manufacturing Co., Ltd., Lewes Road, Brighton.—12-page pamphlet containing a well-illustrated description of their electric clocks, secondary dial controllers and secondary dials, (Murday's patents), of which they have recently taken up manufacturing rights.

Holophane Glass Co., 12, Carteret Street, Westminster, S.W.—New price list and catalogue. It contains a brief description of the Holophane system of illumination followed by illustrations and prices of a variety of Holophane globes and reflectors for electric lighting.

The British Thomson-Houston Co., Ltd., Rugby.—A set of four "Funny Man" enclosure cards have been issued for advertising in an amusing manner the B.T.-H. tungsten lamps.

The Edison & Swan United Electric Light Co., Ltd., 36-37, Queen Street, Cheapside, London, E.C.—New and entirely revised edition (the sixth) of the electric light accessories section of their catalogue. It consist of over 100 pages of well-illustrated matter relating to a variety of accessories, including switches and fuseboards, switchboards, and wiremen's sundries, prices of all of which are also given. We understand that a number of the goods listed have been improved in various details, and in many instances prices have been reduced; there are also a large number of additions. Amongst these may be mentioned a new type of counterweight with specially heavy brass parts, together with several different types of combined wall sockets and plugs. The "Phlatta" switch is also listed in several ornamental designs, and there are a number of patterns of fancy switch-plates included. A new push pattern pear switch, with key holder movement, is shown, together with other designs fitted with tumler action. The heavier type of quick make and break knife switches, double-pole house service or motor switches, and special ironclad switches are also included, together with battery regulators, &c. There are many new and improved forms of cut-outs, one of which is an improved type, specially designed to comply with the most stringent regulations. A complete range of standard fuses of this type is now made; the terminals are mounted on English vitreous porcelain bases, which are designed so as to thoroughly shroud the live fuse and live metal parts, and practically prevent all risk of arcing. The porcelain bases are mounted in a cast-iron case, asbestos lined, and fitted with insulated bushes. A number of designs of Ediswan switchboards appear, and there are also several pages dealing with small accessories, such as jointing materials, insulators, and ironwork, wiring cleats, casings, cable sockets and connectors, and fusible wires.

Ernest Scott & Mountain, Ltd.—Having in view the effects of the eight-hour day on the mining industry, Messrs. Scott and

Mountain have issued an interesting 42-page pamphlet, entitled "8-hours and what can be done to get the most out of them." Needless to say, the pamphlet contains much useful matter relating to the most modern—and electrical, as a matter of course—methods of mining, in the carrying out of which the well-known Gateshead firm has taken a prominent part. The pamphlet is profusely illustrated, and contains data and tabular matter relating to colliery haulage and winding, &c. The firm are prepared to send large copies of the diagrams in the pamphlet to anyone interested in the matter.

Messrs Alfred Herbert, Ltd., Coventry.—38-page publication (Section "L" catalogue) in the firm's standard style and form, illustrating and describing their automatic screw machines.

The British Electrical Trade Supply and Bitumen Co., Canal Bank, Trundley Road, Deptford, S.E.—This is a 16-page pamphlet, in which Mr. A. E. H. Dussek answers the question, "What is refined Trinidad Bitumen?"

Messrs. Victor Nightingall & Co., 191-193, Russell Street, Melbourne.—22-page catalogue illustrating a variety of electro-therapeutic apparatus made in Australia by the firm. These include coils, interrupters, X-ray tubes, screens and complete equipments, electric light baths, and so forth. The catalogue mentions that the high temperature obtaining in Australia has been taken special note of in these articles of local manufacture. At the temperatures of 110° and higher, which are not uncommon in the summer months, coils constructed with paraffin wax are liable to break down their insulation. It is stated that the failure of some large coils both in Australia and in India has been traced to working at too high a temperature. The firm are, therefore, placing a coil of special construction before the medical profession, which they guarantee to stand any temperature.

The Cowper-Coles Engineering Co., Ltd., 82, Victoria Street, London, S.W.—Leaflet illustrating and describing the mechanical features of the "C.C." patent motor headlight, which can be seen in operation at the above address.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—New 20-page catalogue illustrating and giving full descriptive particulars of the O.S. wiring system, with "Metacase" conductors (Kuhlos and Stannos wires) and Kalkos conduits and fittings. The latest additions to the fittings for the O.S. system, to which reference was made in an article in our last issue, are included.

British Insulated and Helsby Cables, Ltd., Prescot.—New pamphlet (P. 103) of 32 pages, containing a full description, with diagrams and excellent half-tone illustrations of their Prescot feeder and distribution pillars for electric light and power. Particulars, reference numbers, weights and prices are given in tabular form of 5 to 8-way, 6 to 10-way, 8 to 14-way, and 10 to 18-way standard pillars; cable units for twin and concentric cables, and for three and four-core (three-phase) cables; special pillars for colliery service; also cable units for sub-station switchboards. A page contains advice as to the method of ordering the pillars.

Mr. George Ellison, Warstone Lane, Birmingham.—Illustrated circular describing a patent adjustable time-limit device for circuit breakers.

Messrs. L. Andrew & Co., 2, Carr Street, Blackfriars, Manchester.—Leaflet giving prices of "Wrendal" metallic-filament lamps.

Messrs. E. Bennis & Co., Little Hulton.—20-page booklet, containing descriptive particulars and a number of illustrations, of their stokers installed at the Sun Flour Mills, Bromley-by-Bow, and at a Dartford Flour Mills.

Trade Announcements.—Messrs. Haslam and Schontheil, electrical and mechanical engineers, Cardiff, announce that, for various reasons, but chiefly owing to the expansion of business, they have turned the concern into a private limited liability company. The whole of the liabilities have been taken over by Haslam & Schontheil, Ltd.

The Royal Electrical Engineering Co., electric lighting and power contractors, have commenced business and opened offices and showrooms at Town Hall Square, Bradford. Proprietor, Mr. L. V. H. Waddington.

Cape Colony.—We have received from the Agent-General for the Cape of Good Hope a copy of the second edition of an interesting book "Cape Colony of to-day." It abounds in pictures showing the Colony's various features of interest and attractiveness, and travellers visiting the land of the Southern Cross, and, indeed, all whose thoughts are at times occupied with business and other matters relating to the country, will find the work both entertaining and serviceable. For the convenience of intending tourists nine different tours have been mapped out, particulars being given of all places of importance *en route*.

Book Notices.—*Motor Cycling.* No. 1, Vol. I. London: Temple Press, Ltd. Weekly, 1d.—With the first issue of *Motor Cycling*, the Temple Press adds one more to its many interesting publications dealing with the applications of the petrol motor. The new paper, which resembles in style its contemporaries issued from the same office, makes an excellent start with many practical and well-illustrated articles, and dealing, as it does, with a branch of sport which is still developing, it has, evidently, a considerable sphere of usefulness before it Judging by the success which has attended *The Motor*, *The Motor Boat*, and *The Commercial Motor*, similar publications, *Motor Cycling*, in the same hands, has every prospect of developing into an equally successful periodical.

"Proceedings of the American Society of Civil Engineers." Vol. XXXV, No. 8. New York: The Society.—This number contains a detailed account of the construction of the Cross Town and East River tunnels of the New York tunnel extensions of the Pennsylvania Railroad, the former by driving headings and the latter with shields, by Messrs. J. H. Brace, F. Mason and S. H. Woodard.

"International Directory of Booksellers, and Bibliophiles' Manual." Edited by J. Clegg. Rochdale: J. Clegg. 1910.—The directory gives particulars of the booksellers of the world, as well as of book publishers of the United Kingdon and the United States, public libraries, and learned societies in all countries, and other matter of interest to the book lover.

"The Prevention of Industrial Accidents." No. I. General pamphlet. New York: The Fidelity and Casualty Co. September, 1909. Price 25 cents.

"Technical Dictionary in Six Languages." Vol. V. Railway Construction and Operation. London: A. Constable & Co., Ltd 1909. Price 12s. net.

"The Alternating Current Motor," and "The Leakage of Induction Motors." By R. Goldschmidt. London: *Electrician* Printing and Publishing Co. 1909. Price 6s. 6d. net.

LIGHTING and POWER NOTES.

Aldershot.—The War Office has decided to supply energy for the balloon factory from the military electric power station.

Argentine.—The Rosario Electric Co. contemplates the construction of a station in the suburb of Sorrento for supplying electricity to the northen suburbs of Rosario; an expenditure of £200,000 is to be made. Rosario is growing rapidly since the electrification of the local tramways.

Ballyclare (Co. Antrim).—At a special meeting of the Urban Council on the 15th inst., the following resolution was passed unanimously:—"That the Council make application to the B. of T. for authority to construct an electric lighting scheme at a cost not exceeding £3,000."

Birmingham.—Remarkable progress has been made by electricity in superseding steam as a motive power in Birmingham within the last few years. Some of the big works generate their own power, but since the introduction of the municipal electric supply in 1900, private installations have largely given way to the public supply, which has been rendered much more accessible and reliable than formerly. Jewellers and others who were engaged in the manufacture of light metal wares suffered for a long time from the want of cheap power. The want, indeed, threatened to cause their transfer to more enterprising centres both at home and abroad. But the introduction of a scheme for hiring motors to manufacturers on favourable terms has proved a great boon to traders, and has put a stop to all complaints. In the aggregate the Corporation power connections amount to about 12,000 H.P. One important feature has been the addition of a H.T supply suitable for large consumers, such as rolling mills, &c., and 25 firms are now taking such a supply. There are 10 rolling mills on the mains, the majority of them also utilising electrical energy for tube drawing. The supply is also largely used by other trades for which the Midland metropolis is famous, viz., in motors and cycles and their components, the pen trade, and engineers' tools, and so on. A few years ago the lowest price at which energy could be obtained in Birmingham was 1½d. per unit, whereas now consumers can get H.T. supply at 1d. per unit, the charge varying according to the amount taken. The extent of the displacement of other forms of power upon which the industries carried on in the city formerly relied, is strikingly shown by the fact that the total number of units sold has increased from 73,000 in 1891 to 24,500,000 in 1909. The earlier figure, of course, relates to current for lighting, for electricity was not adopted in the factories and workshops then.

Bishop's Stortford.—Messrs. May & Hawes, of Westminster, have made a survey of the town with a view to reporting to the U.D.C. upon an electric light installation.

Braunton.—The P.C. has decided to accept the terms of Messrs. Crompton & Co., for public lighting by electricity at £52 per annum, this being the same cost as for the present oil lamps.

Canada.—Ottawa, situated as it is beside the Great Chandieu Falls, capable of developing 50,000 to 75,000 H.P., is peculiarly adapted for manufacturing. Electric power can be obtained there cheaper than at any point in the American Continent. An example of this was shown this week. It became known that the Morrisburg-Ottawa electric road that will be built next spring required a large amount of electric power. The result was pleasing indeed, for the management of the road have received several offers to supply anything over 3,000 H.P. at rates that certainly are a surprise to persons who have not studied the question of Ottawa's electric supply. While the rates were not definite because they came more or less unsolicited, yet there is no doubt that the rate will be below $15, or £3 per H.P. One firm states that it is able to supply 12,000 H.P. This ought to make the electric lines into Ottawa a great success, and there is little doubt but that in the future, lines will run into the city from many directions. The work on the new power house, being built by the Bronson Co., is progressing very fast, and will increase that supply by nearly 7,000 H.P. This will take the place of the old power plant of the Bronson Co., which was the first plant installed in this city, and is over 20 years old. The Ottawa Electric Co. has the lease of the first 4,000 H.P., and an option in the remaining 4,000 H.P. The first 4,000 H.P. will be needed as soon as the plant is in order. The Ottawa Power Co., a few yards away, is now developing 4,000 H.P., and, whenever there is a market, it can develop 4,000 H.P. more. The firm mentioned as being open to supply 12,000 H.P. is neither of these companies.

Colchester.—A statement prepared by the borough accountant shows that £2,868 has been overspent on loans account for mains and services, and £5,713 for machinery, &c. The T.C. has accordingly decided to apply to the L.G.B. for power to borrow a further £8,000. The T.C. has also decided to accept a tender of Messrs. Crompton & Co. to supply the necessary plant for a proposed sub-station at Lexton for £374.

Continental Notes.—FRANCE.—One of the largest electrical undertakings in the North of France is that of the Société Energie Electrique du Nord de la France, formed to supply current for electric lighting and power purposes in the Lille, Roubaix and Tourcoing districts. The power station, which is situated at Wasquehal, is equipped with two 1,800-KW. and two 3,500-KW. turbo-generators, the output being at present equal to about 15 million KW.-hours per year. Among the contracts and concessions which have been secured by the company are the following:—A 30-years' concession for the gas and electric lighting of the town of Roubaix; for the supply of current for lighting and power purposes in the town of Tourcoing during a period of 30 years; and a 25-years' concession for the electric lighting of the little towns of La Madeleine, Deulemont, Linsennes and Lezennes. The company is also supplying the current for the electric tramways in Roubaix and Tourcoing and for the Lille-Roubaix-Tourcoing electric railway. It is expected that, by the middle of next year, the power plant of the company will have an output of 2,500,000 KW.-hours per month.

AUSTRIA.—A large central station is to be built near Krainburg (Carinthia), on the river Save, at a cost of three million kronen, to supply light and power throughout the province. The realisation of the project has been entrusted to the A.E.G. Union Electric Co.

A beginning has been made with the erection of the hydraulic station between Otacae and Zengg, on the river Gacka in Croatia. The capital of the company having the scheme in hand is 10,000,000 kronen. A French syndicate, which is arranging to build an artificial manure factory, will draw its power requirements from the Gacka station.

HOLLAND.—The authorities of Gouda have decided to construct an electric station at a cost of 258,000 florins.

The municipal council of Poststellingwerf has decided to set up an electric station to supply the requirements of its 10,000 inhabitants.

SPAIN.—Under the name of La Electra de Cardona, a society has been formed at Barcelona with a capital of 250,000 pesetas for the production of electricity.

Cromer.—The E.L. Committee has agreed with Messrs. Edmundsons to exchange the present arc lamps for Union Excello arcs, the firm providing the money and the Council paying £5 per annum in addition to the present charge, and having the right to exchange further lamps.

Derby.—The T.C. on November 9th decided to apply for a prov. order for electricity supply in districts outside the borough. The names of the parishes included in the proposed area of supply were recently given in this journal.

Durham.—The directors of the Weardale Steel, Coal and Coke Co., Ltd., in their report issued on the 15th inst., state that the question of the electrification of Thornley colliery has had their very full consideration, and, with the object of securing the most efficient working, and providing also for future requirements, it has been decided to install an electric generating plant at these collieries, and a contract for the work has been placed.

Fareham.—Mr. Spencer Hawes, consulting engineer to the Council, recently reported on the progress of the new oil-engine plant at the generating station, which is nearing completion. Recommendations were made for appointing the necessary staff.

Glamorgan.—The South Wales Electrical Power Distribution Co. has applied to the B. of T. for permission to utilise overhead mains from the Treforest Tinplate Works, Pontypridd, to the new sinking of the Great Western Colliery Co. at Llantwit Fardre (Glam.).

Glasgow.—Mr. W. W. Lackie has been granted permission to give the burghs of Alloa and Motherwell assistance in respect of matters of policy in connection with their electrical undertakings.

Huddersfield.—The Corporation is applying for a prov. order to extend its electric lighting area to South Crosland.

Ince.—At a meeting of the U.D.C. held on Wednesday, the 10th inst., a letter was read from Mr. James Slevin, electrical engineer to the Wigan Corporation, suggesting that a census of probable users of electric light in Ince be taken in connection with the pending L.G.B. inquiry. The clerk wrote in answer thereto offering every assistance, but pointed out that information as to price would perhaps lead to fuller information being obtained.

Keighley.—The T.C. has applied for a loan of £21,000 for additional electric plant, &c.

Lochgelly (Fife).—The T.C. has agreed not to petition either in favour of or against the application by Mr. John Balfour to the B. of T. for a prov. order for the electric lighting of West Fife, including the burgh of Lochgelly. The scheme will be welcomed in the district, which is growing rapidly in importance.

London.—MARYLEBONE.—The Electric Supply Committee reports having considered in connection with the unemployed question an extension of the work, now proceeding, of converting public lamps from gas to electricity. After drawing attention to the fact that the L.C.C. some time ago refused to sanction a loan of £8,000 for this purpose, the Committee proceeds to point out that the scheme adopted by the Council in March last affected 1,964 lamps, and up to date 1,886 of these had been changed over at a cost of £5,523. The remaining 78 are estimated to cost £265. The total cost will thus be £5,788, as against the original estimate of £8,336, and the final estimate of £6,886. For the 1,964 posts, £8,818 per annum had been paid for gas and maintenance, whereas the cost for electricity and maintenance will be £7,350 (energy at 1·42d. per unit, £3,950; maintenance renewals and capital charges, £3,400). If the Committee had obtained a 10 years' loan, the estimated profit of £2,500 per annum would have been increased by £200, representing the charges on the substantial reduction in capital outlay. After taking over 165 more lamps near which cables are laid, there still remain 1,385 lamps in streets where at present there are no mains. The price paid for running these lamps is £5,500. If the Committee were to lay the necessary ducts, and put in mains of sufficient size for the lighting of these remaining lamps (1,385), the capital cost of the mains and the ducts would be with ordinary labour £19,965, or with "unemployed" labour £23,420. The cost of altering the lamps themselves for the purpose of electric lighting would be £1,385. The above includes the full cost of the ducts, which would be available for supply to private consumers along the route. It is proposed that the Committee should spread the cost of alterations to lanterns, &c., as before, over three years, and that it should make application to the L.C.C. for a 25-years' loan of £24,000 for the purpose of extending the mains. Having regard to the greater expense involved in taking over these lamps compared with the cost in streets where mains were already laid, the Committee thinks that the total charge should be at the amount of the present gas lighting, viz., £5,500 per annum. If the charge were £5,500 as suggested, there would be left £1,640 per annum for the electricity, equivalent to ·9d. per unit for the first three years, and 1·17d. per unit thereafter, instead of 1·42d. per unit, the price allowed for the existing lamps. The charge mentioned would yield a profit, and the department would have the advantage of paying off earlier than otherwise would be the case the cost of laying the mains in the remaining portion of the streets (about 24 miles) where no mains exist. With regard to the contention of the London County Council in refusing the loan, viz., that lighting by electricity is not as satisfactory as lighting by gas, there is no question that in actual measured candle-power the streets have now much more light than they had before, and that with regard to the general effect this is in every way satisfactory, the lighting being very equally distributed and giving more efficient results in case of fog. The Finance Committee reports having had under review the foregoing report. It was decided (subject to the usual sanction) to apply to the L.C.C. for the advance of a loan of £24,000 to carry out the scheme.

WOOLWICH.—The Electricity Committee obtained powers at the meeting of the Council on November 11th to obtain and accept tenders for cables and motors required for the equipment of a factory. The Committee has been informed that the freeholder of Roff's Wharf claims £22,000 in regard to its proposed acquisition, and the necessary steps have been taken to have the matter settled by a jury.

SHOREDITCH.—The Lighting Committee has considered a report of the electrical engineer, pointing out that considerable improvement could be secured by the provision of a new feeder main from Whiston Street station to Evelyn Street sub-station. The work of converting the gas lamps south of Old Street for electric lighting is being put in hand. The estimated cost of services to lamp-posts and brackets is £980.

Lowestoft.—A L.G.B. inquiry was held on November 11th into the application of the T.C. for a loan of £1,852 for E.L. purposes, *i.e.*, the provision of a new 250-KW. set and two chain-grate stokers. There was no opposition.

Macclesfield.—The T.C. on November 9th decided that the Gas Committee should inquire into the question of the supply of electricity by the Corporation, and report as soon as possible. The B. of T. has threatened to revoke the prov. order unless some definite steps are taken to carry it out, and the town clerk pointed out that it is not certain whether the decision will satisfy the B. of T. or not.

Newcastle-on-Tyne.—On Sunday, November 7th, the work of completing the electro-pneumatic signalling system at the central station was taken in hand. The original installation was inaugurated two years ago, and the work of completing the change-over (which is in the hands of Messrs. Mackenzie & Holland) was expected to occupy some days.

Oldham.—At a recent meeting of the E.L. Committee, reference was made to the necessity of extending the generating plant in order to meet the demand of the out-townships.

It is proposed to light Union Street by arc lamps.

Pembroke (Dublin).—The Council has decided to apply to the L.G.B. for sanction to an £8,000 loan for electric lighting extensions.

Reigate.—Messrs. Handcock & Dykes have been retained by the Council to investigate thoroughly the working of the electric light undertaking and to advise on the steps to be taken to place it on a more satisfactory footing.

Sampford Courtenay.—A proposal is on foot to illuminate Sampford Courtenay, Devon, with electricity. A meeting was held to consider the matter, and in the end it was decided to appoint a Committee to go thoroughly into details. It was stated at the meeting that the probable cost of a scheme would be £1,200.

South Lancashire.—A correspondent informs us that Electricity Committees of various corporations in central and south-east Lancashire are now arranging coal contracts on more favourable terms than for some years past, substantial reductions being conceded in many cases. The Eight Hours Act has not increased the price of coal in Lancs. as was threatened would be the case.

Southend.—The T.C. has sanctioned mains extensions on the Grand Parade, Southchurch Road and Chalkwell Esplanade districts, at a cost of £324 12s. A loan of £1,000 for the provision of 250 small E.L. standards has been applied for.

Swinton and Pendlebury.—The U.D.C. has decided that the management of the electricity undertaking shall be retained by the Lancashire Electric Power Co., under a new agreement, which shall be terminable after August 31st, 1912, on three months' notice, and on condition that a representative of the company shall reside in Swinton, and attend the Council offices on three days in each week, and that the company shall not carry out any contract work in the district except in connection with motors installed by the company under a hire-purchase agreement.

Torquay.—The Electrical Committee of the T.C. has recommended the provision of a patent smoke abatement apparatus and a patent stoking apparatus at the electricity works at an estimated cost of £950.

Whitwood (Yorks.).—The U.D.C. has under consideration a scheme of electric lighting.

Wimbledon.—On Monday afternoon last the Mayor opened a five days' electrical exhibition, in which particular attention has been given to domestic applications of electricity. The local firm, the Foster Arc Lamp and Engineering Co., which has recently purchased 3½ acres of land on which to erect a new factory, has a good display of its specialities. We understand that over 20,000 of the company's house transformers are in use with metal lamp installations, and the company is exhibiting an automatic switch for cutting in and out the transformer as required, and thus avoiding no-load losses. Other features of interest are arc and metal-filament lamps of the firm's own make, also a transformer system for bell circuits.

Winchester.—The T.C. has decided to engage a consulting electrical engineer to make an inspection of the electrical undertaking and report on matters affecting the Council, as provided in the proposed transfer to the Electric Light and Power Co., Ltd., of the E.L. Order, 1895.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation recently agreed to enforce the award of the arbiter in connection with the supply of current to the Aberdeen Suburban Tramways Co., but agreed in the first place to ask the approval of the B. of T. At the same time the company communicated with the B. of T. stating its objections to the award. The Board has now sent a communication to the T.C. to the effect that in the meantime it refuses to signify its approval of the agreement embodying the award.

Belfast.—The recommendations for the improvement of the electrical plant belonging to the Corporation will include provision for an extension to the amount of a 1,500-KW. plant at a cost of about £62,200. In view of the coming municipal elections in January, the question of the various extensions of the tramway system is becoming more prominent.

Blyth.—The U.D.C. has decided to approach the Whitley Council with a view of having a joint meeting to endeavour to arrange a system of tramways for the district.

Canada.—The Montreal civic authorities are taking steps to prevent the Montreal Street Railway Co. from carrying freight within the city. It does not appear to be certain whether the company has power to carry freight, although it has been doing so for two years, and has amongst its customers the city itself. The city also accepts a percentage of the profit from this business.

On October 19th the power house of the Hull Electric Railway Co. was destroyed by fire, causing a stoppage of the street car service. The Ottawa Electric Co. was expected to give a temporary power supply pending reconstruction.

Continental Notes.—BELGIUM.—Electric traction on the State railways began in 1892 when the Administration made trial of an experimental accumulator car, which eventually determined the lines of six other cars built in 1896 and placed in service on the sections Antwerp to Lierre and Antwerp to Capellon (16 and 15 km. distance respectively) each having accommodation for 76 passengers. A new line is now under construction running from Antwerp to Malines, a distance of 21 km., on which four trains drawn by accumulator locomotives will be run daily. The cost of charging the accumulators will be 0·101 fr. per KW.

AUSTRIA.—Under instructions from the State Railway Department, Civil Engineer Sckenkl, of Graz, is drafting a detailed scheme for the utilisation of the waters of the river Enns for electrical purposes. A large station is to be built to supply current over a wide area and embracing that recently surveyed by the Statthalterei of Steiermark.

HUNGARY.—The local railway between Budapest and Soroksa has just been converted to electric traction. Work is also at present in hand in converting the line between Budapest and Kerepes into an electric railway.

GERMANY.—Plans are at present being prepared in respect of a projected electric tramway between Mittweida, Burgstadt and Limbach.

Devonport.—Arrangements have been made for the repair of overhead equipment on the Devonport and District Tramways between Milehouse and Tor Lane which was damaged in the gale last May. Since the announcement was made that the company had paid to the Corporation the rent of the leased lines and withdrawn its appeal against the decision of the magistrates' fines for discontinuance of the service on the leased lines, there have been repeated rumours that the company comtemplated resuming the service on these lines; but so far as can be ascertained no arrangements have yet been made to provide a service.

Doncaster.—The T.C. has decided to apply for a prov. order for the extension of the tramways to Bentley colliery for the convenience of the village.

Droylsden.—The U.D.C. has instructed its clerk to write to the Manchester Tramways Committee and the Lancashire C.C. asking them to contribute towards the cost of the reconstruction and widening of Christy's Bridge, which spans the canal on the main road from Manchester to Ashton.

Fife.—It is understood that the Dunfermline and District Tramways Co. has decided to promote a prov. order for the continuation of its system to Rosyth. It is believed the route chosen is by Grange Road, the most direct way to the Naval Base. The new Dunfermline tramways are being well patronised, and the promoters of the system are satisfied with the results. Mr. Balfour, managing director of the company, states that the extension to Lochgelly will be finished in three weeks, and that the extension to Kelty will then be commenced.

Glasgow.—The Tramways Committee has recommended the cancelling of the remit to a Special Committee to consider and report upon the propriety of establishing a long-service fund for employés.

Arrangements have been made by the T.C. to allow the tramways employés to take advantages of the vacant plots of ground belonging to the Corporation in the vicinity of three of the depôts, for horticultural purposes. Already one area is under cultivation, and other two will be open to the men early in spring.

Huddersfield.—The Corporation is applying for a prov. order for further tramways in the borough.

Linthwaite.—The announcement of the arbitrator's award in the dispute between the Linthwaite Council and the Huddersfield Corporation over the tramways question was received with surprise by the ratepayers. The arbitrator decrees that the whole of the tramway track within the Council's district shall be relaid at the expense of the Council, and stipulates that the work must be done by next May. The present arrangement is that the Council receives £1,250 annually from the Corporation as rent.

London.—PADDINGTON.—The Works Committee of the B.C. has passed plans submitted by the Metropolitan Electric Tramways, Ltd., for the extension of its lines along the Harrow Road to Edgware Road.

A serious accident occurred yesterday morning at Ealing Broadway Station, when a District electric train collided with the buffer stops, several coaches being wrecked and the guard killed and driver seriously injured. Fortunately the train was an empty one.

Quarry Bank.—The Brierley Hill, Rowley Regis and Quarry Bank U.D.C.'s have once more entered into negotiations with the British Electric Traction Co., with the object of carrying out the scheme for providing a light railway between Cradley Heath, Quarry Bank and Brierley Hill. It is hoped that in this instance the negotiations will be productive of a more satisfactory result than on the previous occasion. In the meantime, application is to be made to the Board of Trade for an extension of the existing order until December next year, and this, it is believed, will be granted.

Southampton.—The T.C. has decided to proceed with the extension of the tramways to Hortham at a cost of £7,428, and to spend an additional £2,400 for cars.

Twickenham.—At the meeting of the U.D.C. a report was received from a conference of representatives from Heston and Isleworth, Southall, Norwood and Twickenham U.D.C.'s recommending that the Middlesex County Council be asked to receive a deputation on the subject of constructing an electric tramway or light railway connecting Twickenham, by way of Whitton, Hounslow, Heston and Norwood Green with Southall station of the

G.W. Railway. Considerable opposition was raised to the recommendation on the ground that tramways had not, up to the present, resulted in any good to Twickenham. The U.D.C., however, adopted the report by 12 votes to 6.

United States.—The St. Louis-Kansas City Electric Railroad Co. has been incorporated with a capital of $5,000,000 to construct an electric railway, 295 miles long, between St. Louis and Kansas City.

The G.E. Co. has completed a single-truck gas-electric street car for the Third Avenue Railway of New York. A four-cylinder totally-enclosed gas engine is mounted between the axles, and drives direct a generator and exciter, the energy developed being transmitted to two railway motors mounted on the axles. The engine runs at constant speed; Bosch L.T. ignition is fitted; the exciter, in addition to energising the generator field, also supplies lighting; and the whole of the control is electrical, as in an ordinary car.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—Mr. E. D. Trowbridge. the concessionaire for the telephone systems of the State of Rio de Janeiro, has been authorised to establish a submarine cable between Rio de Janeiro and Nictheroy for telephone purposes.—*Board of Trade Journal.*

Cables.—The Post Office authorities have given notice of probable delay in the transmission of telegrams to and from Germany and Austria, owing to interruption of landlines and cables. Two of the five cables in the North Sea have been broken. One of the damaged cables is maintained by the English and the other by the German Government. Considerable difficulty in repairing them has been experienced, owing to the fact that the breaks have occurred at a spot over which the fishing fleets are now engaged, and as the boats will remain in the vicinity for some time, a further period must elapse before the necessary repairs can be made.

The cables laid from New York to Colon *via* Guantanamo, Cuba, are jointly owned by the Mexican Telegraph and the Central and South American Telegraph Co. The former company's proportion of the cost is soon to be paid to the latter company, when, says the *Telegraph Age*, a 20 per cent. dividend will be declared by the Central and South American Telegraph Co.

Cables repaired:—

November 9th	...	Tourane-Amoy
November 11th	...	Sitka-Valdez
November 15th	...	Balikpapan-Kwandung

Cables interrupted:—

October 21st	...	Paramaribo-Cayenne
November 3rd	...	Cayenne-Salinas
November 8th	...	Puerto Plata-Martinique
November 8th	...	Cape Haytien-Mole St. Nicolas
November 10th	...	Jamaica-Puerto Rico

Franco-Spanish Telegraphs.—The convention between Spain and France, which will shortly be signed, will involve the establishment of four new telegraph circuits, namely, Burdeos to Madrid, Cette to Barcelona, Bayona to San Sebastian, and Perpignan to Gerona. Each of these will be united to both the Spanish and French networks. The construction will be completed within six months and the circuits opened for working. By means of these new lines direct communication may, if needed, be opened up with both Brussels and London.

Jamaica.—Some uneasiness was caused last week by the complete interruption of communication with the colony. It turned out, fortunately, that the breakdown was due mainly to damage to the landlines in Jamaica by floods; the cable house was isolated from the interior by a flooded river. Landlines were interrupted until the 15th inst. The Turk's Island-Jamaica cable is down, but the repairing steamer *Relay* is daily expected to effect the repair. The Puerto Plata-San Domingo landlines were interrupted on November 8th.

Telegraph Memorial.—A monument is to be erected at Berne, Switzerland, to commemorate the formation of the telegraphic union. Competitive conditions have been agreed, and they will be open to artists of any country.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—November 29th. 1,250 opalescent arc lamp globes for the Council. See "Official Notices" November 12th.

MELBOURNE.—December 6th. 230 A C. and 160 D C. electricity meters for the Council. See "Official Notices" to-day.

MELBOURNE.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" to-day.

MELBOURNE.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

January 31st.—The municipal authorities of Waremme are inviting projects for the establishment of a central electric station in the town.

Chatham.—November 25th. Incandescent electric lamps, &c., for a year; Chas. Day, Borough Surveyor.

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" November 5th.

December 1st.—Electric wiring and fitting of the Workhouse buildings, nursing sisters' residence, and North City Dispensaries, for the North Dublin Board of Guardians. Specifications at the office, North Brunswick Street, or from the consulting engineer, L. J. Lawless, 27, Castlewood Avenue, Rathmines, on payment of the cost of production.

Edmonton.—November 23rd. Electric light and power installation at the new infirmary. See "Official Notices" November 5th.

Gloucester.—November 27th. Stores for the Corporation Light Railways Committee for a year; Leonard Johnston, General Manager and Engineer, Bristol Road, Gloucester.

India.—LUCKNOW.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th, and an article elsewhere in this issue.

Italy.—December 6th. The Italian Naval authorities in Spezia are inviting tenders for the supply of a number of electric searchlights for use on warships.

Leeds.—November 23rd. Electric light installation at the Kingston Unity Friendly Society's Hall, with electric fans; A. Wright, secretary, Kingston Unity Hall.

London.—L.C.C.—Covering with asbestos tape about 2¾ miles of lead-covered high and low-tension electric cables in manholes. See "Official Notices" November 5th.

Newcastle-on-Tyne.—November 24th. Incandescent lamps and arc carbons for a year, for the Tyne Improvement Commission; J. McDonald Manson, secretary, Bewick Street.

Russia.—The municipal authorities of Katuga are about to invite tenders for the establishment of a central electric lighting station in the town.

South Africa.—JOHANNESBURG.—November 29th. Tramway poles, overhead material, electric cables and joint-boxes for the Municipal Council.

Spain.—December 9th. The municipal authorities of Llanes are inviting tenders until December 9th for the concession for the electric lighting of the town during a period of 10 years. Tenders to El Senor Presidente del Ayuntamiento de Llanes. Local representation necessary. The Board of Trade Commercial Intelligence Department has particulars.

Wakefield.—November 25th. Stores for the Wakefield and District Light Railway Co. See "Official Notices" November 12th.

York.—November 25th. E.L. fittings, lamps, &c., for the North-Eastern Railway Co.; F. H. Clark, Stores Superintendent, Gateshead.

Telegraph stores, for the North-Eastern Railway Co.; C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Colchester.—The T.C. has accepted the tender of Messrs. Crompton & Co. for plant for the sub-station at Lexden, at £374.

Glasgow.—The T.C. Committee on Works and Stores recommend the acceptance of the following:—

Special track-work and spare points and crossovers.—Lorain Steel Co.

Renewable plates for special track-work.—Acme Steel and Foundry Co

Colonial Contracts.—Messrs. Sanders Rehders & Co., Ltd., have recently secured the following Colonial contracts for "Sarco" fuel economy specialities:—

Municipality of East London, S.A.—One "Sarco" combustion (CO_2) recorder, type B, and four "Sarco" dial draught gauges.

Municipality of Sydney, N.S.W.—Repeat order for five "Sarco" combustion (CO_2) recorders, type B (three machines, type A, have been in use here for some years.)

Adelaide Tramway Trust.—One "Sarco" combustion recorder, type B; seven "Sarco" dial draught gauges; two dozen "Sarco" pipe thermometers; two dozen "Sarco" high temperature stem thermometers; one steam pressure gauge and one hand gas testing set.

Melbourne Electric Supply Co., Ltd.—Four "Sarco" dial draught gauges.

London.—L.C.C.—The Stores Committee recommends the acceptance of tenders from the following firms for brass and gun-metal fittings, &c., copper rail bonds and gun-metal cable connections, for the year ending December 31st, 1910:—E. Barber and Co., Deptford Engineering Co., Estler Bros., Forest City Electric Co., Gabriel & Co., Hayward-Tyler & Co., Highton & Co., R. & H. F. Phillips.

The tender of Messrs. Holland & Hannen, at £6,827, for the building and architectural works required for the completion of the second portion of the Greenwich generating station, is recommended for acceptance.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 19th. At 7.30 p.m. At the Literary Society, Sunderland. Resumption of discussion on Mr. D. Myles's paper on "Notes on Marine Boiler Design, Construction and Economy."

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, November 19th. At 8 p.m. At the Glasgow Technical College. Paper on "The Localisation of Breaks in Submarine Cables," by Mr. W. H. Young.

Institution of Electrical Engineers (Manchester Students' Section).—Saturday, November 20th. Visit to the Oakamoor Works of Messrs. T. Bolton and Sons, Ltd.

Tuesday, November 23rd.—At 7.30 s.m. At the Municipal School of Technology, Manchester. Paper on "The Testing of Electrical Machinery," by Messrs. R. F. Blackmore and V. W. Newman.

Institution of Electrical Engineers (Newcastle Section).—Monday, November 22nd. At 8 p.m. At the Armstrong College, Newcastle. Inaugural address by Prof. H. Stroud.

Institution of Civil Engineers.—Tuesday, November 23rd. At 8 p.m. Further discussion on three papers on "Electric Railways."

Royal Society of Arts.—Wednesday, November 24th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "Photo-Telegraphy," by Mr. T. Thorne Baker.

Institution of Electrical Engineers (London).—Thursday, November 25th. At 8 p.m. At the Institution of Civil Engineers. Paper on "The Present Aspects of Electric Lighting," by Messrs. H. W. Handcock and A. H. Dykes.

Northampton Institute Engineering Society.—Friday, November 26th. At 5.45 p.m. Paper on "Single-Phase Electric Traction," by Mr. T. A. Collett.

Physical Society.—Friday, November 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Effective Resistance and Inductance of a Helical Coil," by Mr. J. W. Nicholson; and other papers.

Association of Engineers-in-Charge.—Saturday, November 27th. Social. Dance.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 22nd.—"A" Company. Technical drill, 6.30 to 9.30 p.m.

Tuesday, November 23rd.—"B" Company. Technical drill, 6.30 to 9.30 p.m.

Wednesday, November 24th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, November 25th.—"C" Company. Technical drill, 6.30 to 9.30 p.m.

Friday, November 26th.—"D" Company. Technical drill, 6.30 to 9.30 p.m.

Saturday, November 27th.—"C" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station at 3 p.m. Tickets will be issued at the station.

(Signed) P. H. Campbell, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

THE FREUND TUMBLER BRAKE.

As the construction of this brake, which was mentioned in our issue of last week, presents several interesting features, we have thought it desirable to explain its action, with the assistance of diagrams. Figs. 1 and 2 show its application to ordinary brake shoes, with the "tumblers" acting directly upon them, while figs. 3 and 4 represent the application to magnetic shoes.

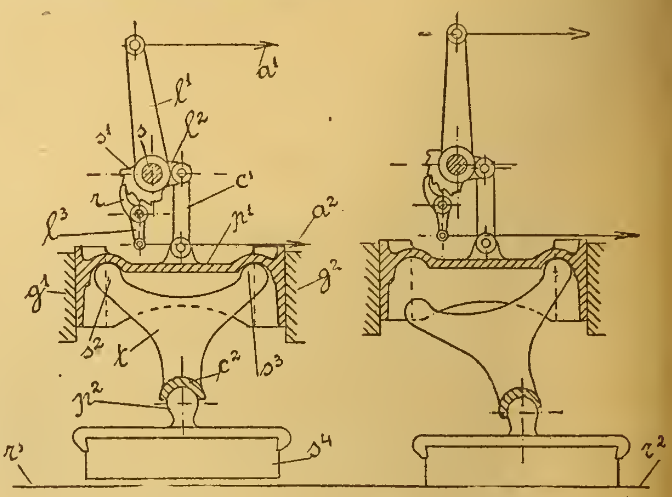

Fig. 1. Fig. 2.

Tumbler Brake Applied to Ordinary Shoes.

The operating lever l^1, fig. 1, which can be turned to the right by means of the usual winding gear from either platform, is keyed upon the cross brake shaft s, on which are also keyed the depression levers l^2. The latter are linked in the usual way by connecting rods c^1 to lugs on top of the depression plates p^1. The plates can thus be lowered between the guides g^1, g^2, and their movement is transmitted through the tumblers t to the shoes s^1, which are, till then, kept off the rails by ordinary release springs (not shown).

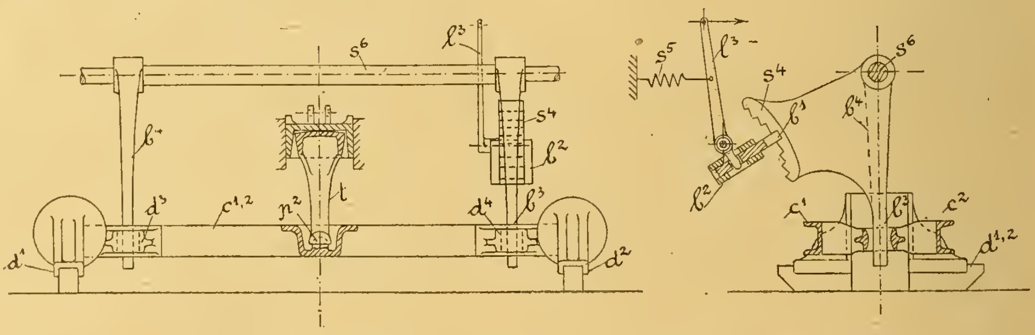

Fig. 3. Fig. 4.

Tumbler Brake with Magnetic Shoes.

The movement of the lever l^1 to the right effects the change shown in fig. 2. As soon as the brake blocks touch the rails they lag behind the car, and tilt the tumblers. The depression plates p^1 and the brake shoes are through this movement forced apart, and as the depression plates are prevented from receding upwards by the ratchet wheel s^1 and pawl r, a considerable part of the weight of the car is thus brought to bear upon the brake blocks. The lagging of the shoes behind the car is generally referred to as "drag," and it is obvious that the more drag is allowed the greater is the brake pressure.

The regulation of the drag is effected by a sector s^4, figs. 3 and 4, with which a bolt b^1 engages. This bolt slides in a box b^2 fixed on the truck, and is controlled by lever l^3, which is connected by pulls to both platforms. A spring s^5 tends to move the bolt b^1 to the right.

The tumbler t acts upon a pivot p^2, mounted on two channel irons, c^1, c^2, which bridge the two magnetic shoes, d^1 d^2, which in this way receive equal loads and wear uniformly. In this respect this arrangement differs from that indicated in figs. 1 and 2. With the sector s^4 is combined lever b^3, and shaft s^6, on which it is keyed, carries also lever b^4. The two levers engage with bridge bars d^3, d^4, attached to the girders c^1, c^2, and ensure equal drag of both brake shoes.

It will be seen that the shoes are allowed all necessary side play without risk of skidding, because the farther the shoes move sideways the heavier becomes the reaction from the increase of brake pressure, which this movement produces in a manner similar to the drag worked in the other direction.

NOTES.

The Prevention of Industrial Accidents.—There is, we believe, no country in the world where industry claims so many victims as it does in America. What becomes of the maimed victims we do not know, in the absence of a poor law. Presumably they exist and become a burden on their friends. But attention has been drawn to the question, and the technical Press of the United States has constantly dinned it into the public ear that killing and maiming of workers represents very direct pecuniary loss. The Hartford Boiler Insurance Co. have for years endeavoured to mitigate the loss from boiler explosions by their endeavours to bring stresses nearer to European standards. The Fidelity and Casualty Co., of New York, some of whose officers we have been privileged to meet, have long urged greater care and attention. Fly-wheel insurance, for example, has been made a special feature of their business; now they are paying special attention to general machinery accidents, and in a pamphlet with the above title they have drawn on their experience of business, and the fund of knowledge of causes acquired by their various inspectors. The pamphlet is divided into eight sections, under the headings of Care on the part of Employers and Employés, Safe Devices, Steam Boilers, Engines, Electrical Apparatus, Elevators, The Factory, and Wood-working Machinery.

This is a sufficiently miscellaneous gathering on which to found many essays on safety. To begin with, Germany is cited in comparison, because of her very complete statistics, and it is shown that nearly 60 per cent. of accidents are preventible, only 42 per cent. being classed as inevitable. Then in each chapter the special considerations affecting matters dealt with in that chapter are taken into argument. Thus in steam boilers there is the relationship between quantity of water and quick rise of pressure as an element of danger. There is water hammer. The stored energy in heated water is referred to and its great amount noted. We do not know what are now standard American rules for strength, but at one time not long past the stress allowance was dangerously high. This boiler chapter is excellent; so also is that on engine guarding, and the subject of fly-wheel rims and racing, including safety stops, such as the vacuum breaker on lightly-loaded engines. Then under the electrical heading comes the question of mats and gloves of rubber, of dry platforms, of frame grounding and cable insulation, and the use of red paint on dangerous parts. Elevators are used in America to an extent far beyond what is usual here, where the habit of most elevator men is to regard the passenger as an affront. Indeed, elevator working in London, except in a few modern buildings, is far behind what it was 20 years ago in New York, where both in number and velocity, as well as in attendance, the elevator system is excellent. Indeed, unless it were, there would be no use for the major part of any high office building.

The limiting speed of elevator cages is given as 400 ft. per minute, but 350 is recommended as fast enough with 500 ft. as the speed at which a safety device should act. The tendency to-day in America is towards the use of the direct ram elevator, once universal in Great Britain, and very deep holes are bored to take the ram cylinder. The rams are, of course, very long, and they are of small diameter and sway to and fro, but the cars are counter-balanced considerably.

In factories the question of machine guards is very wide, and there is no machinery more dangerous than that for wood-working. The danger parts of these machines are invisible when most dangerous, for an outsider especially cannot see a rapidly rotating wood-cutter.

This pamphlet should be purchased by everyone who has to deal with machinery of any sort. Its price is only 25 cents, and it is published by the Fidelity and Casualty Co., of 97, Cedar Street, New York, and should carry by post for 3d.

Institution and Lecture Notes.—INSTITUTION OF MUNICIPAL ENGINEERS.—A visit to the Surrey Commercial Dock will be made on Saturday, November 20th. A general meeting will be held at Caxton Hall, Westminster, on December 11th, at 11 o'clock, followed in the evening by a dinner.

An interesting lecture was delivered before the LEICESTER ASSOCIATION OF ENGINEERS on October 30th, by Mr. Alfred E. Ball, entitled "Some Recent Examples of Modern Electric Time Service." The system introduced by Messrs. Gent & Co. was described, and it was explained that it was not a system of setting or temporary correction, but of automatic regulation of pendulums which might be of any beat or length, the advantage being that in the event of, say, overhead wires being disconnected by storm, the clock affected by the disconnection would have been regulated up to the last hour, and would be again brought under control on the circuit being resumed.

Fatalities.—At the works of Messrs. Thos. Firth & Sons, Sheffield, on November 3rd, an employé, named Oxley, touched a live wire, and receiving a shock, fell a distance of 30 ft. He received injuries which terminated fatally last week. Deceased, as it transpired at the inquest, should have climbed a ladder and gone along a gangway in order to reach a crane, but instead of so doing, he climbed up a short cut to save time, and came into contact with the wire mentioned. A verdict of "Accidental Death" was returned.

Last Friday night at the Southport electricity works at Blowick, some of the machinery became over-heated, and while it was being oiled by two employés, one named Wm. Sanders, who lives at Banks, and Hesketh, who lives in Poulton Road, Southport, the oil became ignited, and both men were seriously burnt. They were taken to the Southport Infirmary, where Sanders succumbed.

An inquest was held on Monday. Deceased was 39 years of age, and married.

Mrs. Sanders, the widow, said that before the deceased went to work on Friday he told her that the engine he was to work upon had recently been repaired. She asked him if they had put in a new cylinder, and he said he did not know, but that probably they had put some hands round it. About a week ago he told her he had discovered some defect in the engine, and he reported it to the foreman. It had been attended to, but instead of using copper, they had used asbestos packing. Shortly before his death he said the engine was running hot, and he had had to stop it. He added that a new oil of an inferior kind had been used, and this, in his opinion, was the cause of the explosion.

The town clerk attended on behalf of the Electricity Committee, and after expressing sympathy with the widow and family, said every facility would be given the jury to inquire into the cause of the explosion. The Corporation might have to submit some evidence to contradict or support part of the widow's statement in regard to the inferior oil, but he submitted they could not accept that statement at this stage.

The inquest was then adjourned until January 5th, and the town clerk said that every assistance would be given to the widow and children of the dead man, and also to the family of the other injured man.

The Belgian Electro-chemical Industry.—According to the official *Agenda de l'Electricité*, there are in Belgium 48 electro-chemical factories, situated mostly in the manufacturing districts of Liége and Charleroi and in the mining districts around Antwerp and Brussels. Details regarding these factories are—Four employ between 600 and 2,000 workmen with machinery of a capacity ranging from 180 and 140 H.P.; seven employ from 50 to 100 workmen with horse-power ranging form 60 to 100; fifteen employ between 10 and 50 hands with power between 5 and 55 H.P.; and 22 from 5 to 10 hands with horse-power from 1 to 15. The value of the products last year attained a total of 28 million fr., the goods exported forming 41 per cent. of the whole.

A Narrow Escape.—A correspondent sends us the following:—A well-known scientist was lecturing on the sun's heat, and, in the course of his remarks, said: "It is an established fact that the sun is gradually losing its heat, and in the course of some seventy millions of years it will be exhausted; consequently this world of ours will be dead, and, like the moon, unable to support any form of life." At this point a member of his audience rose in an excited manner, and said: "Pardon me, professor, but how many years did you say it would be before this calamity overtakes us?" "Seventy millions, sir," said the professor. "Thank Heaven!" was the reply; "I thought you said seven millions!"

Appointments Vacant.—Chief junior assistant in the Birmingham Corporation Electric Supply Business Development Department (£150). Switchboard attendant for Doncaster (26s.). See our advertisement pages to-day.

Electric Driving of Textile Factories. — The following interesting letter appeared on November 16th in the *Manchester Guardian*:—

"Sir,—The report of the Bradford Engineering Society hardly does justice to the subject of electric driving of textile factories. It would have been more valuable if some data had been given with regard to the various experiments instead of generalities.

"When the discussion on the merits of electric driving was being carried on in your columns, I was struck by the entire lack of actual data such as would convince Lancashire mill owners of the truth of the statements made by electrical engineers. The result was a series of experiments on the speed variation in a large cotton mill both before and after the change to electric driving. The lesson of these experiments was most remarkable; it was a clear proof of the steadier drive and increased output.

"In one instance the speed recorder was coupled direct to the tin roller shaft of a ring spinning frame, the speed variation with mechanical drive being 8 per cent. and with electric drive 2½ per cent. The mean speed in the latter case was 3½ per cent. above the mean speed with the old drive. The drive from the motor to the line shaft was by means of ropes and from the shaft to the frames by belt, whereas the mechanical drive was through spur and bevel gearing with vertical shafts. If motors had been fitted to each frame the speed variation would have been reduced to ¼ of one per cent., but practical considerations prevented this. With the new drive breakages were almost nil, whereas, previously frames had to be stopped for piecing up. The output with the electric drive was increased 10 per cent.

"Engineers admit that the method of driving a new mill requires careful consideration, but where steam turbines are to be employed electricity is almost essential. It is to be remembered that the majority of old mills are gear-driven, and in these the results are far from good. It is here that the electrical engineer can help most.—Yours, &c.

"W. F. RHODES.

"Squirrel Works, Stockport, November 13th."

Annual Dinner.—The annual dinner of the London General Omnibus Co., Ltd., Electrical Department, was held at the Hotel Europe, Leicester Square, on Saturday last. A company of 120 sat down, Mr. Stuart A. Curzon, the departmental manager, being in the chair, and Mr. W. G. Brown (electrical department) in the vice-chair. Full justice was done to the dinner, and the evening was then given up to harmony, a strong vocal and instrumental programme having been arranged. Mr. D. Duff, jun., proposed "The Success of the Electrical Department," and pointed out how necessary it was to the company, it being impossible to run their 'buses without ignition and lighting, and electric motive-power for their garages. Mr. S. A. Curzon, who was given an enthusiastic reception, in his reply, prophesied that it would in the very near future be found that the Electrical Department of the L.G.O. Co., Ltd., would be the leading department, as electric traction was bound to come, and the day of petrol would be past. The toast of "The Visitors" was proposed by the vice-chairman, Mr. W. G. Brown, and responded to by Mr. Duncan, who, after expressing the pleasure that all had enjoyed during the evening, went on to compliment Mr. Curzon on his versatility, pointing out that in addition to his being the head of the electrical department, he had, on this occasion, proved himself an orator, a musical composer of ability, and a humourist and singer of the first water. The proceedings closed with musical honours for the chairman and Auld Lang Syne.

Accident.—Alfred Peck, electrician, of Bonnybridge, on the staff of the Scottish Central Electrical Power Co., was engaged at the sub-station at Carron Grove making a connection when he fell. He came in contact with a 3,000-volt live wire, and he was terribly burned about the head, hands and feet. He was removed to the Denny Cottage Hospital.

American Combine.—The American Telephone and Telegraph Co., a Mackay concern, has obtained control over the Western Union Telegraph Co. The combine is regarded as the most important since the formation of the United States Steel Trust, the issued capital of the two companies being over 50 millions sterling. It is anticipated that one effect of the amalgamation will be to increase the traffic over the Commercial Cable Co.'s cables and those of the Western Union Co., which hitherto has acted in conjunction with the Anglo-American Co. The new corporation will have a practical monopoly of the American telegraph lines of the Western Union Co. and the Postal Telegraph (Mackay) Co., and it is suggested that this is but a step in a scheme for bringing the whole of the Atlantic cable systems into one huge combination.

Electro-Harmonic Society.—The Ladies' Night on Monday last was well attended, and proved, as usual, in every way successful. To single out any item for special comment, where all were so good, would be invidious. We may be allowed to suggest that smoking, even in the gallery, and conversation during the performance of musical items, are not good form; needless to say, the fair sex were absolutely guiltless in both respects.

The Brennan Mono-Rail Car.—On Wednesday last week Mr. Brennan gave a demonstration of his gyroscopic monorail system, with a car 40 ft. long, weighing 22 tons, and carrying 50 passengers. The experiment was successful, though the 80-H.P. petrol engine, used to drive the dynamo which supplies electricity to the traction motors, was out of action, and a 20-H.P. petrol-electric set, employed for driving the gyroscope motors, had to be used for both purposes. The two gyroscopes weigh 1½ tons each, and run at 3,000 R.P.M. *in vacuo.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. Fletcher, of the Nottingham and Derbyshire Power Co., has been appointed third engineer at the Heston and Isleworth U.D.C. electricity works.

Tramway Officials.—Mr. E. Harrison, chief of the clerical department of the Coventry Electric Tramways Co., was on Tuesday last the recipient of a handsome case of fish knives and forks, presented by the staff and employés on the occasion of his marriage. The presentation was made by Mr. Whitehead, the manager.

General.—Mr. W. Yorath Lewis, who has had some 19 years thoroughly practical and remarkably varied experience in electrical and other departments of engineering work, has opened offices in London and New York, in both of which cities he will carry on practice as an "advisory engineer." Mr. Lewis will pay periodical visits to London, where his address is 49, Queen Victoria Street, E.C., and to New York (U.S. Express Building). His practical experience has been gained in connection with large electric power generating stations in this country, the installation of gas, and steam-electric power plant and wiring equipments under Mr. W. H. Massey, at the Royal Palaces, the reconstruction and reorganisation of power plant at a large cement works, as mechanical-electrical engineer under contractors on the Pennsylvania Railroad Tunnel, as engineer on important exhibitions, including the last held in Paris, and the Imperial International Exhibition at the Great White City, London, this year. He acted as secretary to the Engineering Jury at the last-named exhibition, and organised the "Engineering Day" held thereat a month or two ago. Mr. Lewis, in the course of his experience, has made a wide circle of friends, personal and business, which will enable him to handle satisfactorily any engineering proposal that is put before him. He carries with him into his new sphere of action our best wishes for a further continuous record of success.

Mr. James Beaton, of the electric light department at Methil Dock, Fife, has received an appointment on the North Nigerian Railway at a salary of £300 a year.

At a meeting of the Council of Armstrong College, Newcastle-on-Tyne, on the 15th inst., Mr. F. O. Hunt was appointed assistant demonstrator in Electrical Engineering.

Mr. C. L. Agnew has been elected chairman of the board of Galloways, Ltd., engineers and boiler makers, of Manchester, in place of Mr. E. N. Galloway, resigned. The electrification of the firm's works is in progress.

An Indian contemporary states that Mr. H. L. Tyson-Wolf, the E.I.R. Co.'s electrical engineer at Jamalpur, availed himself of 15 months' combined leave home from October 16th.

Obituary.—On Friday, November 12th, the death took place, after a long and painful illness, of Mr. Arthur Henry Wright Radcliffe, who was formerly well known in the electrical world. Mr. Radcliffe was born at Chorley in 1836, and at an early age he entered the service of the Electric Telegraph Co., and was stationed at Plymouth Dockyard. During the Indian Mutiny he was for a time at Windsor Castle in charge of a special installation of telegraphic apparatus, placed there for the use of her late Majesty, Queen Victoria. Mr. Radcliffe was a member of the Institution of Mining Engineers, and of the old Society of Telegraph Engineers. From 1873 until 1892 Mr. Radcliffe held the post of electrical engineer and contractor to the Corporation of Birmingham, and was at the same time carrying out big contracts for important railway companies. We understand that he was the first to introduce the use of electricity into coal mines, the initial installation taking place at the Tapton Colliery at Chesterfield in 1868. Some of our readers may remember that on the occasion of the terrible catastrophe at the Risca Colliery in 1880, Mr. Radcliffe, who was on the spot at the time, gave his opinion—an opinion supported by Sir John Gavey and Sir William Preece—that the explosion was caused by a flash of lightning striking the headgear of the shaft, and thence travelling downwards This theory was hotly contested at the time, but was eventually proved to be correct, and thus a new field of observation was opened up. After a long and honourable career, Mr. Radcliffe suffered heavy financial losses, and finally came to London, where, after a short residence, he was seized with the complaint which reached its fatal termination on Friday last. The interment took place on Wednesday morning last at Wandsworth Cemetery. Mr. Radcliffe leaves a widow and a family of grown-up sons and daughters.

Mr. Georg Czolba, engineer in charge of the construction of the transmission line of the Chapala Hydro-Electric & Irrigation Co., Ltd., which is being built by Siemens-Schuckertwerke, Berlin, died at Guadalajara, Mexico, on October 29th, of typhoid fever, probably contracted in the construction camps which are at present located to the west of the above city. Mr. Czolba was only 32 years of age, and had been joined less than two months previously by his wife and one little daughter.

The death is announced of Mr. Francis Seddon Bolton, of Edgbaston, Birmingham, at the age of 81 years. Mr. Bolton was the second son of the late Mr. Thomas Bolton, the founder of the well-known copper firm of Thomas Bolton, Sons & Co., Ltd., of Birmingham, Oakamoor and other places. As well as being concerned with the affairs of that firm, Mr. F. S. Bolton was interested in many other business undertakings. According to the Birmingham *Daily Mail* the deceased gentleman was largely interested in the Kingsland electric traction system.

NEW COMPANIES REGISTERED.

Burford Electric Light and Power Co , Ltd. (105,826).—This company was registered on November 9th, with a capital of £400 in £1 shares (15 founders), to carry on the business of electricians, mechanical engineers, manufacturers and workers of electricity, motive power and light, &c. The subscribers (with one share each) are:—B. P. Gibbons Dingley, Tilehurst, Berks, director; A. C. Nash, Glenfall Lawn, Cheltenham, engineer; E. R. Nash, Glenfall Lawn. Cheltenham, engineer; C. H. Darlow, Lechlade, manager; J. Jacobs, Burford, Oxon, gentleman; A. C. King-Turner, Fairford, medical practitioner; D. Kennedy, 18, The Fubury, Reading, accountant. Private company. The number of directors is not to be less than two or more than five; the first are E. R. Nash and B. P. Gibbons; qualification, £20; remuneration, one guinea each per meeting attended. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Acadia Syndicate, Ltd. (105,823).—This company was registered on November 9th, with a capital of £12,000 in £1 shares, to enter into an agreement for (*inter alia*) the Moneton Electric Street Railway Heat and Power Co., and to carry on the business of railway, tramway, omnibus and van prodrictors, suppliers of electricity for light, heat, motive power, or other purpose, &c. The subscribers (with one share each) are:—J. W. Miller, 4, Bishopsgate Street Within, E.C., clerk; W. Larnoch, 154, Southchurch Road, Southend-on-Sea, accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered office, 4, Bishopsgate Street, E.C.

De Matis Electric Storage Syndicate, Ltd. (105 869).—This company was registered on November 11th, with a capital of £25,000 in £1 shares, to acquire patents relating to, and turn to account, any invention capable of being used in the manufacture of electrical accumulators, to adopt an agreement with H. de Matis, and to carry on the business of motor cars, electric vehicles, airships and aeroplanes of all kinds, &c. The subscribers (with 10 shares each) are:—C. Weston, 34, Kensington Park Road, W., gentleman; J. D. Jones, 201, Westminster Bridge Road, S.E., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are C. Weston, R. N. Fairbanks, and J. D. Jones; qualification, ten shares; remuneration, £100 each per annum (chairman £150). Registered office, 61, Gracechurch Street, E.C.

Cross & Cross, Ltd. (105,754).—This company was registered on November 4th, with a capital of £2,000 in £1 shares, to take over the business of constructional and electrical engineers carried on at Pleck Road, Walsall, as "Cross & Cross." The subscribers (with one share each) are:—G. H. Stone, 9, Westbourne Road, Walsall, electrical engineer; H. J. Nicklin, Bridge Street, Walsall, solicitor. Private company. The number of directors is not to be less than three or more than seven; the first are H. J. Nicklin (chairman), G. H. Stone and C. J. Cole; qualification, £25; remuneration of chairman, £12 per annum. Registered office, Nicklin & Hawley, Walsall.

Electricity Generating Co., Ltd. (105,830).—This company was registered on November 9th, with a capital of £1,000 in £1 shares, to carry on the business of generators of electrical energy, producers, accumulators, transmitters and distributors of electricity and gas, manufacturers of and dealers in dynamos, lamps, globes, insulators, &c. The subscribers (with one share each) are:—F. Henwood, 62, Greyswood Street, Streatham, S.W., clerk; A. C. Paine, 8, Wellington Square, Oxford, clerk. Private company. The number of directors is not to be less than two or more than five; the first are F. Henwood and A. C. Paine; remuneration as fixed by the company. Registered office, 16, Great George Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Foots Cray Electricity Supply Co., Ltd. (86,863).—Particulars of £5,000 debentures created August 10th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's property, present and future. No trustees.

Tamplin & Makowski, Ltd. (53,914).—This company's annual return was filed on September 24th, when 550 "A" and 461 "B" shares had been taken up out of a nominal capital of £20,000 in 1,000 "A" and 1,000 "B" shares of £10 each. £6,000 has been paid on 550 "A" and 50 "B," and £4,110 is considered as paid on 411 "B". Mortgages and charges: Nil.

Ogmore Valley Electric Light and Power Supply Co., Ltd. (34,191).—Issue on October 7th of £500 debentures, part of a series of which particulars have already been filed.

Cascade (1906) Power Co., Ltd. (89,964).—Mortgage dated October 19th, 1909 (supplemental to trust deed dated September 21st, 1906, securing £75,000 4 per cent. 1st mortgage debentures). Property charged (in substitution for that charged by original deed): 570 gold coupon bonds of 500 dollars each in the Cascade Water Power and Light Co., Ltd. Trustees: West Australian Gold Fields, Ltd., 3, London Wall, E.C. (in voluntary liquidation); and F. F. Begg, Bartholomew House, E.C., (liquidator thereof.).

Cleveland and Durham Electric Power, Ltd. (89,539).—Issue on October 22nd of £15,000 second debentures, part of series to secure £ 50,000.

Rhondda Tramways Electric Supply Co., Ltd. (94,470).—Particulars of £70,000 debentures created by resolutions of August 7th, 1907, and October 26th, 1909, and covered by trust-deed of August 8th, 1907, and supplemental deed of October 26th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital (as per principal deed). Trustee: L. B. Schlesinger, 21, Cornhill, E.C.

Vaughan & Son, Ltd. (61,526).—This company's annual return was filed on October 16th, when 3,811 preference and 20,689 ordinary shares had been taken up out of a nominal capital of £50,000 in £1 shares (20,000 preference). £1 per share has been called up, and £24,500 has been paid. Mortgages and charges: £5,000.

Electrical Apparatus Co., Ltd. (96, 191).—Debentures dated October 27th, 1909, to secure £500, charged on the company's present and future undertaking and property. Holder: Dr. L. Arons, 3, Brucken Allee, Berlin.

Telephone Co., of Egypt, Ltd. (17,824).—Acknowledgment of indebtedness dated October 27th, 1909 (supplemental to trust deeds of July 27th, 1904, and to certain resolutions of the company and the board), to secure a further £50,000 debenture stock, making, with the amount already issued, a total of £200,000, charged on the company's undertaking and property, present and future, except uncalled capital. Trustees: G. F. Braithwaite and H. J. Grewing.

Manaos Tramways and Light Co., Ltd. (101,081).—Particulars of £500,000 debentures created July 13th, and secured by trust deed dated October 20th, 1909, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1908, the amount of the present issue being £300,000. Property charged: Concession by the State of Amazonas of the electric services of the State including tramway and lighting system in Manaos, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Metropolitan Trust Co., Ltd.

Marzi Loud-Speaking Telephone Co., Ltd. (95,699).—Debenture dated October 29th, 1909, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: F. W. P. Swinborne, and L. P. Swinborne, 33, St. Andrew's Hill, E.C.

Buenos Ayres New Tramways Co., Ltd. (In liquidation) (27,592).—A memorandum to the extent of £330,000 (being whole amount issued) on September 23rd, 1909, of mortgage dated December 1st, 1904, (and the indenture dated October 29th, 1908, supplemental thereto), securing £400,000 5 per cent. conversion debenture stock and further stock to such an amount as might be necessary for raising the amount required for redeeming an issue of £50,000 prior lien bonds, has been filed.

Filaments, Ltd. (104,108).—Particulars of £500 debentures created November 4th, 1909, filed pursuant to Sec. 93 (8) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

The sixty-fifth ordinary general meeting of the shareholders of the above company was held on Wednesday at Winchester House, Old Broad Street, Mr. W. B. Kingsford in the chair.

In proposing the adoption of the report, the Chairman said that the traffic receipts for the half-year under review showed a decrease of £1,535, although the profit on the six months' working was £1,326 more than in the corresponding period. The increased profit was due to the item of repairs to cables being £2,525 less than in 1908. It was quite impossible to foreshadow what the expenditure on cable repair was likely to be from half-year to half-year, because so much depended upon the length of cable used in carrying out the repairs. For instance, in the present case they had used only 24 knots of cable, as compared with 55 knots a year ago. The expenses of working the 21 stations showed an increase of £311. The result of the half-year was that the directors had a balance of £15,698 to deal with. Notwithstanding the heavy fall in gilt-edged securities their investments showed a depreciation of only £2,274 or £2 16s. per cent. He felt sure the shareholders would regard that as being very satisfactory. He was sorry to say that early in the morning of July their offices in St. Thomas, which were their headquarters, were totally destroyed by an incendiary fire. The ordinary losses were covered by insurance, but unfortunately the fire destroyed all the company's important archives, going back to the very beginning of the concern. The whole of the staff were very speedily on the spot, and behaved admirably. All the instruments having been destroyed, they borrowed an electric alarm bell from the Government fort and cleverly altered it for cable work. They were thus able to restore communication in temporary offices with an interruption of business of only four hours. He could not speak too highly of the conduct of the staff in this sudden emergency. As they would have seen by the papers, since the date of the report, disastrous floods had taken place in Jamaica. They had caused damage to various crops in the island and in other ways, and he regretted to say that their landlines between Holland Bay and Kingston, 50 miles in length, were partly washed away by the floods. Their cables also had suffered severely. On the 8th inst. the cable connecting Holland Bay with Pouce and Porto Rico, and the cable between Panama and Kingston, were interrupted. On the 9th the Holland Bay-St. Juan-Porto Rico cable was interrupted, and by the Porto Rico interruptions communication with the rest of their system was, and still was, cut off. When the interruptions occurred, their repairing steamship, the *Henry Holmes*, was at Trinidad undergoing her annual boiler survey, in accordance with Lloyd's regulations. In all probability she was now well on her way towards Jamaica to effect the repairs to the interrupted cables. He was glad to tell them that the Jamaica landlines had been already repaired, but in the face of very great difficulties. Their representative in Kingston (Mr. MacLeod), who rendered such excellent services at the time of the earthquake in Jamaica, again acted with very great promptitude, and succeeded in restoring communication with Kingston on the 14th inst. The floods, he might say, had also interrupted the cables of other companies in the West Indies.

Mr. Henry Holmes seconded the motion.

Replying to questions, the Chairman said that the board considered the reserve fund quite sufficient. Of course, they would gladly add to it if and when possible; but seeing that the dividend upon the second preference shares was still in arrear to some extent, they did not consider the present was the time to increase the reserve. As to whether the company was likely to benefit from the opening of the Panama Canal, he was afraid that time was too far distant for him to be able to say anything useful on the subject at present. He had purposely refrained from saying anything in regard to the traffic receipts for the current half-year, as owing to the floods they felt very uncertain as to what would be the outcome of the next two months. As, however, he had been asked the question, he was pleased to say that up to the present the receipts had shown an improvement of between £800 and £900, as compared with a similar period last year.

The report was then adopted.

British Electric Transformer Co., Ltd.—An extraordinary general meeting of the above-named company was held on November 11th at Salisbury House, London Wall, Mr. J. F. Albright (chairman) presiding, at which a resolution was passed approving of a new set of articles of association, which had been drawn up in order to consolidate the old regulations, so as to make them more conformable to modern practice. The only new article was one which gave the directors power to appoint an alternative, or substituted, director in place of one going abroad.

Aluminium Corporation, Ltd.

On Thursday, November 11th, pursuant to directions of Mr. Registrar Hood, dated October 26th, 1909, a meeting of the unsecured creditors of the above-named company, whose claims amount to over £10, was held at Winchester House, for the purpose of considering and, if thought fit, passing the following resolution:—"That the liquidators be and they are hereby authorised to consent to the registration of a new company to be named the Aluminium Corporation, Ltd., with a memorandum and articles of association which have already been prepared with the privity and approval of the liquidators; and that the scheme of arrangement with draft agreement scheduled thereto and expressed to be made between this company and its liquidators of the one part, and the Aluminium Corporation, Ltd. (new company), of the other part, and submitted to this meeting be, and the same is hereby approved, and that the said liquidators be, and they are hereby authorised to enter into an agreement with such new company (when incorporated) in the terms of the said draft, and to carry the same into effect with such (if any) modifications as they think expedient."

Mr. Robert Lawson, the joint liquidator, with Mr. A. H. Gibson, presided, and said it would be remembered that a meeting was held on April 27th, at which a scheme was passed for reorganising the company. The shareholders came forward with £40,000, and debentures amounting to £10,000 were promised. As this was quite insufficient, it became obvious that the scheme would have to be amended, while at the same time it would be useless to submit any further scheme for approval, unless it could be definitely stated that the cash required to carry through the new scheme would be forthcoming. As the result of several months' anxious negotiations, the liquidators had been able to frame a fresh scheme under which the necessary money could be found. The differences between the two schemes would be apparent to them, as they had the printed copies before them, but the main point was whether they were prepared to accept 7 per cent. preference shares to the full amount of their claims, as finally admitted on the lines laid down in the scheme. They had reduced the proposed debenture interest from £100,000 to £50,000, and, therefore, in accepting the shares, the creditors would be in a much better position than at present, because now they had preferential claims, costs of liquidation, &c., amounting to something like £45,000, and this was in a company which was complicated by numerous legal difficulties, and which had not any branch of its business in working order. Further, they would have the benefit of the new cash, which was being put up by the shareholders alongside the same shares that the creditors were being offered. If the scheme was carried, the position would be that, in a few months, they would have the bauxite mines in France equipped with the necessary facilities for loading bauxite on the railway, thus making them a self-contained working property. They would also have the bauxite works at Hebburn completed and selling alumina, which would make the shares of the company a liquid asset of considerable value. The Foil agreement would be settled, and the small plant erected, and the shares of the Foil Co. made into another liquid asset. The necessary work to enable the company to use the Dolgarrog water-power, together with the payment of the uncompleted purchases of water rights on the Dulyn scheme, would have been completed, and the Dolgarrog would be a compact works, complete in itself. The carbon works would have been put in working condition and made a valuable unit, whilst the serious difficulties in connection with the metallurgical works at Wallsend would also have been solved. He might add that since the April scheme was issued, the price of aluminium had materially increased, which was, naturally, greatly in favour of the new company. As to the criticism which had been directed as to the terms upon which the debentures had been tentatively arranged, it had to be remembered that, whilst a portion had been taken up by shareholders and creditors, yet a considerable balance had to be placed elsewhere, and as this money was essential to the success of the scheme, they must admit that those who found it had the right to state the terms on which they would do so. If the scheme was accepted by the creditors and shareholders, arrangements for placing the whole of the debentures had been made. With reference to the offer of Mr. Tait referred to in the circular of October 29th, that offer had been withdrawn. The total amount of the claims lodged was £191,480, but if the scheme went through he thought they might safely rely on at least £80,524 of that amount being withdrawn, and it might be possible to still further reduce the claims by £7,500 or £8,000. So far, therefore, as he could judge at present, the claims they would have to deal with would amount to about £103,480. On the other hand, if Mr. Tait's offer had been accepted, all that the creditors would have been likely to receive was 3s. to 5s. in the £, and that only after several months of waiting. Should the scheme be passed, the liquidators would apply to the Court for confirmation, and lose no time in carrying out the details. Proxies to the amount of £135,000 had been lodged by creditors in favour of the scheme. In conclusion, the Chairman pointed out the serious position they would be in if the scheme were rejected, as the Official Receiver would be in the position to sell the property for what it would fetch, for it was not possible at this late stage to contemplate any other scheme for preserving the assets.

Mr Scott formally proposed, and Mr. Murray seconded, the resolution.

Answering questions by Mr. Humphrey, the Chairman said that if the scheme were carried out all outstanding claims were practically settled. No formal claim had been lodged by the North Wales Power Co. The liquidators were not prepared to admit a large claim from that company, but they would deal with any claim if the scheme went through.

Mr. Humphreys said the North Wales Power Co. had a claim which would amount to not less than £25,000.

The Chairman said they could not deal with it until it was lodged. He considered it inopportune to discuss the amount of the claim and the view which the liquidators might take in the ultimate settlement of it.

Poll cards were handed in, and the chairman announced that with the exception of one, and two who were neutral, the whole of the meeting was in favour of the resolution.

An extraordinary meeting of the holders of the participating preference shares and another meeting of the ordinary shareholders followed, when similar resolutions were carried.

Prospectuses.—*Bikam Rubber Estate, Ltd.*—200,000 shares of 2s each have been offered for subscription at par. 350,000 are allotted to the vendors in part payment of purchase price. The company is to acquire and develop the Bikam Estate in Perak, Federated Malay States.

Selaba Rubber Estates, Ltd.—40,000 shares of £1 each have been offered for subscription. 85,000 are to be allotted to vendors in part payment of the purchase price. The estates are in Lower Perak, Federated Malay States.

Malacca Rubber Plantations, Ltd.—An issue of £500,000 6 per cent. first mortgage debenture stock has been offered at par.

South-East Borneo Rubber Plantations, Ltd.—32,000 shares of £1 each have been offered at par. The plantation is known as Tanah-Intan, and consists of about 3,325 acres in South-East Borneo, 345 acres of which are planted with rubber trees of one, two or three years' growth.

Bradninch and District Electric Supply Co.—Dr. D. K. Muir presided at the first annual meeting of this company. The directors reported that the light was first available on December 9th of last year, and that since then, considering the difficulties inseparable from a new installation, the running of the plant had been satisfactory. The total number of customers now being served was 63; the lamps, after a period of nine months' working, were 819; and current was also supplied to three motors during the day. The number of consumers and lamps were steadily increasing, and the outlook of the company was most promising. Within the past few weeks the smaller of the two turbines had been overhauled and was now available for alternative use. The share capital stood at £1,285, and, in addition, there was a loan of £200. The income for the nine months was £178, and £34 had been set aside to form a depreciation fund. The report was unanimously adopted. Messrs. W. Baker and F. W. Cuming were re-elected as directors.

Richardsons, Westgarth & Co., Ltd.—The *Financial Times* states that the profit of this company for the year ended August 25th amounts to £1,430. Debenture interest and other preferential charges absorb £18,756, thus showing a loss on the year's working of £17,326, and making, with the debit balance of £9,377 brought forward, a total debit of £26,703.

Stock Exchange Notice.—The Committee has appointed a special settling-day as under:—

December 2nd.—Northern Light, Power and Coal Co.—$1.399,200 5 per cent. first mortgage 20-year gold bonds, Nos. 1 to 567 of $100, 701 to 1,117 of $500, and 1,151 to 2,281 of $1,000 each.

The Committee has ordered same to be officially quoted.

Castner-Kellner Alkali Co, Ltd.—The report of the directors shows that the net profit is £134,155, plus £15,369 brought forward, making £149,524. Debenture interest required £9,313; interim dividend at the rate of £10 per cent. per annum, paid for the six months ended March 31st, 1909, £22,500; leaving an available balance of £117,711, out of which the directors recommend the appropriation of £35,000 to depreciation reserve, £1,370 in writing off the balance standing to the debit of suspense account; £25,000 to the general reserve account, £40,500 in payment of a final dividend of £9 per cent., making (with the interim dividend paid in May) £14 per cent. for the year; leaving £15,840 to carry forward.

Auckland Electric Tramways Co., Ltd.—An interim dividend of 6 per cent. per annum (7½d. per share), less income-tax, has been paid on the ordinary shares for the past half-year.

Puebla Tramway, Light and Power Co.—It is announced that Dr. F. S. Pearson and Mr. H. Malcolm Hubbard have resigned from the board of this company, owing to pressure of other engagements.

Bordeaux Electric Tramways Co.—The directors have declared dividends of 4·80 fr. and 4·48 fr. respectively on the registered and bearer shares.

Kuala Lumpur Rubber Co.—Out of the past year's profits of £43,033 a dividend of 20 per cent. is paid; £3,853 is carried forward.

France.—La Société Industrielle des Telephones, of Paris, is declaring a dividend of 16½ fr. per share for the last financial year.

Cape Electric Tramways, Ltd.

The thirteenth ordinary general meeting was held on Tuesday at the London Wall Buildings, London Wall, Sir Charles Euan-Smith presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, November 5th, page 744), said that last year a request was made by a shareholder for greater details in the report. They had, therefore, appended extracts from the reports of their general managers at Cape Town and Port Elizabeth, which would enable shareholders to judge for themselves as to the operations of the system for the past year. This practice the board intended to continue. The results for the past year differed in no essential respect from the results shown for the previous year. No distinct and important progress in the general prosperity had as yet manifested itself in the Cape Peninsula, although the returns of traffic for Cape Town, now coming to hand, showed a slight increase. For the first four months of their financial year their profits showed an increase of £3,000 over the corresponding period of the previous year. It was early yet to congratulate themselves that the tide had turned, but the outlook was decidedly hopeful. He regretted to say that, as yet, Port Elizabeth gave no indication of returning prosperity, and dependent as it was entirely on the up-country trade, a revival of general business must be gradual. Meantime, in working their tramway in that town at a reasonable profit on the traffic secured, their general manager was maintaining the system at its high level of efficiency, and at the same time practising the most rigid economy. Since he last addressed them the political situation in South Africa had undergone a momentous change, and the birth of a United South Africa was an accomplished fact. As a tramway company they did not meddle with politics, but political conditions must nevertheless always have an important influence on their well-being. He was glad to say that in the opinion of the board the political changes which had now resulted in the Union of South Africa should ultimately prove largely beneficial to their enterprise. They might expect, amongst other things, that the Union Government would free itself from the hampering local influences under which they had suffered of late years so severely, and especially from the unfair competition of the Sea Port Railway, which could only have been maintained by the active help and tacit approval of the Government. If under more joint political conditions the Sea Port Railway was to take its chance, and stand by itself, as they (the Cape Tramways) did as a transport company, without illegitimate nursing on the part of the Government, then the board had no fear that their tramway would successfully hold its own against what had hitherto been a very unjust handicap on this section of the company's system. Although Cape Town had not secured for itself the honour of being both the legislative and the administrative capital of the Union, it would become the legislative capital of the new State, and before the Union Parliament began its first session in the latter part of next year, the board looked for a revival of general business which should have an immediate advantageous effect on the tramway returns. The official opening of the Union Parliament by the Prince of Wales they might also take into account as a factor in the company's favour.

Mr. Ludwig Breitmeyer seconded the motion, and the report was adopted without discussion.

Amazon Telegraph Co., Ltd.

The fifteenth ordinary general meeting was held on Tuesday at the offices, 42, Old Broad Street, Mr. George Keith presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, November 12th, page 790), said that for several years their business in the Amazon had been steadily improving, but this year he was sorry to say the report showed a decrease in revenue, and an increase of expenditure, as compared with the previous 12 months. The rubber trade, upon which their business greatly depended, continued, during the year under review, very dull and stagnant, owing in a great measure to the rubber coming down the river being taken off the market, and held up for higher prices. The river was also unfavourable for the maintenance of communication, and the interruptions, though of short duration, were very frequent, especially during its fall. All those conditions had adversely affected their business. In the result the traffic receipts showed a falling-off of about 11 per cent., and the total revenue, including subsidy and interest, came out at £77,365, or £7,612 less than in the preceding year. The increase in expenditure was principally due to the heavier costs of maintaining the cables. Besides the ordinary repairs required during the year, the original cable in the Main River was interrupted, and it became so firmly embedded in the bottom of the river that all endeavours to lift it proved useless. Some 17 miles had to be abandoned, and new cable laid in its place, which considerably increased the cost of cable used for repairs during the year. Altogether the working expenses amounted to £18,691, or an increase for the year of £5,517. The debenture charges for interest and sinking fund remained unchanged, and after taking these charges and the working expenses there was a surplus of £1,690, which he was sorry to say was unsatisfactory. This year the river had risen higher and fallen lower than it had done for many years, and landslips on the banks had been causing serious interruption to the cables and great loss of traffic, especially during the last two months. He was glad to say that the river was now on the turn, and would become as it rose more favourable for the maintenance of the cables, and they looked forward to the coming rubber season, which brought increased business, to recoup the loss which had taken place during the recent fall of the river. Several years ago owing to the interruptions with the single line of cable it was found necessary to lay a second cable between Manaos and Amatary, a distance of some 76 miles, which was one of the worst portions of the river. Since then the communication on that section had been practically maintained without interruption, because they were able to repair one cable while the other was working. For the same reason it had now become absolutely necessary to duplicate the other sections of the main cable. At the last meeting he informed them of that, and told them that they were in communication with the Brazilian Government on the subject. He was glad to say that their appeal for the necessary assistance to enable the duplication of the cable to be carried out had been favourably considered. The Government had granted a 20 years' extension of the present concession, and of the payment of the present annual subsidy of £17,125. In granting the concession the Government had made certain alterations in the sliding scale of tariffs which was adopted when the rates were raised in 1884, and as the traffic increased the alterations would have the effect of reducing the rates of the local Brazilian messages, which it was hoped would be made up by an increase of traffic. Last year a very careful survey was made, and a route had been found almost entirely along the side of the water of the river, where the new cable would be laid, where it would be less liable to interruption than the present one. The manufacture of the cable was now being proceeded with, and arrangements were being made to have about two-thirds of it laid before the end of next July, so as to have the whole of the upper portion of the present cable duplicated before the fall of the river next year. The trench cable required to join the side waters would be laid during the dry season between August and October. It was expected that the remainder of the cable could be laid in December when the river rose, and the whole cable completed and in working order by the end of the year. The laying of the cable in the side waters would be a work of great difficulty, and would be carried out by their own staff under the supervision of their manager and engineer, who had surveyed and knew the route from end to end. Additional capital was now required, and they would be asked to sanction the issue of new 5 per cent. debentures in order to provide for the cost of duplication and for paying off the debentures now outstanding, which would simplify matters and improve the security of the new issue. It was proposed to issue the bonds at 98 per cent. and redeem the whole issue at 105 per cent. by a cumulative 2½ per cent. sinking fund. The result would be that the annual charge for interest and redemption of the new issue would be less than what it was at the present for the existing debentures. When the duplication was effected he thought they would have reason to look forward to an increased revenue, which would enable the company to build up a reserve for renewals and maintenance of cables, and in time, if all went well, to pay a dividend to the shareholders.

Mr. E. B. Ellice Clark seconded the motion.

Mr. Ellis Elias said he thought in connection with the issue of fresh debentures that it would be a good thing if the board were to reduce the capital and write off the debit balance. If they were to do that the company would become a dividend-paying concern very much earlier than it was likely to if they went on writing off the heavy debit on profit and loss account out of annual profits. In the ordinary way he supposed it would take eight or 10 years before they were quit of that disagreeable item, but by making the plunge they could get rid of it at once without hurting anybody's pockets. By reducing the shares from £10 to £8, they could get rid of the debit of £49,000 and become a paying concern, and within a very short time he believed the shareholders would get the £2 back in the rise of value of the shares on the market.

The Chairman said that the suggestion should be taken into consideration, but there was one little objection to it. The Government might at any time take over their property, and if they did so, they would have to pay the outstanding capital plus 10 per cent., so that if they wrote down the capital, they would be the losers. He could not say that there was any immediate prospect of the Government exercising their right to purchase, but they had made it one of the conditions of the contract which they had just signed, and, of course, they were liable to be taken over at any time.

The report was then adopted.

An extraordinary general meeting was afterwards held, at which resolutions were passed authorising the directors to issue debentures for an amount not exceeding £300,000, and altering the articles of association relating to the borrowing powers of the company.

Replying to a Shareholder, the Chairman said he calculated that the cost of the new cable would be about £150,000, or rather less.

Douglas Southern Electric Tramways Co., Ltd.—The directors in their report said that the company's season consisted of 125 days, against 115 days last season, and the mileage run was 36,570, as against 34,049 last year. The total receipts are £4,790, or £222 less than last year. This decrease has been due to the continued stagnation in trade and to the general unsettled state of the weather. The passengers carried were 194,826, against 206,994 last year. The net profit for the year is £1,522, as against £1,479, which, added to £79 balance from last year, gives a disposable balance of £1,602. The directors recommend a dividend of 5 per cent. upon the preference shares, leaving £303 to be carried forward. Nearly half of the total traffic receipts were taken in August.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Nov. 10	2,521	— 32	23	34,405	— 760	..	..
Ayr	,, 13	368	+ 4	26	9,283	— 95	8	..
Bath	,, 13	1,368	— 7	45	35,143	+ 1,370	..	..
Belfast	,, 12	7,595	+ 268	31	124,837	+ 5,312	37	..
Birkenhead.. ..	,, 14	1,986	— 7	32	35,203	— 381	13·63	..
Birmingham Corp.	,, 6	13,508	+ 598	32	208,709	+ 6,074	56·5	..
Blackburn	,, 10	2,064	+ 19	33	36,903	+ 1,272	13·97	..
Blackpool	,, 11	880	+ 73	..	47,958	+ 4,108	..	..
Blackpool-Fleetw'd	,, 13	565	+ 9	19	21,448	+ 1,414	..	..
†Bolton	,, 8	2,387	+ 256	32	75,472	+ 127	26	..
†Bournemouth ..	,, 3	1,436	— 56	31	55,534	+ 289	21·96	..
Bradford	,, 6	9,443	+ 525	31	156,584	+ 4,800	54·81	..
Brighton	,, 14	1,633	+ 145	33	34,015	+ 1,673	9·5	..
Bristol	,, 12	10,468	+ 877	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Nov. 5	418	— 14	44	9,686	— 92	3·65	..
Barnsley	,, 5	335	— 11	,,	7,454	— 374	..	..
Barrow	,, 5	450	+ 26	,,	10,343	— 585	5·37	..
Cavehill	,, 5	114	— 19	,,	3,879	— 92	..	..
Devonport ..	,, 5	739	— 178	,,	16,347	— 4,224	8·85	..
Gateshead ..	,, 5	1,990	— 38	,,	48,981	— 528	11·25	..
Gravesend ..	,, 5	401	+ 30	,,	9,580	— 41	6·5	..
Greenock.. ..	,, 5	1,046	+ 90	,,	24,731	+ 1,399	7·25	..
Hartlepool ..	,, 5	450	+ 9	,,	10,488	— 144	6·72	..
Kidderminster ..	,, 5	175	— 5	,,	4,826	— 180	..	..
Leamington ..	,, 5	337	+ 11	,,	7,928	+ 234	..	..
Merthyr	,, 5	371	— 48	,,	9,360	— 40	2·9	..
Metropolitan ..	,, 5	12,337	+ 924	,,	276,161	+20,576	22	..
Middleton ..	,, 5	575	— 7	,,	14,924	— 934	8·5	..
Mid. Joint Com'tee	,, 5	11,412	+ 223	,,	252,788	— 1,185	..	..
Oldham—Ashton	,, 5	1,081	+ 16	,,	24,873	— 1,231	9·18	..
Peterborough ..	,, 5	215	— 5	,,	5,301	— 433	5·31	..
Potteries	,, 5	3,820	+ 113	,,	79,154	— 512	29	..
Rothesay	,, 5	82	— 5	,,	9,701	+ 140	2·75	..
Southport.. ..	,, 5	455	— 37	,,	12,931	— 393	8·17	..
S. Metropolitan ..	,, 5	1,500	— 24	,,	35,605	— 599	..	..
Swansea	,, 5	1,985	+ 159	,,	43,226	+ 1,359	12·5	..
Tynemouth ..	,, 5	322	+ 27	,,	11,107	+ 823	3·75	..
Weston-s-Mare ..	,, 5	78	+ 3	,,	6,995	+ 391	3	..
‡Worcester ..	,, 5	508	— 3	,,	12,505	— 117	5·75	..
Wrexham ..	,, 5	186	— 11	,,	4,378	— 183	..	..
Yorks. Wool. Dist.	,, 5	1,905	+ 119	,,	40,780	+ 203	17	..
Miscellaneous ..	,, 5	393	+ 36	,,	9,319	+ 201	..	..
Burnley	,, 13	2,457	+ 279	..	..	..	..	..
Burton-on-Trent ..	,, 14	490	..	33	8,857	— 214	6·63	..
Bury	,, 14	2,195	+ 165	32$\frac{4}{7}$	39,035	— 218	22·5	..
Cardiff	,, 6	4,148	+ 183	32	71,488	+ 1,128	..	..
Carlisle	,, 13	294	— 24	45	7,528	— 364	..	..
Chatham and Dist.	,, 11	1,578	+ 27	45	37,406	+ 1,649	14·98	..
Cork	,, 11	883	+ 2	45	20,434	— 518	9·89	..
Croydon	,, 5	3,137	+ 482	..	50,263	+ 3,970	11·25	4·75
Darlington	,, 13	343	— 37	33	6,122	— 458	..	..
Darwen	,, 13	491	+ 47	32	8,177	— 140	4·36	..
Dover..	,, 6	352	— 6	32	7,151	— 409	4·75	..
Dublin	,, 12	10,067	+ 149	..	109,869	+ 2,049	54·25	..
Dundee	,, 10	2,230	— 72	25$\frac{4}{7}$	29,7.8	— 559	15	..
East Ham	,, 13	1,851	+ 97	32$\frac{1}{2}$	33,306	+ 4,304	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	,, 13	33,982	+ 261	..	405,487	— 5,150	94$\frac{1}{2}$	5
Hastings	,, 11	1,668	— 54	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeston	,, 10	239	— 5	32	4,446	— 241	..	..
Ipswich	,, 13	659	+ 9	33	13,745	+ 144	10·5	..
Kilmarnock ..	,, 6	268	— 16	25	3,770	+ 123	4·25	..
Lan'kshire Trm.Co.	..	..	..	..	..	..	..	..
Lancashire United	,, 10	2,433	+ 126	45	59,728	— 660	39	..
Leeds	,, 6	13,134	+ 428	31	218,188	— 5,734	57·5	6·5
Leicester	,, 13	4,292	..	..	..	..	..	..
Leith	,, 6	1,096	+ 99	25	15,864	+ 2,015	9	3
Liverpool	,, 6	21,197	— 213	44$\frac{2}{7}$	476,281	— 1,977	58·5	
‡L.C.C.	Oct. 30	77,778	+6,377	..	1,130,870	+46,158	124·7	2·375
London United ..	Nov. 13	10,686	— 40	..	276,004	—28,404	..	..
†Lowestoft	,, 6	169	+ 4	6	983	— 1	3·5	..
Manchester ..	,, 13	29,386	+ 569	33	493,881	— 6,801	105	..
Newcastle	,, 13	7,772	+ 178	..	127,476	— 1,200	..	..
Newport	,, 6	1,216	— 57	32	21,244	— 256	14·5	..
Oldham	,, 14	3,411	— 50	33	62,337	— 3,879	23·75	..
†Pontypridd.. ..	,, 6	421	+ 30	31$\frac{1}{2}$	13,237	+ 1,041	5·5	1·75
Portsmouth.. ..	,, 13	3,536	+ 200	33	71,935	+ 2,316	14·5	·75
Preston	,, 10	1,376	+ 25	..	..	..	..	..
Rotherham.. ..	,, 11	1,237	— 68	32	19,175	— 953	10	·66
Salford	,, 8	8,803	+ 92	31$\frac{5}{7}$	146,735	— 4,225	..	..
Sheffield	,, 16	11,353	+ 700	33$\frac{3}{7}$	189,034	+ 1,080	39·62	2·6
Southampton ..	,, 10	1,991	+ 30	32	35,441	— 269	..	..
Southend-on-Sea ..	,, 10	755	+ 62	32	18,588	+ 2,521	..	..
South Shields ..	,, 13	1,055	+ 7	32$\frac{3}{7}$	18,700	— 51	..	..
†Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 10	787	+ 22	19	8,516	+ 304	..	..
Wallasey	,, 13	1,662	+ 69	32$\frac{1}{2}$	31,007	+ 799	..	·22
Walthamstow ..	,, 13	1,136	+ 56	33	21,673	+ 353	9	..
West Ham	,, 4	4,591	+ 310	31	74,265	+ 4,596	15·25	·43
Wolverhampton ..	,, 10	1,698	+ 188	32	27,085	— 85	14·25	1·75
Baker St.-Waterloo	,, 13	6,835	+ 635	19	58,360	+ 860	4·25	..
Cen. London Rly...	,, 13	11,415	— 873	19	98,466	— 43,269	6·32	·55
Char. +, Eus. Hamp.	,, 13	8,050	+ 915	19	70,735	+ 7,270	7·75	..
City & S. Lon. Rly.	,, 14	6,487	+ 266	19	59,098	+ 1,844	7·3	..
Dublin-Lucan Rly.	,, 12	232	— 4	19	2,931	+ 71	7	..
G.N. and City Rly.	,, 13	2,986	+ 61	19	25,056	+ 49	3.5	..
G.N., P'y. & Brmtn.	,, 13	12,050	+1,840	19	99,395	+ 8,030	9·25	..
L'pool Overh'd Rly.	,, 14	2,688	— 22	19	28,257	+ 58	6·8	4·3
Llandudno-Col. Bay	,, 12	254	+ 18	50	13,998	+ 2,200	..	..
Mersey Railway ..	,, 13	8,990	+ 154	19	86,806	+ 1,378	4·5	..
Metropolitan Rly...	,, 14	33,588	+1,052	..	304,393	— 5,513	24·5	..
Met. District Rly...	,, 13	31,452	+2,212	..	185,157	+ 8,589	24	..
Anglo-Argentine ..	,, 11	84,868	+3,881	..	1,772,108	+108,296	..	..
§Auckland	,, 5	13,452	+1,157	44	149,953	+13,607	22·3	1·38
Bombay (B.E.T.) ..	Oct. 14	5,246	+ 140	..	102,917	+ 5,558	..	..
§Brisbane	,,	16,775	+1,865	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 13	6,259	— 410	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Oct.	3,589	..	..	38,073	..	20·5	..
Madras	Nov. 15	1,369	+ 220	..	27,038	+ 1,156	..	..
§Melbourne.. ..	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	Nov. 12	2,900	+ 182	33	63,046	+ 784	28	2·4

* Compared with the corresponding period of 1908. † One week only. ‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

The stars in the financial firmament fight against the Stock Exchange. Monetary tightness is now supplemented by domestic difficulties within the markets, and the probable approach of the General Election lays a restraining hand upon business already troubled by apprehensions common to the end of the year. It must be said that the electricity sections are steering fairly clear of the shallow waters towards which other prices show a strong tendency to drift. The most buoyant markets are those in copper shares, a factor which may not be regarded with much favour by proprietors of electrical shares.

Rubber companies appear with fresh issues every day in a manner which suggests that this class of speculative investment continues to hold public attention very successfully. Prices in the rubber section are firm, and it is thought that the gamble may yet run merrily enough for some time to come, seeing that in most of the later cases the companies do not expect to enter the really productive stage for at any rate two or three years to come.

The disaster which has overtaken Jamaica, is the chief feature of discussion in the Telegraph market, where the earlier earthquake is still remembered with painful interest. Happily, the floods of last week have been attended with results far less serious than those of the previous shock, and the cable companies, it is thought, will reap substantial advantage from the access of business occasioned, in spite of the wireless competition, and the probable damage to some of the submarine lines. On balance, West India and Panama First Preference are $\frac{1}{8}$ better, and the Second Preference $\frac{1}{4}$. Eastern Telegraphs rose $\frac{1}{2}$, and Eastern Extensions $\frac{1}{4}$.

Anglo-American Telegraph Deferred improved, moving with the American Railroad market, and Amazon 5 per cent. Debentures rallied 3 points. Marconis keep about $1\frac{1}{16}$. The new issue shares were carried over on Monday last at 15s. The President of the New York Wireless Telegraphy Company is said to be in London, on a mission to secure the Postmaster-General's consent, if possible, to the establishment of a number of wireless stations in this country.

National Telephone Deferred has replaced its $\frac{1}{2}$ fall of last week. New York Telephone Debentures, with 57 per cent. paid, are rather easier at $2\frac{3}{8}$ premium for the ordinary settlement.

Electrical Railway stocks are quite good, Central London Ordinary and Deferred being a point up, City and South London the same, while a rise of $\frac{1}{4}$ is registered by Metropolitan District stock. Baker Street and Waterloo Debenture, however, shows dulness, the price having receded to $97\frac{1}{2}$. It may be observed in passing, that London General Omnibus stock has fallen to $17\frac{1}{2}$ upon the introduction of a fresh scale of "cutting" fares, which now range from a halfpenny upwards. British Electric Tractions continue to be bought, the Preference still being favoured the most, but the First Debenture has a point advance to its credit. Montreal Light, Heat and Power Capital stock at 124 is 3 points lower.

Further pressure to sell British Columbia Electric Railway Deferred has led to another fall of 2. Argentine Trams are all fairly steady, in spite of martial law being proclaimed in Buenos Ayres, after the assassination of a high police authority. Mexico Trams and Mexican Light and Power are colourless, none of the issues showing much movement. Rio Trams at 90 have regained their last fall, and Sao Paulo Trams rose 1 to $152\frac{1}{2}$. United Electric Trams of Monte Video Ordinary and Preference are unaltered at $5\frac{1}{2}$ and $5\frac{7}{16}$ respectively.

The Madras Electric Construction Debenture has been marked down 5 points to $52\frac{1}{2}$, the reason, no doubt, being that the time draws near—it is in 1911—when the stock becomes convertible into shares. Madras Electric 5 per cent. Debenture Tramways is, of course, quite a different stock, and stands at par. Supply shares are no better than usual. The shrinkage in the prices of the metropolitan shares goes on, falls being recorded in Charing Cross, Chelsea, City, Metropolitan and London Electrics. Edmundson's Preference shed $\frac{1}{8}$. Victoria Falls Power Preference moved back $\frac{1}{32}$ upon flatness breaking out amongst Kaffir shares.

Manufacturing descriptions remain firm, and India-Rubbers have rallied 5s. Telegraph Construction Debentures are $\frac{1}{2}$ up, and Castner-Kellners rose to $2\frac{3}{16}$ on the declaration of a dividend of 9 per cent., making 14 per cent. for the year. Babcock & Wilcox Ordinary have retained their rise, but Willans & Robinson Ordinary and Preference down-graded. Electric Constructions, too, are easier.

Anglo-Portuguese Telephone Co., Ltd.—An interim dividend of 3 per cent. ($7\frac{1}{5}$d. per share), free of income-tax, has been declared for the past half-year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Nov. 9th.	Closing Quotations Nov. 16th.	Business done week ended Nov. 16th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8 — 8½	8 — 8½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	96 — 99	99 —102	..	..	+3	4 18 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —146	144 —146	144½	..	..	5 9 7
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8¼%	8⅞%	8⅛%	£8 4s.	61 — 63	61 — 63	..	..	..	5 8 2
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	8 %	8 %	6 %	101½—102½	101½—102½	102⅛	101½	..	5 17 1
8,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	22¼— 22¾	22⅝— 22⅞	22⅞	22¼	..	1 15 7
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾— 8⅛	7¾— 8⅛	..	..	..	4 18 6
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 89½	87½— 89½	89	88	..	4 9 5
18,000	Cuba Telegraph	10	5 %	5 %	8 %	6 %	8⅜— 9⅛	8⅜— 9⅛	8⅜	..	..	6 9 9
8,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	3 — 8½	..	..	..	5 14 8
8,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13 — 13½	13 — 13½	13⅜	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	126½ —129½	127¾	126	+ ½	5 9 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	83½ — 85½	85	84½	..	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock, Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103¼	102	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅝— 12⅛	11¾— 12¼	12	11⅞	+ ⅛	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10½	10 7/16	..	5 8 8
181,127	Do. do. 8 % Pref...	10	8 %	6 %	6 %	6 %	13½— 14	13½— 14	13⅝	13½	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28½— 29½	28½— 29½	28¾	..	..	7 0 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	51 — 53	51 — 53	52⅛	51⅛	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 95	93 — 96	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	15/3	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	8 %	6 %	6 %	¾— ⅞	¾— ⅞	17/3	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	8 %	6 %	107 —108½	107 —108½	108½	..	..	5 10 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	119½—121½	120 —122	121	119¾	..	4 18 9
15,000	Do. do. 8 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	10⅞	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10⅛	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 3/16	5½	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	..	..	..	5 5 9
50,000	Do. do. do. 8 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½— 88½	86½ — 88½	88¼	87½	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	8 %	6 %	8 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 15/16— 7 3/16	6 15/16— 7 3/16	7⅛	6 15/16	..	5 10 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	..	..	..	4 8 4
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜— 1⅝	31/3	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13¼— 13¾	13½	13 5/16	— ½	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	¾— ⅞	¾— ⅞	17/3	14/-	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9⅜	9 — 9½	..	..	+ ⅛	6 6 4
4,669	Do. do. 8 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8¾— 9¾	9 — 10	..	..	+ ¼	15 0 0
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4½— 4¾	4½— 4¾	92/6	91/10½	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼— 4½	4¼— 4½	..	..	..	5 11 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	90½— 92	90½—92	91¾	90¾	..	4 7 0
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅝— 4¾	4 9/16— 4 11/16	93/9	92/6	— 1/16	4 4 3
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	8 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	..	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	8 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	55/-	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	147 —152	145 —150	150	147	—2	5 6 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	122 —126	121 —125	121	..	—1	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —111	107 —110	..	..	—1	4 10 11
233,000	Do. 4½ % 1st Mort. Debs., 1 to 8,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102½ —104½	104¼	103¼	..	4 6 2
183,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝— 1	⅝— 1	16/3	15/-	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅜— 2¾	2½— 2⅞	55/-	51/3	+ ⅛	5 6 8
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	83 — 86	84 — 87	85¾	85½	+1	5 14 11
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	58 — 62	..	..	..	7 5 2
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 8 % Cum. Pref.	5	6 %	6 %	8 %	6 %	6⅛— 6½	6⅛— 6½	6 5/32	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 - 106	..	..	..	4 4 11
204,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 8 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,018,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 51	..	..	..	7 18 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16— 11/16	7/16— 11/16	..	..	..	Nil
50,000	Do. do. 8 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	8 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	4½%	4½— 5	4½— 5	92/6	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	95/-	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	6 18 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 6⅛	5⅝— 6⅛	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	8 %	12 %	12½%	2 1/16— 2 3/16	2⅛— 2¼	44/-	42/3	+ 1/16	5 11 1
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3¼%	60 — 62	61 — 63	62⅜	61	+1	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	44 — 46	..	..	+1	5 8 8
1,480,000	City and South London Railway	Stock	1¾%	1½%	2¼%	1½%	29½— 30½	30½ — 31½	30¾	29½	+1	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½ - 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Nov. 9th.	Closing Quotations Nov. 16th.	Business done week ended Nov. 16th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
		*										
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	22/-	21/-	..	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	21/9	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	13 3/16	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1⅛%	3/32— 7/32	5/32— 9/32	8/6	..	..	31 5 8
17,139	Do. "A" shares, 01—017,139 ..	5	4⅛%	4⅛%	2½%	2½ %	1 — 1½	1 — 1½	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 11/16	⅜ - ⅝	..	..	— ⅛	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1 3/16— 1 7/16	1⅛ - 1⅜	..	..	— 1/16	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
73,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 73,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
30,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ - 13½	12½— 13½	12⅞	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ - 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15½— 16½	15¾— 16½	..	..	+ ¼	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
500,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
399,930	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅜— 2⅞	2⅜— 2⅞	51/3	..	..	13 0 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,732,062	Metropolitan Consolidated	100	2⅝%	1 %	⅜%	⅜%	36¾— 37½	36¾— 37½	37½	37	..	1 6 10
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 — 66	64 —66	6½	65	..	4 3 4
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	15½- 16	15¾— 16¼	16 13/16	15⅞	+ ¼	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32— 11/16	19/32— 11/16	..	..	..	6 10 11
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	7½d.	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16— 13/16	11/16— 13/16	15/3	14/3	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	94½	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½—127½	124½—127½	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	..	..	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	84 — 87	..	..	—2	5 3 6
87,350	Telegraph Construction and Maintenance	12	5 %	15 %	17½%	15 %	34½— 36	34½— 36	..	..	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	100½ —102½	..	..	— ½	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100 —101	100⅜	..	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	..	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	31 — 33	31 — 33	32½	31½	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	¼ - ½	..	..	— ⅛	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	1¾ - 2¼	..	..	— ¼	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	7¼	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	99½	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3¾ - 4¼	3½— 4	80/-	75/-	— ¼	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ - 4⅞	4⅜— 4⅞	..	..	..	4 12 4
30,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 5 11
445,736	Do. - do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 - 101	98 —101	99	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3½— 4	3⅜ - 3⅞	72/6	70/-	— ⅛	5 16 2
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10¼— 10¾	10 — 10¼	10 15/16	10¼	— ¼	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	..	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞ - 3⅜	2⅞ - 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅞— 8⅛	7⅞— 8⅛	7 15/16	7 11/16	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10 13/32	..	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	99 —101 xd	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅜— ⅞	⅜— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	59½	57¾	..	7 10 0
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	93	92½	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	..	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	100 —102	100½	..	+1	4 18 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1¾— 2⅛	1⅝— 2	..	..	— ⅛	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅞ - 5¼	4⅞— 5½	..	..	..	5 14 3
332,855	Do. do. 4 % 1st Mort. Deb. Stk. Red,	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	95½	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4½	3¾ - 4¼	80/-	77/6	— ¼	5 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜— 5	4⅜ - 5	95/-	98/9	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½ - 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½— 82½	80½ - 82½	..	..	..	6 1 3
13,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	71 — 75	73¼	72½	..	4 13 4
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	103¾	102¾	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	84 — 86	84 — 86	85⅜	84½	..	5 16 3
960,000	Midland Electric Corporation, 4½ % 1st Mort. Deb,	100	4½%	4½%	4½%	4½%	98 — 100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¾— 5¼	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13½	12½ — 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1 9/16— 1 11/16	1 9/16— 1 11/16	..	..	..	4 14 10
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32— 1 7/32	1 3/32— 1 7/32	22/9	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	104½	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	8⅞	8½	..	6 7 0
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	7 1/16	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	9/16— 13/16	9/16— 13/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜— 3	2⅜ - 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 3 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜ - ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼ - 1¾	1¼ - 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ - 78½	74½ - 78½	..	..	..	5 14 8
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	15/16— 1	29/32 - 31/32	..	..	— 1/32	5 4 1
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅜ - 8⅞	8⅜ - 8⅞	8½	8 7/16	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞ - 5⅜	4⅞ - 5⅜	98/1½	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd. 1909

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 756.)

On one recent occasion the writer, with only rough exposure-reproducing means at his disposal, employed a Heurtley test to localise a cable fault which totally interrupted communication on a cable. The usual dual and triple current tests placed the fault about 100 ohms from shore. (The fault was eventually picked up 96 ohms from shore, and proved to have been caused by a kink, the sheathing wires at which were unbroken.) An apparently good and steady Heurtley balance gave 115 ohms to the fault, a result not acted upon, as the previous concordant results were considered satisfactory as shown in graph E, fig. 39.

On investigation, the extra 115 − 96 = 19 ohms resistance apparent in the Heurtley result was found to have been due to the salt water block interposing between the copper artificial exposure and the sides of the sheathing-earthed bucket containing the salt water in which the "artificial" core was immersed.

It is clear that on the occasion in question the metallic *earth* conditions on the two respective sides of the Heurtley exposure-balance could scarcely have been more diametrically opposed than they in fact were in regard to the respective water-distances separating the natural and the artificial copper-exposures from a metallic earth.

In the case of the very small natural exposure subsequently discovered at the kink in the cable, this was within a small fraction of a centimetre distant from the unbroken steel sheathing wires of the cable kink, whilst the artificial exposure was at the end of a short length of core bent round, and made to stand up in an iron bucket of salt water in which lay coiled a few turns of iron binding wire earthed on to the cable sheathing, the artificial exposure in this case being separated from metallic earth by the surrounding volume of water in the bucket.

Then, again, before a Heurtley exposure balance was obtained and *passed*, that is to say, before the artificial exposure, at first *too small*, showed up as *greater* than the natural exposure, a length of fully 12 in. of copper wire was bared in the bucket of salt water. Yet, when eventually the repairing ship cut into the cable and picked up a short distance to the kink, the sheathing wires were found intact, and the fault so far invisible, until on the kink being cut out, and opened up, a dirty green caked-up copper exposure amounting to about 1 sq. mm. was discovered.

The very great difference in the exposed-copper superficial areas, which respectively, on opposite sides of the Wheatstone bridge system, actually balanced each other, was apparently due to the small natural exposure being close to the metallic earth of the cable sheathing, whereas the artificial exposure in the bucket had, between it and metallic *earth*, an effectively large volume of water.

On the other hand, cases have often occurred in the writer's actual experience where the exposed conductor at a break has been found at the end of a length of uncovered core, a fathom or so from the nearest of occasional sheathing wires corroded, and worn to needle points. In such cases, however, owing to the practically limitless mass of the surrounding water, the water-resistance effect is not so marked, as it is in the bucket of water.

In short, it appears to the writer that in a Heurtley test the artificial fault—that is, the core with the adjustable exposed copper immersed in the earthed bucket of water ought to lie in the water within or in fairly close proximity to a helix of iron binding wire likewise immersed and connected, at its near end, to the testing earth on the sheathing of the cable under test.

When the break or the fault lies in fresh water (as up the Amazon) similar conditions can be tentatively reproduced round the artificial exposure. The same also applies to cases when indications appear to suggest that the cable break is buried in mud or sand. The Heurtley test would probably lend itself in all these cases to reproduction and balancing of existing conditions at the break.

The writer has devised the following graphic routine based on Heurtley's method of balancing the real exposure against an artificial one.

In the writer's graphic (Heurtley) method, as shown in fig. 52, only four readings are required, namely, two at each extremity, so to speak, on one side and on the other, of a Heurtley balance.

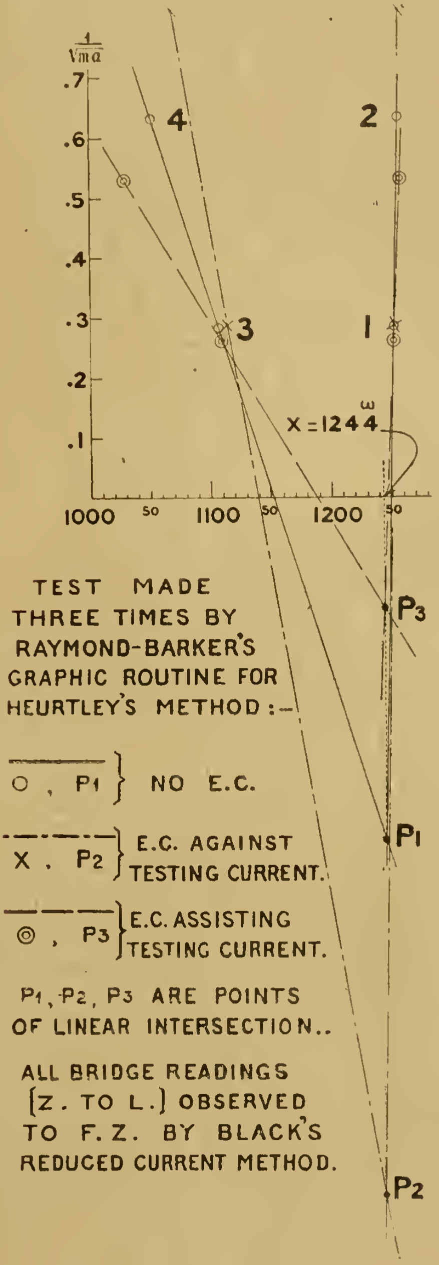

Fig. 52.

The true x or resistance up to the break or fault is then arrived at graphically and without calculation, in the following manner:—

Let two bridge readings, viz., with higher and lower currents be noted with artificial exposure balanced against the broken or faulty cable *one* way, say, with the artificial exposure decidedly too *large*, as proved by the fact that the bridge reading with the higher current is less than that with the lower current.

Then let another couple of readings, viz., with higher and lower currents, be obtained with artificial exposure much too *small*, as proved by the bridge reading with the higher current being more than that with the lower current.

These two pairs, then, represent respectively two extremes of the Heurtley conditions. These four readings are now to be plotted, as in Jona's localisation curves, on the calculator-board, or other squared paper arrangement, with bridge readings as abscissæ, and $\frac{1}{\sqrt{\text{m.a.}}}$ values as ordinates. (See fig. 27 in Hand-book.)*

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* "Hand-Book on Cable-Break Localisation." By E. Raymond-Barker. H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

Two straight lines, each respectively drawn through each of the two pairs of plottings are extended towards and past the line of resistance till they will be found to intersect one another. Then a perpendicular raised from the point of intersection will be found to cut the line of resistance at x, viz., true resistance up to cable break, or fault.

The following actual tests made by the writer, with the negative current, on real 130 Cu/130 G.P. core exposures in salt water through artificial resistances, bear out the accuracy of the writer's graphic routine for the Heurtley method, as may be seen on reference to fig. 52.

The length of exposed conductor in the core representing the broken cable was $\frac{1}{4}$ in. (6·35 mm.).

The two artificial exposures balanced successively against the cable exposure, were respectively $1\frac{1}{2}$ in. (38·1 mm.), and a flush cut.

Bridge readings, Nos. 1, 2, 3, 4, were observed to F.Z. by Black's reduced-current method, and the current flowing to " line " was noted on a mil-ammeter in the usual way.

Telluric current *nil*.

With artificial exposure = $1\frac{1}{2}$ in. :—

$$1\text{st pair}\begin{cases}12{\cdot}5\text{ m.a.}\quad \dfrac{1}{\sqrt{\text{m.a.}}} = 0{\cdot}283,\text{ bridge gave }1{,}253^{\omega}\\ 2{\cdot}5\quad ,,\qquad ,,\quad = 0{\cdot}633,\quad ,,\quad ,,\quad 1{,}257^{\omega}\end{cases}$$

With artificial exposure a flush cut :—

$$2\text{nd pair}\begin{cases}12{\cdot}5\text{ m.a. gave a bridge reading of }1{,}114^{\omega}\\ 2{\cdot}5\quad ,,\quad ,,\quad ,,\quad ,,\quad 1{,}048^{\omega}\end{cases}$$

The four bridge readings, taken in conjunction with the corresponding $\dfrac{1}{\sqrt{\text{m.a.}}}$ values, were quickly plotted in single circles as shown in fig. 52. This was done on Calculator-board scale, viz. :—

$$1\text{ cm.} = 10^{\omega}\text{ and }5\text{ cm.} = \frac{1}{\sqrt{\text{m a.}}}\text{ of }0{\cdot}1.$$

The perpendicular from the point of intersection P_1 of the two lines 1.........2 and 3.........4 (single circle plottings) in fig. 52, was found to cut the line of resistance at between 1,243 and 1,244. The true resistance was 1,244·5 ohms (ctd.) this involving a very slight discrepancy fully accounted for by possible inexactitude in observation, plotting, and line ruling.

With a *negative* E.C. coming from cable, and therefore opposing the negative testing current, readings 1, 2, 3, 4 were repeated as follows :—

Art. Exp. = $1\frac{1}{2}$ in.

$$1\text{st pair}\begin{cases}12{\cdot}0\text{ m.a.}\quad \dfrac{1}{\sqrt{\text{m a.}}} = 0{\cdot}289,\text{ bridge gave }1{,}253^{\omega}\\ 1{\cdot}5\quad ,,\qquad ,,\quad = 0{\cdot}816,\quad ,,\quad ,,\quad 1{,}257^{\omega}\end{cases}$$

Art. Exp. = a flush cut.

$$2\text{nd pair}\begin{cases}12{\cdot}0\text{ m.a. gave on bridge }1{,}114^{\omega}\\ 1{\cdot}5\quad ,,\quad ,,\quad ,,\quad 1{,}067^{\omega}\end{cases}$$

The corresponding plottings are shown in fig. 52 as *crosses*.

With a *positive* E.C. coming from cable, and therefore assisting the negative testing current, readings 1, 2, 3, 4 were again repeated :—

Art. Exp. = $1\frac{1}{2}$ in.

$$1\text{st pair}\begin{cases}14{\cdot}5\text{ m.a.}\quad \dfrac{1}{\sqrt{\text{m.a.}}} = 0{\cdot}263,\text{ bridge gave }1{,}252^{\omega}\\ 3{\cdot}5\quad ,,\qquad ,,\quad = 0{\cdot}534,\quad ,,\quad ,,\quad 1{,}255^{\omega}\end{cases}$$

Art. Exp. = a flush cut.

$$2\text{nd pair}\begin{cases}14{\cdot}5\text{ m.a. gave on bridge }1{,}109\\ 3{\cdot}5\quad ,,\quad ,,\quad ,,\quad 1{,}028^{\omega}.\end{cases}$$

The corresponding plottings are shown in fig. 52 as *double circles*.

The perpendiculars from the points of intersection P_2 and P_3 corresponding respectively with the foregoing second and third series of readings, will be seen in fig. 52 to practically coincide with P_1 in cutting the line of resistance at from 1,240 to 1,244 ohms.

In the foregoing second and third tests, affected as these were by E.C.'s, the F.Z. deflection was naturally much more extended than in the first instance, necessitating the shunting down of the galvanometer, thereby lessening somewhat—though not unduly—the sensitiveness of the test.

It may here be remarked that when, in the presence of a strong telluric current coming from the cable, it is thought undesirable to decrease the sensitiveness of the test by heavy shunting of the galvanometer, the " spot " deflected by the E.C. may, preparatory to the observation of a series of bridge readings, be brought to any convenient point on the galvanometer scale by Mr. G. B. Winkfield's device.* This is the addition of a circuit across the bridge galvanometer terminals (or equivalent electrical position) consisting of a battery of from one to three cells with a reversing-key (to give the local current the direction required to neutralise the E.C. deflection) and a high resistance at least five times that of the galvanometer.

Fig. 53 shows a collection of graphs, by the writers' method, of all the tests given in the foregoing table (p. 755), viz., tests numbered 1 to 5.

That same table includes a column headed " Graph plottings," with letters A to R, which identify all the bridge readings, and concurrent $\dfrac{1}{\sqrt{\text{m.a.}}}$ values with the corresponding plottings in fig. 53.

It will be noted that the plottings have been made from the more extreme bridge readings, that is to say, those farthest removed, one way or another, from the Heurtley balance.

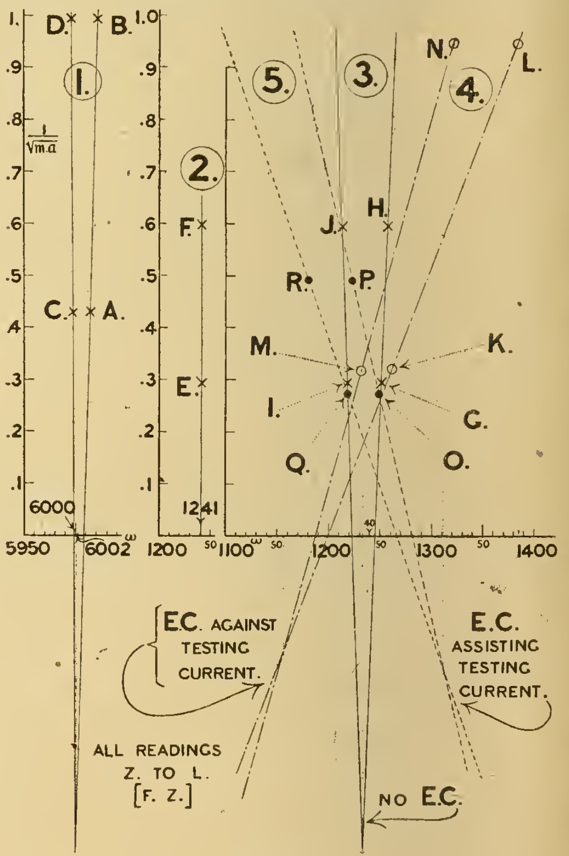

Fig 53.

In graph No. 1 the dotted line perpendicular from the point of intersection aforementioned, is seen to practically coincide with the actual resistance (x) up to break, which eventually proved to be 6,002 ohms, as given by Heurtley.

Graph No. 2 shows how Jona plottings of a dual test in which two current-powers—by exact Heurtley exposure adjustments—produce exactly similar bridge readings, result merely in a vertical line intersecting the line of resistance at x, viz., ohmic distance up to break, in this case 1,241 ohms, an error of 1 ohm.

In graph No. 3 the dotted line perpendicular comes approximately near the true x, viz., 1,240 ohms.

Graphs Nos. 4 and 5 illustrate the combined effect of symmetrically *incomplete* adjustments of the Heurtley balance, and strong telluric currents respectively against, and in the same direction as the testing current.

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* The Electrical Review, July 27th, 1906. See also Kempe' " Handbook of Electrical Testing," seventh edition, page 291.

The dotted line perpendiculars from the points of intersection of the boundary lines respectively of the graph formations K, L, M, N (for No. 4), and O, P, Q, R (for No. 5) are seen to be almost symmetrical in their respective wrong results of *minus* 80 ohms in the case of No. 4, and *plus* 70 ohms in No. 5.

An interesting point is noticeable in the fact that the strong telluric currents, in one case *against*, in the other *assisting* the testing current, influence the bridge readings, not because of their presence or direction, for the action of the E.C. in that respect is, of course, neutralised by the bridge readings being observed to false zero. The telluric currents in one direction or the other affect the bridge readings only in so far as they affect the total mean current flowing through the cable in the two instances given in tests Nos. 4 and 5.

Thus, a reference to the foregoing table will show that the milliamperes from the higher and lower testing powers which, in No. 3, without any telluric current, were respectively 11·5 m.a. and 2·8 m.a., were, by the telluric current in No. 4, reduced to 9·6 m.a. and 1·1 m.a., and No. 5 increased to 13·0 m.a. and 4·1 m.a.

Seeing, then, that "*other things being equal, the smaller the testing current the greater the resistance of an exposure*," it is clear that the presence of a telluric current affects false-zero bridge-readings in a manner quite apart from the theoretical automatic elimination of E.C. error effected by false-zero working.

The writer, then, has placed on record graphs 4 and 5 in fig. 53 merely by way of submitting to fellow-students some points of interest which may be found worthy of some further investigation. Far from wishing to dogmatise, the writer realises that in regard to the behaviour of copper-exposure cable faults in all their infinite variety of being and of attendant E.C. conditions, he will ever remain a student.*

(*To be concluded.*)

CONDENSER TELEPHONE RECEIVER.

It has long been known that ordinary paper condensers emit a sound when charged or discharged, owing to the mechanical vibrations set up between the plates. It was found that the higher the voltage used, the greater was the volume of sound roduced, and Varley and Dolbear constructed condenser eceivers, some 25 years ago, in which the plates were normally harged to a comparatively high voltage by means of a any-cell battery, whilst the speaking voltage fluctuations ere superposed on this voltage. These telephones did not come into use chiefly because of the expense of the battery and because of the fact that the tones were reproduced an octave higher than the original. Other patents followed in America and Germany, but all still required some form of high charging voltage (100 to 300 volts).

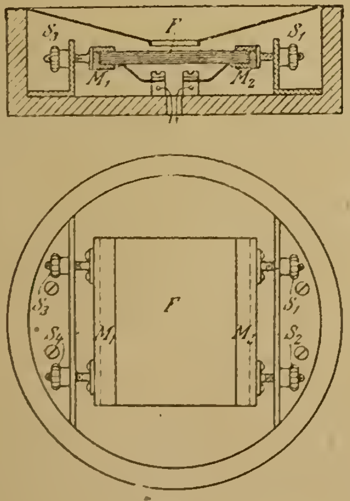

Fig. 1.

Some experiments carried out by Herr Karl Ort and Herr J. Rieger recently on the Duddell singing arc brought the matter prominently before them, and have led them to the construction of some greatly improved condenser receivers, which operate satisfactorily at such low voltages as 4 or 6. After trying many forms of apparatus they hit on the plan of keeping the condenser metal plates under uniform mechanical tension, so getting rid of the irregular vibrations at the free edges of the plates. At the same time this construction enabled the intermediate layers of paper to be entirely dispensed with, and to be replaced by a thin coating of shellac or similar material. The construction is shown diagrammatically in fig. 1, whilst fig. 2 shows a collection of the finished pieces of apparatus. The metal laminæ F are held in the two straining clamps M_1, M_2, and these can be adjusted exactly by means of the screws S_1—S_4.

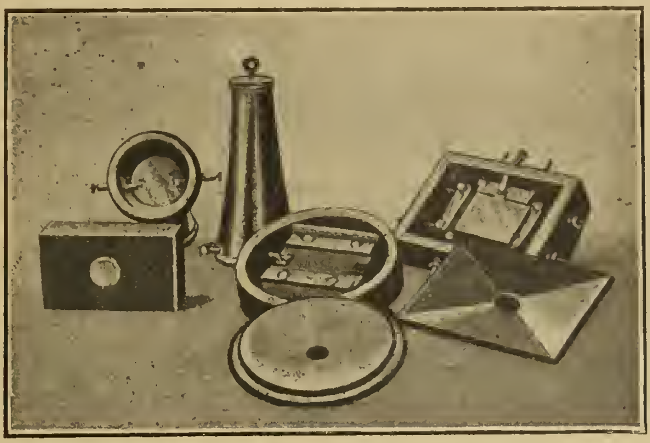

Fig. 2.

Various forms of connections were experimented with, one of which is shown in fig. 3. Here the poles of the condensers C_1 and C_2 are connected to the two or three-cell batteries, B_1 B_2, employed in the circuits of the microphones M_1 M_2. The ordinary microphone induction coils are shown at T_1 T_2. In this way separate charging batteries are entirely dispensed with, and, when tried on an 8-kilometre telephone line, quite satisfactory results were obtained.

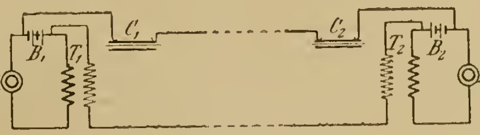

Fig. 3.

For a louder transmission, the connections shown in fig. 4 were adopted. Here the condensers were connected to separate batteries B_1' B_2', of some 20 volts each, but as these were only used for charging purposes, they were of quite small dry cells. With this arrangement, results equal to the ordinary electromagnetic receiver were obtained. For still louder results, such as could be heard all over a room, a condenser voltage of at least 100 volts is necessary, and as a battery for this value would be too expensive in practice, a dynamo was tried instead, as shown at D (fig. 5). This

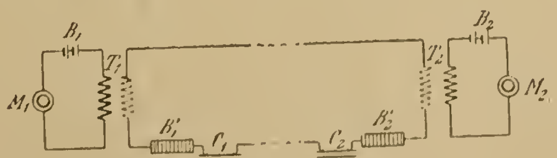

Fig. 4.

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* See "Localising High-Resistance Breaks in Cables." By Rymer-Jones. H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, ondon, E.C.

dynamo took the form of the ordinary central station supply at 120 volts, and the secondary winding of the induction coil T served to eliminate the small commutation voltage fluctuations, which were otherwise easily audible. In this way, very loud speech reproduction was obtained, which could be heard easily all over a large room. The action of the dynamo is very important in this result, for the fluctuating currents set up in the secondary of T by the microphone flow through the windings of the dynamo and influence its magnetic field, and so intensify the result.

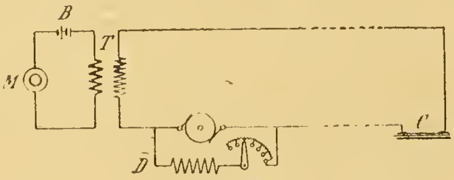


Fig. 5.

Still better results were obtained by means of the connections shown in fig. 6. Here each of the condensers was influenced by the dynamo voltage, which was itself influenced by the secondary of the microphone induction coil T. Any number of condensers can be connected in parallel and each reproduces the sounds. In some cases, in order to protect the induction coil secondary from overheating, it is advisable to insert a condenser of sufficient capacity in series with it. The current taken from the dynamo is extremely small, so that a quite small machine is sufficient.

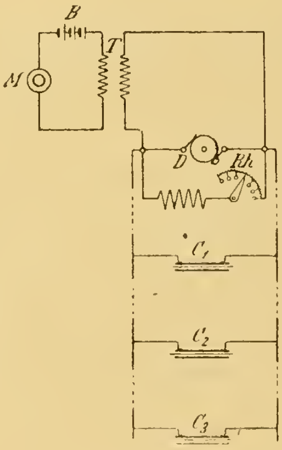


Fig. 6.

The size of these condenser receivers is normally about 4 × 6 cm., with a capacity of ·015 to ·04 mfd.; but the larger the condenser, the louder is the reproduction with any given charging voltage. For loud reproduction, therefore, condensers of ·05, ·2 or even 1 mfd. were used, having a size of about 12 × 20 cm.

These receivers have the advantage over electromagnetic instruments of being uninfluenced by earth currents, and, also, the natural frequency of the plates is not within the range of ordinary speaking currents provided that the proper mechanical tension is given to the plates. On this account, especially for loud speaking, the tones are much purer than with electromagnetic telephones. A full account of the system was given in the *E.T.Z.*, part 28, 1909.

The British Fire Prevention Committee.—The work of this Committee for the session that has just commenced includes the preparation and issue of reports in respect of a number of doors and roller shutters that have been recently tested by the Committee and will be embodied in five reports. Two reports are also in preparation on fire extinguishers, including a petrol extinguisher. Regarding tests to be undertaken in the near future, these include a further concluding series of door tests mainly relating to composite doors and the matter of roofing materials will also shortly have the attention of the Committee. The next testing days have been arranged for the end of this month and the beginning of next month.

REVIEWS.

Hydro-Electric Developments and Engineering. By Frank Koester. New York: D. Van Nostrand Co.; and London: Archibald Constable & Co. Price 21s. net.

This book starts off with some very striking data concerning the relationship between rainfall and wooded areas. It appears that the French Government spent £700,000 between 1861 and 1877 in reafforesting 235,000 acres, and the results were so good in promoting rainfall, &c., that about £7,000,000 is now being spent in covering 2 million acres. Between 1843 and 1883 the Ekaterinoslav Government in Russia covered 5,000 acres with trees, and entirely changed a district subject to droughts. Between 1893-1897 the average rainfall was 18 in. for freeland, and 22¼ in. for the forests. Australians ought to note this.

Some tall figures regarding water power in the United States, are quoted. For example, more than 30,000,000 H.P. is now available, and with storage reservoirs it could be increased to 150,000,000 H.P. To develop 30,000,000 H.P. the best steam plant would take 225,000,000 tons of coal per annum, and with the average steam engine plant as now existing, more than 600,000,000 (in the book there is a printers' error here). At an average price of $3 per ton, this coal would cost $1,800,000,000 per annum. At the present time only about 3,000,000 H.P. is developed by water power.

There is an interesting reference to a steel frame dam erected by the Helena Power Transmission Co. across the Missouri River. It was 75 ft. high and 630 ft. long, with the entire upstream side lined with steel plates $\frac{5}{16}$ in. and $\frac{3}{8}$ in. thick. It failed in April, 1908, but no doubt we shall hear of more steel dams; for smaller sizes, where transport is difficult, the idea seems too good not to be worked out further. The Necaxa dam in Mexico is 180 ft. high and 1,276 ft. along the top, it spreads out at the base to 950 ft. wide, and is 54 ft. wide at the top.

Under the heading of penstocks, particulars are given of those of the Loch Leven Water and Electric Co., Scotland. There are six penstock lines 6,230 ft. long, 40 in. in diameter and $\frac{3}{8}$ in. to $\frac{7}{8}$ in. thick. The lower sections carry a pressure of 425 lb. per sq. in., and they are in 19·7 ft. lengths. The concrete anchor blocks are 175 ft. apart.

Particulars of wooden penstocks, or stave pipes, are given. One for the Trenton Falls Water-Power Plant, Atica, New York, is 3,700 ft. long and 84 in. diameter. The Great Northern Power Co., Duluth, has three wooden stave penstocks 7 ft. diameter and 4,000 ft. long.

Wooden and steel poles and steel towers are treated very fully. The standard construction of the future is evidently going to include steel towers about 70 ft. high, having four legs 15 ft. apart, and the towers arranged eight to ten to the mile.

The pin insulator, used for pressures up to 60,000 volts, and the suspended link insulator for pressures of 100,000 volts, are fully described. The unit formation of the latter makes it possible to increase the effective insulation as the line voltage is raised, and the position of the conductor below the cross-arm permits the supporting structure to act as a lightning rod in times of atmospheric electric stress.

The usual spacing of conductors is as follows:—

5,000 to 10,000 volts	... ...	24 to 36 in.
10,000 to 30,000 „	... ...	36 to 60 „
30,000 to 60,000 „	... ...	60 to 84 „
60,000 to 100,000 „	... ...	84 to 96 „

Hard-drawn copper is mostly used. It has an ultimate tensile strength of 60,000 lb. per sq. in.; whereas aluminium has a tensile strength of 28,000, and steel 100,000 lb. Although the conductivity of steel, to that of copper is only as 12 to 100, the stronger metal has already been used for long transmissions, and it is likely to come still further into use for branch lines.

Reference is made to the corona effect of two conductors near each other when charged to a high potential. After a certain value is reached, a bluish glow visible in the dark surrounds them, and coincidently with the glow, loss of power begins. A further increase in E.M.F. produces a brush discharge, which takes place not from the conductor but from the external bands of the luminous envelope. This discharge results in further augmentation of electrical loss, and is usually accompanied by a hissing or crackling noise. It is intermittent in character, and is reddish violet in colour. The name "Corona" has been given to these combined luminous manifestations.

In Part III the author describes in detail the following hydro-electric plants, which he has picked out because they exhibit different characteristics :—

Ontario Power, Canada, medium head ...	60,000 volts
Great Falls, U.S.A., low head	11,000 and 44,000 volts
Necaxa plant, Mexico, high head	60,000 volts
Kykkelsnia-Hafslund, Norway, low head...	20,000 volts
Urfttalsperre, Germany, medium head ...	35,000 volts
Uppenborn, Germany, low head	50,000 volts
Brusio, Switzerland to Italy, high head ...	50,000 volts

The description of the Ontario Power Co. plant is summarised from five different papers. The author gives considerable prominence to the Brusio transmission, which he considers one of the best engineered plants now at work. There are some printers' errors; thus, Galileo is stated to have said in 1830 (?) that the laws governing the flow of water were not as well known as those governing the movements of the celestial bodies.

A valuable feature is the bibliography at the end of each chapter. The book is an excellent one in every way. E. K. S.

Continuous-Current Dynamos and Motors and their Control. Rewritten. Second edition. By W. R. Kelsey, B.Sc., A.M.I.E.E. Manchester : The Technical Publishing Co., Ltd. Price 7s. 6d. net.

The writer reviewed the first edition of this book in the issue of July 17th, 1903, and is glad to see that it has come out again in enlarged form, for Mr. Kelsey has a lucid style and selects his matter and illustrations well. In writing small books it is knowing what to leave out that requires most skill.

Since the first edition, the use of equaliser rings, interpoles, and special constructions for steam turbo-dynamos have come out, and one naturally looks to see how they are dealt with. Considering the space at the author's disposal, these modern developments are well described.

When dealing with the construction of poles, the author refers to the old device of interposing deep grooves on the pole face, and says that, unless the magnet can be entirely divided by such grooves, the weakening of the cross flux is simply due to the reluctance of the lengthened path in the iron. He then gives a footnote saying that in Mawdsley's patent field the pole cores are cast solid with the yoke ring and are divided into halves by a gap of considerable width opening through the yoke. It may be of interest to mention that the writer took out a patent for a similar method of minimising cross flux in 1897, but he carried the idea further by laminating the poles and yoke in a plane at right angles to the armature disks, and arranged each lamination to go right round from one pole to the next.

Several illustrations show the construction of high-speed commutators, and Bourke's method of interlocking the commutator segments is referred to.

Calculations for a typical dynamo are gone into in detail, and the last chapters on control and testing are good.—E. K. S.

The Story of the Electric Organ. By J. W. Hinton, M.A., Mus.D. London : Simpkin Marshall & Co., Ltd.

It is not often that a scientific publication has occasion to express an opinion upon a book such as that now before the reviewer. The advent of this work, however, shows that, despite the sad plaint of the Postmaster-General bewailing the lack of artistry in the design of telegraph poles, there is a certain connection between the science of applied electricity and the art of music, or, perhaps, one should say, music making. Had it not been that the Editors in their wisdom decreed that this work should fall to the lot of the present reviewer, who is not wholly unversed in the internal mysteries of the *kist of whustles*, it might have been a matter of some little difficulty for the whole of the book to have been dealt with. Mr. Hinton says it is folly for the electrical arrangements in connection with an organ to be entrusted to the mere electrician ; but really the converse appears to be equally true—although in the book it is ignored—for we have a tale of many attempts to apply electricity to organ control which appear to have failed, or whose success was at least imperfect, from the fact that the "mere electrician" appears not to have been consulted at all, or else from the organ builder's imperfect knowledge of the science.

To casual but inquiring readers, for whom the book appears to have been written, it may not be without interest. It explains very clearly the fundamental principles underlying the control of the keyboard over the access of the wind to the pipes. It shows how the depression of a key through the media of sundry mechanical connections causes the opening of a valve or pallet which normally stops the wind from causing the pipe to sound. It is shown how the interpolation of a pneumatic device which lessens the physical work of the player achieves the same result. But here the reviewer wishes to join issue with Mr. Hinton, who regrets the necessity for the latter device, saying that it "absorbs the most subtle refinements of the player's *touch*," which, he says, is not the case with the purely mechanical action. Now, the word *touch* in that sense, divested of sentimentality and strictly analysed, really means the player's ability (or lack of it) to control the volume or intensity of sound emitted by means of the digital control at the keyboard. In the piano, the intensity of the sound depends upon the force with which the key is struck; but in the organ the intensity of the sound is controlled by fixed factors, the "scale" of the pipe, the wind pressure, &c., so that the operation of the key, whether its effect be transmitted pneumatically or otherwise, cannot in any way affect the volume of sound. The reviewer is aware that the word *touch* is used in a wider sense than this, but it is an entire misuse of the word ; what is really implied, and no doubt what Mr. Hinton means, is *technique*. As a matter of fact, the reviewer has seen, and if he may be allowed to say so, has played upon organs where the pneumatic control was even more efficient from that point of view than the somewhat noisy mechanical control, and which, owing to the absence of physical labour, were capable of producing more artistic results.

The author refers to the pneumatic control as paving the way for electric control by rendering possible an electro-pneumatic system. Surely he has not assimilated the history of his subject, or has he not read of attempts at direct magnetic control ? These were not successful, owing to the difficulty of obtaining conveniently magnetic power sufficient to overcome the wind pressure on the pallets. However, he refers in an added note to attempts in this direction in 1826, whereas the original pneumatic control (Barker's lever) did not appear until after 1834. The author ascribes to Sturgeon the invention of the electromagnet in 1826. Sturgeon certainly first used that name, but the credit is due to Arago and Davy in or about 1821.

Mr. Hinton goes on to describe in a lucid manner, assisted by admirable diagrams, the several systems of pneumatic-electric control, and it is gathered that the failure or imperfect success of all of them is largely due to the difficulty of avoiding damage due to sparking at the contacts. The author recommends dipping mercury contacts; rubbing contacts are referred to, but condemned, owing to wear and unpleasant feel when operated. Touching contacts are anathema, "unless made of massive gold . . . platinum burns away . . . "; nickel is objected to because of high resistance, although said to be suitable otherwise. (It is not clear how the latter could be of importance, seeing that coils of comparatively high resistance would be in circuit with the small amounts of nickel necessary for contact points.) Thus the organ builder! The "mere electrician" would unhesitatingly adopt rubbing contacts of dissimilar metals—platinum and silver for instance—to obviate mutual friction, or what is known as a "tearing" action, and place the common device of a non-inductive shunt across every electromagnet, to absorb the self-induced E.M.F. and do away with the deleterious sparking.

The author also considers the application of electricity to the blowing of organs, and again rules the electrician out of court whilst recommending the adoption of a motor-driven gear with crankshaft transmission to operate the ordinary bellows. Blowing by fans is the last resource recommended. Now the reviewer has seen and played upon organs where the latter has been installed with no little measure of satisfaction to both the player and the payer, even in a case where an hydraulic engine—apparently Mr. Hinton's ideal—was ousted to make way for a fan. These results, however, were obtained not by the organ builder alone, as Mr. Hinton suggests to be necessary, but by the organ builder having expert advice from a mere electrician, which is obviously the correct course whether playing or blowing be concerned. Mr. Hinton's acquaintance with the question seems to be rather limited, for the fans to which the reviewer refers were installed by a firm (Taylor, of Leicester) who subscribe to his book and advertise in its fly-leaves.

In conclusion, the reviewer would sum up by quoting the old proverb *Chacun son métier*, which Mr. Hinton seems to ignore.

R. M. H.

THE LYONS COMBINED DIRECT-CURRENT AND SINGLE-PHASE STREET RAILWAY.

Following what has become common practice in America and has also been occasionally tried in Europe, the Lyons Omnibus and Street Railway Co. have, since the beginning of the year, been operating their extensive lines on the mixed current system using a 600-volt direct-current supply for the central parts of the town, and a 6,600-volt single-phase supply for the outlying districts. In one direction the line extends a distance of 7¾ miles (3 miles direct-current) and another 4¾ miles is to be added later. In the other direction the line is 13 miles long (3¾ miles direct-current) and is to be extended to St. Bremaz, a distance of 37 miles.

Standard gauge rails are employed, and they are bonded with 50 sq. mm. Chicago bonds. The trolley wire is of figure-8 form and 50 sq. mm. in section. It is suspended from a 7-strand steel cable by triple-petticoat insulators tested to 50,000 volts.

Inside the town Mannesman tubular poles with steel arms are used for suspension, while in the suburbs 160 mm. H iron masts are employed, and at stations cross wire bridge suspensions are used.

On the straight the poles are from 35 to 54 m. apart. The poles are supported in concrete and are metallically connected to the rail.

Section cut-outs are introduced at 3 km. intervals. These are in the form of overload oil cut-outs, and are placed in separate small chambers containing also a lightning arrester and an earthing arrangement for use when repairs are being carried out on the section.

The H.T. lines are supplied through two feeders, 2¾ and 4 miles long, from a separate sub-station while the direct-current lines are supplied direct from the town station. The sub-station contains two motor-generator sets each composed of a 300-H.P. 450 rev. 600-volt D.C. motor directly coupled to a 225-K.V.A. 6,600-volt 15-cycle single-phase alternator with exciter attached. One of these sets is sufficient for the normal load. Optical and acoustic signals notify the attendant when the automatic cut-outs operate through short circuits or overloads.

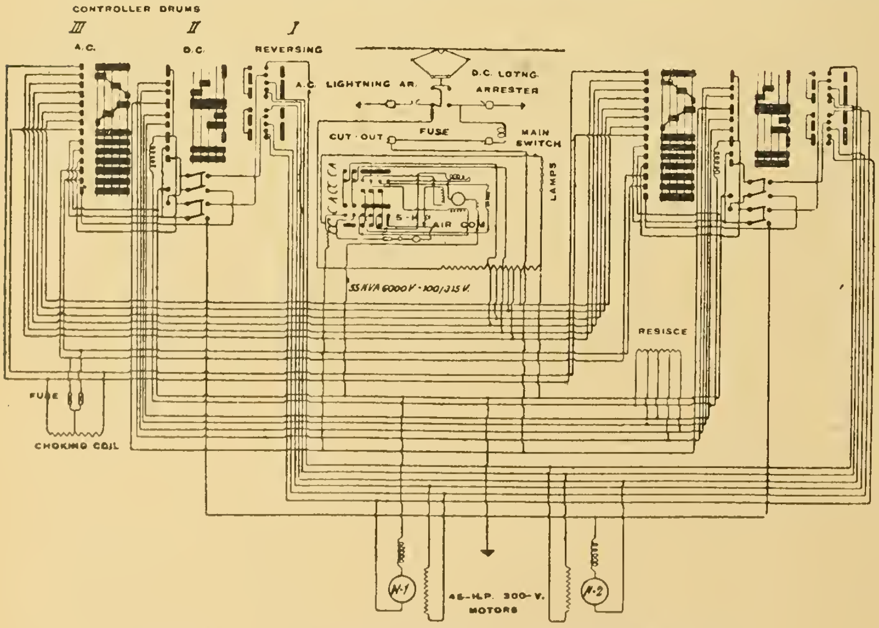


Fig. 1.—A.C.-D.C. Motor Connections, Lyons Street Railway.

The junction points between direct and alternating supply are made dead sections, and an automatic switch on the roof of the car makes the necessary changes in the connections at these points.

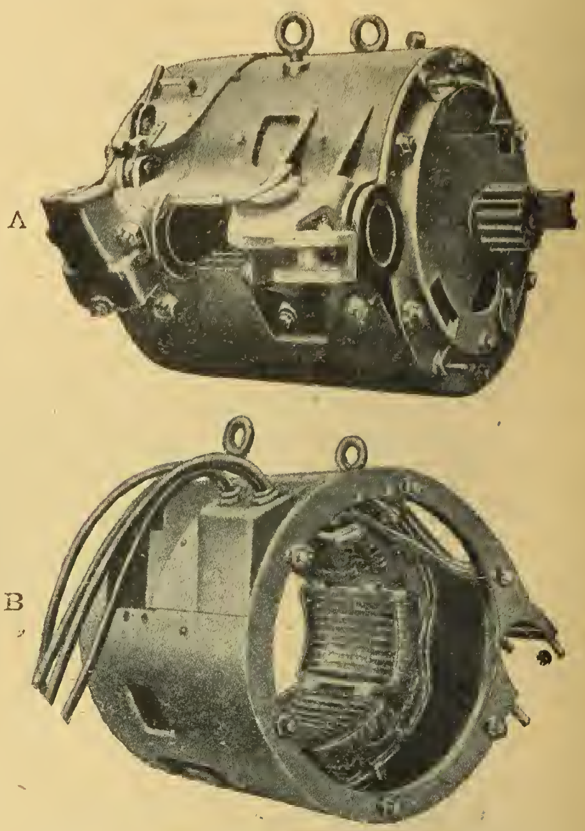


Fig. 2.—Compensated-Series Traction Motor, Lyons Street Railway; A, Complete Motor; B, Stator.

The rolling stock consists at present of three cars on each of the two main sections of line. A 30-minute service is given on one section and an hourly service on the other section, but these are expedited to 20-minute and 30-minute services, respectively, on Sundays and holidays. The maximum speed of the cars is 31 miles per hour and the average speed, exclusive of stops at the end stations, is 15 miles per hour. The cars rest on two two-axle Brill trucks, the gross length of the car is 36 ft. and the breadth 6 ft., the distance between truck centres is 21 ft. and the distance between the two truck-axles is 4 ft. Each car accommodates 50 passengers. The entrance is in the middle and a driver's compartment is arranged at each end. First and second class accommodation is provided.

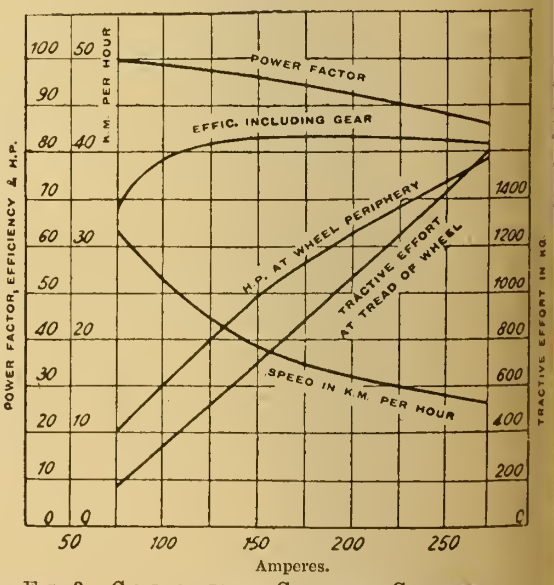


Fig. 3.—Characteristic Curves of Compensated-Series Traction Motor.

The electrical equipment of the cars was supplied by the French Westinghouse Co., and on each car it consists of two 45-H.P. motors, a 55-K.V.A. auto-transformer, two three-drum controller switches the automatic D.C. to A.C. switch, a D.C. lightning arrester and an A.C. one, main switches, cut-outs, resistances, a 5-H.P. D.C. and A.C. air-compressor motor, two trolley wheel collectors for D.C. and a pneumatic pantograph collector for A.C. A diagram of the connections is shown in fig. 1. The motors (fig. 2) are compensated series ones with resistance connections between the commutator and the winding, and they can operate with either 300 volts D.C. or with 300 volts 15 cycles A.C. Each motor drives one of the under-trucks through single-reduction spur gearing. The motor characteristics are shown in fig. 3. When supplied with D.C. the two motors are worked permanently in series, whilst with alternating current they are connected in parallel. The controller used has three rotating drums:—One reversing drum for use with both D.C. and A.C. supply, one drum for speed regulation on D.C. and one for speed regulation on A.C. The regulation with D.C. is effected by means of resistances as usual, whilst, for the sake of economy on the long runs with A.C., the regulation with A.C. is effected by varying the voltage at the motor terminals between 100 and 315 volts by means of the auto-transformer.

Only one controller handle is supplied to the driver. This fits both the D.C. and the A.C. drums and has to be changed from one to the other as soon as the supply changes.—*E. K. and B.*

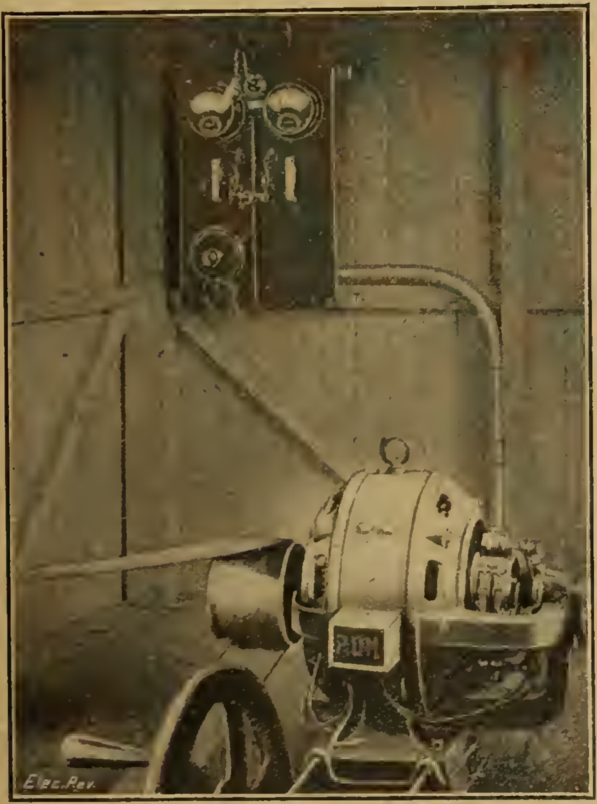
A VILLAGE LIGHTING SCHEME.

Recently we referred to the introduction of the electric light at the old-world village of Grassington, in Yorkshire.

Although only a village of some 500 inhabitants, on the bank of the River Wharfe, Grassington has some claims to township, as it was granted a charter as far back as 1286, and was a market town of some importance up to 50 years ago, with tanning and mining industries.

Grassington stands some 700 ft. above the sea, and it is now recognised as a health resort.

The originator of the scheme for electric lighting was Mr. James Crowther, and to Mr. Charles Pullan, of Bradford, belongs the credit for suggesting and carrying out the actual scheme.



P.D.M. Generator and Main Switchboard, Grassington.

From an electrical point of view, the plant would be uninteresting but for the fact that it is such a small one and for a public supply undertaking.

The prime mover consists of a 26-in. vertical shaft Samson water turbine, capable of developing 30·9 B.H.P. under a working head of 8 ft. of water. The turbine is of the mixed flow type, and with an 8 ft. fall will pass 2,523 ch. ft. of water per minute and run at 175 R.P.M. It is a standard machine of its type, having buckets of heavy flanged mild steel. The centre boss and ring is of cast-iron, keyed to a heavy steel vertical shaft. The guide casing and discharge cylinder is of cast-iron, with all flanges and joints machined and bolted together.

The shaft of the turbine is extended with a length of steel shafting 3 in. dia., on the top of which is a cast-iron wheel fitted with beech cogs and gearing on to a horizontal shaft arranged to run at 250 R.P.M. The spindle for gate gearing is also extended and carried forward into the power house.

Mounted on the horizontal shaft is a cast-iron belt pulley which drives the generator by means of a 6-in. cotton woven belt. The horizontal and vertical shaft bearings are provided with sight feed lubricators, thus enabling the whole plant to run long periods without attention.

The dynamo is of open protected multiple compound-wound type, direct-current, capable of giving an output of 20 KW. at 1,100 R.P.M. and is fitted with commutating poles. The pressure of supply at the consumers' terminals is 230 volts.

The switchboard calls for little remark; it is built up on enamelled slate mounted on teak battens and provided with the following:—Everett, Edgcumbe voltmeter and ammeter, voltmeter key, lamp bracket, D.P. main switch and fuses, and shunt regulator.

Turbo-Generator House; Grassington Electric Supply.

The power house consists of a wooden building with corrugated iron roof, the whole being securely bolted down to foundations. The principal dimensions are 20 ft. long × 9 ft. wide and 7 ft. 6 in. high to eaves with a lean-to, built over the turbine pit to cover the gearing, 8 ft. × 8 ft.

Immediately outside the power house at a point near the switchboard is the terminal pole carrying the main feeder cables, these being 19/15, single braided and compounded aerial cables. These are carried across the river and for a distance of approximately 600 yd. across fields and open country. The poles are the ordinary creosoted stock pattern 30 ft. long, except in one or two special cases, and provided with oak arms carrying insulators.

At a point at the bottom of the village these cables terminate at a distribution board consisting of slate panels mounted on teak battens and fitted with bus-bars, S.P. knife switches and D.P. porcelain handle replacement type fuses to control distribution mains. This board is fitted inside a weatherproof cupboard, on the pole, about 10 ft. from the ground.

The distribution mains from this point consist of 7/14 aerial cables of the same class as the others, and are run, as far as possible, at the back of the houses, so as to be out of sight. Advantage has been taken of the opportunity of using bracket supports on chimneys to do away with poles, where convenient.

From the foregoing it will be seen that the whole distribution system is arranged overhead, and the services will be taken off at the nearest and most convenient points.

The price for lighting is 5d. per unit, and Reason electrolytic meters are used. Power rates for heating, small motors, &c., will be specially arranged between the company and the consumers, as they will be very few. It will be noticed that the plant is of the simplest description throughout, this being necessary for many reasons. In the first place, capital cost had to be kept down to a minimum, and the plant had to be made as simple as possible, not only to reduce wear and tear, but to enable it to be left for long periods without attention; it had to be so designed, and of such a nature, that it will not be necessary for an engineer to be in constant attendance, as it will be readily understood that the revenue accruing from a station of this size will not warrant a large wage bill.

Apart from a guarantee which the engineer has given, Mr. Pullan will act as electrical and general adviser to the company. It is to be hoped that this electricity scheme will be the forerunner of many similar ones utilising streams and rivers in this country with low falls.

The water turbine and gearing were supplied by Messrs. James Gordon & Co., of London; the generator by the Phœnix Dynamo Manufacturing Co., Ltd., of Bradford; the cables by the British Insulated & Helsby Cables, Ltd., of Prescot; and the switchboards by the Midland Manufacturing Co., Ltd., of Birmingham.

SOME RECENT CASES OF INTEREST TO THE ELECTRICAL WORLD.

As we have recently entered upon a new legal year, it may be timely to examine some of the important cases which have lately occupied the attention of the Courts. Cases actually relating to electricity are, of course, few and far between; but there are many decisions which indirectly concern those who consume and supply electricity.

Agreements in restraint of trade often have to be considered by the Courts. An electrical firm which engages a traveller or other servant, naturally endeavours to protect itself against the possibility of such a man entering into competition with them after the end of his time. A covenant providing for this must be reasonable if it is to be enforceable. One case (Leng *v.* Andrews, 1909, 1 Ch. 763) affords an illustration of what is *not* a reasonable covenant. In that case a reporter who had been taken on the staff of a Sheffield paper agreed that he would not, after leaving the service of the paper, "either on his own account, or in partnership with any other person, be connected as proprietor, employé, or otherwise, with any other newspaper business carried on within a certain radius of Sheffield." This was held to be an unreasonable covenant, and therefore void.

A question affecting the supply of the electricity arose in the case of the County of Durham Electrical Power Distribution Co. *v.* Inland Revenue Commissioners (1909 1 K. B. 737). There a supply of electric current was deemed to be a supply of goods rather than the doing of work. The appellants had agreed to supply a customer for seven years with electric current for various purposes at 1d. per unit, with a fixed minimum charge to be paid each quarter. This agreement was deemed to come within Schedule I of the Stamp Act, 1891, and duty was held to be payable at the rate of 2s. 6d. on the aggregate amount of that minimum quarterly payment for the period of seven years.

With regard to telegraphs and telephones, the case of the Postmaster-General *v.* National Telephone Co., 100 L.T. Rep. 659, involved an important point. The question at issue was the extent of the monopoly purchased by the State in telegraphs and telephones some 40 years ago. The respondents' claims would, if they had been established, have knocked the bottom out of the purchase. It was finally held that private lines, such as those from a man's office to his private house, or from a head to a subsidiary office, are excepted from the monopoly; but the class of private line which would connect two or more separate and independent persons or businesses are within it, as are also unlicensed electric signals where no telephone is used.

The legal position of trade unions has been considered in various cases. Thus, in Jones *v.* South Wales Miners' Federation, it was held that an addition to the rules of a union providing for miners' levies for Parliamentary representation was illegal. In another case (Conway *v.* Wade) a union official went to the plaintiff's employer and threatened to call the men out if the plaintiff was not discharged. The employer discharged the man, who promptly sued the officer for damages. The House of Lords decided in favour of the plaintiff, holding that busybodies and outsiders who, in the absence of any trade dispute, interfere with contracts, are liable.

There is one case relating to water supply which is indirectly of great interest to those who supply electricity. The question has often been raised in the columns of the Electrical Review—can an electric lighting company supply electricity to a consumer whose premises are on the boundary of its supply area, and can the electricity so supplied be used on that part of the premises which is without the boundary? This question has been decided in the negative in relation to gas—when it was held that a supply given to a railway company at its terminus could not be lawfully distributed by it to other places along the line outside the area of supply. In the case of Attorney-General *v.* West Gloucester Water Co., it appeared that a water company was authorised to supply a parish. The company agreed to supply a man who was in the next parish, the mains being carried to the boundary, and thence by a pipe laid at the consumer's expense. This was held to be *ultra vires*, the Court holding that supply took place at the place of consumption.

There is one point in the law relating to highways which is often discussed, and which is of interest to large contractors. Where traffic of an "extraordinary" character is led along a highway, the law provides that the cost of repairing the damage occasioned by that traffic shall not be paid by the ratepayers, but by the person responsible for the traffic. Thus, suppose the erection of a dam for a reservoir necessitates bringing hundreds of tons of earth along a road, to the detriment of the hard highway, the person "by or in consequence of whose order" the traffic was conducted, would be responsible for it. The action to recover these expenses must, however, be brought within six months from the date of the completion of the work. It has been held, in a recent case, that this means completion of the whole work.

In the domain of law which governs the relationship of master and servant, there have, of course, been numerous decisions during the past year. The more important of these have been noticed in the columns of the Electrical Review from time to time, but there are one or two which may be mentioned. The following have been held to be "accidents" within the meaning of the Compensation Act. The bite of a cat in a stable—the person bitten being a teamster; a fall from a ladder between a ship and a quay, the victim being a night watchman going ashore to get refreshment. It has been held, however, that a man found drowned in a dock alongside his ship was not the victim of an accident, there being nothing to show that the accident arose out of, and in the course of, his employment.

THE FETISH OF THE STEADY JOB.

A Minor Philosophy.

There has of late years been a wild and undignified rush for the permanent position, and its effect is being felt in every trade and profession. A man has no sooner left college or finished his apprenticeship, than he becomes painfully aware of the difficulties of getting on. It comes to him as a sudden shock like a cold douche, and the reaction is severe and disastrous.

The modern tendency is to avoid hardship, risk and worry at all costs, and the only means of accomplishing this, as it seems to the immature mind, is to obtain some berth where the possibilities of dismissal are rare since the responsibilities are nil, and where there is a prospect of an uninterruptedly quiet life with a pension in the future. Hence the Government job, or a humble post in one of the large firms which never die, is the thing to be aimed at. The excuse for this desire is almost invariably the same—that a man wishes to settle down, which is one way of stating that he wants to put a millstone round his neck.

It is true that such men lead comfortable lives—it is true they have no worries—that they do not want. They speak vaguely about the value of optimism, and they pity the men who fight for their livelihood, but they are the most drear and dismal of pessimists—the real pessimists who, when they predominate, will be the ruin of every country. Incentive is dead within them, therefore they have no ambition, since it makes not the least difference whether they are workers or sluggards—whether they are brilliant or dull. There is a sort of trade unionism in all the steady jobs, particularly those under the Government, which prevents one man from moving faster than his fellows, and yet the very holders of these positions are the first to decry trade unionism, of which they know nothing, while unconsciously exemplifying its most glaring weakness.

It is the outcome of pure cowardice and a failure to appreciate the true object of life which brings about this state of affairs. Is it the aim and end of all things that we should settle ourselves into a comfortable routine, serene in the knowledge that nothing can make any difference to us? Is it the men who act on this principle who count in the world? These queries scarcely need an answer. The whole world's history goes to prove that the man with the steady job has never done anything to aid progress or to play his part in the real evolution of things. Why should he? One must take the world as it is, and not sentimentalise. If a man does not gain personally by any deed of his own he will not take the trouble to do it, and the holder of the permanent position, who knows what his state will be in the next year and in the next twenty years, has no reason to attempt to move out of his groove. He has his hobby—he reads novels, perhaps, and calls himself cultured; he may be a theatre-goer, and think he is literary, or he may even aspire to plentiful visits to picture galleries and deem himself artistic. But he does not count. He leaves the world as he entered it, and has therefore no right of existence.

We have only to examine the history of the rise and fall of nations in the last decade to see immediately the effect of this tendency. The wonderful advance of the United States people in every direction is in reality due to nothing else than the uncertainty of tenure of position—to this metaphorical sword of Damocles which hangs over the head of every man, who knows that any day may find him deprived of his means of livelihood. We call America an enterprising nation, but that is only our old-fashioned way of expressing the fact that the inefficients are being killed off—literally being starved out of existence.

The American has been brought to learn that specialisation is valueless, since he may not be to-morrow where he is to-day; therefore, he becomes self-reliant and afraid to tackle nothing, simply because he knows that if this fear grips him he is lost. Of course, he may make mistakes and fall, but such failure helps the ultimate prosperity of the nation, however disastrous it may be to the individual. To the American, marriage and the "settling down" process are but minor considerations, and the only thing worth living for is work with its consequent advancement, personal in aim but national in importance. It does not make life more comfortable, but it makes it infinitely more interesting and worthy. The Germans are following on exactly the same lines, and to prove that the reverse holds good, we have only to cast a glance at our nearest neighbours. Why is France a decadent nation? Those who delve deeply into the economic conditions of peoples may arrive at all manner of complex conclusions, but the real one in this case is quite elemental. Every French mother—the ruler in family matters—from the day of her child's birth looks forward to nothing with such intense hope as to see her son fixed in some permanent post, preferably under the Government, where his future is as inevitable as the movement of the earth. What chance has the child always tied to apron strings till he reaches manhood when he finds his life a closed book?

Let us look at the matter broadly. Nobody denies, in theory, that self does not count, but that all things should be viewed from their effect upon the final evolution of the universe. Personal comfort, therefore, should not enter into the question, but it does, and we must attain the desired result through some other means, until humanity reaches the stage of sinking the self. This means is none other than that which has been arrived at in America by a natural process. Steady jobs should be made impossible, and all men should fight to their last ounce for their very existence. Some would suffer in the competition, some would fall and be trampled on, but the real men would rise to greater heights untrammelled by the retarding influence of those with no incentive, for it is undeniable that under the present conditions in England the weak can keep back the strong; one need not particularise except to say that the Government, county councils and municipal authorities are particularly bad offenders.

It may be said that this philosophy makes no allowance for mediocrity, of which the majority of the engineering profession is constituted, but the fact is, it has for its aim the annihilation of mediocrity and the production only of supermen. Not that those we now call mediocre would be stamped out, but rather would they rise to the higher state themselves through force of circumstances, since they would have no alternative. Let no man be certain of his position, let him fight every day of his life for what he has, and the nation's progress will be as rapid as if it were composed entirely of those whom we now call great.

A. P. C.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

HONDURAS REPUBLIC.—It is necessary that the exact net and gross weights in kg. should be marked on each package and specified on invoices, bills of lading, and certificates of origin. The net weight of each class of goods should be stated, and information as to the origin of the goods should be given on all documents. Invoices must be made out in Spanish on special forms to be obtained at the Consulates of the Republic in the country of origin. Four copies of invoices must be made out and signed by the Consul of the Republic. A fee of 8s. is charged for invoices of £20 value. Goods are dutiable according to the chief component material without taking into consideration accessory parts of other materials entering therein as ornaments. In case, however, the apparent ornamental part should represent about one half of the total weight of the goods, duty is chargeable on the highest taxed component material. Duties are payable in currency.

Peso currency = about 1s. 8d. Kg. = 2·204 lb.

	Pesos per kg.
Steel wire	·20
Copper and brass wire	·50
Iron and telegraph wire, steel and iron bars, lead pipes	·10
Pottery	·10
Aluminium manufactures	2·00
Chandeliers, crystal	·10
" metal	·20
" gold	10·00
" silver	6 00
Wire cables, boilers and their accessories	·04
Candelabra of crystal, iron or brass	·10
" gold	10·00
" silver...	4·00
" white-metal...	2·00
" gilt	1·00
Caoutchouc, raw	·20
" manufactures not specified	1 00
Copper, unwrought or plates	·10
" manufactures not specified	·20
Street lamps...	1·00
Glass lanterns, reflectors	·76
Gutta-percha manufactures not specified...	·50
Implements for arts and trade	·20
Instruments, scientific	·50
Lamps of all kinds, lamp globes	·20
Chinaware, porcelain manufactures	·20
Rails, axles, wheel tires, mining machinery, turbines, cranes, steam engines, electric motors	·02
Machinery and electric supplies, not specified	·10
Lamp shades...	·70
Lightning conductors	·02
Telephones, telegraphs and their accessories	·10

Note.—To date from August 1st, 1909, it was proposed to admit free of duty machinery and tools for roads, agriculture, mining and industries, machines and materials for railways, tramways, &c., but it is not certain whether these proposals have been put into force, the matter having been left to the option of the Government.

ICELAND.—No import duties are levied on electrical and similar goods on importation into Iceland.

Electrical Contracts for Glasgow Drainage Scheme.—Messrs. Hamilton Bros., of Glasgow, have recently secured an order for 36 of their "W. H." motor control panels for the Glasgow Corporation main drainage scheme, Outfall Works, Shieldhall, Glasgow. Each panel consists of slate, 1¼ in. thick, having ammeter, ironclad switch, bell push, and "W. H." ironclad motor starter mounted thereon. The apparatus on several of the panels has to be damp, dust and gas proof, and all the "W. H." starters are fitted with hinged covers, no asbestos being used in their construction. All the apparatus is of British manufacture throughout, being made at the firm's Edinburgh works.

Messrs. Wright & Wood, Ltd., of Halifax, have recently secured the contract (through their Scottish agents, Messrs. Hamilton Bros., of Glasgow) for several of their direct-current motors, varying in horse-powers from 3 to 30, for the Glasgow Corporation main drainage scheme. These machines are of the firm's totally enclosed type, fitted with split frames and bearings, and auxiliary poles, and are capable of withstanding an overload of 30 per cent. for two hours. The scheme in question is one of the largest, if not the largest, in this country dealing with sewerage, and will be in complete operation early next year.

Canada.—The National Carbon Co., of Cleveland, U.S.A., is going to build a large factory in Toronto for the manufacture of dry batteries and carbon products.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,064. "Improvements relating to electric incandescent lamps." F. H. Hall. November 1st.

25,083. "Improvements in and relating to electric safety fuses." R. Taussig November Ist.

25,096. "Improvements in apparatus for use in the electro-deposition of iron." S. O. Cowper-Coles. November 1st.

25,103. "Improvements in the construction and manufacture of condensers and artificial line for use in duplex telegraphy." A. Muirhead and Muirhead and Co., Ltd. November 1st.

25,112. "Improvements relating to telephonic receivers." E. A. Graham. November 1st. (Complete.)

25,129. "Improvements in or relating to electric signalling systems." H. T. Hansen. (Date applied for under Sec. 91 of the Act, October 3rd, 1908, being date of application in United States.) November 1st. (Complete.)

25,132. "Improvements in and relating to electric switches." W. A. Morse. November Ist. (Complete.)

25,144. "Improvements in or relating to dynamo-electric machines or electro-magnetic power devices." A. Kendal, T. Smith and P. Good. November 1st.

25,156. "Improvements in electrical switches." S. Evered and Evered and Co., Ltd. November 1st.

25,175. "Improved controlling mechanism for electrically actuated apparatus." J. W. Sugden and A. Keiohley. November 2nd.

25,190. "Transmitting apparatus for electric signalling." P. O. Pedersen. November 2nd. (Complete.)

25,204. "Electric vehicles." G. Barker. (H. C. Welsh and H. K. Parkman, United States.) November 2nd.

25,205. "Electric motor and controlling systems." G. Barker. (H. C. Welch and H. K. Parkman, United States.) November 2nd. (Complete.)

25,217. "Improvements in and relating to power generators." C. C. Tuch. November 2nd. (Complete.)

25,236. "Improvements in sparking plugs for internal combustion engines." Firm Robert Bosch. (Date applied for under Sec. 91 of the Act, July 8th, 1909, being date of application in Germany.) November 2nd. (Complete.)

25,273. "Improvements in and relating to electric storage battery separators." Tudor Accumulator Co., Ltd. (Accumlatoren Fabrik Akt-Ges., Germany.) November 2nd. (Complete.)

25,278. "Improvements relating to electric switches." H. R. Schultz and F. B. Holt. November 2nd.

25,288. "Improvements in connection with installations of electric incandescent lamps connected in series." E. Booth and N. R. Booth. November 3rd.

25,296. "Improved method of and apparatus for heating water by electricity." C. Kratt. November 3rd.

25,365. "Improvements in apparatus for operating ships' rudders by electricity." E. C. R. Marks. (Societe Italiana Gio Ansaldo Armstrong & Co., Italy.) November 3rd. (Complete.)

25,373. "Improvement connected with electric arc lamps." L. C. H. Mensing. (Application for Patent of Addition to No. 3,243/04.) November 3rd.

25,383. "Apparatus for soldering the filaments of incandescent lamps," C. G. Redfern. (Compagnie Generale d'Electricite, France.) November 3rd. (Complete.)

25,445. "Improvements in electric fuses." O. Nordentoft. November 4th. (Complete.)

25,449. "Improvements in coupling devices for electric cables." W. T. Henley's Telegraph Works Co., Ltd., and S. H. Penning. November 4th.

25,452. "Wireless train telegraph." G. Lanzarotti and P. Crespi. November 4th.

25,511. "Improvements in and connected with enclosed arc lamps." W. R. Ridings. November 5th.

25,512. "Improvements in and connected with flame arc lamps." W. R. Rinings. November 5th.

25,524. "Improvements in the construction and operation of mechanism for the opening and closing of switch blades on contacts controlling electrical circuits." Callender's Cable and Construction Co., Ltd., and J. C. A. Ward. November 5th.

25,536. "Improved insulator for high-tension electric circuits." Siemens Bros. & Co., Ltd., and W. Dieselhorst. November 5th.

25,541. "Improvements in or relating to magnetic friction clutches." G. von Zweigbergk. November 5th.

25,542. "Improvements in or relating to wireless telegraphy or wireless telephony." Compagnie Generale Radiotelegraphique Carpentier, Gaiffe, Rochefort. (Date applied for under Sec. 91 of the Act, November 13th, 1908, being date of application in France.) November 5th. (Complete.)

25,551. "Improvements in electric switches." J. P. Jakobsen and H. F. Jensen. (Date applied for under Sec. 91 of the Act, August 11th, 1909, being date of application in Denmark.) November 5th. (Complete.)

25,572. "Improvements relating to fire preventing devices for electric lighting, heating, or other installations." S. R. Evans. (Application for Patent of Addition to No. 21,308, 1906.) November 5th.

25,574. "Improvements in electric gas lighters." F. F. Dier and W. C. W. Whitcher. November 5th. (Complete.)

25,577. "Improvements relating to electrical wiring systems." A. E. Woodhouse. November 5th.

25,581. "Improved protector for the mouthpieces of telephones and the like." D. Gestetner. November 5th.

25,586. "Improvements in and or connected with electric driving." E. R. Elliston and H. Marryat. November 6th.

25,629. "Improvements in the control of vehicles employing electrical transmission of power." J. W. Burleigh. November 6th.

25,639. "Improved means for effecting telephonic communication without connecting wires." H. G. Matthews. November 6th.

25,659. "Improvements in printing telegraph receivers." Siemens and Halske, Akt. Ges. (Date applied for under Sec. 91 of the Act, November 12th, 1908, being date of application in Germany.) November 6th. (Complete.)

25,668. "Method of and means for operating electrical switches or other devices on three-wire systems." F. Fernie. November 6th.

Radium.—The Austrian Government has received a considerable quantity of radium in an impure condition from Joachimsthal. The process of purification will shortly be completed, when at least a gramme will be available for public purchase. Preference will be given to Austrian subjects. A Radium Institute is being built in Vienna.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Insulating Process for Electrical Machines. A. J. Boult. (Felten and Guilleaume Lahmeyerwerke Akt.-Ges.) 19,263. September 14th. (Rights under Sec. 91 Patents Act, 1907, not granted.)

Electricity Rectifiers. T. J. Murphy. 21,366. October 9th.

X-ray Tubes. E. P. Rittershause and G. Bautze. 21,577. October 12th.

Apparatus for the Electro-Deposition of Metals. T. A. Smith and T. Deakin. 21,687. October 14th.

Apparatus for Limiting the Supply of Electrical Energy. G. Wilkinson. 21,779. October 15th. (Post-dated October 16th, 1908.)

Distribution of Electricity by Means of Transformers. J. D. Annacker. 21,955. October 16th.

Method of and Apparatus for Compensating for Variation of Current due to Variation of Resistance arising from Changes of Temperature in Windings such as Field Windings of Dynamo-Electric Machinery, Solenoids, and the like. W. Stansfield and J. J. Hatt. 22,159. October 20th.

Control of Marine Electric Steering Gear. B. Parker-Haigh. 22,880. October 28th.

Automatic Switch for Electric Batteries. Nalder Bros. & Thompson, Ltd., and F. H. Nalder. 23,118. October 30th.

Means for Draining Manholes of Electric Conduit Systems. D. Livingstone and A. J. Smith. 23,716. November 5th. (Date applied for under International Convention, November 5th, 1907.)

Secondary Electric Clocks. T. J. Murday. 24,583. November 16th. (Date applied for under Rule 13, October 27th, 1908.)

Controllers for Electric Motors. A. West. 25,721. November 28th.

Safety Devices for Polyphase-Current Machinery. J. M. S. Fontecha. 26,274. December 4th.

1909.

Electric Ignition Devices. W. A. Trier. 7,299. March 26th. (Cognate application 8,422 of 1909.)

Alternating-Current Dynamo-Electric Machines. Siemens Schuckertwerke Ges. 9,048. April 16th. (Date applied for under International Convention, June 25th, 1908.)

Electric Terminals. C. J. Beaver, J. Stratton, W. Shaw and E. A. Claremont. 10,539. May 4th.

Jointing of Electrical Conductors. C. Vernier. 15,413. July 1st.

Hygienic Guard for the Talking Funnels of Telephone Apparatus. E. Sand. 16,912. July 20th.

Telephone Systems. Siemens & Halske Akt.-Ges. 16,928. July 20th. (Date applied for under International Convention, August 20th, 1908.)

Electric Transformers and Distributing Mechanism for Sparking Devices. G. D. Rogers. 16,913. July 20th. (Date applied for under International Convention, August 7th, 1908.)

Insulators for Telegraph, Telephone and like Wires. A. M. Bourke. 18,690. August 13th.

Dynamo-Electric Machines. F. R. Kunkel. 19,394. August 23rd. (Date applied for under International Convention, September 8th, 1908.)

Electrical Ignition for Internal-Combustion Engines. J. O. Bell. 195. January 4th.

Electric Traction Systems. E. H. Munro and Railless Electric Traction Co. 1,078. January 15th.

Telephone Apparatus. A. J. Boult. (International Telchromometer Co.) 1,548. January 21st.

Electric Ironclad Switches. T. Birchall. 1,67. January 23rd.

Vapour Electric Apparatus. A. Audibert. 1,706. January 23rd.

Electrical Relay. M. S. Conner. 5,145. March 3rd.

Automatic Electric Generating Systems. M. A. Newstetter. 10,198. April 29th.

Electroplating Apparatus. R. Walker and W. C. Pinson. 12,482. May 26th.

Signalling Installations having Optical and Acoustic Apparatus. Siemens and Halske Akt.-Ges. 14,213. June 17th. (Date applied for under International Convention, June 23rd, 1908.)

Curtis Turbine Used as Regulator.—In an article in our contemporary, the *Journal of Electricity, Power and Gas*, Mr. W. J. Davis, mentions that an interesting example of the effectiveness of a Curtis steam turbine when used as a regulator on a large power system, is found in the new Oakland power house of the Pacific Gas and Electric Co., of San Francisco. The installation consists of a 9,000-kw. vertical type Curtis turbo-generator, manufactured by the General Electric Co., eight 750-h.p. McNaull water-tube boilers, and a Worthington condenser outfit having a cooling surface of 20,000 sq. ft. The 60,000-volt transmission system of the Pacific Gas and Electric Co. entering Oakland is delivering more than 100,000 kw. during maximum demand. Of this amount, 20,000 kw. maximum is supplied to Oakland and the immediate vicinity, the load factor being about 60 per cent. While the new plant is of great value in carrying the local peak load during hours of maximum demand, it is almost continuously kept connected to the transmission system on account of the steadying effect on the voltage and consequent improvement in the lighting service. When acting as a regulator, the duty is especially severe, the turbine taking sudden momentary swings in load from 500 to 9,000 kw. In a way, the action of this turbine on an alternating-current system is equivalent to that of a large storage battery on a direct-current system. The ability of the Curtis turbine to successfully take these sudden fluctuations in load is due to the large fly-wheel effect (about 10 times that of a reciprocating engine of equal capacity), close speed regulation, large radial clearances between moving and stationary steam-using elements and sturdy mechanical construction. This use of a Curtis steam turbine is particularly interesting on account of the high economy obtained under varying load. Even when the turbine is operating as a regulator, the overall economy of the plant is exceptionally good.

THE
ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE PRESENT ASPECT OF ELECTRIC LIGHTING.

THE paper on the above subject, read last night at the Institution of Electrical Engineers by Messrs. Handcock and Dykes, is a further contribution to the problem of how to charge for electric lighting, with special reference to the supply of small houses.

The authors believe that the flat-rate system has failed to meet the new conditions which have resulted from the improved lamp, and they put forward data showing the difficulty of securing an adequate return upon the capital invested in the case of small consumers and free-wired installations. They maintain, however, that by the adoption of a suitable method of charging this can be done, and, further, that the field at present occupied by gas can be successfully invaded. On the face of it, it is only reasonable to anticipate that so marked a reduction in the cost of lighting by electricity should immediately facilitate the substitution of electric light for gas on small premises.

The Electric Lighting Act is elastic as to methods of charging, the only real limitation being in the maximum rate which is governed by the fourth schedule of the Provisional Orders; under its first section the rate is usually fixed at 8d. per unit, with the right of charging a minimum for any amount of energy consumed up to 20 units. In practice these limits are rarely put in force, the flat rate charged being generally much below this maximum, and the minimum charge frequently abandoned to meet the objections of consumers, who dislike paying for what they do not receive.

Under the Electric Lighting Act of 1882, Clause 18 expressly provides that the suppliers of electricity "shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way to control or interfere with the manner in which electricity supplied by them under this Act is used"—provided that it does not interfere with the supply to other users; and under Clause 20, no undue preference may be shown between one customer and another. To raise the price of energy simply because of the greater efficiency of the metallic-filament lamps would be unwise, as we pointed out in our issue of March 12th last.

Of course, much is to be said in favour of a system which equitably provides for dealing with the long-hour consumer, and Wright's maximum-demand system went far towards meeting the case; but the failure of the public to understand it has made it difficult of application. If the electric lighting accounts had been collected half-yearly so as to avoid the discrepancy between the winter and summer accounts, instead of quarterly, when the summer quarter's excessive charge for a small consumption created dissatisfaction, probably there would have been less complaining.

Messrs. Handcock & Dykes suggest other methods of charge, based upon certain fixed prices per lamp per annum, and propose two systems which they distinguish as the "Contract" and the "Contract Demand," practically designed to secure a guaranteed revenue from the supply of energy, irrespective of the quantity consumed.

The Norwich system of securing a certain revenue, based upon the rating value of the houses instead of the maximum demand, and charging a flat-rate (in addition to the fixed assessment) of 1d. per unit for all purposes, is said to have worked very well, and Mr. Long, the inventor, has expressed his satisfaction with the results obtained. It is doubtful, however, whether it could be generally applied. The rating value of houses depends upon their position in the town; in some cases premises consuming the same amount of electricity and having the same maximum demand may be rated at half as much as others in more desirable areas, and to charge one resident nearly double the price for his energy, because he pays double the amount of rates, cannot be justified.

A charge of so much per lamp per annum is another method referred to, but this also is wrong in principle, as some lamps will be used for much longer periods than others; besides, the facility for changing them from one candle-power to another, at the will of the consumer, is another practical difficulty. On the other hand, the supply authority, and not the consumer, would be the loser if the contract were not observed in the spirit, and therefore this system is free from the objection that it differentiates inequitably between consumers. Seeing that, in a small installation of metallic-filament lamps, the standing charges for supply bulk so largely compared with the small cost of producing the energy supplied, it cannot be denied that the arguments in favour of this system have been greatly strengthened by the new conditions.

In order to avoid the tendency to limit the number of lamps installed, the authors, as in their former paper, suggest the use of a device setting a fixed limit to the number of lamps in use at one time, but leaving the number installed uncontrolled, and they propose to charge the full contract price only for the former, while making a small charge for each of the latter, assuming them to be wired by the supply authority. This constitutes the "Contract Demand" system.

In both cases the cost of the meter is avoided, and a single service could be used to supply a whole block of the small houses that the authors have under consideration.

For larger houses, the ordinary systems of charging by meter are not likely to be displaced; after all, there is nothing so readily understood by the public as the flat rate system of paying so much per unit as recorded on the meter. This is what the public have been accustomed to in paying for their gas, and although probably very few people ever look at their meters, which are installed in cellars and out-of-the-way places, they are satisfied, because the system is readily understood.

Another principle suggested by Messrs. Handcock and Dykes is to charge for *light* and not electrical energy. Thus they propose a sort of lump-sum charge for lighting a house, including the wiring and supply of lamps. Of course, the obvious objection to such a system is that the charge must be based upon the *possible* consumption of energy, and not upon any general average of ordinary usage; probably, in practice, people would not, as a rule, keep lamps burning day and night, or have an excessive brilliancy of illumination simply because it cost them no more, but there would be nothing to prevent their being very long-hour and extravagant consumers at the expense of the lighting station.

Apart from the consumption of current in the new lamps being so small, another important feature is their longevity, which far exceeds that of the best carbon lamps, thus securing for the consumer a greater economy than was contemplated when they were first introduced. This is a most important point, when comparing the electric light with that of the most up-to-date gas mantles. The metal-filament lamps are found to last as long as 2,000 hours, *without any material reduction in the light*, whereas the incandescent gas mantles deteriorate within a few weeks of being installed and require frequent renewals. The public appear to be grasping the new conditions, and the prospects of the electric lighting companies are therefore rapidly improving.

COPPER.

Although the price of copper cannot be considered high, it remains a subject for surprise that it does not exhibit a marked tendency to go lower. The visible supplies, as shown by Messrs. Merton's circular for November 15th, have now surpassed the 100,000 tons anticipated in these columns, and reached the figure of 102,952. Deliveries, on the other hand, are, if anything, low, being only 28,025 tons for last month, and 16,018 for the first half of November. American demand is reviving, as evidenced (amongst other indications) by a re-shipment of 50 tons, but buyers in this country still hold off, on the principle, apparently, that the market is not weak, and, if approached by two or three well-known buyers, would promptly respond by an increase in price.

The various financial papers are exercised by rumours of an extensive combination, but, as yet, can give no certain information on the subject. Obviously, if such a combination exists, it is not working with quite the smoothness desired by "bull" operators. One would have expected the market to decline slowly but firmly to something lower than the present value, finishing up with a "slump" to favour the extensive buying operations to precede the rise. This does not appear to be so easy to manage as formerly. But, if nothing of the kind is in progress, why these continually increasing visible supplies fed into the innocent and trusting European market? It cannot be supposed that the control is anywhere but in the hands of the largest producer. We must fall back upon the theory of divided interests.

The *Financial Times* is rather inclined to support this view. In an article of November 4th on the outlook, the writer says, "Undoubtedly there are interests that would like to bring about an agreement for the 'betterment of the industry,'" but it is difficult to see how the opposition of the Guggenheims, the Calumet and Hecla and other producers who persist in selling their copper for what it will fetch on the market as fast as it can be produced, can be overcome. Again, "The new low-grade mines in Nevada, Utah and Arizona, which are being rapidly developed, are mining at a cost of 9 cents per lb. or less, and they are not likely to restrict their earning capacity out of consideration for their older competitors." This latter argument does not persist if the cheap producer gets his own terms in a combination, surely. Here, however, we have a summing up on the side of continued low prices.

Later, November 16th to be precise, the same paper tells us that reports were freely circulated (in the States) that an agreement had been reached to make a combination with a capital stock of a billion dollars, which would embrace practically all the producing copper interests; further, that these reports were emphatically denied. The report alluded to, the *Financial Times* explains later, asserts that a combine is to be formed on the same basis as the United States Steel Corporation, and that the combination will include all the big producing mines, that all the large producers will agree to sell through one agency and eliminate price-cutting, and that the Rio Tinto and Calumet and Hecla companies will join the combine. The information which the paper endeavoured to secure on the subject was necessarily rather vague, but pointed to the inception of such a combine, although inclined to the opinion that the Rio Tinto and some of the cheaper producers were at present holding out.

The *Financier*, in an article in their issue for November 4th, attributed the present price to excessive production during the last two years. This article did not consider that a combination could be attended with results satisfactory to the producers, and was inclined to anticipate a continuance of moderate price. On the 10th, the *Daily Telegraph* correspondent published a fairly assured intimation that the combination was in progress. "Unofficial statements," says this report, "say that the companies certain to be in the merger, include the Amalgamated Copper Co., the Cole and Ryan properties, the Phelps and Dodge interests, and the Guggenheim interests, and, perhaps, also the Calumet-Hecla Co., though the latter has thus far declined to enter into negotiations."

On the 13th inst. the *Financier* announced that the Arizona Copper Co., the only American copper company controlled in this country, had been approached on behalf of the combine, and that the chairman was about to leave for New York, in order to conduct negotiations on the spot. This notice gave as the moving spirit Messrs. J. P. Morgan & Co., with the Cole-Ryan interests, and, consequently, the Amalgamated Copper Co. The leading European mines were not to be included. This news as to the Arizona Copper Co. also appeared in the *Times* of the 15th.

In commenting on the situation on November 17th, a writer in the *Financier* says: "Though still lacking official confirmation, the report that steps are being taken to establish a great combine of American copper producers may be accepted as substantially correct." This article does not anticipate that an American combination could control the market to its own satisfaction. Any advance in prices would be followed by increased production in the free European mines.

In the face of this evidence there can be little doubt that a combination is being attempted, cautiously, and, therefore, with more chance of satisfactory agreement and strength. Such an organisation can hardly fail to have an influence on prices, in the upward direction, especially when first officially announced. From the slowness with which it is being effected, and the apparently premature announcement of its existence, it would seem that many important firms are holding off, and, under these circumstances, a serious position for the consumer need not be anticipated. If he can contrive to hold off at the present price, he will find some mode of existence which will not force him into the market at a higher one.

Publicity. In our last issue we advocated the reform of procedure at Institution meetings. Another matter on which we wish to comment is of less general interest, as it relates only to the Institution of Civil Engineers and its attitude towards the technical Press. We refer to the strict rule of the Institution which forbids the publication of papers and discussions except in its own *Transactions.* In this respect the Institution of Civil Engineers stands alone and aloof. We may not even publish a condensed report of the proceedings at its meetings; we are permitted only to reproduce an official abstract of a paper, which usually is confined to the heads of discussion, and is remarkably free from useful and interesting data. A notable example of this practice occurred in our last issue; three interesting and valuable papers on electric railway traction were read before the Institution on the 9th inst. (they were not then discussed; as pointed out by a correspondent, there was no time), and on Tuesday last week they were discussed—but the reproduction of the official abstracts, of which we gave the gist, was the extent of our privileges. We do not for a moment question the right of the Institution to avoid publicity in this way; it is fully entitled to hold its meetings *in camera*, and to conduct its proceedings in secrecy—if its members so desire.

It may be that the Council believes that by this means engineers will be forced to become members, in order to receive the papers and discussions *in extenso.* We doubt, however, whether the members as a body are in favour of this course; the views of the Council are not necessarily those of the members, and may in fact be diametrically opposed to them.

We question also the wisdom of the procedure; there was a time when close corporations, guilds and secrecy were the rule—but publicity is the key-note of the present day, and that "it pays" is well exemplified by the phenomenal growth of the Institution of Electrical Engineers, which has nearly doubled its membership in ten years, shows no sign of approaching a limit, and at no distant date will certainly exceed in numbers the Civil Engineers, which, indeed, is the only Institution of the kind possessing a larger membership.

There are signs of an awakening in the counsels of the Institution, which may bring about a reform in this as in other directions. We admit that our attitude may be regarded as biased in the interests of our readers; on the other hand, the whole of the technical Press would share in any extension of privilege, and we firmly believe that the removal of the present restrictions would prove advantageous not only to the ordinary engineer, but also to the Institution itself.

Gas v. Electricity. It is interesting to note that gas engineers are beginning to imitate, so far as they are able, the example of electrical engineers in hiring out lamps. Mr. H. N. Clark, of West Ham—where he has found the competition of the electricity supply department particularly keen—read a paper on the subject at a recent meeting, which was reproduced in the *Gas World* on November 6th; from this we learn that a two, three or four-burner gas lamp is rented at a rate of 6s. per quarter, the net profit being 5s. 6d. at the end of four years (if the lamp lasts so long) plus the profit on the gas supplied. No allowance is made, so far as we can see, for interest on capital, which would swallow up the small profit hoped for.

For £2 1s. per quarter the Corporation supplied (and fixed) a flame arc lamp, including energy for burning 800 hours. As the cost of the gas is not stated, we cannot further compare the rival schemes; but the fact that the gas people are following the electrical example is a good sign—a sign that they are "feeling the draught." Attempts have been made also to evolve illuminated gas signs, which have "attracted much attention" and "produced many inquiries," but apparently are in use only at the gas company's showrooms. In this department electricity is so obviously paramount, that we can only wonder at the temerity of the gasicians in trying to invade the field.

For high-pressure gas lighting, Mr. Clark, with admirable taste, recommends the electrically-driven blower as a stand-by, lest the gas-driven blower should fail. But why put in the latter at all?

Criticising the electricity department, the author states that a 50-C.P. Osram lamp is rented at 4s. 9d. per quarter, including the supply, fixing and maintenance of wiring, and energy at 1¼ watts per candle. At 3d. per unit, the energy costs 15s., leaving 4s. to cover maintenance, renewals and installation charges, a sum which he regards as absurd, unless maintenance is free. But the useful life of Osram lamps averages far more than 1,000 hours; moreover, the cost of supplying lamps which are used 1,000 hours per annum is not nearly 3d. per unit, so that the cost of energy is much smaller than he estimates. The cost of maintenance of an installation of wiring and fittings, of sound workmanship and material, is so small as to be practically negligible, and interest and depreciation on the cost of the installation are readily covered by 1s. per lamp per annum. There is, therefore, no reason to suppose that the rate does not return a reasonable profit.

In several places, we gather from the discussion, the maintenance of gas burners is being undertaken free of cost for labour, only materials being charged for; Mr. Clark admitted that they must look to the inverted gas burner to enable them "to maintain the premier position," and that it was "a little less easy to manipulate" than the upright type—hence the free labour.

One speaker was surprised that an electric stand-by should be suggested, and pointed out that the high-pressure installation in Fleet Street was worked without the aid of electricity. Four engines are used, as it appears, *one at a time.* The stand-by, therefore, is three times the size of the running plant. Comment is needless.

THE REES ROTURBO CENTRIFUGAL PUMP.

The centrifugal pump, although an old type (that is to say, it became a practical machine between 1845 and 1850), had great limitations for the first 50 years of its existence, its defects being low efficiency, and the few conditions to which it could be applied. Until about ten years ago it was generally agreed that centrifugal pumps were only suitable for low lifts and large volumes of water—such as occur in irrigation, sewage and salvage work, and for circulating water for condensation.

The whole theory of the centrifugal pump was, however, worked out for the early designers before the conditions of engineering could allow it to be fully applied, and Prof. Unwin's paper before the Civil Engineers in 1877-8, giving a complete review of the knowledge up to date, is still, and is likely to remain, a standard work on centrifugal pump design.

The enthusiasm of the early designers and their conviction that the centrifugal type should not be limited to a few of the problems in the pumping world, is shown by the patents taken out in the attempts to overcome the well-known difficulties, and to make the centrifugal suitable for high lifts by using a number of impellers in series.

No doubt the delayed development was due to the fact that to get the best results on a centrifugal pump, impellers should be of small diameter running at a high speed, rather than of large diameter running at a low speed, but until the advent of the electric motor there was no means of driving centrifugal pumps at the necessary speeds except by means of belting or gearing, and to gear up from a slow speed steam engine to the 1,600 or 2,000 revolutions, or even higher speed sometimes desirable on a centrifugal pump, created difficulties and losses in transmission which neutralised the advantages aimed at in the design of the pump.

The reason for the high speed lies in the fluid friction of the revolving impeller. The head which a centrifugal pump will work against increases as the square of the peripheral velocity, that is to say, the most economical head is approximately $\frac{v^2}{2g}$, v being the peripheral velocity of the impeller in feet per second. This peripheral speed can be attained either by a small impeller running at a high speed, or a large impeller running at a low speed, but as the impeller is running in the fixed casing of the pump, and is surrounded by water, there is a certain amount of friction between the revolving disk and the water in the casing, which is a constant quantity whether the pump is discharging water or running on a closed valve. As impellers are increased in diameter, this fluid friction increases at a much greater rate than the increase of head. Stated briefly, for a given speed of rotation, the head, or height of lift, increases as the square of the diameter, but the fluid friction increases approximately as the fifth power. This law is quite sufficient to account for the fact that the centrifugal pump began a fresh development when electric motors came into general use, and is the reason of the improved efficiencies which then became possible. The old arrangement of impellers in series was revived so as to give higher lifts, and the centrifugal pump became a strong competitor of the ram pump for conditions which used to be looked upon as only suitable for reciprocating pumps.

Perhaps the defect which has been the most difficult to overcome, and which has decided the buyer in many cases against this type of pump, has been the fact that it would only work at its best at the exact head for which it was designed, the reason of this being that the blades of the impeller were shaped so as to pass a certain amount of water with the minimum friction or loss due to cavitation; but if the head against which a centrifugal is working is reduced, a greatly increased volume of water passes, and the impeller then becomes unsuitable for the increased speed of the water through it, and begins to act as a water brake, the power on the driving machine being increased very greatly. Large numbers of motors driving centrifugal pumps have given trouble, or been burnt out (if they had not a large margin of power), due to the overload created by an unsuitable head against the pump.

These conditions were well known, and it was attempted to overcome them by bending the blades of the impeller in a rearward direction, so as to reduce the brake effect, but in Unwin's paper the effect of this re-curvature is very clearly shown, in that the speed of the impeller has to be increased to compensate for the slip of the water, and beyond a certain amount of re-curvature the *capacity* of the pump is very greatly reduced, and the internal friction of the impeller increased.

Our illustrations of the Rees Roturbo pump shows one of the latest type of centrifugal pumps, in which the problem of varying heads is completely solved. In this pump, the departure from the ordinary practice is in the impeller, which, instead of being built as a flat disk with recurved blades is in the form of a drum, with large internal capacity to secure a constant internal pressure which is independent of the head (see fig. 7).

The inner portion of the impeller between the eye and the largest section of the pressure chamber which is near the rim may be looked upon as a centrifugal pump proper, and the blades in this portion of the impeller are designed as in an ordinary centrifugal pump. The rim portion, beyond the pressure chamber, is designed as a reaction turbine, having rearwardly directed nozzles discharging from the pressure chamber.

The impeller, therefore, becomes a pump and a turbine in series, with a pressure chamber between the two portions. The pump portion is, therefore, always discharging *into* a constant pressure, which is the ideal condition for a centrifugal pump, and the turbine is always discharging *from* a constant pressure, which is the ideal condition for a turbine.

The result of the combination of pump and turbine, with pressure chamber between them, is that the self-regulation is perfect, and at any head lower than the normal duty, the power taken by the motor is prevented from rising.

As the speed of the water in passing through the pressure chamber is reduced, internal friction is reduced to a minimum, and a high efficiency is secured without the necessity of machined or polished blades or surfaces. It is claimed that internal wear is also minimised.

In practice it is found with this type of pump, that the highest efficiency point is at a duty in which the speed of the water issuing from the turbine blades is about half the peripheral speed of the impeller, consequently, the resultant speed up the cutwaters in the fixed casing is also only half the peripheral speed of the impeller, this being the reason given for the reduced wear when pumping gritty water.

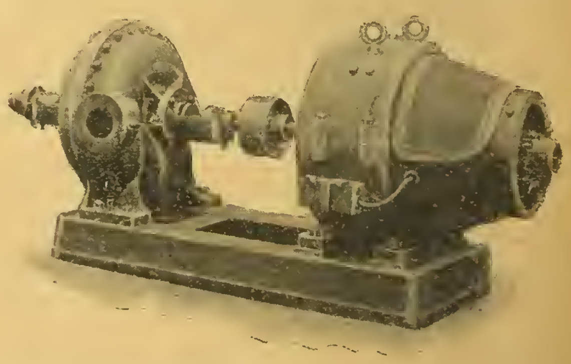


Fig. 1.—Motor-driven Fire Pump, Bengal Nagpur Railway

The illustrations show examples of these pumps for a wide range of duties. Fig. 1 shows a motor-driven pump, one of several supplied for fire purposes to the Bengal Nagpur Railway, to the specification of Sir John Wolfe Barry.

The motor is of the Rees Roturbo continuous-current gapped-frame type, from which the armature can be removed by a vertical lift on removing the top half of the magnets.

Each pump is capable of dealing with 48,000 gallons an hour, to a total height of 160 ft. The pumps supply water to systems of water mains for fire purposes, and are so designed that the pressures are maintained within a margin of 15 per cent. from full delivery to no delivery, when all valves are closed.

Fig. 2 is a boiler feed-pump for the Chester Corporation, also driven by a Rees Roturbo continuous-current gapped-frame motor. The pump impellers are 8½ in. diameter, and the water passes through eight pressure chambers in series.

The boiler pressure against which the pump is designed to work is 175 lb. per sq. in., the speed of the set being 1,725 to 1,625 revolutions, the lower speeds being arranged for speed regulation if desired for lower duties.

The duties, with the efficiencies guaranteed, were as follows:—2,000 gallons an hour, 40 per cent. efficiency; 4,500 gallons an hour, 48 per cent. efficiency; 6,500 gallons an hour, 60 per cent. efficiency.

Fig. 3 is a curve of the actual performance of the pump, in which it will be seen that the guaranteed efficiencies were exceeded.

Fig. 4 is an interesting example of a centrifugal pump at a comparatively low speed—namely, 925 R.P.M., the high efficiency of over 84 per cent. attained in this case being due to the fact that the volume of water was sufficient to enable the pump to be designed for a high lift on a single impeller, and the fluid friction on the impeller, although 25 in. in diameter, was a small proportion of the total power absorbed by the pump.

The duty of the pump is 150 ft. lift, 132,000 gallons an hour, when running at a speed of 925 R.P.M. The impeller is 25 in. diameter, and the diameter of the pipe, 12 in.

The actual efficiency tested under stringent contract conditions was 75 per cent. from *electrical* H.P. to water H.P. at the normal duty, giving an efficiency of 84 per cent. from *brake* H.P. to water H.P. The curves of the performance of this pump, shown in fig. 5, are typical of the Roturbo design.

Starting from the specified duty point—namely, 132,000 gallons and 150 ft. head, the power is reduced from 120 H.P. to 54 H.P. as the water is cut off (by screwing down the valve), but to the right of the curve, where the valve is opened so as to reduce the head against which the pump is working, the volume of water is increased to 200 per cent. of the normal, showing that there is no throttling in the pump, and no reduction of capacity.

The characteristic of the pump is shown in the power curve, which, instead of rising at the lower heads, is actually reduced from 135 H.P. to 105 H.P., due to the turbine effect of the impeller.

The last two figures (6 and 7) show a 150-B.H.P. vertical-spindle sewage pump, one of four pumps supplied to the sewage outfall pumping station at Trowse, Norwich. The particular pump is driven by a 440-volt electric motor, as shown, and is arranged for automatic starting and stopping during the night. Each pump has a capacity of 2,800

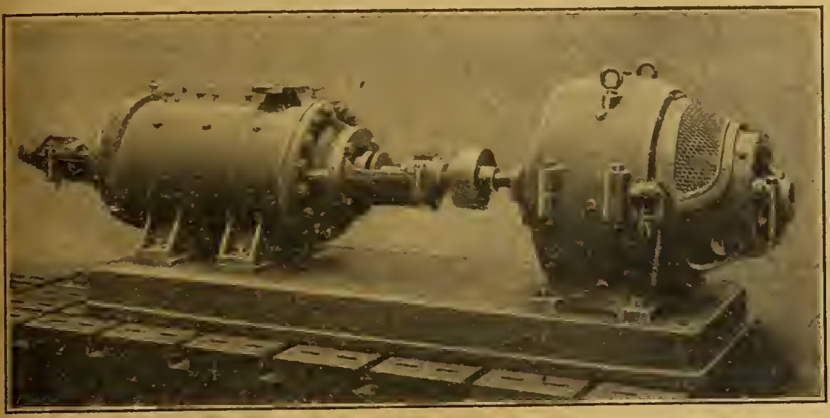


Fig. 2.—Rees Roturbo Boiler Feed Pump, for 175 lb. pressure.

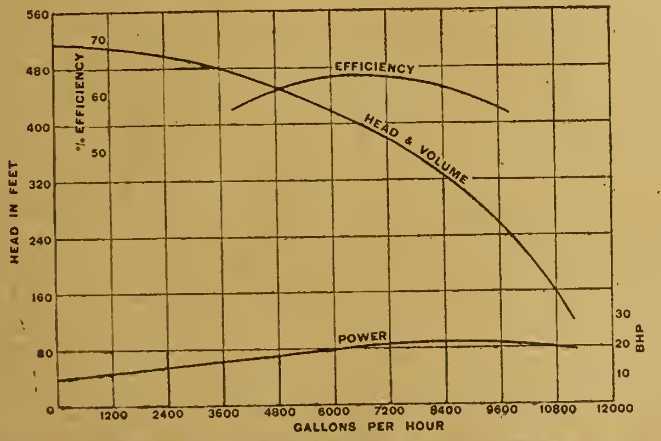


Fig. 3.—Efficiency Curves, Rees Roturbo Boiler Feed Pump.

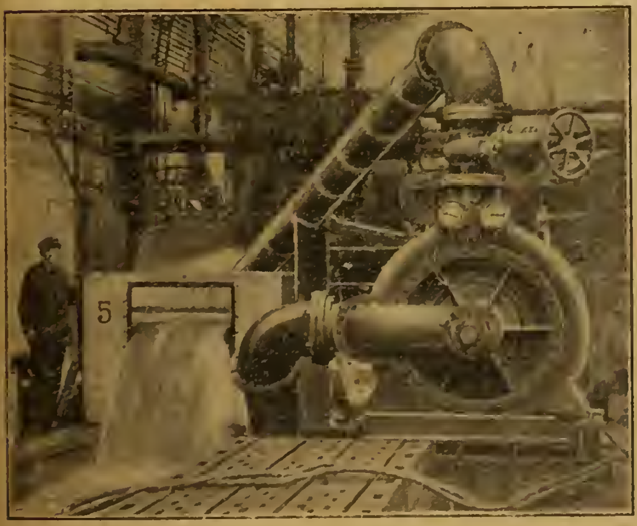


Fig. 4.—Low-speed Rees Roturbo Pump.

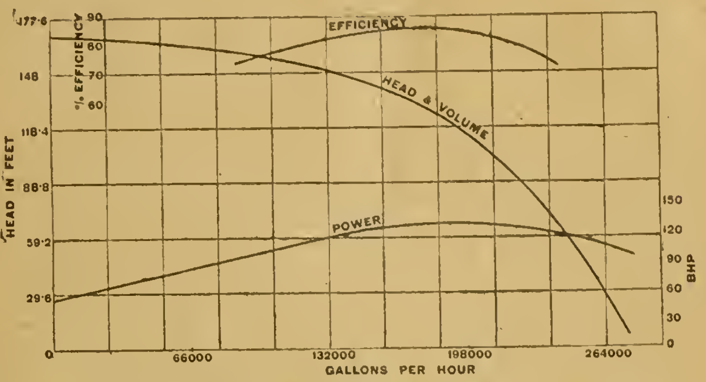


Fig. 5.—Efficiency Curves, Low-speed Rees Roturbo Pump.

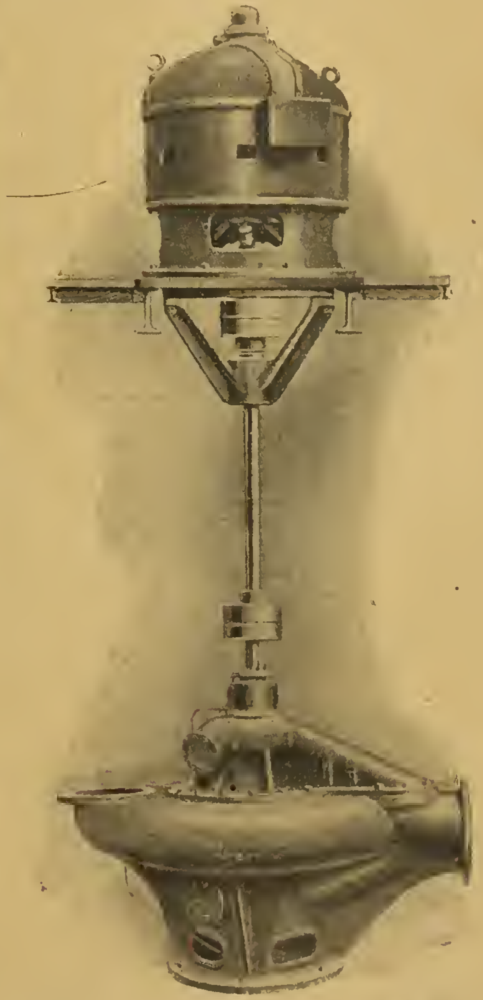


Fig. 6.—150-B.H.P. Roturbo Sewage Pump.

gallons per minute at a maximum total head (including friction) of 117 ft., and is designed to deal with a variation of head from 117 ft. to 94 ft., the volume of water increasing inversely as the head.

The guaranteed normal efficiency of the pumps was 70 per cent., but an efficiency of 78 per cent. was obtained at the makers' works.

Fig. 6 shows pump and motor complete, and fig. 7 shows the pump with the cover removed and pressure chamber lifted.

Having once secured the high efficiency and the self-regulation, the modern high-speed prime movers in the shape of electric motors and petrol engines remove the limitations of the centrifugal pump entirely, and our present illustrations show that there are few conditions of pumping which the modern centrifugal is not perfectly fitted for.

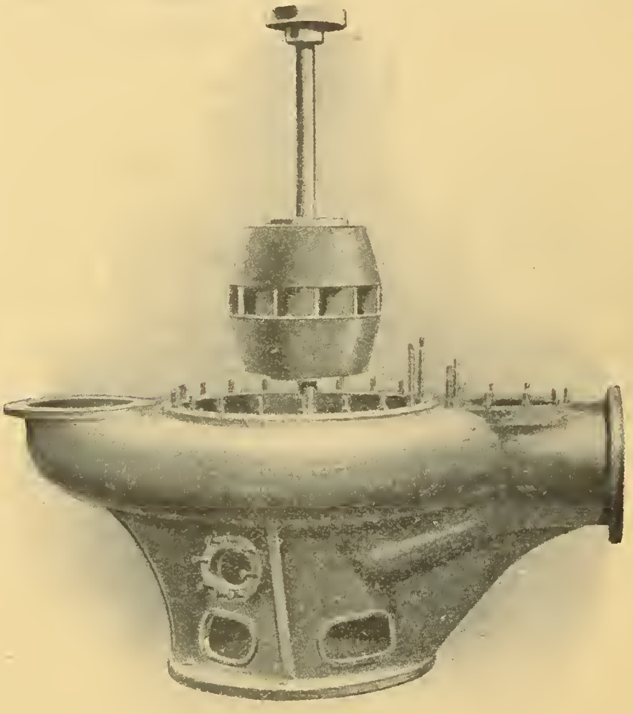


Fig. 7.—Sewage Pump, with Impeller Raised.

SOME RAMBLING NOTES FROM INDIA.

[COMMUNICATED.]

It is refreshing to see the Electrical Review trying to awaken home interest in trade matters abroad, and as its columns always welcome notes from contributors in temporary or permanent exile, a few random remarks will be jotted down here.

Where electric supply companies are at work—and that is in a very small sprinkling of large towns only—the metal lamp has been welcomed, and more light rather than less metered energy has been the order of the day. But what we want is *cheaper wiring*. One of your contemporaries, in an endeavour to realise Sir W. Preece's ideal of "the poor man's light," tells us that the cost of wiring in England is now 15s. a point, and that it wishes to bring it down to 7s. 6d. I wonder if the firms who export wiring material to India realise that we have to pay often £2 a point for good wiring in teak casing without fittings; that no endeavour is made to introduce, much less to push, any of the cheaper systems (except in the case of Continental firms and their wares); and that, even so, we reckon depreciation on wiring at about 8 per cent. Of course there are reasons to account for some of this excessive cost, of which the most potent is the high cost of European or even Eurasian supervision compared with a foreman wireman's wages; but when all is said and done £2 a point is a very heavy price to pay where electricity has to compete with kerosine oil, even though climate favours the more expensive illuminant.

Most of the business done here concerns private plant, largely in native states, with some street lighting thrown in occasionally. The Presidency towns have their public supply and their tramway companies, some of which are doing very well. There seems to be no wild rush, however, in the smaller towns. It was hoped in 1903 that the legislation then undertaken would encourage enterprise in this direction, and some few companies were floated for this purpose. They have not turned out gold mines, however, and things are more or less at a standstill. Fresh legislation is now being ground in the Government mill, chiefly with a view to bulk supply, but the question is, where are the *distributors* to come from? British capital shows a distinct distrust of the situation with or without a "purchase clause."

Water-power, as you have lately remarked, has great latent possibilities, but they remain latent for the most part; otherwise there would hardly have been references in the Review (p. 621) to the *great* Simla hydro-electric scheme. The whole project amounts to under 1,000 h.p., and it had already been discussed for a matter of 10 years before it began to take practical shape! *Parturiunt montes* exactly fits the case. The rival hill station of Mussoorie has not been without its troubles. No sooner had the undertaking there begun to deliver power, than an unprecedented fall of rain washed away a considerable length of the pipe line; and when the interrupted supply was resumed, an unfortunate misunderstanding caused several deaths from contact with the 6,000-volt lines.

Our railways are, at least so far as mail trains are concerned, improving their rolling stock greatly. Stone's system seems to have almost a monopoly, despite a constructional drawback inherent in the slipping belt; but it works well. Osram lamps, 25-volt, are displacing carbon filaments successfully, and fans are fixed in many first-class carriages. What this means in the hot weather is beyond the ken of Pagett, M.P., and his kindred.

For some years past wireless telegraphy has been used for communicating with the Andaman Islands, mainly in connection with the meteorological reports, and now we have entered the ship-to-shore stage with the arrival at Bombay of the first P. and O. steamer so fitted up. As the system extends, it should prove of incalculable value in the forecasting of the monsoons, on which the prosperity of the country depends. It will also give more timely warning of the approach of cyclones, of which unwelcome visitors Eastern Bengal has lately had experience.

The recent magnetic storm completely stopped telegraphic working on some of the longer lines, which are said to have been charged to 300 and 400 volts—some of them, as the local paper's reporter in the old days said, "weighing several pounds." A present-day reporter on this storm remarked on the extensive display of "aurora borealis" in the southern hemisphere!

Prof. Fleming hopes for great things from a direct solar engine yet to be invented. From what one reads of the late summer weather in the old country, that engine will have to be used mainly for conversion straight back into heat, on the lines of the man who wanted to fill his turbine reservoir from the tail race, with an electric pump. However, if any experimenter wishes to get undiluted sunlight, we can supply him here; the cold water runs out of my tap at 160° F., after passing through pipes on the roof which were not originally intended to act as superheaters. A sun-worked "Therol" water-heater might, with a little trouble and a lot of lagging, be evolved for the service of the morning tub; but it would not help one's load factor.

Let us be serious once more. In general it is our custom abroad to grumble at the manufacturer. Sometimes he makes a note of it, and matters improve. I rather think it is the local firm's turn now. In Indian commercial centres we have old-established firms who act as managing agents for scores of companies—tea, jute, shipping, and what not—and who have engineering departments. They also have home branches, consisting generally of partners who have retired from India. But beyond a certain amount of advertising in newspapers, there is nothing in the way of publicity. If inquiry is made about new devices that have been described in the home papers, it is long odds against them otherwise than on a special order. Recently I was told of an engineer who, in a private note to a friend in the metal lamp industry, suggested that samples of certain new lamps might advantageously be sent out, as other types were being well taken up. He sent out a few hundred to a local firm, who promptly called upon my informant to take them over and "get them off their books." That does not seem the best way to introduce new goods. I think that a recent contributor in your paper, in discussing Australian matters, hit the nail on the head when he suggested that general merchants dealing in all sorts of commodities are not the best people to take up engineering work. Another very common complaint against contractors is that it takes so long to get a job finished off. No doubt the great distances to be travelled, and the time it takes to get goods from England, are influences that tell here; but it is irritating when a contract is practically complete to have to wait for a lot of small odds and ends to be supplied.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Single-Phase Motors.

I was very much interested in the article in your issue of September 17th, 1909, on the "Single-phase Motor" and, in common probably, with many other readers, I should be glad of more information with regard to the suitability of single-phase motors for ordinary engineering and other similar works.

With respect to one point in the article mentioned above, would not the high periodicity of the original single-phase stations (generally 100 cycles I believe) have been a considerable drawback to the use of motors?

Taking a works in which are installed hoists, centrifugal pumps, fans, &c., driven by direct-coupled motors, would the writer of the article, in the case of such a works, advise single-phase in preference to direct-current working, the size of the works, and other considerations causing a voltage of, say, 100 volts only to be decided upon? This is an imaginary case, but I am acquainted with several fairly extensive works in which D.C. dynamos, supplying current at 110-120 volts, are installed, and in the case of a single-phase installation the alternators would generate at the low voltage also, I presume?

How would the single-phase motor compare with the D.C. motor with respect to convenience in reversing and in regulating the speed? I have in mind D.C. motors with commutating poles direct coupled to blowers and fans and regulated by means of shunt resistances.

In the case of, say, a 100-volt 80 B.H.P. motor direct coupled to a centrifugal pump, could this be started up as conveniently as a D.C. motor and without taking an abnormal starting current?

Although, generally speaking, the D.C. motor as designed and manufactured nowadays leaves little to be desired, I have frequently found it very difficult, in dirty and dusty situations, to keep the brushes and commutators in order and also the starters, and in any case the renewal of brushes is an ever present nuisance, hence it seems to me that if single-phase motors can be relied upon to start up without trouble in such cases as mentioned above, there should be a very large field open to them in the future, and I should be interested to hear the opinion of the writer of the article referred to on this further application of single-phase working.

Advocate.

Straits Settlements,
October 20th, 1909.

In reply to "Advocate" my article referred principally to undertakings in which single-phase plant is, or was installed, and to the fact that the single-phase stations of this country have not progressed with motor loads as have similar undertakings abroad.

This is due to the general belief among engineers that the single-phase motor is unsatisfactory. They scrapped single-phase plant and replaced it by D.C. or three-phase; and the undertakings supplying single-phase current for lighting and D.C. for power, often with separate generating sets, and necessarily with separate systems of mains, give general confirmation to the unfortunate bias against the single-phase motor, for such radical alteration or expenditure would not have been embarked on, had single-phase working been regarded as hopeful. These changes in some cases might have been justified, say, in the case where the single-phase units where small or more or less obsolete, so far as the generating station was concerned, but there is the often greater expense of relaying or adding a completely new system of mains, and if three-phase is adopted, transformers, &c.

Periodicities of 100, which were common till 1900, did, to some extent, retard the adoption of the single-phase motor, but now quite satisfactory single-phase motors for periodicities higher than 100, can be obtained. The difficulty appears to have been rather a matter of design and due to the comparatively poor quality of sheet-iron then available; the latter undoubtedly did affect the development.

For an engineering works such as "Advocate" mentions, it is probable that, unless great and lengthy speed variation were required, three-phase working would give the most satisfactory results, both from a capital cost and operating point of view. If, however, great speed variations over lengthy periods were necessary, and assuming that the motors were used in dusty places, and were not required to give a starting torque of over 50 per cent. of full-load torque, single-phase would give most economical operation.

This case, taken generally, would not lend itself favourably to single-phase working, as its chief points—simplicity in distribution, great flexibility, and absence of out-of-balance loads—would hardly need to be considered, as they would on a mixed system of lighting and power, with varied irregular demands, such as obtains in supply undertakings. D.C. working, in the writer's opinion, occupies a second and third place in the above cases respectively.

These can and must be judged on their merits, with consideration to requirements, class of labour available, and other local conditions that may affect the case. With, say, a fairly modern single-phase generating plant existing, single-phase working should be adopted.

Single-phase induction motors compare favourably with D.C. or three-phase motors in reversing, and can be obtained giving 50 per cent. full-load torque at starting, with 150 per cent. full-load current. This torque is sufficient for the operation of fans, blowers and centrifugal pumps, provided the latter are not working submerged. This class of motor has, in the writer's experience, been used for such severe work as punching and shearing for a number of years, equalling in performance either D.C. or three-phase motors.

Where high starting torques are necessary, recourse must be had to the commutator induction type of motor, and, as already mentioned, this motor will deal with starting torque up to 400 per cent. of the normal. The maintenance and renewal of brushes is practically nil, as these are subject to misuse only during the period of starting; but such motors are not suitable for very dirty or dusty situations.

A. O. Buckingham.

Some Business Anomalies.

Among the many diverse items which go to the formation of the ordinary technical journal, none is more interesting to the layman who cannot enter into the fearsome intricacies of a long-drawn out academic discussion upon this or that theory, than the pages devoted to "Contracts Open and Closed."

A regular, even although somewhat cursory, examination of the contents of these pages will reveal to the searcher after truth, one or two problems of more importance to any firm than the existence or non-existence of a certain factor in an imaginary equation. One or two of these the writer begs to submit to the consideration of kindred spirits, in the hope that some one wiser than he will be able to unravel the mysteries here pointed out.

One often sees in the lists of tendering firms the names of firms quoting for material which they do not make, and such firms not infrequently are favoured with the magic word "accepted" tacked on in the usual place. Such firms are not always merely "merchants," so this does not explain their quoting, and their only title to being able to quote seems to be that they are something "electrical." Nor, as might be supposed with reason, is the material which they propose to supply always foreign. Here is a case in point. A large undertaking invite tenders for various supplies, and two firms (A and B) are in the running when tenders are opened. A is a well-known firm of undeniable repute and standing, and they can supply the material direct from their own works. B, on the other hand, cannot make this material. Their offer, however, is a little lower; they are asked to give a guarantee that the stuff shall be British made, and doing so they obtain the order. It is not clear how this can be done, but that it is done regularly is beyond doubt.

Another matter which more directly concerns the consumer is also of a somewhat similar nature, and can also be best illustrated by example. A colliery manager, say, requires some electrical goods for his installation, and orders them from a local firm of contractors. The contractors ask a general electrical manufacturing firm to supply the material, but this firm does not make it. In their turn they have to order the goods from the maker, who specialises in such. Four parties in one transaction. The goods go direct under plain label to the consumer from the works where they are made. How do all three make a profit, and what about the consumer's buying ability? Of what use are the technical journals to such a buyer?

The above instances are examples of cases which occur often enough, and the questions suggested in both cases seriously affect equally the manufacturer and consumer.

G.

Protection in Natal.

It is most satisfactory to me to note the strong lead you are giving to Free Traders, not only in England, but in the more distant parts of our Empire, where your journal is extensively perused.

In this particular portion of it we are experiencing the way in which Protection defeats its own ends by increasing the cost of living and of production to such a degree that duties have to be continually raised, not only with a view to establish new industries, but to keep alive those which are already precariously struggling.

I think that an impartial report, following an examination into the effects of Protection in Natal, would be a most convincing document to those whose aim is the common good. Can every Protectionist lay his hand on his heart and swear that he can lay claim to be included in this category? I believe that the ELECTRICAL REVIEW does not subordinate the interests of our beloved country to those of even the electrical engineering profession, and that is why it will be likely to flourish wherever an Englishman makes his home.

J. R.

Durban, Natal, *October 22nd*, 1909.

Protection of Tramway Trolley Standards.

I have been interested in seeing in your journal a copy of the Board of Trade's circular letter with regard to the better protection of tramway trolley standards.

I have been endeavouring to reason out how the suggestions contained in their letter would have prevented the recent death to a man travelling on the top deck of one of the cars on the Wolverhampton and District Tramways. His body and feet were making direct connection between the earthed handrailing and the live trolley standard, and he was found by the conductor in this position, dead.

If the magnetic blow-out fuse had been in use, the standard would have been connected to earth, and therefore at earth potential, previous to the leakage occurring; but immediately the latter happens, the earth is removed and it becomes dangerous. Such a device seems, therefore, to remove the safety earthing just at a time when it is required for protection of life.

The man who was killed would, therefore, have received the shock just the same, and he would be under its influence until the conductor had heard the signal and had time to pull the trolley from the wire. If the car was a full one, with possibly passengers in the gangways or on the platform, and the conductor was engaged in issuing fares, it is quite conceivable that an appreciable period of time would elapse before he could get to his trolley rope. This interval, during which the passenger is subjected to the shock, might easily be sufficient to cause death or serious injury.

It is also suggested that, until better provision is made for the protection of trolley standards, the ruby lamps at present in use should be bridged with a suitable fuse. I cannot quite see where any advantage would be gained, as, in the event of the trolley standard becoming alive, the fuse would blow, and the car attendants would be dependent upon the ruby lamps for any warning of danger, in exactly the same way as they are at present.

It would seem that the only really safe method to adopt is to follow the first recommendation of the Board of Trade—*e.g.*, "To electrically connect the trolley standard to the wheels of the car in such a manner *as to prevent the possibility of the standard becoming electrically charged.*"

From the present circular letter of the Board of Trade, it would seem desirable to combine this method with an audible signal, so that the attendants may know which car is earthing the system.

Inquirer.

A Question on Load Factor.

It will make matters quite clear to "Ratio" if he will look upon the battery as a device for securing economy, just as he would an economiser or condenser. After all, is not fuel saving one of the principal functions of a battery? It enables generating sets to be shut down when they would otherwise be running at so small a load as to be inefficient. Of course the battery may also (and in this case no doubt does) save labour by reducing the number of shifts; and it may also render less generating plant necessary by helping to take the peaks. There is, however, I contend, no reason to treat the battery as anything else than a piece of apparatus for the more economical running of a station. A mechanical stoker saves labour, though not by saving a shift, and the saving in capital cost has its counterpart in the condenser, the absence of which would, in theory at any rate increase the capital expenditure on boilers.

J. S.

Voltages for Country House Installations.

In reply to the remarks of Mr. P. W. Doell, I think there are three voltages desirable for ordinary purposes in small town or village lighting, and the system which will provide all of them is the best possible.

For motors, 500 volts is now becoming a standard, and it is, perhaps, as good as any other. For arc lamps, 80 volts, or thereabouts, will give the best results; and for incandescent lighting, 25 volts is, in my opinion, the best possible.

This, of course, may be varied; I would go much lower for small houses, and others would go higher for large ones.

I would not mind going to 80 volts if I had to deal with both arc and incandescent lamps run from the same supply; but to find any voltage which will give satisfactory results with metallic lamps and motors is, in my opinion, impossible, and they must be kept separate.

As regards arc lamps in series—this is a point which is important—there are several instances quite near here, where single lamps have been fixed, and nearly as many where they have been taken down again.

They were not used to light shops, or goods for sale, but as advertisements only; one was over a public-house door, another was over a pawnshop. It is by no means a pleasant job to explain that one lamp alone is wasteful, and that two or three will not take more current than one.

An average man is not favourably impressed by ifs and buts, and would prefer to have the thing he asks for to any explanations by electricians who, for anything he knows, are not playing the game fairly. Gas men can do these things—they do not need to fix two or three lights to get economical results—and neither should we.

I believe that it would pay many of the supply companies to return at once to low voltage.

I believe my own scheme will meet all the requirements which have to be met now, supplying the voltage most suitable for the different requirements. I am sorry I am not quite ready to explain it fully, but I may say that for the instance Mr. Doell gives—800 lamps—requiring under present conditions, 512 amperes, I would not use any larger cable than 7/16, nor have any heavier current than 25 amperes.

I intend to ask the editors shortly to send someone to see what I am trying to do, and to publish an account of it if they think it is sufficiently interesting for them to do so.

Every week they publish accounts of lighting orders being revoked, always on account of the cost being too great for the revenue likely to be obtained if carried out.

If this cost could be reduced 50 per cent., and if the running costs could be reduced another 50 per cent., things might be altogether different.

J. Jackson.

London, N.W., *November 23rd*, 1909.

I think we are most of us agreed on the following :—

Advantages of a 25-volt circuit :—

1. Wires of a very low grade of insulation can be used, such as 300-megohm, this would cheapen the otherwise increased cost of copper, provided runs not long.
2. The low pressure of such an installation lends itself admirably to the employment of the various "cheap-wiring" systems now on the market.
3. Low candle-powers (down to 4-C.P. tungsten and 5-C.P. tantalum) can be successfully used in candle-fittings, night-lights, and corridors.
4. Greater efficiency and cheapness of lamps.

Disadvantages :—

1. *Extremely* difficult to obtain fans, small motors, or heating apparatus ; and even if obtainable, they would take excessive currents.
2. Large drop over long runs ; the 25-volt circuit is not advisable for straggling houses, churches and warehouses.
3. No arcs or lamps of higher candle-power than 32, can be obtained.

Of course, circumstances (such as the compactness of the building) alter cases, but to save complication, I would strongly advise two standard voltages for country-house work, 25 volts up to 150 lamps, and 110 volts beyond ; 110 volts should be standard for churches and warehouses, where runs are long, and power or high candle-power lamps are required ; 110 volts has been standard for so many years, that it is easy to obtain arcs, motors or heating apparatus. I know no reasons for adopting 65 volts ; it has none of the advantages of the 25-volt supply, with most of the disadvantages of the 110-volt, so far as regards fire-risk, low C.P. lamps, &c. With regard to cheap wiring methods for 25 volts, in two installations recently erected in a small church and house—Glaslough, Co. Monaghan, Ireland—3/20 S.W.G. and 3/22 S.W.G. lead-covered 400-megohm wire was found to be highly successful—using, of course, continuity fixtures. All lamps were of the tungsten type, except portable standards, where tantalums were used, being less fragile.

I would add that the lead-covered wire was attached to the wainscot, and painted to match—excepting in sitting rooms, where it was buried in the plaster. As to 4, 8 or 16-volt circuits, they are in the nature of toy installations, and could scarcely be employed for more than a dozen lamps.

Seymour Leslie.

London, W.

[Our correspondents show a tendency to digress from country-house lighting to warehouses, pawn-shops, &c. ; the subject proper is of considerable interest, and is essentially distinct from any question connected with electricity supply from public mains.—Eds. E.R.]

Electric Lighting for Villages.

Your article in the Review of October 1st, on engineers "At Home and Abroad," has suggested to me the advisability of submitting to you or to your readers a problem which I have been considering lately.

You have described and illustrated in the Review a great many large electrical schemes and plants for power supply, lighting, and other purposes, but one looks in vain for any particulars of small plants for lighting and power such as would be suitable for the lighting of small towns and villages, especially for villages in these colonies where the conditions are considerably different from those of home villages.

To explain the problem I put, I shall give the particulars of a proposal which has been under consideration here, and which is to some extent typical of several other cases.

A village of, say, 60 to 70 houses, compactly situated on an approximately square area.

Water-power available near one side, the distance from the power station round the village and back to the station making a circuit of about 8,000 ft.

Two methods of carrying out the lighting of this place have been suggested, one proposal is to use direct-current dynamo, charging, say, 15 sets of accumulators in series ; each accumulator set supplying a small group of three or four houses, and having a maximum output of, say, 500 or 600 watts.

The other proposal is to use an alternating dynamo with transformers similarly arranged to supply the small groups of houses.

In either case the most efficient metallic-filament lamps would be used, arranged for, say, 25 volts.

There would be advantages and disadvantages in each case, and the problem is to find which has the outweighing advantages.

I would point out that, to suit the conditions here, the first cost must be as low as possible, and therefore everything should be arranged of the plainest and simplest kind consistent with due efficiency ; and that a strong point in favour of the accumulator system, for a small plant of the kind proposed, would be the saving of an attendant at night, the cost of whom would be a high proportionate item in a small plant.

A result distinctly in favour of either system will ease the path of

An Engineer Abroad.

October 20th, 1909.

[Various village installations have been described in recent years in our columns ; apparently our correspondent has overlooked them.—Eds. E.R.]

The "Steady Job."

Referring to the article which appeared in your journal last week under the initials "A. P. C." sub-titled "A Minor Philosophy," I would like to say I have seldom seen a sillier sham printed in any journal. A much more suitable title to my mind would have been "A Pseudo-Philosophy." The whole article teems with illogicalities and misstatements.

It is apparent that the argument of the survival of the fittest cannot and never could apply to our present business system until it is so drastically altered that *equality of opportunity* is given to every individual. But your contributor openly advocates the former principle, assuming that the best men will come to the top, regardless of the fact that the best men in many cases may have started so handicapped that it is next to impossible to rise at all. His remark "if a man does not personally gain by any deed of his own he will not take the trouble to do it," is a downright slander on all the greatest writers, inventors and artists of all time. It is often truer that the inventor receives meagre advantage from his inventions, and long after he has ceased to receive any interest whatever from them they continue to swell the fortunes of shareholders who, whatever else they possess, never had a spark of inventive genius. How does your contributor account for the fact that such great inventors as Edison, long after they have accumulated more money than they could ever spend, continue to invent ?

Again, his remark that "the wonderful advance of the United States people . . . . is due to the uncertainty of tenure of position," is of all bosh the most utter. A country gifted with natural resources and opportunities such as no other country is, increases its trade and rises to be a great nation, and he explains it with a piece of flabby philosophy about uncertainty of tenure. Rather would it be cause for wonder if such a nation did not advance with advantages such as this particular nation has.

It is quite clear from his next point that he thinks we should imitate the example of the American. He says : "The American has been brought to learn that specialisation is valueless . . . . therefore he becomes self-reliant and afraid to tackle nothing." Yes, I know such. You can see them every day in England, America and everywhere else; they are mostly semi-engineer-travellers, who, when they meet something of which they know less than nothing, shut up and try to look intelligent. Such people usually end by getting themselves and their firms into such a mess that it takes the quiet calculating man to unravel them.

I contend, and challenge your contributor to prove otherwise on any moral grounds, that when a man has reached middle age, has a wife and the privilege of moulding and forming the minds of his children, that it is not right or even necessary he should dash about with hare-brained schemes for worsting his business rival. What your contributor calls the survival of the fittest means the *survival of the unscrupulous.*

He asks "Why is France a decadent nation?" and then proceeds to answer himself by explaining it is entirely due to the French mothers having a longing for permanent positions for their offspring. This is almost laughable. He contends that a nation loses its stamina and becomes decadent because its people have succeeded in "pulling together" instead of turning the country into a bear garden of conflicting small-souled business fiends, each with a great idea of his own powers and determination to worst everyone who comes in his way.

Again, supermen are not produced by industrial competition, and they never have been, but by *intellectual competition*, and the two are as far apart as the poles.

As I have said, when a man has reached middle age, it is his time to enjoy, as far as he can, what is left of his life. What is the earth for? To turn into a great murky industrial battlefield with ineffaceable signs all around of the crushed out and the maimed to nauseate and embitter those on top? Or is it not rather for the use and enjoyment of all its inhabitants? Are the great inventions, electricity and others, here simply to be exploited for the profit of one or two shareholders, or to make the lot of man easier?

Is the world as a whole better because some of its inhabitants, with a preponderance of brain power, think it good to fight and shriek and scramble in their efforts, usually to pile up profit for someone else? I can name a host of world's greatest engineers, artists and inventors who have died poor, whose genius was, in some cases, only recognised after their death, who would undoubtedly have been crushed out in the struggle your contributor eulogises—men whose names and works will live long after the last sweater-hustler's name has ceased to be remembered.

A. C. Circuit.

A Correction.

Your report in last week's issue of the Review will cause our friends and ourselves needless pain and loss, and although we do not propose to discuss in your technical paper the details of a sordid trade dispute, we trust you will allow us to state two facts.

1. We were not able to instruct or appear to answer the claim, owing to enforced absence caused by serious illness.
2. The statements made by a Mr. Truman—a person whom we do not know that we have ever met—had really nothing to do with the issue which had to be tried, and are wholly untrue, having no foundation whatever in fact.

J. E. Wakelin & Co.

Institution Proceedings.

We shall all owe you a debt of gratitude if, by taking up this matter as you have, you can bring to an end the present practice of authors reading their papers in full at the Institution meetings.

Too often have we had to sit patiently in a crowded chamber, whilst the author has, I was about to say, gabbled through his paper in a tone which would seem to betoken a total lack of interest in its matter, and a desire only to get to the end of it.

After an hour or more of this when most people are already somewhat bored of the proceedings and anxious to escape, we are allowed a few minutes only for the only really interesting part of the proceedings, viz., the discussion.

What is the result? At the most, a very few members can take part in it, and those others who might wish to offer or obtain information on the subject under discussion must do so afterwards, informally over a cup of coffee.

Surely this is not the way to make the proceedings of the Institution interesting or instructive?

It is high time that the old system was done away with and reforms instituted on the lines suggested in your leading article.

M. Farrer.

Electricity Works, Twickenham,
November 19*th*, 1909.

Your leading article advocating that printed papers should be sent in advance to every member, and that discussion should proceed without wasting time in reading a technical paper to the meeting, will be heartily endorsed by everyone who desires that engineering societies should be really useful.

I would like to make another practical suggestion, viz., that those members who cannot express their views without recourse to formulæ and diagrams should send their views in writing "for interment in the Society's *Journal*," and so leave the discussion open for those who can put their spoken views into plain English.

Practising engineers who want mathematical instruction can attend classes, or consult text-books; but they do not want discussion obscured by masses of figures and formulæ, hastily written up on a distant blackboard.

Scrutator.

PROCEEDINGS OF INSTITUTIONS.

The Electric Ignition of Internal Combustion Engines.

By John W. Warr, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, November,* 2*nd*, 1909.)

In whatever form it is applied, electric ignition is a notable advance on what previously existed. It provides absolute immunity against fire, the spark is well suited to the explosive mixture, and charges which are so weak as to give irregular impulses with the hot tube, can be fired with absolute certainty. Further, an increased efficiency is obtained by being able to fire the charge at the moment of maximum compression, it admits of automatic timing and consumption of current and the use of higher compressions.

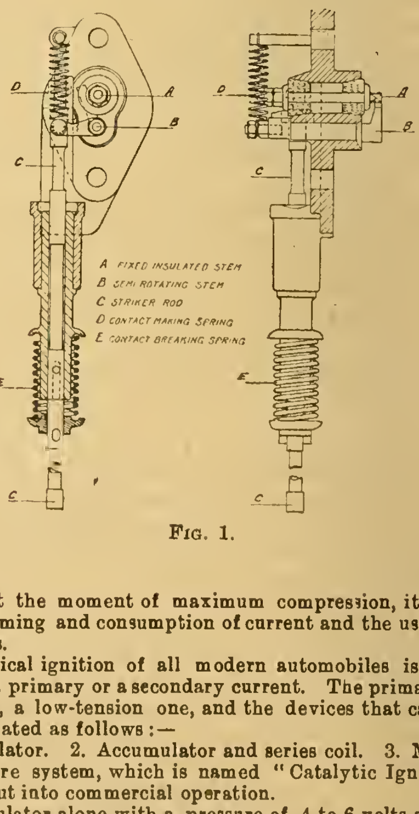


Fig. 1.

The electrical ignition of all modern automobiles is produced from either a primary or a secondary current. The primary current is, of course, a low-tension one, and the devices that can be used may be tabulated as follows:—

1. Accumulator. 2. Accumulator and series coil. 3. Magneto.

The hot-wire system, which is named "Catalytic Ignition," has never been put into commercial operation.

The accumulator alone with a pressure of 4 to 6 volts appears to be one of the very earliest devices, but owing to the large current taken on short circuit, the ignition points were quickly destroyed and the high temperature of the points set up by the large current frequently caused premature ignition.

Later the accumulator and series coil was introduced, the presence of self-inductance or extra current making its appearance as a bright hot spark at the tappet points at the moment of breaking circuit.

The low-tension magneto driven from the cam shaft was rapidly brought forward, perhaps on account of the necessary recharging of accumulators and their other attendant evils.

Contrary to the high-tension system, all low-tension ignition has to be operated with mechanical make and break tappets from the cam shaft. The gear shown in fig. 1 is representative in principle of those used by leading builders and is attached vertically to the sides of the cylinder. The fixed insulated plug is shown at A. The tappet B is also fitted into the plate to rotate through a small arc, both A and B projecting into the combustion chamber. With the striker rod C in the normal position, the spring E keeps the contacts apart internally. Shortly before ignition takes place the cam raises the rod C through an intermediate pusher rod, and allows the spring D to bring the internal contacts together. A step in the cam then passes the foot of the pusher rod, and allows rod C to fall quickly, due to the influence of spring E. The momentary making of the circuit is at once followed by a quick break, thus producing a spark at A and B. Provision is made for retarding or advancing ignition when desired, the operation being controlled from the steering pillar.

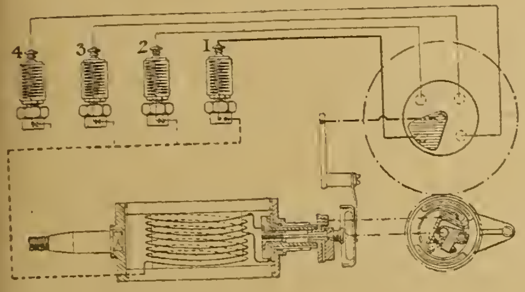


FIG. 2.

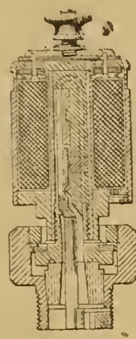


FIG. 3.

In order to dispense with complicated mechanical striking gear and tappets, magnetic plugs or electrical tappets are used. The plug and diagram of connections is shown in fig. 2. A section of the plug is shown in fig 3. The current is generated in the two windings of the revolving armature from the permanent field, and attains a maximum voltage twice during each revolution, the two maximums being 180° apart and producing two sparks per revolution. The armature is driven at crankshaft speed. In the diagram of connections the dotted lines represent the circuit completed by the car frame. On the right-hand side of the armature is shown the contact breaker through which the auxiliary winding is periodically short-circuited just previous to the current attaining its maximum. At the moment of short circuit a sufficient current in the main winding to attract the plug interrupter is not produced. However, when sparking is to take place within the compression space of the cylinder, the platinum points of the contact breaker are severed, the current in the main winding being suddenly reinforced by the extra current of the auxiliary winding. Thus a powerful current flows through the coil of the magnetic plug by way of the distributor, vigorously attracting the armature interrupter of the plug and effecting a quick breaking of the contacts. This in turn produces a powerful and very hot spark in the same way as the mechanical tappets. The variation in timing is effected by rotating the lever embracing the make and break contacts shown on the right-hand side of the drawing, directly below the distributor. By this means the interruption and the spark are produced earlier or later. For a four-cylinder engine the rotation of the lever is about 50° on the crankshaft. The engine is stopped by short-circuiting the armature to the frame through a single-pole switch.

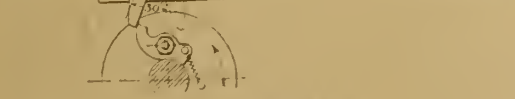


FIG. 4.

There is just one other low-tension magneto igniter that is used chiefly with single-cylinder engines. The current is produced by an oscillating motion of the armature, which is moved out of its position of rest through an angle of 30°, a thumb on the cam shaft striking the trip lever on the armature shaft. The horizontal springs bring the armature into its normal position. The whole arrangement is shown in fig. 4, including the striking rod, which operates the mechanical tappets. The tappets break circuit when the armature has passed a few degrees beyond its normal position. The length of the spark depends largely on the swiftness of the movement of the armature. The variation of ignition is obtained from a device on the cam shaft, so that the releasing of the trip lever takes place early or late as required.

In comparison with the high-tension system the low-tension ignition is not so popular. The objections are: wear of the tappet points and the moving parts within the combustion chamber, wear and tear of striking gear whilst operating at high speeds, and constant need of adjustment, which in many cases can only be perfectly carried out by experts.

The high-tension ignition does not require any of the gear mentioned above, the apparatus used being of such a character as to produce a flaming jump spark between the electrodes of the plug screwed in the combustion chamber. The means used for producing the high-tension spark are:—

1. Battery and induction coil; 2. Magneto and induction coil; 3. High-tension magneto.

The battery and coil ignition is well known. With the modern ignition accumulators we have compactness and fairly large capacities. The celluloid case enables one to see the condition of the plates at any time, and especially during the progress of charging. On the other hand, acid spray and bad joints between the celluloid and the lead terminals have brought them into great disfavour with a large number of motorists, the acid playing havoc with everything that comes in its way. Then we have the question of recharging. But it is doubtful if the accumulator is so black as it is painted.

The primary dry battery has come into great favour lately, and there is no doubt it is being used with satisfactory results. The multiple cell giving an E.M.F. of 6 volts is suggested, with a variable resistance connected in series with the primary of the induction coil and the battery, so that the pressure can be reduced to about 4 volts. When the battery has been used for some time, the E.M.F. falls off; this can be detected by misfiring, and instantly restored by cutting out a small section of the resistance.

Some dry-battery makers recommend multiple-series connections for heavy ignition service on automobiles. The objection to this system of connection will be the weight and accommodation. The author has now used dry batteries for ignition for a considerable time, with most encouraging results.

Induction coils may be divided into two classes, the plain type with primary and secondary winding and condenser, and the trembler type—the same fitted with an external high-speed trembler. Apart from the fact that a multi-cylinder engine cannot be started on the switch with a plain coil, the timing seems to be more exact with a given piston position. A plain coil may be unintentionally left in circuit if the main switch is left closed, which is liable to burn out the coil and exhaust the battery. The trembler coil gives warning when left in circuit.

The best results are obtained when the self-induction of the primary and the capacity of the condenser are balanced, producing resonance. The larger the current passed through the primary (which can be produced by over-screwing the contacts) the greater should be the capacity of the condenser. On the other hand, the gradual burning away of the platinum reduces the current in the primary and produces unbalanced effects with the condenser. Therefore, the desirability of an adjustable condenser seems clearly demonstrated. If the condenser is too small the secondary spark is short and feeble, with incurable sparking at the platinum. If the condenser is too large, the spark is short and fat.

There should be no practical difficulties in the way of turning out every coil perfectly balanced, but until there are better means provided to adjust the contact screw, excessive pitting of the platinum points is bound to take place when handled in ignorance.

The adjustment of a trembler blade apparently requires very great care. When the author was testing a coil some time ago, the ammeter connected in the primary showed that a current of from 1·5 to 6 amperes could be drawn from the 4-volt battery by altering the contact screw, and on closed circuit 15 amperes was indicated. In this instance, how could the motorist say which was the correct current? Both 1·5 and 6 amperes produced sparks that appeared to have equal inflammation capacities. Inexperienced persons adjust their trembler blades by the note that is produced from the rapid vibrations of the armature, a high, shrill note being considered the best. The author has proved that a moving-coil ammeter in the primary of the coil is the only guide, as regards the most effective spark and economical current consumption. The more pressure put on the blade by the screw, the nearer the contacts approach short circuit.

A very light fuse would be a useful addition in the event of the contact screw being lowered too far. This would indicate the presence of too large a current in the primary winding.

After being in use for some time the platinum appears to leave the positive contact and builds up on the negative. A reversing switch would tend to keep the contacts level and do away with the filing of an expensive metal. Of the many faults in connection with ignition coils, internally punctured insulation of the windings and condensers makes up a large percentage. The author is of opinion that a permanently fixed spark-gap would prevent a number of troubles, as the coil is very often operated with the secondary on open circuit by inexperienced persons when endeavouring to locate the causes of misfiring. A good type of trembler is shown in fig. 5.

In either type of coil it is of the utmost importance to have an iron wire core that will admit of rapid changes of the magnetic flux. Lagging magnetic effects seriously hamper the period of inflammation. For instance, when the engine is running slowly it is possible to get correct ignition at the right position of the piston, but when running at high speeds ignition does not take place when expected, evidently due to the time taken to magnetise and demagnetise the core of the coil. With an engine running under practically full impulse, ignition should occur just as the piston starts on the expansion stroke. Without considering any difference in compression pressure, and supposing the period of inflammation is $\frac{1}{120}$ of a second and the engine speed is 600 r.p.m., then $\frac{600 \times 360°}{120 \times 60} = 30°$, or ignition should take place when the crank has still 30° to turn, *i.e.*, —$\frac{1}{12}$ of a revolution or 30° in advance of the dead centre of the piston. From this it is evident that after running at high speeds on the level with the spark correctly advanced, better results will be obtained when mounting a gradient in high gear by retarding the spark because the engine speed is lower.

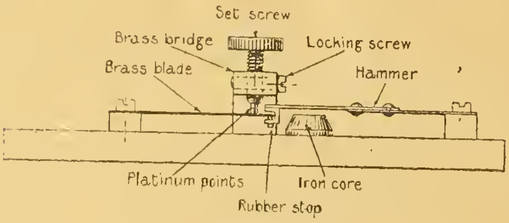


Fig. 5.

We now come to the question of distributing the high-tension current in multicylinder engines. With the single cylinder this is effectively carried out by rupturing the primary current with a simple make and break contact on the half-time shaft. A common method is to provide a low-tension rotary wiped roller contact with as many points of rupture as there are cylinders. This type is shown by fig. 6 and makes and breaks circuit at the correct period in the primary circuit of the coils. The high-tension leads from the trembler coils go direct to the plugs. Levers and connecting rods rotate the fixed contacts through a given arc so as to produce early or late ignition.

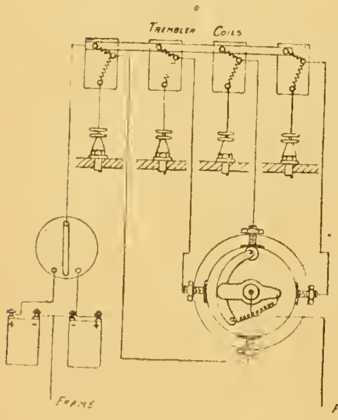


Fig. 6.

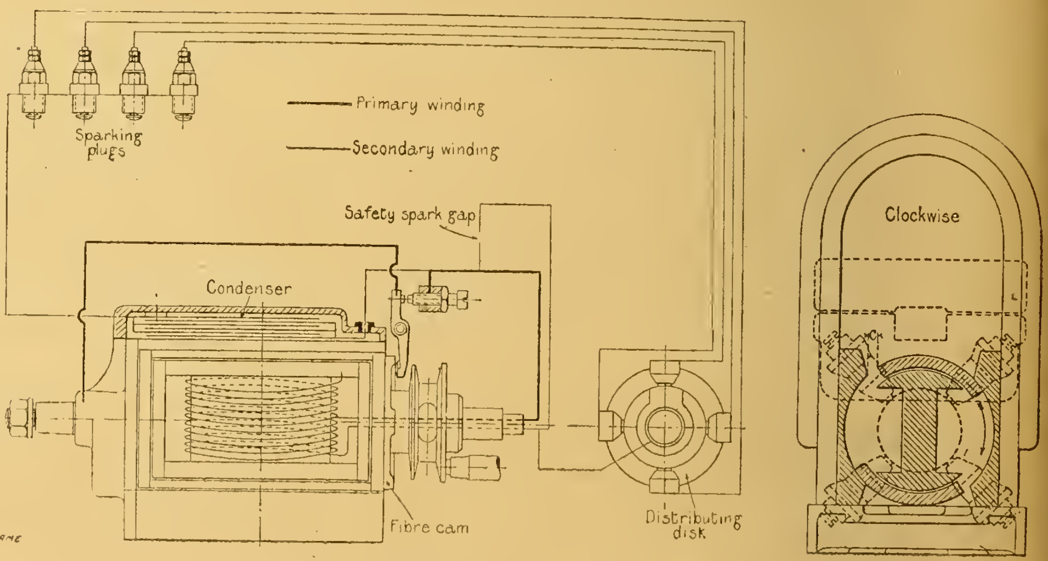


Fig. 9.

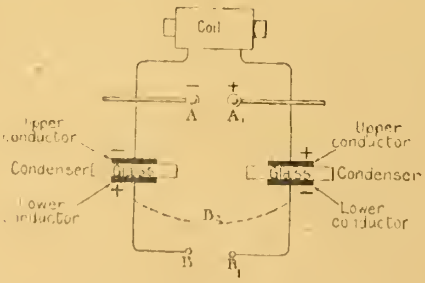


Fig. 7.

Another system consists of a combined low-tension contact maker and high-tension distributor, both being exactly synchronised and timed with the piston. Only one trembler coil is used.

A high-tension battery system can be operated without trembler coils. As most of the troubles arise from the tremblers, this method has a great advantage over the others. A make and break contact is fixed to the half-time shaft, and is capable of being moved to vary the timing. A single plain coil is used.

The B spark deserves attention. The diagram, fig. 7, displays the general principle of the igniter. The high-tension current is connected to the plugs through the intervention of two condensers with their outer coatings shorted through a leakage path or imperfect conductor, the object of which is to keep them always at the same potential, except at the instant of sudden discharge. No strain is thrown on the plug leads, they remaining at the same potential up to the last moment, when the two condensers are full and overflow at A. At this instant everything is liberated, and with great rapidity the condensers empty themselves across A and round the completed circuit to the sparking plugs and ignite the mixture in the compression space. The high-frequency discharge is so violent that soot round the plug electrodes is flung away, also the spark will blaze through water. An accumulator and induction coil with trembler blades furnishes the high-tension current for the condensers, and, contrary to usual practice, the secondary winding of the coil is built up in sections. The coil only takes 0·75 ampere for a four-cylinder engine, which is a very small figure compared with other coils. Only one coil is used, the high-tension current being conducted to the cylinders by a high-tension distributor working on the cam shaft. A spark, large in quantity, and thus more effective in inflammation capacity, free from liability to short circuit with dirty plugs, and rapid in application, is undoubtedly obtained. The idea is due to Sir Oliver Lodge.

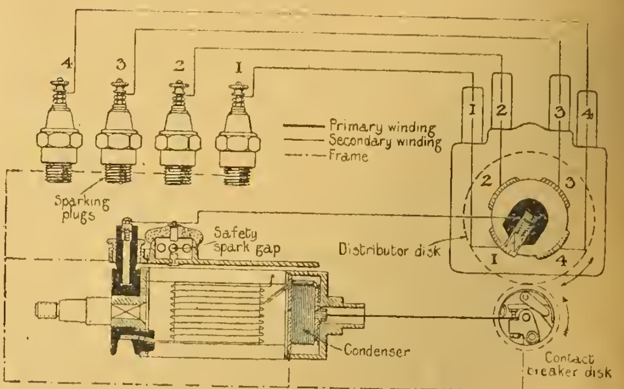


Fig. 8.

Probably the most popular form of ignition is the one in which the high-tension current is generated in the winding of a rotating or stationary armature. The diagram of connections in fig. 8 represents a high-tension magneto for a four-cylinder engine. Between the pole-shoes of the permanent magnets rotates a shuttle-wound armature on which are two windings, a primary and a secondary, the latter forming a direct continuation of the primary. The high-tension current is produced in the secondary by short-circuiting and opening the primary circuit through the platinum-pointed contact breaker twice in each revolution. At the moment the circuit is broken the high-tension current is collected from the slip-ring by a carbon brush and taken to the distributor and plugs by the contact brush driven from the armature spindle. The armature is driven at crankshaft speed, so that when the winding is cutting maximum field its position must correspond to a definite position of the piston.

Another type of high-tension magneto, fig. 9, is one in which the generation is based on the same principle as the well-known inductor alternator. The armature winding is stationary and mounted in the permanent field. A tubular soft-iron inductor envelope, having two slots cut in it, each representing a quarter of its circumference, revolves between the armature and the pole-shoes. By this means the current in the primary will attain its maximum when the inductor has rotated through an angle of 90° or four times per revolution. By rupturing the primary circuit during the effective periods, a current is induced in the secondary winding four times per revolution. As no slip-ring or collector is required, the high-tension current is conducted straight to the brush contact of the distributor disk.

The spark from high-tension machines of this class is more intense than that produced from ordinary induction coils. As an example, the coil spark in one experiment was only justly sufficiently powerful to ignite a mixture of petrol vapour and air in the proportion of 1 to 15, whereas the magneto spark was capable of igniting a mixture of 1 to 19.

Some of the machines have a condenser connected across the make and break, but in all cases spark-gaps are provided. Ball bearings can be fitted if desired, which, needless to say, are infinitely better than the sleeve bearing. Wherever possible gear drive should be used—chain and sprocket wheels severely punish either type of bearing.

The chief advantages of magneto ignition are: an inexhaustable source of current, the induced current is directly utilised, and the sparks have a higher temperature. The vital parts are not scattered in different parts of the car as is the case with the coil and accumulator ignition. With a spare magneto carried in the car the faulty one can be removed in a few minutes. On the other hand, it must be remembered that the magnets require reflashing periodically, bearings and platinum contacts require attention, a perpetual load is always on the engine, and the adjustment in the timing is not so flexible as with the coil.

It is common practice to provide accumulator and coil ignition for starting the engine, afterwards throwing over to the magneto.

A very ingenious device has just been introduced for starting. The principle is based on the temporary use of the primary and secondary winding of the high-tension magneto armature as an induction coil. Current from a dry battery furnishes the current which is conducted by suitable switchgear to the armature primary winding. If the engine has to be started after it has not been working for a few days, a turn of the handle is required to rupture the dry battery current in the primary winding, but if a charge is left in one of the cylinders previous to running, the pressing of a button switch will start the engine whilst the driver is seated. The author is of opinion that energising the armature in this way will in time reduce the field strength of the permanent magnets.

Discussion.

Mr. J. G. Walthew said that for motor-cars the low-tension system had very many advantages, but for the stationary engine the high-tension system was undoubtedly the best, except in the case of single-cylinder engines. Excessive wear on the sparking points was generally due to unequal or bad setting of the contact maker and breaker. The spark in the ignition box should not be more than about $\frac{1}{16}$ in. at the outside in the low-tension system. It was possible to fail to get a spark from the low-tension plug, simply because the small moving contact-maker had a fine coating of dust or dirt, which arrested the electric connection. The trouble with the accumulators was the only weak spot in the high-tension system. He had found that the current necessary with a 6-volt primary circuit varied from about 2 to 3½ amperes, when the trembler blade was working practically the whole time.

Mr. Frith said that he did not think that motorists would consent to a fuse in the battery circuit of their cars, with the possibility of the fuse blowing. He did not think it was right in theory to employ only one coil to ignite a multi-cylinder high-speed engine, as the electromagnetic conditions of the coil could hardly be expected to follow the changes required at sufficient speed. The question of simultaneously firing the charge at more than one point in the cylinder by means of two plugs in series, worked from the same coil or magneto, was engaging the attention of motorists; could the author say if this was worth the extra complication of double-pole plugs, &c., which it involved? And in the simple accumulator and coil system, did it matter at all how long the stream of sparks was allowed to flow after the explosion had actually started?

Mr. R. B. Slacke said that the corrosion of the terminals of accumulators could be stopped with a vaseline cup. Most of the troubles of accumulators were due to under-charging and over-discharging, &c., especially over-discharging. As far as motor-cars were concerned, there was one thing in favour of the accumulator; if the battery ran down they could probably by walking a few miles obtain another one. A spare magneto was valued at something like £10 to £20, whereas a spare battery cost about £2. A system in use for large gas engine work with a voltage from 60 to 100 was practically the same as the low-tension system on a car. It had a mechanical tappet, but this was operated by a solenoid. There were slip-rings on the cam shaft, and as each contact piece made contact with the brush, it closed the circuit, which at the same time closed the solenoid, and also closed the circuit through the tappet, the tappet in its normal position being closed, so that the effect of the solenoid was to open the tappet and shut it again. The tappet itself was of cast-iron, and it did not seem to have given any trouble from wear. Several makers of Continental gas engines used that system. One of two of them had had experience with the Lodge ignition, and in one case that had been adopted in preference to the other, and had been found to be very satisfactory. One did not alter the timing to alter the speed of the engine, but according to the value of the mixture.

Mr. J. M. Atkinson said, with regard to large gas-engine work, one of the great faults with the low-tension system was that one could not get the surfaces of the plug and the contact to exactly line with each other. They would wear to a ridge, giving uneven firing in the cylinder. They arranged to time the ignition for both ends at once, but at one end there might be more wear than at the other. The consequence was that the plugs had to be taken out and filed down. The Lodge system had been used by Messrs. Ehrhardt & Sehmer. Magneto ignition worked very well, but he thought that high-tension ignition was the one that had come to stay.

Mr. Cox said not only the battery but the coils had weak spots. It certainly was an advantage to have a gap on the outside, especially in multiple cylinder engines; it gave them a chance of actually seeing if there was a plug mis-firing due to any external cause.

Mr. Stelling said the author had not emphasised the relative merits of the oscillating and the rotating shuttle in magnetos. Personally, he was in favour of the oscillating shuttle combined with what the author described as an inductor envelope. The great advantage of this envelope when combined with the oscillating system was that there was a very small moving mass, and in consequence there was slight mechanical reaction, whereas with an ordinary wound shuttle oscillating, they were apt to get unnecessary vibrations and broken wires. Another advantage was that they were able to get very accurate timing with the former, and by adjusting the tappet, they were always able to take the current at the top of the wave.

Mr. H. J. Coates said, referring to the practice of placing the high-tension winding over the armature winding, it was questionable whether this really was the best place in which to fix the secondary winding. The difficulties of sound insulation were often considerable, in spite of the limitation of the voltage-rise due to the provision of a protective spark-gap. In some few makes it had been the practice to place the transforming element over the armature box underneath the arch of the magnets; this disposition appeared to be a better one for providing effective insulation and reducing the risk of breakdown. With really good coils and a suitable auto-trembler common to them all, little difficulty should be experienced in running with a current of ½ ampere, and with such a small current there would be very little trouble from pitting contacts.

Mr. Warr, in reply, said he would always prefer high-tension ignition for motor-cars and for stationary engines. The ordinary gas engine driver and the modern chauffeur could not usually diagnose a sickly accumulator, or even recommend a cure, and this was one of the reasons why the dry cell should be encouraged. He advised the use of the dry cell for an ordinary make-and-break contact and the plain coil, but with a trembler coil the cell was subjected to heavy duty, and was quickly exhausted. A reliable cell could now be obtained with high capacity and reasonable weight. A perfectly balanced coil should not take more than ·75 ampere with an E.M.F. of 4 volts. Reflashing the magnets was synonymous to remagnetising the permanent magnets. This was more satisfactorily carried out by constructing a large electromagnet and stroking the poles of the permanent magnet on its face. Remagnetising would probably be required every three or four years. With regard to the type of contact, one that had a combination of the wipe and make-and-break was obtainable. To ascertain the correct position of the contact screw of the trembler blade, the ammeter should be connected up in circuit between one terminal of the two-way switch and the common bar of the coils, shown in fig. 6. The application of the fuse was to be recommended for setting the trembler blades only. As to retarding the spark when climbing a gradient, if one timed the spark to occur when the piston was just starting on the expansion stroke with the engine stationary, the position of the spark would not be the same when running at high speeds on the level; the timing was late, due to the lagging magnetic effects of the coil. Seeing that the engine speed was lower when mounting a gradient, it was better to retard the spark from the position used at high speed. He had tried the vaseline cup round the accumulator terminals, but the acid spray made a mess of them in spite of this precaution. The insulation of the secondary winding was subjected to an enormous electrical stress if the two ends of this winding were on open circuit, and the safety gap which he mentioned as an advantage, was analogous to the relief valve of the steam boiler. Comparing magneto and coil ignition, the magneto was certainly more expensive in initial cost than the coil equipment, but the mechanism was more simple and compact, and the magneto was a more reliable article; there was no doubt that greater power was obtained from the magneto than the coil. The reason for this was that as the speed of the armature increased, the spark produced became larger and hotter, and combustion was commenced and progressed more rapidly.

Institution of Electrical Engineers (Glasgow).

At the opening meeting of the Glasgow Section on November 16th, Mr. E. G. Tidd, chairman, delivered his inaugural address, dealing with the progress of electrical science during the past 25 years. Referring to the Glasgow electricity supply undertaking, he stated that the total capacity of the plant installed was 39,780 H.P., with 16,926 customers, 837 public arc lamps, and 3,853 motors, equalling 23,748 H.P. He believed he was correct in stating that the existing stations were practically filled up. At the present time in Glasgow there were 180½ miles of tramway track, having a total of 13,000 H.P. in the generating plant, besides auxiliary and exciter plants. Turning to the state of the manufacturing business, Mr. Tidd thought that one of the chief features which had helped the manufacturers to arrive at the present state of perfection, was the introduction by mechanical engineers of electrical departments. This woke up the manufacturers of electrical machinery to the fact that sound mechanical engineering was the foundation of all good electrical machinery. To-day the standardisation and perfection of design in electrical machinery was probably in advance of any other class of engineering. Electric wiring had probably been hampered by undue cutting of prices, more than any other industry, and they could only hope that reputable firms, who did thoroughly honest work, would survive the cutters, and by increased output and better methods, make the business more profitable to themselves, while not increasing the cost to the consumer.

Institution of Electrical Engineers (Newcastle-upon-Tyne).

The subject chosen by Prof. H. Stroud, chairman of the Section, for his inaugural address on Monday last was "Radio-telegraphy," with special reference to the new wireless installation at the Armstrong College. The apparatus provided includes the spark and Poulsen arc sending systems, with means for varying the wave length over a wide range, and corresponding receiving apparatus for Marconi and Poulsen waves. The author stated that the new Telefunken "shock excitation" system, based on Wien's "quenched spark," 1906, had proved a great improvement on the ordinary spark method for the production of electric waves. In the latter, reaction took place between the primary spark circuit, as long as the spark lasted, and the secondary antenna circuit, this reaction resulting in the production of waves of two wave lengths. In the new Telefunken system, advantage was taken of the very large damping of a series of very short sparks. The primary oscillations were "quenched" by this damping after but one or two swings, and the secondary circuit continued to oscillate in a single period, giving rise to an electric wave of definite wave length. An alternator having a frequency of the order of 1,000 per second was used to give, by means of a transformer, a very high number of discharges per second. One of the principal advantages of this system was the musical tone produced in the telephone at the receiving end; this was distinctive of the station transmitting, and very different from the noise of atmospheric disturbances.

In the Lepel system, a very short cooled spark between two flat metal plates, 3 in. in diameter, was used. These plates were separated by paper except at the centre, and the supply voltage was 400-500 volts. The receiver in this system contained two tuned circuits, the aerial and the intermediate, and an aperiodic circuit in which was the detector, of the thermo-electric type.

The problem of directive wireless telegraphy had made considerable advance towards solution by the experiments of Bellini and Tosi, who had constructed a complex antenna, by means of which the waves were sent almost entirely in one direction. Similarly at the receiving antenna they could locate the sending direction.

Experiments with this system were made with satisfactory results last year between Dieppe and Havre, and Dieppe and Barfleur.

LEGAL.

Anderson v. H. P. Saunderson & Co.

In the King's Bench Division on Thursday, November 18th, before Mr. Justice Darling and a special jury, Mr. James Chapman Anderson, of Aikenhead, Blairgowrie, in Perthshire, sued Messrs. H. P. Saunderson & Co., electrical and motor engineers, of the Elstow Works, Bedford, for the recovery of the sum of £280, moneys paid to defendants in respect of the purchase of a 30-B.H.P. "Universal" motor tractor, which plaintiff bought from defendants to generate electric light, and also for agricultural and farm uses. Defendants counterclaimed £90 balance due on the purchase price.

Mr. Abel Thomas, K.C., with Mr. F. O. Robinson, was counsel for the plaintiff; and Mr. Norman Craig, K.C., with Mr. Schiller, appeared for the defence.

Mr. Thomas stated that his client was a retired Indian official living on his estate in Scotland. In July of 1907, he was desirous of cultivating his estate by engine power instead of by horses, and also of lighting his house with electricity. He communicated with the defendants with a view to procuring a motor which would do these things, with the result that he eventually agreed to purchase a 30-H.P. Universal tractor for the sum of £370, which the defendants declared would do what plaintiff required of it, and which had the advantage of being able to run on petroleum as well as petrol. At plaintiff's request defendant firm sent a representative to Perthshire, and a contract was entered into for the lighting of Mr. Anderson's premises with electricity at a cost of £400. After considerable delay, continued counsel, the tractor was delivered; when plaintiff came to work it, he found that it would not burn petroleum as stated by defendants, and furthermore, it was most extravagant in its consumption of petrol. It failed to do the work required, and caused considerable trouble. Eventually, plaintiff had it examined by an expert engineer, and as a result asked defendants to take the engine back. This they had refused to do. Plaintiff declared that the motor was inefficient for the work, that the construction of the carburetter was faulty, causing excessive use of petrol; further, that the ignition was faulty, and that the system of accumulators, coils, contact breakers and wiring was so intricate that only a skilled mechanic could work it. Further, the contact-breakers were insufficiently protected against dust and rain water; the cylinders, too, were faulty in construction, and the water jackets leaked. With regard to all these points defendants had been guilty of a breach of their contract and warranties, and his client claimed the return of the moneys paid, or damages. The defendants, concluded counsel, denied that there was any breach of contract or that the engine was inefficient, and they counterclaimed £90, the balance of the purchase price of the motor.

Mr. Black, plaintiff's agent, was called, and supported counsel's statement. In cross-examination, Witness admitted that to use a 30-H.P. motor to run the electric light installation would, in itself, be a very wasteful process, but the machine was also required to drive a threshing mill, which would consume about 20 H.P., and the dynamo was to be driven at the same time.

Evidence was given by Mr. Douglas, consulting engineer, of Dundee, Mr. William R. Bell, a mechanical engineer engaged in the motor trade, and others.

The hearing was resumed on Saturday and Monday.

After further evidence for the plaintiff had been called, Mr. Norman Craig, for the defence, declared that the truth of the case was that the plaintiff, having purchased the tractor, found it was too expensive for his requirements, and wanted to throw it back on defendants. The bulk of its work consisted of driving the dynamo for the electric light, and for that purpose the machine was much too powerful. It was suggested at the time that it would be more economical to purchase a smaller engine to drive the electric lighting plant, and use the tractor simply for farm work, but plaintiff would not agree. No warranty had ever been given with the machine, and it was quite capable of doing all that was required of it.

Mr. H. P. Saunderson, managing director of the defendant company, said his firm had sold motors, such as that supplied to the plaintiff, in all parts of the world. The machines had successfully stood the tests at all sorts of agricultural shows, and had won medals at home and abroad. These motors would run on paraffin, and worked well.

Other evidence was also called by defendants to uphold the reputation of the machine, and Prof. Capper, of London University, stated that the motor was sufficient for all the purposes for which it was designed.

The jury returned a verdict for the plaintiff, awarding damages £290. The machine, they held, did not come up to guarantee, and plaintiff was entitled to return it.

Judgment was entered accordingly, with costs, and stay of execution was refused.

Workmen's Compensation Claim.

In the Manchester County Court on Wednesday last week a claim for an award of 15s. 4d. per week was made by an electrician's wireman named John Daley, of Rochdale Road. While assisting in an electrical installation in Piccadilly for Messrs. Bentley & Co., of Newton Street, he fell from a ladder on a concrete floor, dislocating his elbow and receiving other injuries.

Mr. Mainprice said compensation was paid until July 26th. Daley was operated upon for a rupture which he alleged was caused by the accident, and after the payment stopped the matter was referred to a medical referee, who had decided that the rupture was not caused by the accident, and that the applicant was now quite fit to do his work. He had tried to find work, but had been unsuccessful, and Mr. Mainprice therefore submitted that as the inability to get work was due to the accident happening, he was entitled to an award until he was able to get something to do.

Judge Parry said that the contention was an ingenious attempt to get outside the Act of Parliament, but it was questionable whether it would be worth while to take it to the House of Lords. This was not like the case of a man with a broken limb or a lost limb. Employers refused to take them on again because of the loss. The medical referee having found that the incapacity caused by the accident was at an end, there must be an award for the respondents, but the costs would not be taxed unless further proceedings were taken.

Electrical Apparatus in Fife Mines.

A prosecution of interest to all concerned with the management of mines where electrical apparatus is in use was heard on Thursday last week before the Sheriff at Dunfermline. Charles Augustus Carlow and Henry Rowan, described as "managers and agents" appointed by the Fife Coal Co., were charged with having, between April 1st and August 7th, permitted the use at the company's Foulford Pit, Cowdenbeath, of electrical plant and apparatus which did not conform with the special electrical rules, and that despite the fact that on April 30th Mr. Robert McLaren, H.M. Inspector of Mines, had addressed a letter to the company directing hat the plant and apparatus should be made to conform with the ules William Edward Richardson, certified colliery manager at 'oulford Pit, was also similarly charged. In each case the charge as denied. Mr. J. S. Soutar conducted the prosecution, and nong those present were Mr. McLaren, and Mr. Robert Nelson, a lome Office expert. The respondents were represented by Ir. R. S. Horne, advocate, who was accompanied by various ining and electrical experts.

Mr. C. A. Carlow was called first as a witness against Richardson. le said the company had 37 pits, and four were being sunk. Part f his duty was to look after the stores, upon which was expended early anything up to £240,000. All the officials of the company ad before them a complete statement of what was required of hem by law. At every colliery where there was an electrical stallation, there was a man more or less skilled in electricity, nd nine months ago the company had appointed a Mr. Fraser, an lectrical engineer, who was specially trained in colliery work, to ave charge of all electrical plant. A year and a half ago they ad commenced a process of making all the machinery conform to ne rules independently of any instructions from the Mines aspectors, and during that time they had scrapped machinery to ne value of thousands and thousands of pounds. When any gent complained that certain plant was not in good order, the ompany had never refused to accede to his wishes. Their ttitude was absolute willingness to carry out all suggestions made y the Mines Inspectors for the safety of the men. They wanted have it proved, after spending thousands of pounds, that cables ere unsafe before sending them to the scrap heap. Answering ne Sheriff, Mr. Carlow said he practically ignored the letter of anuary 30th sent by Mr. McLaren, and he did not think it his uty to send the letter to the party whom he considered esponsible.

Mr. Henry Rowan asserted that Mr. C. A. Carlow had nothing hatever to do with seeing the rules enforced in the pits. Two years efore Mr. McLaren had directed the company to make the achinery conform with the special rules, witness had given structions to that effect, and when Mr. McLaren wrote, the nprovements were still proceeding. From October, 1908, to anuary, 1909, between £300 and £400 had been spent on the lant at Foulford Pit, and what was complained of involved very ttle expense. The complaint was attended to immediately on is attention being drawn to it in August. If there was a difference of opinion in regard to electrical matters between H.M. nspector and himself, he would defer to the Inspector.

Mr. Charles Carlow, managing director of the company, said he id not see Mr. McLaren's letter of January 30th, but he would ave treated it in the same way as his son did. It was a circular n the face of it, and was of no importance to the company, who ad already determined that their plant was to be brought up to ne regulations. Answering Mr. Horne, witness said Mr. Rowan as one of the most expert colliery managers in Scotland, and was ghly paid for his responsibility and experience. If responsibility ere to be fastened on to the head office—on to his son and himlf—that would mean that the men who were paid for handling ne works, the managers, had no responsibility under the Act. ich a practice would tend to the very opposite of efficiency.

Mr. Robert McLaren, H M. Inspector of Mines, said that his tter was the result of a trial in the Sheriff Court which failed ecause intimation had not been sent by him to the owners to comply ith the regulations. He had sent the intimation to 37 owners in cotland. What was meant by the letter was that where electric ant had been put in prior to the establishment of the special lles in April, 1905, that plant should be taken out at once, and ade to comply with the rules. If Mr. Carlow, jun., had taken the ouble to look at the back of his notice, he would have discovered at a number of pits, including Foulford, were specified.

Mr. Horne objected to this evidence, because in the letter in ocess, there were no pits named, and the Sheriff upheld the jection.

Cross examined, the Inspector said he had not gone down oulford Pit, but his assistants had made him aware of the plant ing defective. He thought the best way to bring the owners up the scratch was to take the bull by the horns. The source of nger lay in the cables carrying 500 volts being bare at points. e could not tell what subjects in Foulford Pit were complained of ior to January 30th, 1909.

Mr. Horne: As a Government inspector, are you here to say at your assistants informed you of defects in electrical plant in oulford Pit prior to January 30th, and you have no note of these?

Witness: I do not have them here, but I have them at home. I pected as an honest man——

Mr. Horne: I am not disputing your honesty. They were not ing down to that level. But it was a most extraordinary state matters that he was bringing out a complaint without knowing s facts. To the witness: Give me the date when you first got formation from an assistant with regard to any of the matters w complained of.

Witness: April 30th, from Mr. Masterton. He complained that gate-end box was not earthed, and that electric cables were not operly hung on the roadside. Subsequently, he got information out the fuses, switchbox and abrasions in the cables from Messrs. elson and Masterton, who made a joint inspection of Foulford t.

At this point, Mr. Horne contended that the case had broken wn in respect that more than three months had been allowed to pse between the time the matters complained of arose and the stitution of proceedings. After considering the point, the Sheriff d the Act admitted of more than one interpretation, and at at stage the proper course for him was to repel the objection and it come before the High Court.

Mr. John Masterton, assistant inspector of mines, stated that there was evidence of carelessness at various points in fixing the cables. He found the wires of a cable exposed to the extent of $\frac{1}{10}$ in., which was sufficient to kill a man. At one point he saw a cable resting on a rail, which was a contravention. Witness also spoke to seeing portions of the cable where the insulation was damaged and the wire exposed and a place where the tubes were rubbing on the cable.

Mr Robert Nelson, electrical expert at the Home Office, said he found the cable very much abraded, and he very quickly found bare parts, in spite of the fact that he could not give undivided attention to the cable. Witness also spoke to finding defective earthing at the terminal boxes, and he objected to the type of switches and fuses in use for lighting. He did not consider it unreasonable or impracticable to work up to the rules. He thought the rules represented the minimum of safety.

Among others who gave expert evidence were Mr. William Charles Hawtayne, consulting electrical engineer, London; Mr. Ernest Adie Runciman, electrician for the company in the Cowdenbeath district; Charles George, overman at Foulford Pit; and James Maguire, pit fireman.

The first witness for the defence was Mr. Henry Savage, of Henley's Telegraph Works, London and Glasgow, who stated that his firm supplied the cable, the construction of which he described. He added that there was no danger from the mere outside surface of the cable being frayed, so long as the insulation next the wires was intact.

The Court rose after sitting nearly eight hours, and it was agreed to hear the rest of the evidence on December 6th.

The Electro-Peat Coal Co. Litigation.—Mr. Darlington Simpson's Appeal Allowed.

On the resumed hearing of the appeal by Mr. George Darlington Simpson from the judgment of Mr. Justice Lawrence on the finding of a special jury in the case of Barker *v.* Earl Mayo, holding him liable for certain alleged misstatements in a prospectus of the Electro-Peat Coal Co., Ltd. Mr. Cozens-Hardy argued that there was no evidence whatever to justify the finding of the fact, that Mr. Simpson had authorised the particular document complained of being shown to the underwriters. He contended that the only material fact was, did Mr. Simpson mislead the plaintiff by showing him, or by authorising the showing to him, the prospectus in question? He submitted with deference that there was confusion in the mind of the learned judge in the Court below, and he had not distinguished between "showing" and "authorising the showing." The promoters of the company were undoubtedly the Electro-Peat Coal Syndicate. Bowden and Walker were either members of that syndicate or were employed by it, but it was never proved or ever suggested that Mr. Simpson ever had a share in it. As a matter of fact he had not; and a very significant fact was that neither Bowden nor Walker was called at the trial to say that he had shown the prospectus to the plaintiff or brought it to his knowledge by anyone's authority. It was not done on the authority of Mr. Simpson, and one would have thought that if the plaintiff wanted to prove authority he would have called both Bowden and Walker.

Lord Justice Fletcher Moulton pointed out that as the appellant had no opponent they must look at the evidence. If there was no evidence he must succeed.

Mr. Cozens-Hardy said the way it was put was that there were meetings of the intending directors, and it was decided that the company must have underwriters. At a meeting of January 18th—two days before the prospectus was shown by Bowden to the plaintiff—a document was produced. Mr. Simpson was present at a meeting and saw it,, and, according to his evidence, it was the only document he saw. The document had blanks for the names of directors, and on the back was a note intimating that the prospectus was subject to such improvements or modifications as might be approved by counsel. Mr. Simpson was not a director, and did not sign that document, and the prospectus of January 20th he never saw. The only one he saw was that of January 18th, and that was shown to Mr. Barker by some one else.

Lord Justice Fletcher Moulton suggested that all it was necessary for Mr. Simpson to prove was that there was no evidence of any authority to show the prospectus.

Mr. Cozens-Hardy: The one agreed fact in the case, as Sir Edward Carson, who represented the Earl of Mayo, said, was that the Peat Coal Syndicate was the promoter. He (counsel) was not concerned with the April prospectus, as with regard to that the jury had found in Mr. Simpson's favour.

After considering the evidence, the Master of the Rolls, in giving judgment, said that it seemed to him that there was absolutely no evidence to support the finding of the jury that Mr. Simpson, or, in fact, any of the defendants, authorised the showing of the prospectus to the plaintiff. He thought, therefore, that there had been a miscarriage of justice. The learned judge in the Court below in his summing-up seemed to have really treated the question as a formal and unnecessary one which could only be answered in one way. He much regretted that the Court had not had the benefit of hearing an opponent to the appeal, because with a case that had lasted 17 days in the Court below, it was not satisfactory to ask the Court to say that there was no evidence to support the findings of the jury. Having regard, however, to the fact that the plaintiff did not think fit to appear, it seemed to him they were bound to allow the appeal, and judgment must be entered for Mr. Simpson.

Lord Justice Moulton: I entirely agree.

Lord Justice Farwell also agreed, and the appeal was accordingly allowed.

The Proceedings Against the Welsbach Co.

At the Clerkenwell Police Court on Saturday, Mr. Bros resumed the hearing of the summons issued against the Welsbach Incandescent Gas Light Co., Ltd., at the instance of the Wolfram (Tungsten) Metal-Filament Lamps, Ltd., and the General Electric Co., Ltd. This was the fifth day of the hearing.

Mr. Rufus Isaacs, K.C., M.P., Mr. H. A. Colefax and Mr. Ernest Lunge appeared in support of the summons, and Mr. A. J. Walter, K.C., and Mr. Bodkin represented the defendant company.

Dr. Otto Oberlauder, a doctor of philosophy, and consulting chemist and engineer, 29, Queen Street, E.C., was the first witness. He said that for a number of years he had followed the development of electric lighting, and had been professionally associated with it. He was acquainted with the publications that referred to new inventions in electric lighting, and was familiar with the manufacture of metal-filament lamps. He had previously seen the two lamps produced. One was sent to him in Berlin. It was handed to him by Mr. Remane, of the German Auer Co., and the other was given to him by Mr. Fletcher, of the General Electric Co. Each one was marked "Welsbach" "Aur." He was acquainted with Baron von Welsbach, and osmium was used by Welsbach for the metal-filament lamp. His examination of the lamp produced enabled him to say that it was made of tungsten or wolfram. The osminm lamp was invented by Dr. Welsbach, and patented in 1898. When the invention was published it commanded the attention of technical people throughout Germany. Previous to that time the filament of an electric lamp was made of carbon, and the osmium lamp showed a distinct advantage over the carbon lamp, giving about twice as much light with the same power. The osmium lamps were introduced into this country on a commercial scale about 1903 or 1904. Dr. Welsbach had applied for other patents apart from this lamp. In so far as these lamps related to filament lamps they all referred to osmium lamps, and the Welsbach electric lamp was one whose filament was made of osmium. They were put on the market by the German company. He had seen the company called by several names in technical and English publications. In this country it was called "Auer Gesellschaft," "Auer Company" and "Auer Society," and was so known in this country. After the publication here of Welsbach's invention, the question of the filament of electric lamps was further investigated, and in 1904 a filament of wolfram or tungsten, a metal known by both names, was proposed. The German Auer Co. made lamps in accordance with that invention. They commenced in 1905, and the sale of the lamps had, to his knowledge, been a very large one. They were introduced into this country by the General Electric Co. Witness had frequently seen such lamps in this country with marks on them indicating that they came from the Auer Co. That company had, from his knowledge of the trade, been the reputed mannfacturers of the Osram lamp. Some of these lamps had been made in this country since last year.

Mr. Rufus Isaacs: Would it be right to describe a lamp whose filament is made of osmium as the invention of Baron von Welsbach?—Yes.

Would it be right to describe a lamp whose filament is made of tungsten as an invention of Baron von Welsbach?—No. Osmium and tungsten are totally different metals.

The name of Welsbach was well known in the lighting world. It was one of the best known names. It had become known in connection with incandescent gas lighting.

Have you ever heard of the defendants making metal-filament lamps?—No.

Replying to a further question, Witness said the lamp produced (Exhibit 7) was not made by the Welsbach Co. It was made by Ehrich & Graetz.

Cross-examined by Mr. Walter, the Witness said he knew that tungsten or wolfram was patented in 1889 for metallic-filament lamps, but that did not lead to the tungsten lamp. He had not heard of proceedings being taken against the Welsbach Co. by Just and Hanaman.

Mr. Walter: Are these proceedings in the police court taken because the owners of the patent are unable to sue the Welsbach Co. for infringement?—No, they are not.

Were you aware that the name "Auer Gesellschaft" was dropped because of the complaint of the defendant company?—It was dropped at the request of the General Electric Co., and the letters "G.E.C." were substituted. The osmium lamps were not a commercial success, but the Osram lamps had been a very great commercial success.

Do you know of any lamp prior to the lamp now complained of, that had ever been put upon the market with the word "Welsbach" upon it?—No, I don't.

Or of any electric lamp being put upon the market with the letters "Aur" upon it?—I do not.

Are you prepared to deny that the word "Welsbach" on merchandise in this country commonly means goods of the Welsbach Co?—It does not include electrical goods.

Are you prepared to deny that the letters "Aur" upon merchandise commonly means merchandise of the Welsbach Co.?—I deny it in connection with electrical goods.

Do you suggest that Welsbach's inventions with regard to metal-filament lamps were confined to osmium?—I do.

Have the defendants to your knowledge ever described the wolfram tungsten lamp as the Welsbach lamp?—I have seen it so described in many publications, but it was wrongly described.

Mr. Duncan Watson, of 102, Charing Cross Road, a member of the Institution of Electrical Engineers, said he had had a great deal of experience in electrical matters, including electric lighting. He remembered the introduction of osmium lamps. He first heard of it through information contained in a technical paper. The lamp was a great improvement on all other metal-filament lamps. An advertisement which appeared in the *Daily Telegraph* of September 22nd conveyed to him the impression that the lamp referred to must be the osmium lamp under the Welsbach name. He formed that opinion because it had on it the words "Welsbach" and "Aur," and further stated that the metallic-filament lamp was invented by Baron von Welsbach.

Mr Walter (cross-examining): You have known for years of the Welsbach Co., and that the word "Welsbach" upon goods in the United Kingdom means goods of the Welsbach Co.?—Certainly.

And you have know for years that the trade mark of the Welsbach Co. has been "AUR"?—No. I did not know that until I heard it in this Court a fortnight ago. Witness added that he had taken no interest in the Welsbach Co. from the point of view of their trade mark, but he had been interested in the company in other respects. It was what he saw in the technical journals principally that made him think the lamp referred to was the osmium lamp.

Do you mean that looking at the picture you thought from the shape of the lamp that it was the osmium lamp?—My answer is that the similarity of the lamp and the words "Welsbach" and "Aur" made me think so.

You have never seen a lamp labelled "Welsbach" except the lamp put upon the market by the defendant company?—No.

If you had known that the trade mark "Aur" was the trade mark of the Welsbach Co., you would have arrived at a different conclusion?—No, I should have thought it was very smart on their part. I should have thought it was very good as far as they are concerned, inasmuch as it is connected with the name of Baron von Welsbach.

Will you refer me to a single advertisement of the General Electric Co., or any company handling the Osram lamps, that refers to the "Auer" or to "Welsbach?"

The Witness said he would have pleasure in handing several publications to counsel, in which these references appeared. He produced the Electrical Review of October 5th, 1906.

This is a paper circulating amongst electrical engineers?—Yes.

And this is an article describing modern glow lamps?—Yes.

Counsel quoted from the article, which was to the effect that one of the latest of these lamps is the Osram, in which the filament consisted of a layer of osmium with wolfram. There was also a reference to the German Welsbach Co. introducing this lamp. Witness also produced the Electrical Review of January 24th, 1908.

Mr. Walter: I see—the same paper, circulating amongst the same class?—Yes.

Counsel then quoted from page 156, announcing that a French company would shortly be formed to utilise the Austrian patents for the wolfram lamp, that the Industrial Wolfram Co., and the German Incandescent Gas Lamp Co., of Berlin, would participate in the undertaking, which was to have a share capital of £188,000. Witness further produced a copy of the Electrical Review of October 30th, 1908, which referred to "a German view" of the future of the metallic-filament lamp. He also produced a paper by Mr. Hirst, of the General Electric Co., read before the Institution of Electrical Engineers on May 21st, 1908, and also a copy of the *Review of Reviews*, containing an interview with himself (the witness), entitled "Electricity *v.* Gas."

Are you the Mr. Duncan Watson mentioned in this interview?—There is not another one that I know of.

Is this in the advertising part of the paper, or is it an inset?—Not at all; it is news of the most interesting kind. I may say it would be utterly impossible to have that published as an advertisement.

Extracts from these publications were read.

In further cross-examination, the Witness said that he knew the Osram lamp had nothing to do with Welsbach.

Tell me, the General Electric Co. do not happen to be interested in your business, are they?—That is about the last question I should have expected to be asked here. Certainly not, or any other concern of any kind at all.

Mr. Walter: It was merely a matter of curiosity. What made you think this was an Osram lamp?—For the very simple reason that lamps of precisely the same manufacture are sold under various names. I mean that lamps coming from the same factory are sold by retailers with a name purporting to give it distinction. Carbon-filament lamps, although coming from the same factory, have been known to be sold under different names.

Replying to further questions, Witness said he thought that Baron von Welsbach had something to do with the Osram lamp, because the "Auer Gesellschaft" and Baron von Welsbach, he understood, were very closely connected. He always thought the connection was a very direct one, inasmuch as the product of the same factory was the Osram.

Re-examined by Mr. Isaacs: According to the Electrical Review of June 19th, 1906, it was announced that the German "Auer" Co. was introducing the Osram lamp?—Precisely.

If that is stated in a paper like that, would it become generally known?—There is no question about that.

And was it, in fact, generally known from the time of the introduction that the "Auer" Co. were manufacturing and introducing it into this country?—Yes.

In the trade?—Exactly.

I see the Electrical Review that was referred to is a technical paper. Is that a paper which is seen and which circulates among the trade?—Yes, it is the oldest and, I believe, retains the largest circulation.

The suggestion is that it only circulates among scientists?—I have no doubt that many members of my profession would deem it an honour to be called a scientist.

I notice in looking at the ELECTRICAL REVIEW that a very large portion of it consists of trade advertisements?—Exactly.

The hearing was adjourned until Saturday, December 4th.

ALUMINIUM CORPORATION, LTD.

IN the Companies' Court on Tuesday, Mr. Justice Swinfen Eady had before him a petition by the Aluminium Corporation and its liquidator for the sanction of the Court to a scheme for the transfer of its assets to a new company.

MR. YOUNGER, K.C, in support of the petition, stated that the company, which had works at Newcastle-on-Tyne, Dolgarrog, North Wales, and elsewhere, was incorporated with a capital of £500,000. Of that amount £440,000 was in 7 per cent. participating preference shares and £60,000 was in ordinary shares. The preference shares had a participating cumulative preference of 7 per cent., the ordinary a non-cumulative preference of 7 per cent., and of the remainder of the profits 40 per cent. was to be divided amongst the preference, and 60 per cent. amongst the ordinary shareholders. Of the preference, 257,205 £1 shares were issued, and of these 252,220 were fully paid, 2,826 had 15s. per share paid upon them, and 2,159 had 10s. per share paid. There was a debenture issue of £26,906 odd, and a large unsecured debt. In 1908 the company was wound up, and liquidators were appointed in March of that year. In May a scheme of arrangement was sanctioned by Mr. Justice Neville, but it fell through owing to the company being unable to find sufficient cash to carry it out, and an attempt by the liquidators to realise the company's property had also proved abortive. By the scheme now proposed the general creditors would be paid in full in cash, those unsecured creditors whose debts were under £10 would be paid in full in cash, those unsecured with debts of over £10 would receive preference shares in the new company to the nominal value of their debt, and the shareholders would receive partly-paid shares in the new company.

His LORDSHIP asked if the affairs of this company had not been before him on a previous occasion.

MR YOUNGER said that this company must not be confused with the British Aluminium Co., which was a much larger concern.

There was no opposition, and subject to some slight alteration and the production of evidence as to the willingness of the shareholders to take the new shares, his Lordship sanctioned the scheme as proposed.

LONDON ELECTRIC SUPPLY COMPANIES AND COMPULSORY PURCHASE.

AN advertisement appeared in the *Times* of November 19th, which shows that it is the intention of the London County Council to apply for an Act of Parliament for the purpose of becoming the purchasing authority of the undertakings in the County of London. This proposal is obviously part of a general scheme by which the entire production of electricity in London may become vested in the County Council. The exact objects of the proposed Act are thus defined.

> To constitute or make provision for constituting the London County Council (hereinafter called "the Council") the purchasing authority of the undertakings (in which expression is included lands, buildings, works, materials, plant, property, rights, powers and privileges) of the companies in lieu of, and in substitution for, the local authorities as defined by the Electric Lighting Acts, 1882 and 1888, or any other local authority or authorities by whom any such undertaking or any part thereof, may be purchaseable, either under those Acts or under the London (Westminster and Kensington) Electric Supply Companies' Act, 1908, or under any of the Acts and orders regulating the several companies mentioned in the second column of the said table, and for that purpose to extend and make applicable to, or to re-enact with respect to the said companies, or any of them, all or any of the provisions of Secs. 23 to 27, both inclusive, of the London Electric Supply Act, 1908, either without modification, or with such modification as may be contained in the said intended Act.

The names of the companies set out in the table are the Kensington and Knightsbridge Co., the Notting Hill Electric Lighting Co., the St. James' and Pall Mall Co., the Central and Electric Supply Co. and the Westminster Electric Supply Corporation.

To properly understand this notice, it is necessary to refer to the London Electric Supply Act, 1908, Ch. CLXVII, which provides by Sec. 23 (1) that the County Council may purchase any undertaking which may be purchased by a local authority. The County Council must, however, give three years' notice of their intention to exercise such powers. By Sub-sec. (2) the County Council cannot give notice to purchase the undertaking of any one company unless they shall at the same time give notice to purchase the undertaking of all the companies. By Sub-sec. (3) the terms of purchase are to be as set forth in the Electric Lighting Act, 1888, Sec. 2, subject to this, that the undertaking of the Charing Cross Co. is to be purchased on special terms, and that of the City of London Electric Lighting Co., Ltd., is to be entitled to compensation for profits which might have been made by that company between August 2nd, 1900, and August 18th, 1932. By Sub-sec. (5) the date of purchase is to be August 26th, 1931. By Sec. 24 certain restrictions are placed upon the companies increasing their charges after the notice to purchase has been given by the County Council; by Sec. 25 the County Council may discharge any part not exceeding three-fourths of the sum payable to a supply company in respect of such purchase; by Sec. 26 the Council may make certain advances to the companies, and by Sec. 27 provision is made for expenditure by the London County Council.

The local authorities which are now empowered to purchase by the Electric Lighting Act of 1888, are enumerated in the schedule to the Electric Lighting Act, 1882. Broadly speaking, they are the London Borough Councils. It remains to be seen what attitude these bodies, or such of them as have electric lighting companies within their boundaries, are likely to take up towards the proposed Bill of the London County Council. Having regard to the fact that this is an attempt to unify the supply of electricity all over London, it may well be that some of the Borough Councils would be glad to retain the right which Parliament has given them, while others would be glad to part with it if they were to be adequately compensated.

It is interesting at this point to consider what is meant by compulsory purchase.

The law on the subject is to be found in Sec. 2 of the Electric Lighting Act, 1888. It is therein provided that a local authority within whose area the property of a supply company is situate, may within six months after the expiration of 42 years from the date of the passing of the company's provisional order, and within six months after the expiration of every subsequent period of 10 years, require the company to sell the undertaking. The terms upon which such request may be made are that the local authority will pay: "the then value of all lands, buildings, works, materials, and plant of such undertakers suitable to and used by them for the purposes of their undertaking within such jurisdiction, such value to be in case of difference determined by arbitration." Pausing here, it will be seen that the local authority is under no compulsion to buy the undertaking; it merely has an option to do so, and, when we consider the terms upon which the purchase must be effected, it is quite possible that when the time arrives, the local authorities will not care to speculate. The terms are as follows:—"The value of such land, buildings, works, buildings and plant shall be deemed to be their fair market value at the time of purchase, due regard being had to the nature of and then condition of such buildings, works, material and plant and to the state of repair thereof, and to the circumstance that they are in such a condition as to be ready for immediate working, and to the suitability of the same to the purposes of the undertaking, and, where a part only of the undertaking is purchased, to any loss occasioned by severance; but without any addition in respect of compulsory purchase, or of goodwill, or of any profits which may or might have been or be made from the undertaking, or of any similar considerations."

The reference to compensation for compulsory purchase excludes anything like the 10 per cent. which is added to the purchase price of land required under the Lands Clauses Acts. It may therefore be assumed that all the companies selling their undertakings would get would be the actual value. There would be nothing to be made out of it. But would the local authority be a likely purchaser?

In County of London orders in favour of companies it has been the practice to provide that the period of 42 years shall run from one fixed date—that is to say, August 26th, 1889. The object in view evidently was to secure that in the event of a purchase all the electric lighting concerns of the metropolis in the hands of undertakers other than local authorities, might be acquired at one and the same time. It is obvious it must have been contemplated that the County Council or some similar body would decide to purchase; but it is not very easy to see what there will be to compel the local authorities who now supply electricity to sell their undertakings to the County Council. We know of no statute by which they can be compelled to do so, and it was obviously contemplated, when the Act of 1888 was passed, that the local authorities in London would be ready and anxious to become undertakers themselves.

It is probable, however, that when the time for exercising this right to purchase compulsorily does arrive, the fact that the right is to be exercised by the County Council will be of enormous advantage to the companies and their shareholders. It is difficult to foresee what may be the state of affairs in 1931—the earliest date when such a purchase can be effected. And in presence of such uncertainty it is hardly to be supposed that any prudent board of directors is relying much upon what the property of the company will fetch in 1931, especially having regard to the old iron prices prescribed by statute.

One other point remains to be considered: it is a matter which will doubtless be provided for in the Bill for which the London County Council are going to Parliament. Sec. 3 of the Electric Lighting Act, 1888, authorises the Board of Trade to vary the terms upon which a local authority may require the undertakers to sell *in such manner as may have been agreed upon between such local authority and the undertakers.* Assuming that the County Council steps into the shoes of the borough councils, this section would enable the County Council to negotiate privately for the purchase of all the property of the London Electric Supply companies.

Whether this is one of the objects which the County Council have in view must only be the subject of conjecture.

BUSINESS NOTES.

Universal Domestic Motor.—With reference to the letter on this subject in our last issue, Mr. E. E. Coy, of 77, St. John's Road, Bootle, Liverpool, sends us the specification of his special small-power motor, which, he contends, meets the case. It develops ¼ horse at about 2,600 R.P.M., and can be attached by means of an adapter to any ordinary lampholder; the price is quite moderate. It can be supplied at a small extra cost mounted on a suitable wooden base with S.P. switch and D.P. fuses, and no starter is required. The motors are a speciality, and are of standard pattern, being the same as used in his "Whipall" electric tire pump recently described in our pages. They are supplied for any voltage up to 250 at the same price, and have been used for organ blowing.

Mr. F. T. Turquand also writes to say that he has recently seen an electric motor fitted up as Mr. Urquhart suggests. It is apparently a new invention, and is said to be entirely fool-proof. It is lighter than other motors for the same power, can be reversed under full load, and started also without external resistance or starting switch. The armature can be jammed up at full voltage without injury to the motor. A spindle is carried on to which several domestic appliances can be fitted, *e g.*, tooth wheels, polishing buffs, blacking brushes, &c. The company marketing this novel and useful application of electricity is, he says, the Dynamic Co., Ltd., 6, Broad Street Place, E.C.

Turkey (Asia Minor).—The *Bulletin Commercial* (*Brussels*) of November 6th states, on the authority of the Belgian Consul General at Smyrna, that there are good openings in that town for electrical machines and accessories. Attention is drawn particularly to continuous-current dynamos of 2 to 15 KW., switchboards, arc lamps, incandescent lamps with metal filament, electric bells, private telephone installations, &c. For the purpose of securing a market, firms should above all choose a reliable agent, possessing a good general knowledge, and he should be allowed a large measure of discretion and initiative. Articles sent to Smyrna must be of the best pattern, and possess all the most modern improvements.—*Board of Trade Journal.*

Manchester Engineering Exhibition, 1910.—We have received a prospectus relating to the exhibition scheme which is being promoted by our contemporary, the *Engineering Review.* The show will take place in the City Exhibition Hall, Manchester, in October next.

"Luxrae" Lamps.—The Globe Electric Co., Ltd., of Farringdon Avenue, announce a reduction in the price of their "Luxrae" flame lamp, bringing the flame lamp more easily within the reach of the small shopkeeper.

Exhibition.—A Naval, Mercantile Marine and Engineering Exhibition is to be held at Olympia in September next year. It is being promoted by Mr. F. W. Bridges.

Installation Contract.—The Standard Engineering Co., Ltd., have secured the order in connection with the heating and ventilation of the new motor cab garage now being built by Messrs. Panhard & Levassor at Acton Vale, London, W. Messrs. Panhard & Levassor decided to adopt the firm's "Stanlock Multiple Unit System" after investigating existing installations and giving the system a trial in their works. The building in question is approximately 600 ft. long by 300 ft. wide.

Meter Approved.—The B. of T. has approved of the Siemens-Schuckert meter for continuous current, type G.B., deposited last May by the firm of Siemens Bros. Dynamo Works, Ltd.

For Sale.—On Tuesday, December 7th, by order of the Receiver of Kupron, Ltd., Mr. E. H. Henry will offer for sale by auction at Clapham, the plant, machinery and stock of the company. The Marylebone Electricity Supply Department is offering a large secondary battery and certain plant, scrap metal, &c., for sale. The Receiver of the New Ignition Syndicate is offering the undertaking of that company for disposal. See our advertisement pages.

A number of steam dynamos (500, 250 and 60 KW.) and a 120-KW. alternator, boilers, &c., are offered for sale by the Cape Government Railways. Some particulars are given in an advertisement to-day.

Concert.—The Devonport Dockyard Electrical Fitters' Association, which has entered upon its third year, held its first smoking concert of the season at Ackland's Clarence Hotel, Morice Town, on Saturday evening.

Spain.—Although there is a large exportation of English coal to Spain that country possesses extensive coal deposits, the working of which, however, is impossible owing to lack of railway facilities. Attention is now being directed to this subject and *Industria e Invenciones* affirms its belief that a well-studied network of coal railways worked by hydro-electric power, which may be obtained from the various waterfalls in the Pyrenees now unexploited, can supply to Barcelona, and the manufacturers of Catalonia, cheap coal able to compete alike with that from the Asturias and from England.

New Works.—The Madison Dynamo Co. have just started new works at Littleover, near Derby, a suburb which is now being rapidly developed.

Canada.—The Canadian Customs authorities have recently given a decision to the effect that "submarine cable" is dutiable at the rate of 30 per cent. *ad valorem* in the case of foreign goods and 20 per cent. in the case of British manufacture, under No. 407 of the Tariff.

Book Notices.—*Electricity in the Service of Man.* By Dr. R. Mullineux Walmsley. London: Cassell & Co., Ltd.—The publishers are issuing this work in monthly parts, price 6d. each, of which the first part has come to hand. It will be remembered that Dr. Walmsley some years ago practically re-wrote the book, and the first volume has been reviewed in our pages; the second, so far as we know, has not yet been issued. The complete work, we presume, will now appear in parts, and, judging by what we have already seen of it, will constitute a very comprehensive survey of the history, development, and present state of electrical science as applied to modern life.

City and Guilds of London Institute: Report of the work of the department of Technology, 1908-9. London: John Murray.—The Report shows that the number of students in the electrical industries is rising steadily, with the exception of a slight fall of the number of candidates in the elementary examination in electrical engineering—due to an abnormal rise last year, when this examination became a compulsory preliminary to the Ordinary Grade. The examiners comment on the inability of candidates in Telegraphy and Telephony to answer questions involving simple mathematics; and in Electrical Engineering the results are said to be discouraging, the occurrence of the same defects in batches of consecutive papers indicating that the teaching is too often at fault. As the examiners rightly point out, unless the teacher is a practical engineer, in touch with modern practice, satisfactory results cannot be expected. Candidates in Honours Electrical Engineering are warned that they must expect to find questions involving mathematical knowledge increasingly numerous and searching. An interesting diagram is given, showing the growth of the department's work since 1880.

"Practical Testing of Electrical Machines." By L. Oulton and N. J. Wilson. London: Whittaker and Co. 1909. Price 4s. 6d. net.

"Journal of the Western Society of Engineers," Vol. XIV, No. 5. October, 1909. Chicago: The Society.

"Electrotechnics." By J. Henderson. Vol. III. Longmans, Green & Co. 1909. Price 3s. 6d.

"The Physical Review," Vol. XXIX, No. 5. November, 1909. New York: The Macmillan Co.

"Journal of the American Society of Mechanical Engineers." Vol. XXXI, No. 11. November, 1909. Baltimore, Md.: From the Society.

"Auto-Transformer Design." By W. H. Avery. London: E. and F. N. Spon, Ltd. 1909. Price 3s 6d. net.

From the P. and O. Steam Navigation Co. we have received a fine hanging wall-sheet executed in colour; its outstanding feature is a view of Gibraltar, with one of the company's well-known passenger vessels under weigh. Beneath this are given in tabular form particulars of the dates of outward and homeward mails during 1910. A list of the P. and O. ships and their registered tonnages is given. This sheet should be of considerable service in the commercial departments of firms doing business with Egypt, India, Siam, China and Japan, Australia, and other Eastern ports.

The receipt of *Pears' Annual* reminds us that the Christmas season is not many weeks away. A perusal of the 1909 issue of this indispensable feature of Yuletide, and its four accompanying coloured plates, leads us to say that it is well worth the modest sixpence that is charged for it. The advertisement pages are as full of interest as are the editorial.

Trade Announcements.—Mr. S. N. Brayshaw, of Manchester, reports that his trade in milling cutters and other small tools is growing very satisfactorily, and his patent hardening furnaces has led to a great development in the business. A night shift was started some time ago, but the works being too small to deal with the orders booked, they have now been enlarged. The alterations include the provision of more room both for storage and for building furnaces, also a loading way is being built to facilitate the rapid handling and despatch of the large consignments he is now sending out. More men can now be employed both on the day and night shifts. We understand that the orders now on hand include furnaces for many British firms as well as for various firms in France, Sweden and Russia; several of the furnaces are for repeat orders.

Owing to the rise in the prices of raw rubber, Messrs. Dr. Heinr. Traun & Sons, London agency, have issued a notice to the trade advancing their prices for ebonite sheets, rods, tubes, and other lines.

Bankruptcy Proceedings.—H. G. Nicholson.—A sitting was held of the London Bankruptcy Court on Friday, November 19th, before Mr. Registrar Linklater, for the public examination of Mr. Hugh Godfrey Nicholson, who was the managing director of the British Electric Equipment Co., Ltd., which went into liquidation in April, 1907. The receiving order was made last September upon the petition of a creditor, the act of bankruptcy alleged being that the debtor on May 20th and 25th, 1909, gave notice that he had suspended, or was about to suspend, payment of his debts. Mr. A. H. Partridge, chartered accountant, 2, Gresham Buildings, Basinghall Street, E C., has been appointed as trustee to administer the estate in bankruptcy. Questioned by Mr. Daniel Williams, Official Receiver, the debtor stated that in November, 1903, he and his brother purchased an engineering business, carried on in the name of the Britannia Co., at Colchester, and transferred it to a company formed by them in the name of the "Britannia Engineering Co., Ltd.," with a nominal capital of £40,000, afterwards increased to £70 000. Witness acted as a director of the company until it went into liquidation in December, 1907, and was subsequently occupied in negotiations for the reconstruction of the company; these had now been abandoned, and the shares were worthless. In 1904 witness agreed to purchase an electrical engineers' and contractors' business, in which he had been engaged as chief engineer since 1902, and on November 11th, 1904, he formed a company in the name of the "British Electric Equipment Co., Ltd.," with a nominal capital of £40,000, to which he sold the business for £15,216, which was satisfied as to £7,216 in cash, and as to £8,000 in fully paid shares. Witness acted as managing director at a salary of £1,000 a year, until a compulsory winding-up order was made against the company on April 16th, 1907. He attributed his insolvency entirely to the failure of the Britannia Engineering Co., Ltd., and to depreciation in the value of the securities in the hands of the creditors. The examination was concluded. Mr. A. H. Partridge, the trustee, was present in person.

Eric Eaton, electrical engineer, 36, Alexandra Road, Ashton-under-Lyne.—This debtor attended the Town Hall, Ashton-under-Lyne, last week, for his public examination before Mr. Registrar Hall. Debtor ascribed his failure to bad trade, losses on contracts, and want of capital. Through lack of capital he had lost cash discounts of 5 per cent. and 7½ per cent. The result of the bad cotton trade was that his customers could not pay, and were therefore averse to spending money on electrical fittings. His customers asked for longer credit, and when he asked for payment they were offended, and refused to give him further work. The contracts he lost money on, were undertaken in the beginning of his career, when he had not had experience in tendering for contracts. In reply to Mr. Ives with reference to the firm of Eaton & Co., debtor stated that his sister was one of the partners. He was employed by this firm as manager. Debtor was eventually allowed to pass.

Herbert Shuttleworth, electrical engineer, Briggate, Leeds.—A first and final dividend of 2s. 5d. is payable on November 30th, at 24, Bond Street, Leeds.

Private Meetings.—R. E. Walker, 16, Widemarsh Street, Hereford, electrical engineer.—A meeting of the creditors of the above was held a few days ago, when a statement of affairs was presented, showing unsecured liabilities amounting to £193, all of which were due to trade creditors. With regard to the assets, these were estimated to produce £149, or a deficiency of £44. It was reported that the debtor came to Hereford from Manchester about two years ago. He was employed by a local firm at a salary of £2 a week, out of which he saved £70, and then started to trade for himself in a small way from his private house. A few months ago he removed to his present address, where he also added a cycle dealer's business. His present position had been brought about by this venture, as he knew nothing about the trade, and had lost a considerable amount by inexperienced buying. The household furniture was claimed by the debtor's wife, who had also advanced her husband a sum of about £40. Some few months ago the debtor was joined by a Mr. Vickery, who introduced £160, this being the estimated amount of the stock at that time. The sum of £18 10s. shown in the statement was the amount over and above the £160 found to belong to the debtor when stock was taken. It was reported that a sum of £102 had been offered for the debtor's share of the business. This offer was conditional upon the debtor agreeing not to start in opposition within a radius of 20 miles for three years. A deed of assignment had already been executed, with Mr. T. B. V. Wilmshurst, accountant, of Broad Street, Hereford, as trustee. No resolutions were passed at the meeting, although it was said by the trustee that under the deed there would be a composition of at least 12s. 6d. in the £, payable almost at once. The following are the creditors:—

Edlin, Sinclair & Co.	£24
Simplex Conduits, Ltd.	20
Veritys, Ltd.	17
Ravenscroft, Richards & Co.	10
Walker, Mrs.	40

Charles F. Wood, trading as Wood, Wall & Co., electrical engineers, Hagley Road, Stourbridge, late Union Street, Wednesbury.—A meeting of the creditors of the above was held on the 18th inst. at Birmingham, when a statement of affairs as at November 5th last, was presented. This showed liabilities amounting to £451, all of which were due to trade creditors. An offer was made of a composition of 5s. in the £, satisfactorily seconded, and this offer the creditors decided to accept.

Dissolutions and Liquidations.—Joseph Richmond and Co, Ltd., Kirby Street, Hatton Garden, London.—A second dividend of 2s. is payable on and after December 6th, at 2, Clement's Inn, Strand, W.C.

Smoke Preventer Co., Ltd.—A meeting is to be held at Manchester on December 28th to hear an account of the winding up from the liquidator (Mr. Thomas Seed).

Phosphor Bronze Co., Ltd—A petition for winding up this company, lodged by several creditors, is to be heard on November 30th.

Catalogues and Lists.—Messrs. Alfred Herbert, Ltd., Coventry.—Copy of the eighth edition of the firm's catalogue, describing and illustrating in the course of some 20 pages the "Coventry" patent self-opening die head in sizes ½ in. up to 4½ in. Full instructions for grinding the dies are given.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Well-bound catalogue—the eleventh annual edition—of close upon 400 pages, in which we are informed—we have not counted!—there are given 1 500 illustrations and 10 times as many prices. The range covered, in addition to the Simplex system of steel conduits and various accessories appertaining thereto, comprises all types of electrical accessories required for complete lighting installation. To facilitate reference, the list is divided up into sections, each dealing with a particular class of apparatus. The catalogue, as far as it relates to heating, cooking and electrical fittings, has been considerably extended. In regard to the former, the Simplex Co. act as sole selling agents for the manufactures of the Prometheus system, and in the sections relating to these appliances, electrical cooking and heating apparatus will be found suitable for all purposes and for a wide range of prices. A considerable portion of the catalogue is devoted to electric light fittings, and endeavour has been made to include the widest possible range, both as regards style and design, variety and price; for instance, electroliers have been listed from 10s. each to £60. More recent development of the company's business is included in the form of electricity meters; 15 separate types are listed, suitable for both continuous current and alternating current, single and polyphase.

Messrs. Ludw. Loewe & Co., Ltd., 30-32, Farringdon Road, London, E.C.—List containing illustrated information on the application of D.W F. ball bearings to line shafting, also giving prices.

The Sun Electrical Co., Ltd., 118 120, Charing Cross Road, London, W.C.—New circular—being an advance sheet from their catalogue now in the press—showing half-a dozen designs of the "Sun" luminous-type electric radiators, and stating prices of same.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—One more evidence of the enterprising spirit of this firm in making an intelligent appeal to the foreign purchaser of electric lamps, is found in the issuing of another of its series of foreign show-cards extolling the virtues of tantalum lamps. Some of the cards prepared for other markets we have already alluded to. The latest is an effort to take Italy by storm, and the design is varied accordingly. A German show-card has also been added to the series.

Messrs. Falk, Stadelmann & Co., Ltd., Farringdon Road, London, E C.—An effective six-colour poster (20 in. × 30 in.) has been issued on which the now familiar Mephistopheles exhibits the "Efesca" metal-filament lamps. Members of the trade can have copies for posting on wall or hoarding on application to the firm, also a leaflet relating to various other advertising specialities which they hold at the disposal of customers interested in the sale of the above lamps.

Etablissements Cazes, Avenue Dubonnet, Courbevoie, France.—Card relating to their petrol-electric generating sets.

Messrs. Tetley & Co, Falcon Electrical Works, Greengate, Salford, Manchester.—Illustrated and priced leaflet giving information regarding their ironclad fuse gear—ironclad tubular power fuseboards, ironclad distribution boards, terminal type fuseboards, and switch and distribution boards.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electrical Department is now hiring out fans to prevent shop windows being obscured by frost. Last week was found suitable for experimenting, and a small 12-in. fan was placed at the foot of a large window in Union Street. The result was that the window, by the circulation of the air current, was kept quite clear, in strange contrast to the others which were obscured by the severe frost.

Acton.—Messrs. D. Napier & Son have asked for a quotation which would enable them to shut down their own generating plant and take all their supply from the Council's mains. The firm are prepared to give a guarantee to take one million units during the forthcoming year. The clerk was instructed to communicate with the Metropolitan Electric Supply Co. on the matter.

Ceylon.—According to *Commercial Intelligence*, the Hunupitiya Desiccating Mills at Negombo have just been equipped with an electric lighting installation. This is expected to be a great convenience to the staff who start work, shelling and shaving the nuts, long before daylight, while in the busy months work goes on practically all night. It appears that cocoa-nut shells are being used as fuel in connection with this installation.

Chipping Norton.—A local company is being formed to take over the undertaking of the Chipping Norton and District Electric Light and Power Co. It is proposed to erect a generating station in Burford Road, and the compulsory area of supply is High Street, Middle Row, Market Place, Horsefair, New Street, and West Street.

Church (Lancs.).—The U.D.C. has decided to apply for a prov. order for electric lighting.

Continental Notes.—Portugal.—During the past financial year the central stations of the Compagnies Reunies Gaz et Electricité, of Oporto, supplied current for electric lighting purposes to the extent of 4,048,560 kw.-hours—an increase of about 26 per cent. over the preceding 12 months. The energy furnished for power purposes during the same period reached a total of 1,051,829 kw.-hours, an advance of approximately 50 per cent. The report mentions that, although the number of consumers of current has increased about 30 per cent., there has not been a proportionate increase in the consumption, this being attributed to the growing use of metal-filament lamps. The new Tagus electricity generating station of the company is rapidly approaching completion. The plant comprises two sets of steam turbines and alternators of respectively 1,500 and 1,750 kw. capacity, and two sets of engines and dynamos of 750-kw. capacity. This, with the old Bona Vista station, will give the company an annual capacity of between 9 and 10 million kw.-hours per year.

Germany.—The Schlesien Electricitätswerk Gesellschaft is the name of a new company which has just been formed in Breslau, with a capital of £200,000, to establish a large central electricity generating station for the supply of energy for lighting and power purposes in the Breslau district.

Spain.—Don Alfredo Moreno Ossorio, of Madrid, has been authorised to utilise the water of the River Guadalimar, at a place called Los Piezuelos (township of Ubeda), to the extent of 5,000 litres per second, for the purpose of generating electrical energy, to be carried to La Carolina.

Crompton.—The U.D.C. has decided not to apply for a prov. order for electric lighting.

East Barnet.—The Board of Trade has revoked the 1906 electric lighting order.

Edinburgh.—An expenditure of £45,000 is in contemplation on the Dewar Place station of the City Electric Lighting Department. Sir Alexander Kennedy has prepared a preliminary report. By substituting a couple of exhaust turbines for three of the present sets, it is estimated there would be an increased output of 3½ million units per annum without any increase of cost, so far as the coal and water bill is concerned. This means the adoption of cooling towers.

Epsom.—The U.D.C. has rejected an offer from the Epsom and Ewell Gas Co. to light the streets. It was stated that the Lighting Committee after having gone very carefully into the figures, found that the promise of the company, that its offer would result in a considerable saving to the ratepayers, was not justified.

Falkirk.—The Falkirk Iron Co. has written the T.C., asking the terms on which electric light could be supplied for a portion of its works. A supply is to be given to the Camelon Co-operative Society, Ltd., the expense being estimated at £920. The Corporation expects soon to be able to lay a cable to Camelon.

Finchley.—The controversy between the U.D.C. and the L.G.B. regarding the street lighting still drags on. The L G B. has written affirming its decision not to grant a loan for electric lighting on the ground that information as to alternative methods of illuminating (*i.e.*, gas lighting) has not been supplied. The Council is to reply that the whole question was thoroughly gone into at the time of the L.G.B. inquiry. The Chairman said it would be as well to announce that they did not intend to use gas for street lighting.

Glasgow.—Various members of the T.C., including a recently-appointed committee, are actively interesting themselves in the solution of the problem of atmospheric purification, and a proposal has been adopted by which it is expected the comparative merits of gas and electricity as heating factors, will be experimented with in various rooms of the municipal buildings. The fogs experienced recently have emphasised the part played by the emission of smoke in the nuisance, and the following proposal by ex treasurer Stevenson, has now been adopted by the Corporation:—"That with a view to the diminution of the smoke nuisance, it be remitted to a special committee to make arrangements for the holding of an exhibition for the purpose of showing the public the most up-to-date appliances for the utilisation of gas for lighting, heating, and cooking purposes; and that the Committee on Electricity and the Sub-Committee on Air Purification be invited to co-operate." The special committee will consist of 15 members—six from each of the Gas and Electricity Committees, and three from the Sub-Committee on Air Purification.

Gravesend.—The T.C. desires to supply electricity to Denton Hospital, and as underground mains will entail an expenditure of £300, the B. of T. is to be asked to sanction the use of overhead lines.

Haslingden.—On Friday, last week, a L.G.B. inquiry was held, and, in reply to Mr. C. E. Norton, the inspector, it was stated that with reference to the electric lighting and tramway schemes £1,300 of the amount spent on a destructor would belong to the tramways department. The electric lighting order of 1899 had not yet been exercised, and supply for the tramways was being taken from Accrington after being supplied to a regulating station. The town clerk stated that originally they arranged to take energy from the Lancs. Electric Power Co., which was afterwards unable to carry out its agreement, and as the Corporation Act of 1906 did not permit Haslingden to generate current, the Corporation made terms with Accrington.

India.—The Mysore Durbar has provided expenditure for the installation of electric lights in the extensions and the suburban villages, &c., of Bangalore City.

Leicester.—A L.G.B. inquiry was held on November 16th into the application of the T.C. for a loan of £7,000 for electricity purposes. The money is required for the supply of power from the tramway generating station. There was no opposition.

The Corporation Electrical Committee has fitted up a suite of rooms at the offices in Millstone Lane with the object of demonstrating electric lighting, heating and cooking appliances.

Lewisham.—The secretary of the South Metropolitan Electric Light and Power Co., Ltd., recently wrote to the Council suggesting that the development of the Forster Estate presented an opportunity for a trial of street lighting by electricity. The company had been favoured with a contract for the complete installation to the houses in Arran, Bellingham and Bromley Roads, and had been asked to obtain the consent of the Council for the public lighting of these. The Highways Committee of the Council points out that the proposed scheme would entail increased cost without any definite advantage. Under these circumstances, the Committee has decided not to entertain the present proposal.

London.—A new concession has been granted by the City Corporation to the Smithfield Markets Electrical Supply Co., until December, 1972, with the right of determining it in 1932 or 1952.

The Port of London Authority has decided to provide entirely new electrically-driven pumping plant for the purpose of raising the level of the water in certain docks.

Macclesfield.—The B. of T. has informed the T.C. that it will defer for a month from November 9th, the question of revoking the E.L. order. The Corporation Gas Committee has been asked to prepare a report on the question of the supply of electricity for the borough.

Mexico.—The Puebla Tramway, Light and Power Co. notifies that a formal petition has been presented on its behalf to the Government for leave to extend its electric transmission lines for light and power into Mexico City and the Federal district. This step has been rendered necessary by the approaching development of the Tuxpango Fall, which, whilst supplying the power required by the growing needs of Puebla City, will, at the same time, leave available some 25,000 h.p. for Mexico City and the surrounding district.

North Berwick.—The T.C. some time ago received notice from Messrs. Crompton & Co. that they were to ask authority from Parliament to introduce electric lighting into the town. It has been agreed to meet a representative of the company with a view to coming to terms regarding the promotion of an Order.

Pontypridd.—A L.G.B. inquiry was held on November 18th into the application of the U.D.C. for a loan of £6,424 for electricity purposes. There was no opposition.

Radcliffe.—The Lancs. Electric Power Co. has given notice of its intention to apply to the Board of Trade for a provisional order to produce and sell electricity for all public and private purposes within the urban district of Radcliffe, where the District Council already possess monopoly powers. The company proposes to lay cables within two years from the commencement of the order in the main thoroughfare of the town, and will also ask for power to break up a number of other streets.

Reading.—The Electric Supply Co. has decided to apply for powers to extend the area of supply so as to include the parishes of Caversham, Maple Durham, Tilehurst and Theale, and to supply energy in bulk in the districts of Workingham, Bradfield, Wallingford and Henley.

Stanley (Yorks.).—The B. of T. has informed the U.D.C. that the question of revoking the E.L. order, 1902, will be deferred for three months.

Walsall.—The T.C. has applied for a loan of £35,000 for electricity purposes.

West Ham.—Mr. H. H. Couzens reports an interruption of the supply on November 8th. The trouble was due to a current transformer failing, and to prevent a recurrence of the trouble, new transformers are to be obtained. The supply to the Abbey Lane sub-station is dependent on one feeder only, and although the cables in West Ham have proved very reliable, he did not consider they were justified in risking the continuity of the supply to the Stratford factory district. When the new cable supplies are laid to the Town Hall, it is proposed to extend one of these to Abbey Lane. The estimate of the cable work is £5,400. The report was adopted.

Widnes.—The T.C. has decided to negotiate with the Salt Union, Ltd., and Messrs. Merz & McLellan, who are seeking powers to supply electricity, for the transfer of the existing electricity order. Mr. J. H. Crowther has been retained to advise the Council in the matter.

Willesden.—An application from Messrs. Underwood and Bros. for permission to erect overhead mains for power and lighting supplies in connection with the Brent drainage works has been granted, subject to protective conditions. The Council is to give the combined supply of current at 2d. per unit.

Worksop.—The U.D.C. has decided to supply electricity for heating and cooking at 1d. per unit, and to reduce the price of energy where prepayment meters are used to 4½ per unit.

Ystradgynlais. — The ratepayers have accepted the tender of Messrs. Mills, English & Co., of Swansea, for carrying out the electric light scheme, by which about 130 lamps will be utilised for public lighting.

TRAMWAY and RAILWAY NOTES.

Argentina.—The *Boletin Oficial* of October 12th publishes a decree authorising the Buenos Ayres Great Western Railway Co. to extend its lines from the neighbourhood of Sadi Carnot Street to the lines of the port of the capital, passing under part of the city by means of a tunnel. Traffic on the new line is to be worked by electric traction, and the service of electric trains is to run also between Sadi Carnot and Moreno Station, the company being empowered to construct two additional lines between Caballito and Moreno. The company is obliged to set up fire-extinguishing apparatus in the tunnel. Plans of the work must be submitted for approval within 18 months from the date of promulgation of the concession, and the work must be completed within four years and six months after the approval of the plans.

The *Boletin* further contains the text of a decree granting to Messrs. Otto Franke & Co., concessionaires for the electric railway between La Plata and Avellaneda, a concession for the construction and working of an electric railway from the side of the Riachuelo to Retiro station, joining there with the existing lines; a branch line is to be constructed from Entre Rios Street, by way of Brasil Street, to Constitucion Square, and connections are to be made with the lines of the ports of Buenos Ayres and La Plata. The main line is to cross the Riachuelo by a drawbridge and to continue at the same height along a viaduct to the top of Uspellata Street, where it is to enter a tunnel. Fire-extinguishing apparatus is to be provided. Plans must be submitted for approval within 18 months from the date of promulgation of the contract, and the work must be completed within four years and six months after the approval of the plans.—*Board of Trade Journal.*

Bacup.—The T.C. has decided to apply to the Light Railway Commissioners for an order to construct a tramway from the borough and Whitworth boundaries to Bridge Street. The new line will join an existing one at Whitworth.

Belfast.—The Law Committee is to oppose the Bill which the Cavehill and Whitewell Tramway Co. is promoting for the purpose of obtaining running powers over a portion of the Corporation's system.

Bolton.—The Tramways Committee has decided to relay the route between Bromwich Street and Portugal Street with a double track. The question of the adoption of half penny fares has been adjourned to the next meeting of the Committee.

Canada.—The Toronto Railway Co. is now using two motor vehicles in connection with the maintenance of its electric tramway system in Toronto, Canada. One of them is a Berna 3-ton petrol motor-lorry, fitted with a tower and ladders for repairing the overhead wires, while the other is an ordinary pleasure car, the body of which has been replaced by a platform to carry the ladders necessary for wire repairing work.

According to the *Standard*, reports are once more current that the Canadian Pacific intends to electrify some part, at any rate, of its system in the Rocky Mountains. The first experiment is to be made next summer, on the branch line into Phœnix, which will be run with power supplied by the West Kootenay Power and Light Co., in which the C.P.R. is supposed to be interested. The Southern Pacific has electrified a portion of its system with success on the Sierra Nevada division, where the conditions are very similar.

Chile.—Following the article which appeared on page 805 of our last issue, from a newspaper cutting just received it appears that the Chilian Government is in favour of the Italian Westinghouse Co.'s scheme, and that His Excellency, President Moutt, is anxious to proceed with this important reform as soon as possible. The Government will shortly bring the matter of railway electrification up in Congress for consideration.

Continental Notes.—Russia.—The preliminary survey of the projected new electric railway between St. Petersburg and Imatra is almost completed. The necessary deposit has, according to the *Novoe Vremya*, been paid into the Imperial Bank, and the funds for the construction of the line are assured. The Vuocks River falls will be used to generate the necessary electric power.

France.—Nineteen persons were injured in a tramway accident which occurred in the fog, at Vitry, near Paris, on Monday.

Denmark.—According to the *Financial News*, negotiations have for some time been in progress between an English financial and an English electric firm, on the one side, and some towns and municipalities in Jutland, Denmark, on the other, concerning the construction of an electric railway between the towns of Aarhus and Randers, which is calculated to cost some £200,000, and of electric central stations for the purpose of supplying a good-sized district with electric current for power and light, which may entail an expenditure of rather more than £150,000. The loan, probably of £400,000, will be guaranteed in various ways.

Germany.—Work is about to be commenced on the construction of an electric tramway between Dresden and Klotzsche.

Italy.—Consideration was given at a recent meeting of the Municipality of Belluno, to the project for the construction of an electric railway over the Dolomite Alps. The Construction Committee reported that a private company had offered to construct the Agordino section at its own cost, and had applied for the Government's sanction. After long discussion, it was decided to decline that offer, and to take steps to raise within the province an initial capital 50,000 lire, for the purpose of purchasing the scheme of the Engineer Baudracco, payment for which will be made in two portions—three-fifths at once, and the remainder after obtaining the Government's approval of the project.

A scheme for an electric aerial railway appears, says the *Giornale dei Lavori Pubblici*, likely to be shortly realised. It will be of a length of 13·300 km., and will ran from Prato Sesio to Borgomenero, touching Cavallirio, Boca-Maggiore and Vergano *en route.* It will be worked by an electric plant at Boca, where three-phase generators will produce energy at 350 volts, which will be distributed by aerial lines.

Application has been made by the Società Varesina per Impresse Elletriche for leave to build and work an electric tramway from Varese to Bobbiate. The line will have a length of 3·418 km., the gauge being 1 metre.

Concessions for electric tramways between Mestre, Treviso and S. Artemio, and between Trani and Corato, have been sanctioned by the Italian Public Works Department, the granting of a yearly subsidy of 1,500 lires per km. for 50 years being also approved in the latter case.

Consent has been accorded to the application made by the Società dei Tramways Fiorentini for a concession to construct and work an electric tramway from Badia to Ripoli and Grassina, being an amplification of the existing lines between Florence, Bagno and Ripoli. The new line will have an extent of 4·230 km.

Devonport.—The Devonport and District Tramways Co. has written to say that the leased lines will be re-opened for public traffic as soon as they can be got ready. The company having given notice to apply to Parliament for a Bill to amend the terms of the Acts of Parliament and lease relating to the leased lines, the town clerk was instructed to to take steps to oppose the Bill and retain counsel and Parliamentary agents.

Doncaster.—Another tramway extension, to the colliery village of Warmsworth, is being promoted by the T.C. The length is 2,330 yards, and the estimated cost £11,600.

Dundee.—The Tramways Department is going to try vestibules on tramway cars for the protection of the drivers and conductors.

Falkland.—The B. of T. has confirmed the Falkland Light Railway (Extension of Time) Order, 1909.

Fife.—The Wemyss Tramway Co. is to apply for a prov. order authorising the construction of tramways in the burghs of Kirkcaldy and Lochgelly, and also in a number of adjoining parishes.

Haslingden.—The earnings of the electric tramways por car-mile from April 1st to October 31st were equal to 11·20d.; during October they were 11·48d. compared with 11·54d. in September. The passengers carried during the seven months were 658,858.

Llandudno.—A settlement has been arrived at in the action brought by the U.D.C. against the Llandudno and Colwyn Bay Electric Railway Co. for the interpretation of the agreement between them. This agreement fixes the scale of prices to be paid to the Council for energy for working the tramway. The omission of the words "per annum" in certain cases led the company to contend that, the minimum consumption being once passed, only the lower rates were chargeable against them in subsequent years, while the Council held that the scale should come into operation afresh each year. The terms of the compromise show that the company have assented to the Council's construction of the agreement, but that there is to be no payment to the Council on the basis of that construction until after the date of the settlement. A further condition assented to by the Council is that it will revive a former offer to take a poll of the town on the question of Sunday running, subject to the expense of the poll being borne by the company. The plebiscite is to be taken whenever the company give a month's notice of their desire that it shall be proceeded with, but it is not to be done during the visiting season. It is also stipulated that a sum is to be paid to the Council in respect of costs incurred in connection with this action.

London.—It is proposed to amalgamate the Piccadilly, Bakerloo and Hampstead tube lines, but, as the *Financial Times* remarks, the amalgamation will be largely in the nature of a family affair, as practically all the ordinary stock of the companies, amounting to £11,100,000, is held by the Underground Electric Railways Co., which will own the joint undertaking. The capital of the new concern will be £16,800,000, and the total issue of the three companies amounts to £15,920,000. The extra capital is to be spent, among other things, on a junction between the Bakerloo and Hampstead lines.

The Highways Committee of the L.C.C. has come to an arrangement for through running from Aldgate *viâ* Stratford Broadway to Ilford Broadway and to Epping Forest. This service will involve agreements with the West and East Ham Corporations and the Leyton U.D.C. It is proposed that each authority shall take all fares on its own cars, pay its own working expenses for operating its own cars, supply electrical energy in its own area to the other authorities and run cars according to the length of track in its own area.

The Brighton Co. has decided to commence a public service on its electrical route—to be known as the South London Elevated Electric—on December 1st. The journey, London Bridge-Victoria, is timed to take 24 minutes, as against 36 minutes with the steam trains; the fares are to be reduced, and, in consequence of the frequent electric service, many through-train stoppages will be eliminated.

It is reported that the Sydenham, Victoria and West End Electric Tube Railway Syndicate will not proceed with the Bill until after the General Election.

Northampton.—The T.C. has decided to apply for Parliamentary powers to enable it to extend the tramways from the centre of the town to the outlying district of Far Cotton. Recently the Tramways Committee sent a deputation to Germany to inspect several installations of the trackless trolley system, and the deputation also visited Hendon and inspected the system there. It came to the conclusion, however, that the trackless system is unsuitable for the Far Cotton route, on which there is a very steep incline. Excluding the cost of the application for powers, the capital outlay for the extension is estimated at £14,040, this sum including the purchase of four new cars and the widening of a bridge over the River Nen. The annual outlay is estimated at £2 650, made up of redemption of capital and interest, £850; and working expenses, £1,800. The receipts are estimated at £2,450, leaving a deficiency of £200. At present the Far Cotton district has an omnibus service which is run at an annual loss of £450. Several members of the Council expressed the opinion that electric cars would pay from the commencement. The only opposition to the application for powers is expected to come from the L. and N.W. Railway Co., whose Northampton to Peterborough line is carried over a level crossing on the tramway route.

Perth.—The Convener of the Tramways suggests that an expert be called in to report as to how the system could be improved. Among other proposals is one to separate the offices of traffic superintendent and electrical engineer; Mr. Lamhert to be responsible for the latter duties, and to proceed with the erection of a new depôt in South St. John's Place.

Wakefield.—The B. of T. has refused the application of the Wakefield and District Light Railway Co. for the abandonment of certain sections of the proposed tramways in the outlying districts of the city, but has extended the time for completing the lines to November, 1911.

TELEGRAPH and TELEPHONE NOTES.

Aberdeen.—The National Telephone Co. has transferred the working of its system from the old exchange to a new one in Bon Accord Street.

Argentina.—The "Empresa Telefonica del Chubut" has obtained a 30 years' concession for the establishment and working of a public telephone service between Rawson, Trelew, Puerto, Madryn and Gaiman.—*Board of Trade Journal.*

The American Combine.—Mr. C. H. Mackay, president of the Mackay Companies, has issued a categorical denial of the existence of any connection with the combine; he declares that his companies had nothing whatever to do with it, and knew nothing about it until the public announcement was made.

Canadian Telegraph Rates.—On the 1st prox. an increase in the rates for code telegrams comes into force in Canada. Owing to the difficulty in transmitting code words, such words are to be limited to five letters in all landline telegrams between Canada and the U.S.A.

Communication with Trains.—The American Press reports that successful experiments have been made with a third-rail system of telephonic communication with moving trains on the Erie line. The automatic stopping of trains moving towards one another on the same track was also effected.

Overhead Telephone Wires.—Mr. Garrett, at the West London Court, recently gave his decision in a dispute between the Postmaster-General and the Hammersmith Borough Council in respect of the desire of the Post Office to place overhead wires and telephone posts throughout the borough of Hammersmith. The decision was in favour of the Postmaster-General.

Telegraphic Interruptions. — Heavy snowstorms towards the end of last week, combined with severe cold, seriously interfered with telephonic and telegraphic communication in Germany, and almost cut off communication with other countries.

West Indies.—The condition of West Indian communications remains unaltered. The c.s. *Relay* was expected to arrive at Jamaica this week, and would immediately proceed to repair the Turks Island-Jamaica cable. Messages are still being sent by post between New York, Cuha, Bermuda and Jamaica, and the islands beyond and from there by cable to destination.

Wireless Telegraphy.—A contract has been entered into between the Compania Espanola de Telagrafia sin Hilos and the Government whereby wireless telegraph stations on the French Berthenod system will be set up at Cadiz, Vigo, Barcelona and the Balearic and Canary Islands, including six of the principal of the last-named, which, with the Santa Cruz de Teneriffe and Gando stations, will embrace a radius of 2,500 kilometres, thus establishing communication with Cape Verde, and thence with Pernambuco in South America. The company has just completed the erection of its station at Santa Cruz.

Colonel C. C. Wilson, of New York, president of the United Wireless Telegraphy Co., has come to this country to secure the sanction of the Postmaster-General for establishing a number of wireless stations in England, which he proposes to use for inland as well as for ocean purposes. He is said to have made the ridiculous statement that within five years the cable companies would be driven out of business!

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Melbourne. — November 29th. 1,250 opalescent arc lamp globes for the Council. See "Official Notices" November 12th.

Melbourne.—December 6th. 230 A C. and 160 D C. electricity meters for the Council. See "Official Notices" November 19th.

Melbourne.—December 8th. 4,508 yards of single-conductor lead-covered cable, and 1,500 yards three-core lead-covered cable. See "Official Notices" to-day.

Melbourne.—December 13th. 50,750 incandescent lamps for the City Council. See "Official Notices" to-day.

Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

March 16th, 1910.—A Branching multiple magneto switchboard for the P.M.G., for Canterhury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

January 31st.—The municipal authorities of Waremme are inviting projects for the establishment of a central electric station in the town.

Cape Colony.—December 6th. Electric lighting proposals for the town, for the municipality. It will be observed that the time for submitting schemes is very short. The *Board of Trade Journal* gives a few further particulars.

Cape Town.—January 5th. The Corporation are requiring tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" November 5th.

December 1st.—Electric wiring and fitting of the Workhouse buildings, nursing sisters' residence, and North City Dispensaries, for the North Dublin Board of Guardians. Specifications at the office, North Brunswick Street, or from the consulting engineer, L. J. Lawless, 27, Castlewood Avenue, Rathmines, on payment of the cost of production.

Durham.—December 13th. Stores, including electric fittings, for the Trimdon Grange Colliery Co. (Walter Scott, Ltd.), Durham.

Glasgow.—Messrs. Wm. Barr & Sons (Coal Masters), Ltd., are inviting tenders for stores, &c., for the year 1910, for several of their collieries. Schedule "O" is for electric fittings. Forms of tender at the offices, 10, Bothwell Street, Glasgow.

India.—Lucknow.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th, and an article in our last issue.

Italy.—December 6th. The Italian Naval authorities in Spezia are inviting tenders for the supply of a number of electric searchlights for use on warships.

Middleton.—December 7th. Coal for the Corporation electricity works; Mr. S. Pauls, electrical engineer.

Neath.—2,000 tons of coal for electric generating station. Mr. G. H Thomson, electrical engineer, Green Street, Neath.

Poplar.—December 8th. Electric fan and fittings for the Workhouse Laundry. See "Official Notices" to-day.

Russia.—March 14th, 1910. The municipal authorities of Samarkand are inviting tenders for the concession for the construction and working of eight kilometres of electric tramways in the town.

Spain.—December 10th. The municipal authorities of Tabernas (Province of Almeria) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

The Direccion de Telegrafos has been authorised to acquire 400 kilogrammes of covered wire, 20 metres of type B cable, and 4,000 metres of aerial telephone cable, with 28 conductors.

CLOSED.

Australia.—Melbourne.—According to an exchange, the tender of Messrs. Pfaff, Pinschof & Co., Pty. Ltd, Melbourne, at £340, for 80 A.C. flame arc lamps of the "U.V." type, has been accepted by the City Council.

Bolton.—The tender of Messrs. Dick, Kerr & Co., for 10 electrical equipments for cars, also that of Messrs. Hadfield, for points and crossings, have been accepted.

Doncaster.—The T.C. has accepted the tender of the United Electric Car Co., for four top covers for tramcars, at £91 each, and alterations to staircases, at £24 16s. per car; that of Messrs. J. Butler & Co., Halifax, for a shaping machine, at £80 10s. 8d.; and that of Messrs. Hall & Son, for a steam feed pump, at £86.

Government Contracts.—During the past month the following tenders have been accepted by the Government Departments named:—

Admiralty.

Incandescent lamps.—Edison & Swan Co., Ltd.; General Electric Co., Ltd.
Lamp fittings McGeoch & Co., Ltd.
Telegraph gear.—Chadburns (Ship) Telegraph Co., Ltd.

General Post Office.

Cable, india-rubber and cotton cov.—W. T. Henley's Telegraph Works Co., Ltd.
Cable, paper cov.—British Insulated and Helsby Cables, Ltd.: Johnson and Phillips, Ltd.; Western Electric Co.
Dry cells.—Siemens Bros. & Co., Ltd.
Unmounted generators.—International Electric Co.
Paper, Morse and Hughes.—Colley's Patents, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., &c., Ltd.
Battery equipment and main switchboard installation at the Head Post Office, Bristol.—Westminster Engineering Co., Ltd.
Telephone trunk service equipment installation at Post Office trunk exchange, Sheffield, and at Post Office trunk exchange, Bristol.—British Insulated and Helsby Cables, Ltd.

Heywood.—The Rochdale Electric Co., Ltd., have secured the Government contract for the electric lighting of the Post Office at Heywood.

London.—L.C.C.—The Education Committee received the following tenders for electrical work at the Paddington Technical Institute:—

Deans & Beal, Ltd.	(accepted)	£287 10
G. and E. Bradley		309 10
J. and F. May		348 10
Strode & Co.		367 0

The Switchgear Co., Ltd., whose tender, at £3,517, for high and low-tension switchgear was recently accepted, informed the Council that an error occurred in their estimate. This the Highways Committee reports will make their tender higher than those of two other firms. The acceptance of the tender of Johnson & Phillips, Ltd., at £3,625 is therefore recommended.

Southwark.—The B.C. has accepted the following quotations:—

Siemens Bros.—8 H.P. motor, £30.
Crompton & Co., Ltd.—4 kw. converter and starter, £45 13s. Two 5 kw., converter machines (in place of two 3-kw. machines previously ordered) £117.

Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for the electrical equipment of the laboratory at the Lower School.

Shanghai.—We understand that Messrs. Cryselco, Ltd., of Bedford, manufacturers of the "Cryselco" carbon and metal-filament lamps, have received the contract for the supply of lamps to the Shanghai Municipal Council for the ensuing 12 months.

Wallasey.—The tender has been accepted of Messrs. Imeson, Finch & Co., of Stockton-on-Tees, for work in connection with the extension of the tramways a distance of 3½ miles.

Watford.—The U.D.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a year's supply of meters.

Worksop.—The U.D.C. has accepted the tender of Bell's Asbestos Co., Ltd., for asbestos non-conducting boiler covering, at 10s. per cwt.; and that of Mr. Hadyn Harrison for 200 Osram lamps for street lighting, at 3s. 1d. each.

FORTHCOMING EVENTS.

Northampton Institute Engineering Society.—Friday, November 26th. At 5.45 p.m. Paper on "Single-Phase Electric Traction," by Mr. T. A. Collett.

Physical Society.—Friday, November 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Effective Resistance and Inductance of a Helical Coil," by Mr. J. W. Nicholson; and other papers.

Association of Engineers-in-Charge.—Saturday, November 27th. Social. Dance.

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 30th. At 7.30 p.m. At the University, Manchester. Paper on "Recent Developments in High-Tension Transmission on Overhead Lines," by Prof. E. W. Marchant and Mr. E. A. Watson.

Faraday Society.—Tuesday, November 30th. At 8 p.m. At the I.E.E. Annual general meeting, followed by ordinary meeting. Papers "On the Electro-Analytical Determination of Lead as Peroxide," by Mr. H. J. S. Sand; "On the Influence of Dissolved Gases on the Electrode Potential in the System Silver-Silver Acetate, aq.," and "Contributions to the Study of Ionisation in Aqueous Solutions of Lead Acetate and Cadmium Acetate," by Mr. A. Jaques.

Institution of Civil Engineers.—Tuesday, November 30th. At 8 p.m. Further discussion on papers on "Railway Electrification."

Friday, December 3rd.—At 8 p.m. Students' meeting. Paper on "The Design of Generating Stations," by Mr. G. Ingram.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, December 1st. At 7.30 p.m. At the University, Birmingham. Papers on "Research on Metallic-Filament Lamps," by Mr. F. H. R. Lavender; and "The Present Aspect of Electric Lighting," by Messrs. H. W. Handcock and A. H. Dykes (to be taken as read and discussed).

Institution of Electrical Engineers (Students' Section, London).—Wednesday December 1st. At 7.45 p.m. At 92, Victoria Street, S.W. Paper on "Special Rheostats," by Mr. J. S. Messent.

Institution of Electrical Engineers (Glasgow Section).—Wednesday, December 1st. At 6.30 p.m. for 7 p.m. At the Grosvenor, Glasgow. Annual dinner.

Rontgen Society.—Thursday, December 2nd. At 8.15 p.m. At 20, Hanover Square, W. Paper on "Some Effects of Electrical Discharges on Photographic Plates," by Prof. A. W. Porter.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, December 3rd. At the Technical College, Glasgow. Discussion on "The Training of an Electrical Engineer," led by Messrs. F. A. M'Gowan and G. G. Cree.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

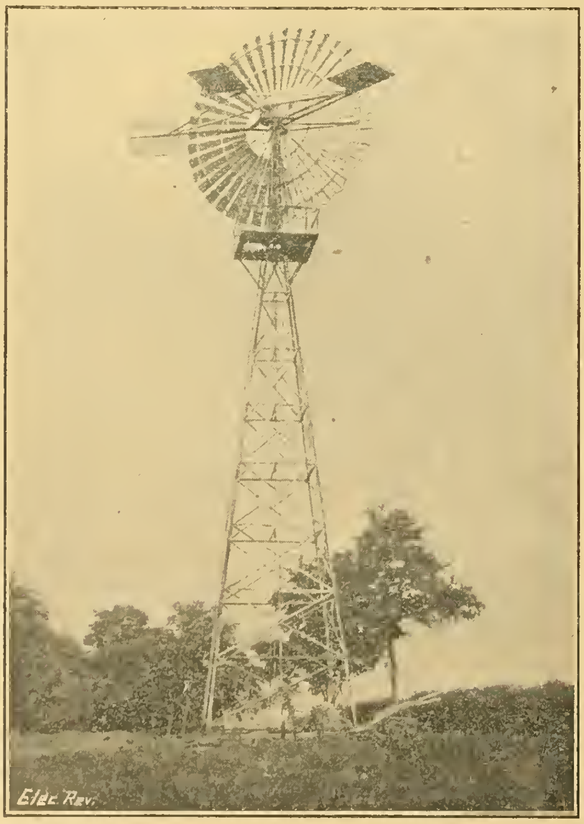
Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 29th.—"A" Company. Technical drill, 6.30 to 9.30 p.m
Tuesday, November 30th.—"B" Company. Technical drill, 6.30 to 9.30 p.m
Wednesday, December 1st.—Gymnasium, 6.30 to 9.30 p.m.
Thursday, December 2nd.—"C" Company. Technical drill, 6.30 to 9.30 p.m
Friday, December 3rd.—"D" Company. Technical drill, 6.30 to 9.30 p.m
Saturday, December 4th.—"C" Company. Week-end run at Coalhouse Fort suspended until December 11th.

(Signed) P. H. Campbell, Capt. R.E. and Adjutant
For O.C. E.E., L.D.

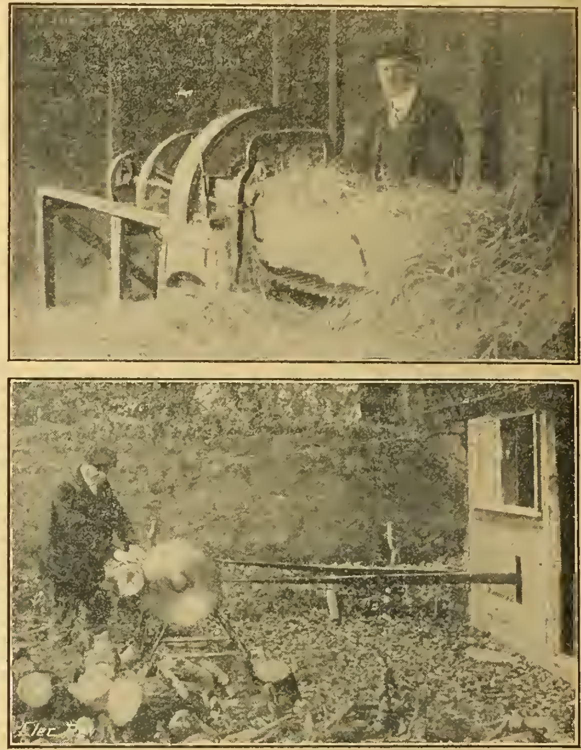
NOTES.

A Country House Wind-Turbine Electric Plant.—An interesting installation has been put in at Buckenhill, Bromyard, Herefordshire, the residence of Mr. R. Phipps, by Messrs. J. G. Childs & Co., Ltd. The motor is one of their standard wind turbines for electric driving, 21 ft. in diameter, and is mounted upon a steel tower 75 ft. high, about 435 yd away from the house, on ground which stands perhaps 90 ft. above the level of the ground round the house. The generator is placed in a small house at the foot of the tower, and the battery and switchboard are mounted in one of the outbuildings of the house. The current is conveyed from the generator to the battery by means of bare copper cables, carried on porcelain insulators mounted on poles, in connection with which lightning arresters are fixed. The generator is of a special design, with a speed variation of 400 to 1,600 R.P.M. and runs with the armature in a vertical position. It is carried on ball bearings, and is driven by a 5-in. belt from the vertical shaft of the wind turbine. The generator is of 4 KW. capacity, with a normal voltage of about 70. In order to have the whole of the control arrangements in the battery room, a separate field wire is carried up to the battery along with the other conductors. The battery consists of 28 cells by Messrs. Pritchetts & Gold, having a discharge capacity of 46 amperes for 10 hours, and is divided into two equal groups, either of which can be used for the lighting circuit, which is fed at 25 volts, using Osram metallic-filament lamps. Arrangements are made for using 50 volts for power, as the plant in addition to running the lights in the house (about 100 in all) also drives a 50-volt motor for running a chaff cutter, circular saw, and root-pulping machine. This motor is placed in a shed about 80 yd. from the house, and is connected to the battery by means of an armoured lead-covered cable laid in the ground. The chaff-cutting required for the homestead is easily dealt with by this machine, and also a considerable amount of firewood, &c., is sawn. The motor is belted direct to the various machines, and, of course, only runs one at a time.



Wind Turbine at Buckenhill.

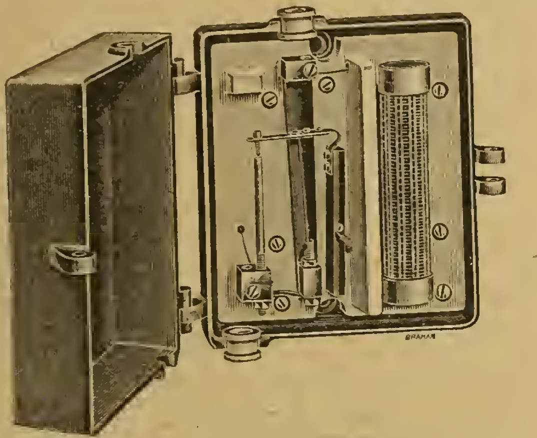
We are informed that the plant has now been running for over a month, and behaves admirably. It is entirely automatic, being fitted with Messrs. Childs's patent tail gear, which gives very accurate adjustment to the wind. This arrangement consists of three tails, two of which stand out at about 20° with the wheel. Two of these are connected together, so that when the wheel is required to stop, these have only to be pulled into a horizontal position, and the wheel immediately comes up into the wind and stops running. In the same way the tails are so balanced, that when the wind reaches a predetermined velocity the tails tend to take the horizontal position, and so bring the wheel out of the wind more or less as the strength of the wind varies. In the recent gale which swept over the Midland Counties, this plant underwent a very severe test of stability; though a very large tree was blown down close to it, the wind turbine suffered not the slightest harm. It is found that the supply from the wind turbine is very reliable, and the plant requires very little attention. All the main bearings carrying load are ball bearings, and the gear is enclosed in a cast-iron oil bath, so that if the plant were left for 12 months no harm would result from want of lubrication. As the wind turbine is placed on ground somewhat higher than the house, there is often a good wind blowing at the turbine, when none is felt down at the house. The plant is guaranteed to produce 3,000 units a year, but in practice it produces at a much faster rate than this. In 12 hours recently it produced 14 units, with wind averaging 15 miles an hour. Estimating that the average wind in this situation will be about 9 miles an hour, the output of the plant in a year will probably be about 5,000 units.



Chaff Cutter and Saw driven by Wind Power.

The Development of Electrical Main Line Traction.—In a paper recently read by Dr. Eichberg at the Allgemeine Elektricitäts Gesellschaft's Works, in Berlin, the present position of electricity in connection with main-line railway work is discussed. He points out that the spread of heavy electric traction has not been nearly so rapid as that of electric tramways, chiefly because the economical advantages of heavy electric driving are more immediately evident in special cases, such as those where the traffic is unusually dense, or the gradients very heavy, where long tunnels have to be traversed, or where there is a possibility of employing water-power. The other advantages of electric driving, such as absence of smoke, do not appear to be appreciated yet in Europe, although, in America, the tendency now is towards prohibiting the introduction of steam traffic within the bounds of the towns. The first main-line electrical experiments were made in 1894 on the Baltimore-Ohio line. Since 1907 all the trains of the New York Central Railway have been brought into the New York terminus by means of electric locomotives, and similar applications of electric driving are also in use on the Paris-Orleans line, and in Italy on the Milan-Gallarate line. As long as the use of direct current is retained, the collection of the current is practically confined to the third-rail system, and this is looked upon with unfavourable eyes by the railway authorities from the point of view of track maintenance. In Italy, and also in connection with the German high-speed trials, a three-phase supply was employed. The higher voltage thus made available permits overhead collection to be retained and long distances to be dealt with; but, although this system has proved itself quite practicable, the fact that two overhead lines, with a large voltage difference between them, are necessary, is a serious drawback. The difficulties are especially great at crossings and points, and have led to the general demand amongst railway authorities all over the world for the use of some system involving the installation of only one overhead line. Since 1903 this demand has been met by the development of the single-phase commutator motor. These were first used on the Niederschöneweide-Spindlersfeld trial line. They were then adopted in Hamburg, to which city the A.E.G. has supplied no fewer than 79 double cars of this type, and the practicable nature of this solution under normal working conditions has since been fully confirmed by the experience of numerous railways. There is now hardly any large European railway which is not concerning itself with the question of electrifying some portion of its system, and there can be little doubt, in the opinion of Dr. Eichberg, that the next few years will see important developments in this direction.

N.C.S. "Limiter."—A simple device has been introduced by Messrs. Nalder Bros. & Thompson, Ltd., of Queen Street, E.C., for use in connection with the current-limit system of charging for electrical energy. As shown in the accompanying illustration, it consists of a resistance and a thermal cut-out, mounted on a slab of porcelain and enclosed in a cast-iron case. It is suitable for both A.C. and D.C. circuits without modification. The thermal cut-out is made of three iron parts—a fixed bar, carrying at the upper end a contact spring with adjusting screw; a wire traversed by the main current; and a pillar, upon the upper end of which the contact is made. Normally the resistance, which is of the woven-wire type in cylindrical shape, is short-circuited by the cut-out; but when the predetermined limit of consumption is exceeded, even by 20 watts, the expansion of the wire due to its rise of temperature opens the contact, and throws the resistance into circuit. The resulting diminution of current strength allows the contacts to close again, and the lamps therefore continue blinking until the excess of current is cut off. The apparatus is unaffected by ordinary changes of temperature, owing to the above-mentioned construction of the chief parts of the same material iron). The device is of interest in connection with Messrs Handcock & Dykes's paper, read at the I.E.E. last night.


N.C.S. Demand Limiter.

Electric Shock Fatality.—On the 19th inst. an inquest was held into the death of Robert Hall, 27, signalman, in the electrical department at Denby Colliery, who met his death from electric shock, on 10th inst, underground. The inquest had been adjourned to allow investigations to be made by the Government electrical expert, Mr. Robert Nelson, who was now present.

Daniel Taylor, a corporal at the colliery, stated that on the day of the accident deceased came down the incline with an empty tub, out of which he took some tools and entered the haulage house. Witness was 15 yards away at the time, and had only gone another 7 yards when he heard a lamp fall in the haulage house; on getting no reply to his shout he hurried to the door, and there saw deceased just falling down, with the appearance of clutching at something. At the same time some sparks and a bright flash were twice in quick succession emitted from the ammeter. Witness hailed the deputy, and then ran to get the power cut off. Deceased would only be in the house half a minute before witness heard the lamp fall, and would have had no time to do any work there.

William Hannah, of Belper, electrician at the colliery, said the plant was new, and had only been worked for trial purposes. They had earth plates to which the cables were connected, and as far as he knew at the time of the accident they were satisfactory, frequent tests having lately been made. On the 15th, whilst examining the system after the accident, he found a loose connection on the earthing cable. There was no other fault on the system of earthing. The day after the accident it was found that the insulation of the ammeter coil was punctured. The ammeter was held by three screws, and the bottom screw was half out, whilst the other two were loose. In his opinion the fault on the ammeter was the primary cause of the accident. The defect would show itself by the flashes. If deceased did not unscrew the ammeter somebody else did. He thought it quite possible that deceased went to the ammeter to remedy the flashing. Deceased had attended to minor faults before without cutting off the current, although he had received proper instructions regarding his work.

Robert Nelson, electrical inspector of mines, said he had inspected the scene of the accident, and it was most probable that there was an intermittent fault in the ammeter. He thought it was deceased who loosened the ammeter, and as he was doing so, he got a shock. He found no fault in the construction of the electric plant, and thought the accident was due to excess of zeal on deceased's part.

The jury returned a verdict of "Accidentally killed."

Radiology and Electricity.—It is proposed to hold a Congress of Radiology and Electricity at Brussels next year, in connection with the International Exhibition. The Congress will meet on September 6th, and the meetings will extend over three days. Prof. E. Rutherford will act as president of the British Committee.

Appointments Vacant.—Electrical fitter for the Children's Infirmary at Carshalton (42s.); working electrical mechanic for Brecon and Radnor Asylum (30s. +). See our "Advertisement" pages for particulars.

Cricketers at Dinner.—The fifth Annual Dinner and Concert of the Kensington and Knightsbridge Electric Lighting Co.'s Cricket Club was held on Saturday last, the 20th inst, at the Addison Hall, Addison Road, Holland Park, W., the chair being taken by Mr. R. S. Erskine, and the vice-chair by Mr. H. W. Miller. Songs and selections were given by Misses Gertrude Cooper and Mabel Moyle, and Messrs. Cooper Mitchell, Guy Docwra, S. W. Alcock, E. Driver, F. Mitchell, H. W. White and E. Williams, Mr. Gordon Goodyer presiding at the piano. Mrs. Steuart Erskine presented the club and other prizes to the various prize winners. Toasts were proposed and responded to, and one or two speeches made.

The Farningham Motor-Car Accident.—The charge against Mr. Clifton Robinson of causing the death of some hop-pickers by knocking them down with a motor-car was before the Maidstone Assizes on the 19th inst. No evidence was offered against the defendant; the jury returned a formal verdict of "Not Guilty," and was discharged.

Design of Electromagnets.—A correspondent asks:—"What size and winding of electromagnet should I require to 'draw' a distance of ½ in. and hold a weight of 2 lb.? Would an accumulator be the best method of energising it? if so, what voltage should I require for, say, 20 magnets, all to be actuated by one switch, and would greater or less numbers be in the same ratio?" Perhaps some of our readers will favour him with the desired particulars.

Cures by Electricity.—Under this heading the *Westminster Gazette* states that a new system of electro-therapeutics has been invented by Mr. K. Mueller, of Zurich, who is said to employ the effects of the electromagnetic field upon the body instead of the direct application of electric current. His invention is based upon observation of the superior health of men working in a strong magnetic field at the St. Gothard Tunnel.

The same note refers to an account by Prof. F. Nagelschmidt of the successes already attained in the curing of diseases by the ordinary system of using high-frequency electric currents, the only sensation experienced by the patient being a rise of temperature. This system, is, of course, much used in British hospitals.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS OF CHILE.—In June last year this Institution was inaugurated; it holds its meetings in the University, Santiago. The programme for this year includes papers on "Continuous-Current Meters," by W. Cordero; "Electrolysis of Nitrate of Soda," by Prof. B. Diaz Ossa; "San Bernardo Electric Tramway," by Horacio Valdes; "The Talca Hydro-Electric Installation," by Prof. Rafael Edwards; "The Electrification of Railways," a report presented by Horacio Valdes; "The Preservation of Wood Poles," by C. A. Smith, A.Am.I.E.E.; "Electric Signals for Railways," by James McKerlie, A I.E.E. and A.M.I.C.E.; and "Governmental Control of Telegraphs and Telephones," by Luis Norero. The directors of the Institute are anxious to hold intercommunication with the engineering Institutions and Societies of Europe and the United States. The postal address is:—El Secretario, Instituto de Injenieros Electricistas, Universidad Santiago, Chile.

On Friday last, at a meeting of the Barrow and District Association of Engineers, Mr. Wm. Drysdale, A.M.I.E.E., read an interesting paper on "Electrical Energy from a Supply Station." In order to show the effect of the metallic-filament lamps on consumers and supply stations, the lecturer gave figures showing the actual saving effected by some of the Barrow consumers with the new lamps. These varied from 46 per cent. saving in consumption, and 66 per cent. increase in candle-power, to 63 per cent. saving in consumption, and 9 per cent. increased candle-power. At a large business house in Barrow, where the candle-power was 512 with carbon lamps, and the annual account £36 1s 9d. for 1906, at the end of September, 1909, the annual account was £18 7s. for 1,486 C.P., the bulk of the latter consisting of metallic-filament lamps; the gross saving was 49·2 per cent., with an increased candle-power of 190 3 per cent. Allowing £4 10s. for actual renewals for 1909, the net saving came out at £13 4s. 9d., or 36 7 per cent. Mr. H. R. Burnett, borough electrical engineer for Barrow, opening the discussion, gave an example of a building in Barrow, where the carbon lamps were replaced by tantalums, and the annual account was reduced from £150 to £81.

PHYSICAL SOCIETY OF LONDON.—At the meeting held November 12th, 1909, a paper entitled "The Absorption Spectrum of Potassium Vapour" was read by Mr. P. V. Bevan, and one entitled "Some further Notes on the Physiological Principles underlying the Flicker Photometer" was read by Mr. J. S. Dow.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—The fourth annual dinner will be held at the Criterion Restaurant, Piccadilly Circus, on December 4th. The hon. sec. for the Electrical Department is Mr. Ernest W. Moss, 20, Huddleston Road, Tufnell Park.

UNIVERSITY COLLEGE, LONDON.—A special advanced Course of Lectures for postgraduate students, telegraph and telephone engineers and electrical engineers on "The Theory of the Propagation of Electric Currents in Telegraph and Telephone Cables and in Electric Conductors" will be delivered by Prof. J. A. Fleming at University College, beginning on January 19th.

ILLUMINATING ENGINEERING SOCIETY.—The inaugural meeting of the first session was held on Thursday last week at the Royal Society of Arts, when Prof. S. P. Thompson, president, read his address. The hon. sec., Mr. Leon Gaster, stated that the membership numbered 164.

Institution of Electrical Engineers (Manchester Students).—The opening meeting of the Manchester Students' Section was held on November 9th in the form of a supper and smoking concert. About 150 members and friends were present, and a most enjoyable evening was spent.

Institution of Electrical Engineers (Birmingham).—The third Annual Dinner of this Section was held on November 12th at the Grand Hotel, Birmingham. The Chairman, Mr. R. K. Morcom, presided, and about 100 members were present. Proposing the toast of "The Institution," Mr. Morcom said that in reading Dr. Kapp's presidential address he had noticed the large number of foreign names which it contained. He did not, however, think that this was a sign of the inferiority of British engineers. It was the capitalists and financiers rather than the engineers who needed technical training. There was no denying that at the present time the state of the electrical industry was not all it might be. Prof. Kapp, in responding, said that as a result of 11 years' experience in Germany, he could confidently assert that the statement of our inferiority to them was not just. In his opinion we held the lead in the manufacture of electrical machinery and apparatus, although we lagged behind them in its use and application. Mr. Morcom had attributed this to lack of enterprise, but he was inclined to think that it was largely the result of the newness of the German industries, which had had to struggle into existence against the competition of very powerful rivals. With us the use of modern plant was not so much a necessity as a convenience.

The toast of "The Birmingham Local Section" was proposed by Mr. W. M. Mordey, who made some interesting statements in regard to the progress of the Institution's new home on the Thames Embankment, which they hoped to enter next June, and in which they expected the next inaugural address would be given. The amount of work done in this country, he said, was very great, but it was spread over too many people. On the whole, however, he had proof that the total work was steadily increasing, and, in fact, the electrical industry was not in such a bad way after all. The Institution must resist any temptation to make it into a Trade Protection Society. Their right aim was to keep up a standard of good engineering and honourable conduct.—Mr. Vaudrey, in reply, said that Birmingham as a centre of electrical industry was particularly strong, owing to the number of varied trades which were carried on there. Mr. Chattock's low figures for power supply had enabled him to capture various firms taking large amounts of power.

Mr. Patchell, in a humorous speech, proposed the toast of "The City of Birmingham," and Mr. Chattock replied, remarking that the electricity supply department was giving over 7,000 kw. of high-tension supply to large works in the district.

A capital programme of musical and other entertainments was performed between the speeches, and conduced to a very enjoyable evening.

New Electrical Proposals to come before Parliament.—The last two issues of the *London Gazette* contained copies of an instalment of the applications that are being put forward for electrical and other schemes for consideration in the next Session of Parliament. The list is not yet closed—November 30th is the last date—when it is, we shall give particulars in our customary form.

Electrical Business in Russia.—A correspondent who has had 2½ years' residence in Russia, in the interests of British electrical engineering, writes:—"I have followed with interest your various articles and notes on business in Russia, and may I add that I agree entirely with the views you have expressed."

Inquiries.—Makers of the following are asked for:—Oiless trolley catcher; rimmed gear wheels for tramcar motors; cylindrical graphite electrodes.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Radcliffe U.D.C. has increased the salary of Mr. Wilkinson, electrical engineer, from £150 a year to £200.

Mr. E. M. Hayward, shift engineer at Fulham electricity works, having resigned to take up a better appointment at Peterborough, Mr. A. Ardern, junior charge-engineer, who has been at the station for five years, is to be promoted to his position. Mr. Pearson, switchboard attendant, is to take Mr. Ardern's duties, and a new switchboard attendant is to be engaged. The Borough Electrical Engineer explained that he recommended this course owing to the heavy work of the winter being at hand, and to it taking "many weeks before a new shift engineer is able to take up any regular duties, as the plant is entirely new to him."

Mr. H. H. Couzens, engineer and manager of the West Ham electricity undertaking, recommends a list of salary increases in the sub-departments, which amount altogether to £690 per annum. He says that unless adequate remuneration is given there can be no continuity of work, and the department becomes merely a training-ground for the benefit of other electric supply undertakings. It is proposed that amongst the salaries raised the following rises should be given:—Mr. Lloyd Jones, station superintendent, £300 to £350, rising, by annual increments of £25, to £400; Mr. E. Seddon, assistant station superintendent, £3 per week to £190 per annum, rising, by annual increments of £10, to £210; Mr. W. A. Gilbert, mains engineer, £200 to £250, rising to £300 on April 1st, 1910; Mr. W. Whitney, assistant mains engineer, £150 to £175.

Mr. J. Johnson, who has been in the employ of the Heston and Isleworth U.D.C. Electricity Department since its formation, has secured an appointment as chief electrician at Beardmore's Steel Works, Glasgow.

On the 9th inst. at St. George's Church, Rollesley, the marriage took place of Mr. C. E. Gray, engineer to the Ross Electric Light and Power Co., to Eleanor Isobel, eldest daughter of Mrs. Butt and the late E. A. le Fleming Ensor, of Rollesley Hall, Norfolk.

General.—The Royal Society has awarded the Hughes Medal to Dr. R. T. Glazebrook, F.R.S., for his researches on electrical standards.

Mr. A. G. Warren, B.Sc. Eng. Hons., has been appointed assistant in the electrical engineering department of the East London College.

A Glasgow paper says that Mr. William Warren, a veteran of electric telegraphy, is retiring from the general managership of the Eastern Extension Co.'s lines in Australia, which he has held for 20 years. A native of Dorsetshire, he entered the service of the pioneer telegraph company in 1852. He was stationed at Turin, Genoa, and Suez. While he was superintendent at Suez, he had to see after the transmission of the numerous dispatches relating to the Abyssinian War.

On the evening of the 19th inst. in the Gateshead Town Hall, the officials and employés of the Sunbeam Lamp Co., Ltd., held their second annual Whist Drive and Dance, over 200 couples being present. Advantage was taken of the occasion to recognise the long service of the secretary and assistant manager, Mr. T. J. Grainger, who has completed 21 years with the company. Mr. J. W. Edmundson, managing director, presided, and Mr. Robt. Scope, director, addressed the gathering. In his remarks Mr. Scope referred at length to the business capabilities of Mr. Grainger and his high personal character, and said that in the lengthy period completed Mr. Grainger had justly earned the appreciation and esteem expressed. The presentation made on behalf of the officials and office staff by Mr. R. M. Beresford consisted of a framed photograph of the various members, artistically arranged by Messrs. Frank & Sons, Gateshead; and, on behalf of the officials and works' staff, a handsome marble timepiece with forams was handed over by Mr. T. Henderson. Mrs. Grainger was the recipient also of a vanity bag. Mr. Grainger suitably responded. The Whist Drive prizes were presented by Mrs. H. W. Edmundson.

Mr. W. O'Brien, of the Formby (Liverpool) Electrical Power Station, has just been appointed to a position at the L. and Y. Railway Co.'s works at Horwich.

Mr. T. J. West, who has retired, after 44 years' service, from the post of Superintendent of the Electricity Department of the Post Office for the North Midland district, has been succeeded by Mr. A. Longden, Assistant Superintendent Engineer.

Mr. F. Bruckshaw, who is about to take up an important position in Spain, was the recipient of a kit bag, travelling trunk, and a pipe, at the Hightown Hotel, on Monday evening, November 22nd. The presentation was made by Mr. Montgomery, resident electrical engineer, Formby (L. & Y.) power station, on behalf of the staff of the electric traction department.

Mr. J. Stoitner, M.I.E.E., who has had some 30 years of practical electrical engineering experience in England, Germany, and the United States, has opened offices at Birkbeck Bank Chambers, Holborn, London, W.C., where he will carry on business as engineer and contractor. It will be remembered that Mr. Stottner held the position of general manager of the Electrical Co., Ltd., London (A.E.G., Berlin), and the enormous progress which this company made during the 15 years of his management is well known. Among the contracts which he successfully closed during that time may be mentioned:—The Stuart Street generating station and sub-stations, Manchester, with 30,000-h.p. generating capacity; about 4,000 h.p. in generators and motors for the Royal Arsenal, Woolwich; the complete electrification of the Holwell Ironworks; the power station and complete electrical drive at the Kearsley Spinning Mills; the underground equipment of the Lambton Colliery, &c. In all, Mr. Stottner has been responsible for close on £2,000,000 worth of various electrical plant in the United Kingdom alone. Mention may also be made of the fact that he was one of the pioneers of high-tension three-phase power transmission in this country, and that he is fully equipped for dealing with any class of electrical engineering business. Mr. Stottner carries with him our best wishes for continued progress.

An Edinburgh paper says:—"Fully two years ago Mr. John Newlands, Deputy-Controller of Telegraphs at St. Martin's-le-Grand, and formerly Controller of Telegraphs in Edinburgh, was 'lent' to the Indian Telegraph Department for the purpose of reorganising the system of telegraph working in that country. It may be remembered that Mr. Newlands' first efforts in that direction were resented by some members of the staff, and that a partial strike took place. Mr. Newlands proceeded with the work of reform, and the great success which has attended it has now been officially recognised. He has been made a Companion of the Most Eminent Order of the Indian Empire; and in the report of Mr. T. D. Berrington, Director-General of Telegraphs in India, warm testimony is borne to the excellence of the work he has accomplished."

Obituary.—The death occurred on November 22nd, in London, of Baron George de Reuter, second surviving son of the late Baron de Reuter, and a director of Reuter's Telegram Co., Ltd.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical Press, Ltd.—This company's annual return was ed on November 17th, when 4,657 shares had been taken up out of a nominal pital of £5,000 in £1 shares. £1,657 has been paid, and £3,000 is considered paid. Mortgages and charges: Nil.

Imeson, Finch & Co., Ltd. (97,639).—Debenture dated ovember 3rd, 1909, to secure £800, charged on the company's undertaking and operty, present and future, including uncalled capital. Holders: Hanson, own & Co., Ltd., Queen's Square, Middlesbrough.

La Capital (Extensions) Tramways Co., Ltd. (55,966).— memorandum of satisfaction in full of charge dated February 10th, 1893, curing £120,000, has been filed.

Magneto Co., Ltd.—Debenture dated November 9th. 1909, to cure £3,000, charged on the company's undertaking and property, present d future, including uncalled capital. Holder: J. J. Horne, Maycroft, Stanley oad, King's Heath.

Schreiber Electric Battery Co., Ltd. (96,715).—Debenture ted November 3rd, 1909, to secure £1,000, charged on the company's underking and property, present and future, including unpaid capital. Holder: . P. Schreiber, 34, Southwick Street, Hyde Park.

CITY NOTES.

German Company Dividends.

HE *Berliner Tageblatt* states that the year 1908-9 has been a eriod of advancing development for the electrical undertakings in eneral. The A.E.G. has increased its dividend from 12 to 13 per ent., the Siemens & Halske Co. will presumably raise its rate from 1 to 12 per cent., and the Bergmann Electricity Co., whose nancial period ends with the calendar year, will very probably aintain its rate of 18 per cent. On the other hand, the conditions n the case of the Felten & Guilleaume-Lahmeyer Works appear to e less favourable, as the directors have announced that a further oderate decline in the dividend will have to be reckoned with or the year terminating with December. When the latter comany was formed as an amalgamation of the two works indicated y its title, the dividend paid in 1905, which was the first year of he fusion, was 10 per cent. and in 1906 11 per cent.; but in the ollowing year of general prosperity the distribution was reduced o 10 per cent. and to 8 per cent. in 1908, whilst 1909, as already entioned, is to witness a further moderate decline. The announceent recently made by the directors was to the effect that the usiness results of the Carlswerk, in Mulheim, have also been atisfactory in 1909, and have not been inferior to 1908, but that hose of the Frankfort department have been less satisfactory, and ill unfavourably affect the total results for the year. Prof. alomon, chief manager of the Frankfort Works, is retiring from he position. A correspondent of the Berlin newspaper points out hat the company, in addition to the construction of machinery ver many years, has embarked upon fresh branches by the stablishment of an arc lamp factory, an apparatus factory, easuring instrument factory, and a glow lamp factory, and ven on the construction of motor-cars. All these special epartments cost money, but this would not have been o bad if other large, medium and small works had not or years past been able to supply the articles cheaply. The rankfort works began where others had finished years ago with tudies and trials, the experience has had to be paid for, and these re the principal causes for the diminution of the financial results. he correspondent adds that just as little is understood in the ulheim Carlswerk about manufacturing in the Frankfort departent as is understood in the latter about the manufacture of cables nd wire ropes. In addition to this the Berlin newspaper submits hat there must not be left out of consideration the circumstance hat the period of depression has not passed over the electrical ndustry without leaving traces. The sale prices of many articles ave considerably declined, and have, in fact, not yet materially mproved. Orders have largely been accepted by individual comanies, often at any price, owing to keen competition, and the ystem of subsidiary companies and interests, which afford a stock f work to the parent undertakings, is less developed in the Felten nd Guilleaume-Lahmeyer works than in the case of two other ompanies.

Paris Compressed Air Co.

THE increase in the receipts of the Compagnie Parisienne de l'Air omprimé from the supply of electricity in 1908-9, was relatively mall, as the company was only entitled to claim on the basis of the upply furnished in 1905, whilst the remainder belongs to the ssociation of Sectors or amalgamated supply works, and serves to ompensate those Sectors whose concessions have been curtailed. he financial position is as follows for the past two years:—

	1908-9.	1907-8.
Share capital	£1,000,000	£1,000,000
Electricity receipts	264,400	263,100
Compressed air receipts	104,400	102,800
Net profits	102,800	101,600
Dividend on ordinary shares in francs ...	34·89	34·78
Dividend on preference shares in francs	26·59	25·96

The company's report states that the supply of compressed air for lifts experienced a further expansion, but that for clocks and power purposes again decreased. On June 30th, 1909, the company possessed 24,310 shares in the Compagnie Parisienne de Distribution d'Electricité, and a further block of 24,341 shares was taken over on the increase of the latter's capital. The large number of shares which a German group held in the Compressed Air Co. have, with the exception of 12,000 retained by a Cologne firm, been repurchased by a French banking syndicate at the price of 145 per cent.

Official Announcements re Companies.—The following companies will be struck off the register in three months, unless cause is shown to the contrary:—

Acoustic Patents (France), Ltd.
Anglo-Brazilian Rubber Syndicate, Ltd.
Beeston Accumulator Syndicate. Ltd.
Birmingham Electrobus Co., Ltd.
Dorchester Electric Light & Power Co., Ltd.
Electric Canal Haulage Co., Ltd.
Electric Mercantile Agency, Ltd.
International Telegraphic Appliances, Ltd.
Lncashire & Yorkshire Electrobus Co., Ltd.
Liverpool Electrobus Co., Ltd.
Malabar Rubber Plantations, Ltd.
Manchester Electrobus Co., Ltd.
Nottingham Electrobus Co., Ltd.
Nottingham Gas & Electric Fittings Co., Ltd.
Provincial Electrobus Co., Ltd.
Richardson Electrical Co., Ltd.
Rubber Syndicate, Ltd.
Scottish Electrobus Co., Ltd.
Tramways Development Co., Ltd.

Dorman, Long & Co., Ltd.—For the year ended September 30th there was a profit of £103,173. A final dividend of 2 per cent. for the year is to be paid. There is written off for depreciation £30,000, and £54,699 is carried forward. Included in the capital expenditure for the year (£71,623), was the final payment for the electrically driven mill.

Mather & Platt, Ltd.—The capitalisation and distribution of a portion of the reserve fund of undivided profits has been recommended by the board. According to the *Times* they propose to divide £200,000 of the reserve as a bonus, and to satisfy such bonus by the allotment of 200,000 fully-paid ordinary shares of £1 each. "These, subject to the rights of the holders of the existing preference shares, will confer the right to dividend computed from January 1st, 1909, and will be issued to the holders of ordinary shares in the proportion of five shares of £1 each in respect of each ordinary share of £10. It is also proposed for the sake of convenience to sub-divide the existing ordinary shares of £10 each into 400,000 shares of £1 each."

Montreal Street Railway Co.—According to a financial daily, the net income for the past year amounted to $1,229,700. A dividend of 10 per cent. has been paid.

Adelaide Electric Supply Co., Ltd.—A dividend at the rate of 6 per cent. per annum is recommended on the ordinary shares for the year ended August last.

Prospectuses.—*Aengsono (Java) Rubber Plantations, Ltd.*—This company is offering for subscription 22,500 shares of £1 each. It has 324 acres planted with rubber and coffee, and during the next two years the planted acreage will be increased to 1,024.

Amazon Telegraph Co., Ltd.—This company is offering for subscription (the list closes on Monday, November 29th) an issue of £300,000 5 per cent. debentures at the price of 98 per cent. The proceeds will be applied to redeeming the whole of the 6 per cent. and 5 per cent. debentures now outstanding, and to providing for the cost of the duplication of the cable, which was referred to at the recent annual meeting of the company (see ELECTRICAL REVIEW, November 19th).

Mackay Companies.—The directors have declared a quarterly dividend of 1¼ per cent. on the Common shares.

France.—The report of the Société des Trefileries du Havre for the last financial year shows a net profit of only £87,712, as compared with £108,338 in the preceding 12 months. The dividend is, however, being maintained at 10 fr. per share.

La Société Centrale d'Industrie Electrique is the name of a new company, which has just been formed in Paris, with a capital of £200,000. The Thomson-Houston Co. and the Gesellschaft fur Electrische Unternehmungen, of Berlin, are interested in the new undertaking.

MARKET QUOTATIONS.

Wednesday, November 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£11	..
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£75	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„		..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	¼d. inc.
c „ Tube (brazed)	„	9d.	¼d. inc.
c „ „ (solid drawn) ..	„	7¾d.	¼d. inc.
c „ Wire, basis	„	6¾d.	¼d. inc.
c Copper Tubes (brazed)	„	9d.	¼d. inc.
c „ „ (solid drawn ..	„	9d.	¼d. inc.
g „ Bars (best selected) ..	per ton	£74	£2 inc.
g „ Sheet	„	£74	£2 inc.
g „ Rod	„	£74	£2 inc.
e „ (Electrolytic) Bars ..	„	£62 15	£2 5 inc.
e „ „ Sheets ..	„	£79 5	£2 5 inc.
e „ „ Rod ..	„	£67 15	£2 5 inc.
e „ „ H.C. Wire	per lb.	8⅛d.	¼d. inc.
f Ebonite Rod	„	3/3	..
f „ Sheet	„	8/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine..	„	5/6 to 6/6	..
h India-rubber, Para fine	„	8/2½	¼d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	51/-	2d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 7 6 to £13 10	2/6 inc
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 17 6	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£137 10 to £138 10	£1 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/9½	½d. inc.
p White Anti-friction Metals:— "White Ant" brand	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a G. Boor & Co.	h Edward Till & Co.
b The British Aluminium Co., Ltd.	i Bolling & Lowe.
c Thos. Bolton & Sons, Ltd.	k Morris Ashby, Ltd.
d F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
e Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	o Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.	

Reduction of Capital.—RAWORTH'S TRACTION PATENTS, LTD., AND REDUCED.—A petition for confirmation of the reduction of the capital of this company from £30,000 to £20,625 is to be heard on December 7th.

Liquidation.—BAKER OIL SEPARATOR CO., LTD.—This company is winding up voluntarily, with Mr. W. E. Frank as liquidator.

Douglas Southern Electric Tramways, Ltd.—The directors report that the season consisted of 125 days, against 115 days last year. The total receipts were £4,790; the net profit for the year was £1,522. The dividend of 5 per cent. upon the preference shares absorbs £1,298, and £303 is carried forward.

Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd.—The directors have declared a dividend for the half-year ended September 30th last on the ordinary shares at the rate of 7½ per cent. per annum, free of income-tax.

STOCKS AND SHARES.

Tuesday Afternoon.

MINING shares, apart from those in copper companies, have fallen so heavily during the end November settlement that other departments feel the strain involved by the necessity for realising investment securities in order to meet speculative losses. With the money market in its present ungenial condition, and with political uncertainty occupying men's minds, there is little or no assistance for the Stock Exchange, where the slump in Kaffirs, with its resultant rally, is the outstanding feature for the time being. Our tale this week must perforce be tuned to the minor, although some satisfaction is to be recorded that, after all, the critical conditions prevalent elsewhere have affected electrical issues perhaps less than might have been expected.

The amalgamation of interests between the Baker Street and Waterloo, Piccadilly & Brompton, and Charing Cross & Euston tube railways has led to no changes in the quotations of the 4 per cent. Debenture stocks of the three concerns. Bakerloo Debenture is 98 and the other two 96. The interest on the former is payable January 14th and July 14th, while on the others it falls due on January 1st and July 1st. Therefore the three prices carry five months' interest, equal to about 1⅝ per cent.

Underground stocks are weak. Central London Preferred and City and South London Ordinary stocks are down a point apiece, and the older Undergrounds have moved down. Districts fell ¼ to 15¾, despite the notice given of a Bill to deal with the interest arrears. The company's 6 per cent. Debenture stock changed hands at 140 on Monday, while the Extension Preference was done at 48 on the same day. The other Preference stock, upon which the 3½ per cent. interest is guaranteed by the Underground Electric Railways of London, stands at 67. The Underground Electric Company's trio of issues are without quotable change.

By a curious coincidence it happened, a few days after our references to radiators, that some of the London companies started a vigorous campaign of advertising and pushing these little devices, as it was suggested here that it might pay them to do. With the snap of cold weather to underline the appeal, the companies ought to be doing well; but perhaps still more could be accomplished by the aid of further personal service and calling upon the users of the current for lighting purposes.

Charing Cross Ordinary are up ⅛, and the Preference down by the same fraction, which amount has also been taken from County of London Ordinary, Edmundson's Preference and London Electric Preference. Rather an unusual feature in this department is provided by a rise of 5/16, to 20s., in Smithfield Ordinary shares, upon attention being called to the improved condition into which the company has been gradually working. River Plate Electric Ordinary drooped, and Victoria Falls Power Preference slipped back to 18s. because of the slump in Chartered and other South African shares. The company's 5 per cent. "A" Debenture stock is par to 102.

The Canadian-Mexican group of light and power companies has withstood the prevailing weak tendency with marked success. Rio Trams at 95 are 5 up, Sao Paulo at 154½ are 2 better, and Mexico Trams gained ½. British Columbia Electric Deferred continues to ease off. British Electric Tractions are steady. Anglo-Argentine Trams 5 per cent. First Preference receded slightly. United of Monte Video Preference rose to 5½, which is the same price as the Ordinary, and the 5 per cent. First Debenture stock is about 102. London United Tramways 4 per cent. Debenture stock at 67½ is a point lower.

Telegraph descriptions are very undistinguished. The Anglo-American division has been flat. West India and Panama Ordinary have shaded off, although the Preference shares retain their rises. Great Northern Telegraphs improved a small fraction. Amazon Telegraphs are ½ better, and the 5 per cent. Debentures did not move on the appearance of a prospectus offering £300,000 5 per cent. Debentures at 98.

American Telephone and Telegraph rose 2, and so did Mackay Companies' Common, on the reports about a fusion of telephone interests in the United States, although it is said that the Mackay Companies will not be included in the arrangements.

Manufacturing shares are somewhat irregular. Castner-Kellners have responded, with a rise, to the good dividend and report. Babcock & Wilcox lost another 1/16 of their recent advance. Callender's Ordinary and Preference and Henley's Ordinary are both lower, on sales, it is said, necessitated by losses in other markets by speculators who held these as investments. Edison & Swan issues are distinctly flat, the First Debenture shedding 3 points. Telegraph Construction 4 per cent. Debenture has regained its small fall.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Nov. 16th.	Closing Quotations Nov. 23rd.	Business done week ended Nov. 23rd, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3½— 4	72/6	67/6	+ ½	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	99 —102	99 — 102	..	..	..	4 18 0
$161,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	6 %	8 %	144 —146	146 —148	147¾	147	+2	5 8 1
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	6½%	8¾%	6½%	£3 4s.	61 — 63	60 — 63	61	..	— ½	5 3 2
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101½—102½	101 —102	102	101	— ½	5 17 8
6,220,770	Do. do. do. Deferred	Stock	½%	1⅞%	1 %	8/-	22⅝— 21⅞	21⅞— 22⅝	22 11/16	22	— ¾	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	6 %	8 %	8 %	7¾— 8⅛	7¾— 8⅛	..	..	..	4 18 6
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 89½	87½— 89½	89	88¼	..	4 9 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅞— 9⅛	8⅞— 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13 — 13½	13 — 13½	..	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126½—129½	126½—129½	128½	127¼	..	5 9 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	84 — 86	85¼	84¼	+ ½	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103	102	..	6 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12 3/16	11¾	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103¼	102¾	..	6 16 11
200,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Snb.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	6 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10 9/16	10⅜	..	5 8 6
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13 23/32	..	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28½— 29½	28½ — 29¾	..	..	+ ¼	6 5 8
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	16 %	13 %	16 %	13 %	51 — 53	51 — 53	52	..	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	8½%	4 %	4 %	93 — 95	96 — 98	..	..	+3	4 1 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— ⅞	¾— ⅞	..	..	..	6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 - 108½	107 —108½	107⅜	107¼	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	120 —122	121¾	120¼	..	4 18 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	6 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	6 18 5
179,613	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	27/6	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½ — 88½	87 — 89	87½	..	+ ½	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	6 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 15/16— 7 3/16	6 15/16— 7 3/16	7 5/32	7⅛	..	5 10 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	..	..	..	4 8 4
80,008	W. Coast of America, 1 to 30,000 & 53,001 to 56,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	8 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13¼— 13¾	13¼— 13¾	13 9/16	13⅜	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	6 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	¾— ⅞	11/16— 13/16	16/-	15/3	— 1/16	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	9 — 9½	9 — 9½	..	..	..	6 6 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	9 — 10	9 — 10	..	..	..	15 0 0
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4½— 4¾	4 7/16— 4 11/16	93/9	88/9	— 1/16	5 2 4
600,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼— 4½	4¼— 4½	..	..	..	5 11 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	90½—92	90 — 91½	91½	91	— ⅛	4 7 5
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4 9/16— 4 11/16	4 7/16— 4 11/16	94/1½	91/3	— ⅛	4 4 3
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	6 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	..	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	145 —150	144 —149	146½	146	—1	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	123	122	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	..	..	..	4 10 11
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102½ —104½	102 —105	104¼	102½	..	4 6 2
188,801	British Electric Traction	10	6 %	Nil	Nil	Nil	⅞— 1	⅞— 1	15/-	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	1½%	2½— 2⅞	2½— 2⅞	53/1½	..	..	5 6 8
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	85½	84¾	..	5 14 11
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	58 — 62	..	..	..	7 5 2
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	7 3/16	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛— 6½	6½	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
904,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,856	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	49¾	48½	..	7 13 10
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	† Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,761 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	6 %	4½%	4½— 5	4½— 5	..	..	..	4 10 0
45,904	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅛— 10⅞	10 — 10¾	10⅜	10	— ⅛	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 6¼	5½— 5⅞	..	..	— ⅛	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2⅛— 2¼	2 3/16— 2 5/16	45/-	44/9	+ 1/16	5 12 6
910,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	107	106½	..	3 18 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	6 %	3½%	61 — 63	61 — 63	62	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	84 — 86	84½	..	—1	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 — 46	43	..	..	5 8 8
1,480,000	City and South London Railway	Stock	1¾%	2⅛%	2¼%	1½%	30½— 31½	29½— 30½	30¾	29½	..	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 96	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Nov. 16th.	Closing Quotations Nov. 23rd.	Business done week ended Nov. 23rd, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	21/10½	20/7½	..	8 17 9
805 000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	21/3	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	$\frac{5}{32}$— $\frac{9}{32}$	$\frac{3}{32}$— $\frac{7}{32}$	..	..	..	31 5 8
17.189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½ %	1 — 1½	1 — 1½	22/6	21/9	..	8 6 8
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	66 — 71	68	..	—1½	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	81 — 84	..	..	—1	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390..	2	7 %	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	23/9	22/6	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103¼	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13¼	12 — 12¾	12⅝	12½	— ½	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 8 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¾— 16½	15¾— 16½	15⅞	..	..	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,930	Do. do. 50,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅜— 2⅞	2⅜— 2⅞	..	..	..	13 0 10
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	67 — 70	66 — 69	..	..	—1	5 15 11
6,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	36¾— 37¼	36¼— 36¾	36$\frac{13}{16}$	36¾	— ½	2 14 5
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 —66	64 — 66	65½	64½	..	4 3 4
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	15¾— 16¼	15½— 16	16$\frac{5}{16}$	15$\frac{13}{16}$	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	$\frac{19}{32}$— $\frac{11}{16}$	$\frac{19}{32}$— $\frac{11}{16}$	..	..	..	6 10 11
814,916	Do. do. Defd...	1	Nil	Nil	Nil	Nil	$\frac{1}{32}$— $\frac{5}{32}$	$\frac{1}{32}$— $\frac{5}{32}$	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	$\frac{11}{16}$— $\frac{13}{16}$	$\frac{11}{16}$— $\frac{13}{16}$	..	..	..	6 8 1
595,600	Do. do 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124½—127½	125 —128	127¼	125½	+ ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	91⅜	91	..	5 7 6
245,500	Potteries Electric Tra tion	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 8 6
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	34¾	34½	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ —102½	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100 —101	100¾	100⅝	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87¾	87¼	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	31 — 33	31 — 33	32¼	31½	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	¼— ½	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	1¾— 2¼	2 — 2½	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906.	1907.	1908	Closing Quotations Nov. 16th.	Closing Quotations Nov. 23rd.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	7⅜	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½— 7½	..	..	..	4 13 4
8[illegible],876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3½— 4	3⅝— 4⅛	80/-	..	+ ¼	6 1 3
80 000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4⅞	4¼— 4¾	..	..	— ⅛	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	80/-	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅜— 3⅞	3⅜— 3⅞	..	..	..	5 16 2
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10 — 10½	10 — 10½	10$\frac{15}{32}$	..	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	12½	..	..	4 12 4
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7½— 8	7⅝	7½	— ⅛	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10$\frac{29}{32}$	10$\frac{23}{32}$	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— $\frac{5}{16}$	⅛— $\frac{5}{16}$	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	½— ¾	..	..	— ⅛	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	57	..	..	7 10 0
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	7 — 7½	..	..	+ ¼	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅞— 5¼	4¾— 5⅛	..	..	— ⅛	5 17 1
832,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3¾— 4¼	3¾— 4¼	..	..	..	5 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	93/9	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½— 86½	85¾	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½— 82½	80½— 82½	82	81½	..	6 1 3
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	71 — 75	73	..	..	4 13 4
$4,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	103⅜	..	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	84 — 86	84 — 86	85⅜	84½	..	5 16 3
[illegible]50,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137 500	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13¼	12½— 13¼	12⅜	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1$\frac{9}{16}$— 1$\frac{11}{16}$	1½— 1⅝	31/3	..	— $\frac{1}{16}$	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1$\frac{3}{32}$— 1$\frac{7}{32}$	1$\frac{3}{32}$— 1$\frac{7}{32}$	23/6	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	$\frac{9}{16}$— $\frac{13}{16}$	⅞— 1⅛	..	..	+ $\frac{5}{16}$	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	$\frac{5}{16}$— $\frac{9}{16}$	$\frac{5}{16}$— $\frac{9}{16}$	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1$\frac{1}{16}$— 1$\frac{3}{16}$	1$\frac{1}{16}$— 1$\frac{3}{16}$	21/10½	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102¾	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	$\frac{29}{32}$— $\frac{31}{32}$	⅞— $\frac{15}{16}$	18/-	..	+ $\frac{1}{16}$	5 6 8
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	..	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞ - 5¼	4⅞— 5¼	..	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1909.

As regards the export section of electrical business, but little movement has occurred as compared with the preceding month, when, it will be remembered, the total was below the average of the year. The import section, however, shows an upward tendency, having reached the highest figure recorded this year, thanks to lamp importations.

The gross export total was £265,523, an amount which includes £28,324 worth of telegraphic material, and leaves £237,199 as the total of general business, comparable with £294,753 in October, 1908.

Of the various items, the totals of electrical machinery, and telephonic and telegraphic material show a fall compared with the previous month, this being more than counterbalanced by increased totals in the majority of other sections.

As regards the imports, which amounted to £164,246—showing a recovery after the depressed returns of some months past—this total compares with £138,462 in September, and includes, as the most prominent item, £60,000 worth of lamps.

It is interesting to note that this item is some £10,000 in excess of that recorded in October last year, despite the additional lamp factories which have been established in this country in the meantime.

Machinery imports were somewhat higher, and telegraphic-telephonic imports some £6,000 less than in September.

The re-export section at £13,830 is some £4,000 less than in September.

Japan, India and the Argentine figured as the most prominent purchasers of the month, while Germany, with a total of £107,673 imports (including nearly £48,000 worth of lamps), retained its usual position as an importer.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	131	90	125	93	40	2,473	...	81	...	...	1,056	4,089
Germany	249	343	46	14	11	325	...	30	...	63	76	1,157
Netherlands	170	707	122	...	109	885	...	...	...	54	978	3,025
Belgium	136	293	25	87	322	778	...	18	...	178	144	1,981
France	85	...	96	490	16	1,751	...	...	...	...	118	2,556
Portugal, Madeira and Portuguese Africa ...	48	126	15	248	6	1,960	1,160	42	...	62	1,054	4,721
Spain and Canary Isles	8	100	50	80	...	585	850	46	...	14	517	2,250
Italy, Austria-Hungary and Switzerland ...	15	...	47	...	329	228	460	...	...	897	2,272	4,248
Greece, Bulgaria, Roumania and Turkey ...	91	111	43	..	...	472	...	26	...	...	508	1,251
Channel Isles, Gibraltar, Malta and Cyprus	10	30	22	16	70	275	...	12	...	...	15	450
U.S.A. and Philippines	35	...	821	11	44	731	...	...	468	...	5,213	7,323
Canada and Newfoundland	170	649	511	140	1,951	2,201	1,532	30	19	25	2,333	9,561
Bermudas, British West Indies and British Guiana	84	...	10	165	...	...	...	...	...	122	31	412
Mexico, Colombia, Panama and Venezuela ..	4	45	27	455	...	2,324	28	8	...	577	190	3,658
Peru and Uruguay	173	...	190	13	10	437	...	...	...	181	43	1,047
Chile	11	415	66	289	40	601	200	96	111	242	20	2,091
Brazil	588	315	679	467	54	3,867	49	12	...	18	141	6,190
Argentine	1,373	6,395	278	1,044	827	21,559	49	748	73	4,420	667	37,433
Egypt	336	195	99	79	...	328	18	219	54	141	212	1,681
Tripoli, Tunis, Morocco and Persia	48	...	...	...	...	945	...	13	...	...	...	1 006
British West Africa and St. Helena	25	750	13	37	104	65	...	126	...	94	5	1,219
Cape of Good Hope	718	796	251	404	123	565	175	81	...	136	...	3,249
Natal	1,077	9,275	86	280	75	1,545	110	49	420	129	97	13 143
Rhodesia and Transvaal	2,072	6,645	253	887	195	3,131	...	32	...	216	15	13,446
Zanzibar, Brit. East Africa, Mauritius & Aden	25	45	14	39	...	...	..	39	...	100	119	381
China and Siam	1,405	2 006	127	119	21	1,388	99	2,782	10	109	...	8,066
Japan	544	14,808	78	90	1,417	11,377	...	34	...	1,887	9,066	39,301
Java	11	...	...	...	...	...	...	6	...	...	806	823
India	2,181	7,755	2,948	2,661	495	8,409	10,037	2,521	212	353	1,271	38,843
Ceylon	26	56	104	131	110	363	53	298	...	23	284	1,448
Straits Settlements and Fed. Malay States...	97	472	248	468	28	626	82	56	84	215	171	2,547
Hong Kong	229	4,571	34	342	...	1,908	...	11	76	166	...	7,337
West Australia	113	20	20	284	356	630	...	366	16	153	...	1,958
South Australia...	372	304	153	70	...	3,218	...	89	...	108	56	4,370
Victoria	967	5,116	71	507	240	929	100	289	69	3,072	64	11,424
New South Wales	1,528	2,867	411	678	393	4,990	...	2,958	...	225	283	14,333
Queensland	88	122	65	226	...	518	...	14	...	...	344	1,377
Tasmania	6	...	...	...	...	...	...	...	...	30	...	36
New Zealand	1,179	1,872	360	462	49	1,717	...	46	32	220	355	6,292
Total, £	16,428	67,294	8,508	11,376	7,435	84,104	15,002	11,178	1,644	14,230	28,324	265,523

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		£
Norway, Sweden and Denmark	5	42	8	81	...	1,152	200	356	...	4,111		5,955
Germany	527	12,858	2,119	47,931	2,204	22,077	50	1,408	8,406	10,095		107,673
Holland	...	...	...	3,195	...	38	...	8	102	6		3,349
Belgium	537	1,698	86	275	177	776	11	334	488	3,907		8 289
France	12	160	684	4,740	241	2,337	...	1,200	3,599	1,709		14,682
Spain	...	...	...	214	...	...	...	...	195	...		409
Switzerland	14	22	...	106	135	1,714	8	2	19	152		2,172
Italy	29	1,032	77	...	...	2	...	...	...	428		1,568
Austria-Hungary	22	463	11	578	...	13	...	32	1,133	26		2,278
United States	2,174	1,148	743	2,589	...	6,915	3,494	431	257	120		17,871
Total, £	3,320	17,423	3,728	59,709	2,757	35,024	3,763	3,771	14,199	20,552		164,246

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	2,156	1,537	...	2,292	...	3,802	...	331	1,254	2,458		...

Total Exports : £265,523. Total Re-Exports : £13,830. Total Imports : £164,246.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Concluded from page* 833.)

THE RYMER-JONES SLIDE RESISTANCE AS A CALIBRATOR.

In the present series of articles on graphic methods of cable-break localisation, a brief note concerning a conveniently improvised mil-ammeter may be found not inapposite. Mr. J. Rymer-Jones has shown how an effective mil-ammeter may be arranged by a combination of the Sullivan (marine pattern) galvanometer, with the Rymer-Jones slide resistances.

The Rymer-Jones slide resistances (shown in fig. 54), although applicable to many test methods, are designed primarily as an improved form of Ayrton-Mather universal shunt (U.S.).

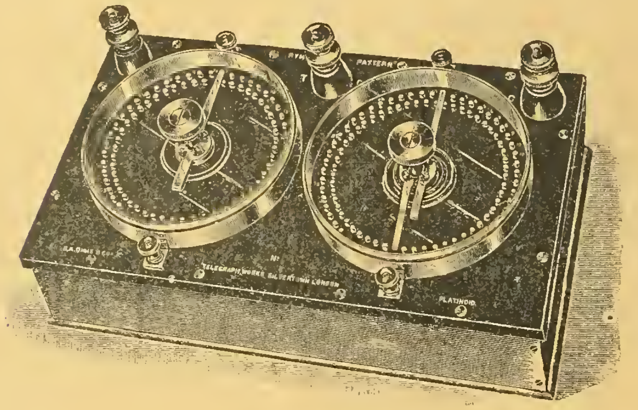


FIG. 54.

The following note summarises the methods by which these slide resistances can be used to calibrate the graduated scale of, *e.g.*, a Sullivan marine-type galvanometer (G) enabling this last-mentioned apparatus to be utilised as a mil-ammeter in cable-fault localisation tests ashore or afloat.

It may happen that a mil-ammeter is not available, whilst a second Sullivan galvanometer, generally used for D.R. tests, may happen to stand handy.

Fig. 55 shows comparatively the theoretical and practical arrangement of the Rymer-Jones slide resistances considered as a galvanometer universal shunt, one of the many uses to which this apparatus is applicable.

Letters between brackets give the lettering as used in practice on the outside of the apparatus.

This apparatus, though based on the principle of the Ayrton-Mather U.S., involves a distinctly improved principle of sliding-contact construction, whereby a fully ample number of possible shunt adjustments, within a conveniently limited superficial area, are obtained for a minimum number of sliding contacts, viz., 99 × 54 = 5,346 different slide values, with only three sliding contacts (in practice, platinum working against gold).

The said arrangement possesses obvious advantages: (1) Minimum change of resistance at contact points, and greatly reduced risk of contact trouble due to accidental grit or other foreign matter. (2) Simplicity of the formula for combined resistance of the shunted galvanometer.

Fig. 55 shows the Rymer-Jones U.S., as consisting of a series of 99 coils, each of 100^ω, or a total of 9,900 ohms, connected between two other series, each of the last-mentioned series totalling 100 ohms. The G terminals go to two arms or contacts rigidly inter-connected, which slide along the two 100-ohm series, so that the more one series is brought between the G terminals, the more the other is excluded, and *vice versa*.

Thus between the G terminals there is a constant resistance of $10,000^\omega$, that is, $9,900^\omega$ *plus* 100^ω made up of either one, or the other, or parts of both of the two 100-ohm series.

In mil-ammeter and other special work (as in the case of the Rymer-Jones special test to localise a high-resistance break-end) a knowledge of the combined G and S resistance is sometimes needful.

In fig. 55 A and B are two resistances in simple shunt with each other.

When T_1 and T_2 are on the zero contacts of their respective series, B becomes *nil*; in other words, G and its constant shunt of $10,000^\omega$ (or whatever the total may be) are short-circuited.

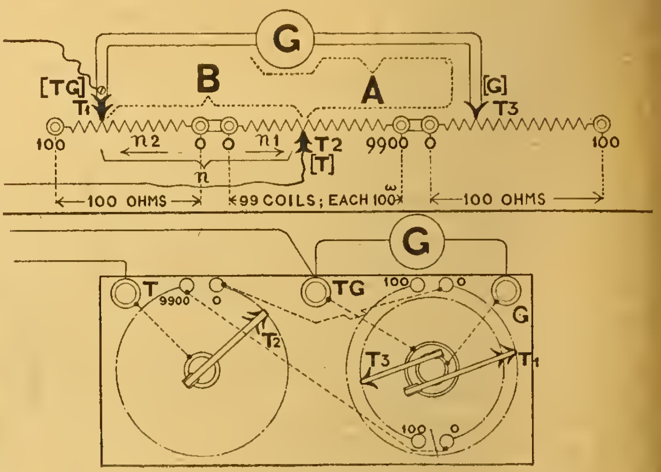


FIG. 55.

In the theoretical diagram, fig. 55:—

n_1 = slide reading of T_2 working to the right by hundreds of ohms.

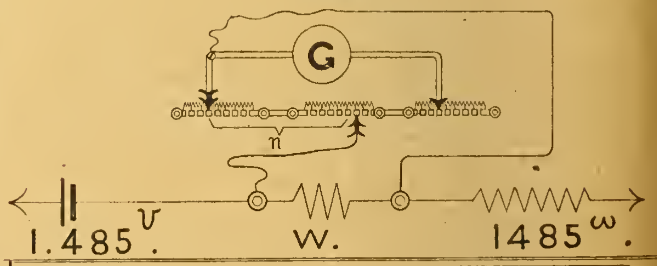
n_2 = slide reading of T_1 working to the left by one or more units.

NOTE.—The two (out of the three) sliding contacts from which readings are taken, are drawn as double arrow heads.

Let the total slide reading of n_1 and n_2 be called n, and let G = galvanometer resistance.

It has been shown that the total slide value = [99 × 100] + 100 = 10,000 which, in this particular pattern of universal shunt, represents also the total ohmic resistance always shunting the actual G terminals.

FIG. 56A.



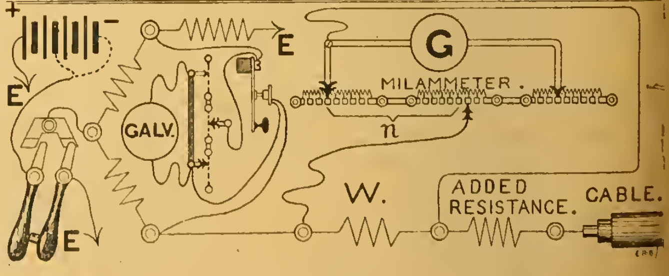


FIG. 56B.

Then A = G + [10,000 − n].
B = n.

The joint conductivity of the branch circuits A and B is represented by the sum of the reciprocals of their resistances, $= \frac{1}{A} + \frac{1}{B} = \frac{A+B}{AB}$, the reciprocal of which expression, viz., $\frac{A\ B}{A + B}$, gives the joint resistance of the two branch circuits.

$$\frac{A\ B}{A + B} = \frac{[G + (10{,}000 - n)]\,n}{G + 10{,}000 - n + n} = \frac{[G + (10{,}000 - n)]\,n}{G + 10{,}000}.$$

Fig. 56 shows respectively :—

(*a*) Tests for calibrating G for use as a mil-ammeter.

(*b*) Use of G as mil-ammeter in an ordinary Wheatstone bridge two-current test to localise a cable break.

Mainly there are two methods for calibrating the scale of G, though variations and refinements for various requirements are elaborated in an article by Mr. J. Rymer-Jones in the Electrical Review for August 11th, 1905.

Method A.—Connections as in fig. 56A. Contacts T_1 and T_2 respectively moved to extreme slide limits—viz., to 99 and to 100.

One or two Leclanché cells of v volts are joined up ready for application through shunted G, and an extra inserted resistance of a thousand times as many ohms as there are volts in v.

For instance, if v = 1·485 volts, inserted resistance = 1,485 ohms; or if v = 2·97 volts, resistance = 2,970 ohms.

The shunted G is then further shunted by a coil of comparatively stout wire (W) of German silver, and of only 2 or 3 ohms resistance, the said shunted system being, therefore, reduced to a practically negligible resistance.

W is experimentally adjusted until, on the completion of the aforementioned circuit, any required convenient deflection is obtained, say, 10 divs. or 100 divs.

Now, any deflection obtained under these conditions necessarily represents $\frac{1·485^v}{1{,}485^\omega}$, or again $\frac{2·97^v}{2{,}970^\omega}$, that is, 0·001 amp. = 1 m.a.

The shunted G is now ready for use as a mil-ammeter (as in fig. 56B), on which a deflection of 310 divs. (W having been adjusted to give 100 divs. for 1 m.a.), would approximately represent 3·1 m.a., or 520 divs. = 5·2 m.a.

To reduce the sensitiveness of these readings, the operator, instead of lessening still further the resistance of W, may move the slide contacts T_2 (and, for final adjustments, T_1) from the maximum limit to convenient points along the slide adjustments, thereby causing V to produce any desired decrease in number of scale divs. for the given milliampere of current already explained.

Method B.—There need not be, in the beginning, any exact adjustment of W as long as this resistance is sufficiently low to bring the G *spot*, deflected by the calibrating battery, within scale limits.

Any desired calibration of the G scale used as a mil-ammeter may be effected by the sliding contacts T_2 and T_1.

In an actual example in the writer's personal experience, with T_2 and T_1 of the U.S. at maximum limits of 9,900 and 100, the extra shunt W of about 3$^\omega$ reduced the deflection of G to considerably over 100 divisions.

Then, by adjusting T_2 and T_1, the following scale deflections were obtained :—

100 divisions with slide reading at 9,874
20 " " " 4,962
10 " " " 28

and as the deflection limit available on the G scale amounted to 550 divisions, these figures afforded a basis for the following three calibrations adapted for various uses.

(1) Volts (v) used in calibration.	(2) Approximate resistance in circuit.	(3) Current in M.A.	(4) Slide reading on U.S.	(5) Scale divs. on mil-ammeter G.	(6) Scale limit in milliamperes.	(7) Scale of calibration.
1·485	ω 1,485	1	9,874	100	5·5	A.
"	"	"	4,962	20	27·5	B.
"	"	"	28	10	55·0	C.

The ordinary divisions of the G scale were then supplemented by pencil lines and figures dividing up the scale divs. into three additional scales, viz. :—

Scale A, 100 divs. = 1 m.a. up to 5·5 m.a.
B, 20 divs. = 1 m.a. up to 27·5 m.a.
C, 10 divs. = 1 m.a. up to 55·0 m.a.

The advantage of this arrangement was that when G was taken from its customary use (which happened to be for cable D.R. tests) to serve as a mil-ammeter for cable-break localisations, all that had to be done was to connect up W and place the sliding contacts of the U.S. at that slide reading which previous experiment had shown would produce whichever of the three calibrations might be chosen as convenient for the work in hand.

Another method has been devised by Mr. C. W. Schaefer for utilising a reflecting galvanometer as a mil-ammeter, particulars of which method may be found in Mr. H. D. Wilkinson's "Submarine Cable-Laying and Repairing," second edition, page 534.

NOTES ON TRADE ABROAD.

A Tug of War and its Lessons.

Japan has been making a strong pull against America for the cotton trade of Manchuria and has got much of it away, whereat the U.S. Consul at Newchwang weeps and reports the reasons for the loss of the predominant position. There is little in common between cotton and electrics—though we like to electrify the mills—but we allude to the matter in order to state the reasons why the U.S.A. has lost ground before the advancing Japs, for among them are points that may be profitably regarded in connection with our exploitation of British electrical manufactures in Far Eastern markets where our brave little allies as they feel their feet may compete against even us. Japanese cottons are shipped by a direct route "right there." American cottons are first shipped to Shanghai and distributed from there, which means the addition of storage charges, commissions, &c., making prices high. That, as any baby knows, is a serious handicap in any competitive market. But further still, before the American goods reach the small dealers they must pass through the hands of numerous middlemen, whose commission must be added! What is the moral? The American Consul advises thus :—Manufacturers of piece goods should follow the lead of Standard Oils and Tobacco interests, who have compelled success by sending an energetic representative to Manchuria to protect their interests, and who ship their goods *direct* and carry stocks there. It is urged that a number of manufacturers, presumably of different departments, should jointly send an agent to arrange to keep stocks in the principal Manchurian markets, these stocks to be shipped direct, and there must be no attempt to redistribute from Shanghai. As we have said, cottons are not electrics, but the method of commercial madness being very much the same in all classes of manufactures, the advice having been given should be made a note of, so that we may be ready to do whatever Manchuria will permit electrically in the near or distant future.

An American has a fit of the Blues.

An American special agent (Captain Godfrey L. Carden) has been visiting a number of important works in Italy, and he has written home reproving American machinery makers for neglecting the Italian market. As an illustration—a very bad illustration—of neglect, he names the military small-arms arsenal at Terni; its name is Precisione d'Artiglieria della Fabrica d'Armi di Terni, and the vice-director in charge is Major Guglielmo Lucci, Cav. Santo Galbardi being the technical chief. Electric drive is employed throughout and everything is of the best, save that "in the entire lot of 1,400 machines in service, there are only 10 American." "In vain I looked for American machines, which for arsenal work are unexcelled! Turning to the technical chief, I asked if any American manufacturers had ever called." Since 1882 only one American machine-tool man had visited the works. In vain should we try to convince this confident American that anything good can come out of England. With envious eyes he looked upon those 900 machine tools supplied to Terni in the early eighties by our own well-known Greenwood & Batley, Ltd., of Leeds—and the annoying part of it all is that they are still running! He actually finds that G. & B. received about $386,000 for the installation. Then he goes on with his story, preparing the way for the American to hang around in the hope of getting an equally acceptable order:—“ Much of the Greenwood & Batley equipment is now old, and it is this material which must, in the general order of things, give way gradually to more modern and superior tools.”

We are 10.

We can imagine the excitement which this ardent American displayed when he came across “ the only encouraging sign at Terni ”—a recently purchased American milling machine of which the technical chief spoke highly, here a couple of American lathes, there a miller or two, to the aforesaid grand total of 10. He goes on to say that there are many types of American machine tools which could be introduced with advantage in the Terni shops. No doubt there are, but let it not be imagined that since those early eighties the British machine tool-maker has been resting upon his oars. When Americans try to get a look in replacing those G. and B. machines, the British manufacturer must see to it that *he* has a look in too, for the American tool-maker is no more necessary in Terni than he is at the North Pole. Our firms have made excellent advance in recent years, and they have devoted a good deal of study to the electric drive, and all this big talk of a disappointed special agent will not settle the Italian Government contracts if our people do their duty.

Nurse the Arsenal.

Messrs. Greenwood & Batley, who supplied the screw machines, will be on the alert, and so we are sure will Messrs. Alfred Herbert, of Coventry, who supplied the lathes, and the others, “ mostly German,” will be on the war-path too. The British manufacturer must show fight. Commercial war to the knife be it if it must. Are we ready? Let us nurse the Terni arsenal straight away, and every other arsenal. There never was greater need for alertness. That stuff still running!—and after nearly 30 years!!—tells its own tale. What a tribute to the quality of British manufactures! If you want machines to last three years, and then scrap them, we can make those too. All we want is a good chance—a fair field, and no favour.

A word more about this arsenal where so much “ old ” British stuff is at work. What does the Consul say about the product, and so on? “ The material turned out here is of the highest grade, and the requirements on all sides are of an exacting character. The workmen are a credit to their officers and their country.” In short, everything is of the best, except that “ old ” British equipment. Incidentally, we may add for general interest that the Terni works are supplied with about 1,000 H.P. for electric driving purposes, from eight hydraulic turbine-driven sets. 500 men are employed on a 9-hour working day, the shops opening at 7 a.m. and closing at 5 p.m.

With all that we have said in the foregoing, however, we cannot help feeling that such reports are of value to American traders. We would like to see a few reports on big works' visits from our own Consuls. They are better than generalisations.

Let us all Kow Tow!

In our detailed consideration of the outlook for British electrical trade in China, we dwelt at some length upon the American ambitions regarding that market, and the steps that our trans-Atlantic cousins were making in order to attain their desired ends. We now read in a U.S. Government trade document that “ the Associated Chambers of Commerce of the Pacific Coast have sent advices to the Government at Washington, and to Consul-General Amos P. Wilder at Shanghai, that they have accepted an invitation from the Chinese Chambers of Commerce to visit China next February. The Associated Chambers include the individual chambers located at San Francisco, Oakland, San Diego, Los Angeles, Seattle, Portland, Tacoma, and Spokane; C. W. Burke is the general secretary, and J. D. Lowman president.”

Shall we ask for an invitation and go and kow tow, too? We need to go to China to obtain an intelligent grasp of the opportunities, but we also want intelligent Chinamen to come here, to see what we, as engineers and electrical manufacturers, are capable of doing. Where is the Electrical Manufacturers' Association and all its former hospitality? or why not ask the I.E.E. to do something as a Trade Expansion Society? Mr. Mordey said last week that the I.E.E. must not deteriorate into a Trade Protection Society, but we are sure that he would not object to efforts at expansion. Let us invite deputations from foreign fields, consisting of the right men, and treat them as they should be treated; or, at least, let the Chambers of Commerce confer with the electrical trades when they have useful visitors. Whatever you please, so long as we do something worth the doing! Later in this article we show how our American electrical cousins have been entertaining Japanese visitors.

Austrian Power Progress.

In a report on motive power machinery progress during 1908, U.S. Consul Brittain, of Prague, says that the greatest advance made was in the use of electricity as a motive power.

In the north Tyrol and Alpine districts the water power has been widely utilised through the construction of electrical plants, furnishing many thousands of added horse-power, especially for numerous small enterprises. The inspector for the Voraelsburg district reports that out of 1,200 motor-driven factories 800 are exclusively, and 70 others partially, driven by electrical power. In the same district, where in the early spring there was a lack of water power for small factories which did not use electricity, there were many benzine motors used. The Diesel engine attained great popularity in these places.

In the central electric station in one Vienna district four steam engines, each of 800 H.P., have been replaced by two steam turbines of 5,000 H.P. each. In an electrical station in another district four turbine steam engines have been installed, giving 10,000 H.P. From Reichenberg, Prerauand Troppau come reports of the increasing use of steam turbines.

Commercial Tongues.

An American Consul at Chemnitz has sent home an interesting report on the rapid progress made during recent years throughout Germany in systematically training the youth of that country in foreign languages. In Chemnitz, which has such extensive trade relations with foreign lands, new facilities are available for children, enabling them to lay in good foundations for more advanced work on entering the higher schools. “ The policy pursued in Chemnitz finds its counterpart throughout the Empire, and it constitutes a powerful factor in the rapid forward movement of Germany as a power in international commerce.”

In another report the same Consul, in discussing the last industrial census of Saxony, refers to the steady growth of the proportion of the population occupied with manufacture and commerce, and to the consequent occupation of a relatively less important position of the agricultural contingent. Independent industrial activity shows a very marked retrograde movement, and the tendency of the day is clearly “ toward consolidation and the elimination of the independent artisan or farmer and the small tradesman.” After putting forth data, he says:—“ These data all tend to show that in Saxony powerful influences are at work changing rapidly the whole fabric of industrial organisation. Concentration and consolidation are dominant features, and the elimination of independent individual units is equally characteristic of this epoch of transformation.”

Transport Difficulties.
A Sample.

An American mining company has had put down in Honduras a complete plant for drilling with compressed air. U.S. Consul McClintock, of Tegucigalpa, says that from a water course 1,000 H.P. is generated. This is transmitted by overhead wires 3¼ miles to the air compressor plant which operates 18 to 20 powerful drills. The plant cost £25,000, and took a year to install. The difficulties of transport were extreme. Pieces of machinery weighing as much as 12,000 lb. each were sent over a distance of 120 miles over rough mountain roads. “ More than once the wagons broke down or upset, and the machinery went rolling down the mountain side, to be brought back at great labour. The wagons had to be especially constructed to haul this machinery, and in places as many as 40 oxen were hitched to a single wagon. On the down grades 30 to 40 men were employed in holding the wagon back. The same company has two electric locomotives operating underground at present, and will soon have two more working on a different level.”

Other Things Worth Noting.

Copies of the proposition made to the Argentine Government by Vickers, Sons & Maxim, Ltd., of London, for building docks and shops at the port of Ensenada, one hour by express train down the river from Buenos Ayres, have been forwarded to the United States as a guide to American firms of the form of proposition agreeable to the Argentine Government. A U.S. Minister is urging Americans desiring Argentine Government work to avail themselves of a "form prepared by eminent contractors of long experience in securing Government contracts." All's fair in business competition. Imitation is the sincerest form of flattery. But we hope that British firms also will study that form of proposition.

German engineers have lately been very actively engaged in Turkey in trying to secure railroad extension powers in the province of Adana. An American Consul reported home that there was an opportunity for the sale of American railroad material, but only if prompt delivery were guaranteed, as previous delays had left a nasty effect behind. Another U.S. Consul at Mersine recently reported that British and French mining engineers had been touring the Turkish province of Adana, exploring the Taurus Mountains for iron, copper, chromium, silver and lead, all of which metals are said to exist there. A large copper mine has already begun operations near Mersine, supported by French interests. A British company operates an iron mine at Anemourium. "If American interests delay their investigations, all concessions will go elsewhere." The Turkish mining laws require, first, a permit for exploration, and after a discovery is made, a formal demand for a concession. The new governor of Adana is favourably disposed to concessionaires. British electrical firms are again urged by the Electrical Review to be on the alert in Turkey. For signs of new enterprise there by our firms we are profoundly thankful.

While alluding to Turkey, we may quote some remarks of the Constantinople correspondent of the *Times* :—"It is notorious that many members of the Turkish Chamber are now solely occupied in furthering the interests of native or foreign company promoters and applicants for concessions and monopolies. It is believed that proposals for legislation on this subject will be laid before the Chamber by an influential Deputy."

In regard to Greece, let it be noted by our people, that in the district of Patras merchants are at present disregarding the overtures of Americans because they have persistently neglected to quote c.i.f. prices, are unwilling to extend long credit, and have no American representatives on the spot to push certain lines of goods. "The largest and most influential importers in Patras are not only citizens of the countries from which they import, but they are in prominent instances vice-consuls of these countries, and have been so long established in Greece that their influence is widespread. If an American agent, handling several different classes of goods, should establish himself on the spot and provide a show warehouse for his specialties, he would in the course of a few months build up a very profitable business."

For its new railway extension into the State of Goyaz the Brazilian Government is to do the building and operating on its own account. This is instead of again giving contractors a 6 per cent. guaranty on a capital of $15,000 per mile. The Government issues 5 per cent. bonds to cover the cost of building.

U.S. Electrical Men Fete Japs.

The Honorary Commercial Commissioners of Japan who have lately been touring through the United States spent November 5th in inspecting industrial works at Pittsburg. The Carnegie Steel Co.'s mills at Homestead were inspected in the morning, and after luncheon the party went by special train to East Pittsburg, where the works of the Westinghouse Machine Co. were visited, the construction of steam turbines, gas engines, steam engines and condensers, being observed. Next the works of the Westinghouse Electric and Manufacturing Co. received attention. Here, according to the New York *Electrical Review and Western Electrician*, a number of Japanese guides took the party in charge and showed them the various departments, where the manufacture and testing of generators, motors, transformers, and other auxiliary apparatus of all types and sizes were in progress. Considerable attention was naturally directed to the large electric locomotives being built for the New York terminals of the Pennsylvania Railroad. With Japan about to move forward in railway electrification, anything of this kind might be expected to leave an important impression on the Japanese mind. At East Liberty a dinner was given in honour of the visitors, who were treated as the special guests of officers of a number of the Westinghouse Companies, and the success of the event was due to the toastmaster, Mr. W. M. McFarland, acting vice-president of the Westinghouse Electric, &c., Co., "whose personal greeting to each guest was greatly appreciated." Covers, it appears, were laid for thirty, and for the interest of our readers we give the following list of some of the specially honoured guests :—

Baron E. Shibusawa, chairman of the commission, president First Bank.

Mr. Buei Nakano, member of the House of Representatives, president of Tokio Stock Exchange and Tokio Chamber of Commerce, director of Tokio Electric Railway Co., Ltd.

Mr. Michio Doi, president of Osaka Chamber of Commerce, Osaka Electric Light Co., Ltd., and Naniwa Electric Railway Co., Ltd., director of Osaka Godo Cotton Spinning Co., Ltd., and Ujikawa Hydro-electricity, Ltd.

Mr. Jihei Nishimura, president of Kyoto Chamber of Commerce, director of Kyoto Shoko Ginko and Kyoto Textile Fabric Co., Ltd., member of House of Representatives.

Mr Kahei Otani, director of Yokohama Water Works Bureau, president of Yokohama Seventy-fourth Bank, and Japan Tea Manufacturing Co., Ltd., director of Yokohama Electric Wire Co., Ltd., member of Yokohama Chamber of Commerce

Mr Tominosuke Katono, managing director of Meiji Ginko and Nippon Cars Manufacturing Co., Ltd., director of Nagoya Electric Power Co., member of Nagoya Chamber of Commerce.

Mr. Heizaemon Hibiya, president of Kanegafuchi Cotton Spinning Co., Ltd., director of Fuji Gassed Cotton Spinning Co., Ltd., and Tokio Woollen Textile Co., Ltd.

Mr. Sakutaro Satake, president of Tokio Electric Light Co., Ltd., and Tenth Bank, Kofu, director of Kabuto Beer Brewery, Ltd.

Mr. Kaichiro Nezu, member of House of Representatives and Tokio Chamber of Commerce, director of Tobu Railway Co., Ltd.

Dr. Riuta Hara, doctor of engineering, engineer of Yokohama Water Works Bureau.

Mr. Narazo Takatsuji, director and chief engineer of Kanegafuchi Cotton Spinning Co., Ltd.

Mr. W. M. Zumoto, editor and proprietor, *Japan Times*.

Consul General K. Midzuno.

It might happen that these gentlemen would like to know what their British allies are doing electrically. Eh ?

MORE NOTES FROM INDIA.

[FROM A SPECIAL CORRESPONDENT.]

Simla.—Active operations are in progress in the long-distance hydro-electric scheme for Simla, and it is expected that the work will be complete by the time Government go up there next March, unless any unforeseen circumstances due to climatic conditions arise. The work is under the immediate supervision of Mr. C. Wilson, executive engineer, P.W.D., Punjab, who has been deputed to devote his whole energies to it.

Calcutta.—The more favourable power rates offered by the C.E.S. Co. to large power users should induce many mill-owners to take advantage of the undoubted economy of electric motor driving. Already one large new Jute Press has an entire equipment of electrical machinery supplied by the Lahmeyer Co., through their agents, Messrs. Shaw, Wallace & Co., and its operation is being watched with keen and critical interest by steam-users.

Allahabad.—An Industrial Exhibition is to be held in Allahabad in December, 1910, on a scale commensurate with the importance of the united provinces of Agra and Oudh. From an electrical point of view this will be important, as conditions in this province are very favourable to the application of electrical distribution for irrigation from wells and other sources of water supply. The exhibition authorities are to be commended for giving such timely notice of their proposal, and all particulars may be had from the Secretary, United Provinces Exhibition, Allahabad, who will be glad to forward prospectuses and all necessary information.

The post of Electrical Inspector to Government U.P., lately filled by Mr. R. P. Russell, has been conferred on Mr. J. S.

Pit Keathly. This gentleman, who represented Messrs. Bruce Peebles & Co. on the Mussoorie hydro-electric scheme during its construction, has recently returned to India to take up his new post.

Government electrical contracts in India during the current year have been few and far between, owing to the small budget sanctioned for P.W.D. purposes. Generally speaking, trade all round is bad, but signs are appearing which indicate that prospects are better and brighter.

A NEW FIELD-MAGNET SYSTEM.

By J. W. BURLEIGH.

The writer has recently designed a new field-magnet system for dynamos and motors. It is proposed in this article to describe this magnet system and to put forward some data in connection therewith.

On referring to fig. 1, it will be seen that a departure is made from the usual radial-pole type of machine.

The main magnet system is arranged in a special manner, and may be said to consist of a number of horse-shoe magnets with commutating poles arranged as shown. The angle θ between the axis of a main pole core and the axis of a commutating pole $= \frac{360°}{\text{NP}}$, where NP equals the number of main poles.

This is a distinctive feature of the design. The arrangement of the poles and windings is shown diagrammatically in fig. 2. The full line represents a winding of a series-wound armature; the dotted lines the portions of the field coils, and the rectangles the commutating poles. Portions A A, fig. 1, of the main exciting coils are brought directly over and parallel with the armature conductors undergoing commutation. This particular position of the field coils lessens the self-induction of armature coils undergoing commutation and saves a considerable amount of copper on the commutating poles. From actual tests it would appear that the excitation required on each commutating pole is not in excess of that required for each commutating pole in a machine having an ordinary magnet system, in which the number of auxiliary poles and main poles are equal. It is found, too, that the brush position is not nearly so sharply defined as in the usual commutating-pole machine.

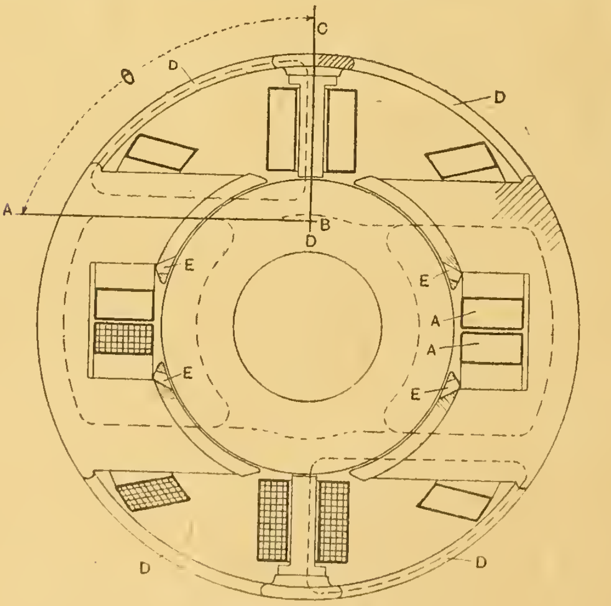


Fig. 1.—New Field-Magnet System.

With this particular construction magnetic leakage is reduced to a minimum. I have tested several small machines, and in no case could detect more than 10 per cent. leakage.

This reduction in magnetic leakage, combined with the short iron path, makes an extremely light field system. In addition to the foregoing merits, the ventilation is much better than in the usual type of construction. Portions D D, being required only to carry the commutating flux, may be cut away, leaving large ventilating spaces. The excellent ventilation thus provided will doubtless admit of larger current densities, not only in the field windings, but in the armature coils as well.

It will be found that, notwithstanding the extra thickness of yoke required in places for main flux, the outside diameter is not greater than in an ordinary machine. In fact, if the field coils are slightly formed, as shown, the external diameter will be less.

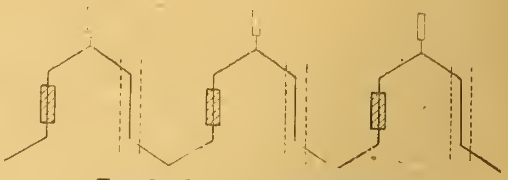


Fig. 2.—Diagram of Winding.

One of the machines made on this principle was a 500-volt crane-rated motor developing 12 B.H.P. at 1,050 revs. The armature of this motor was constructed originally for a machine of quite a different type, and it is therefore to be understood that the dimensions given would be modified in a fresh design. This machine, however, will serve to illustrate some of the characteristics of the new design :—

Motor (Crane-Rated) 500 v., 12 B.H.P. at 1,050 R.P.M.

Diameter of armature	8 in.
Length of armature	$6\frac{1}{4}$ in.
Number of conductors	1,644
Number of commutator bars	137
Diameter of commutator	7 in.
Number of slots	46
Diameter of bore main poles and auxiliary poles ...	$8\frac{3}{16}$ in.
Area of field magnets (steel)	9·2 sq. in.
Area of yoke (steel)	6·2 sq. in.
Area of yoke (cast-iron)	8·5 sq. in.
Calculated amp.-turns without allowance for leakage	2,100
Shunt turns	3,894
Auxiliary turns...	148
Weight of armature copper	$15\frac{1}{2}$ lb.
Weight of shunt copper	32 lb.
Weight of auxiliary copper	17 lb.
Weight of cast-steel	70 lb.
Weight of cast-iron	145 lb.
Weight of armature laminations	$53\frac{1}{2}$ lb.

Temperature rise after one hour's run at 20·5 amperes through armature :—

Armature	68° F.
Commutating-pole coil	60° F.
Main-pole coil	57° F.

Size of commutating-pole	4 in. × $\frac{3}{4}$ in.
Reactance volts (calculated by Hobart's method)	6·9 volts
Mean reactance	4·4 volts

Density required (commutating pole) =

$$\frac{\text{Mean reactance volts} \times 10^8}{\text{L} \times \text{V}} = \beta,$$

where $\text{L} = 2 \times lc \times 1{\cdot}1 \times \text{T}$,
lc = Effective length of conductor,
T = Turns per section,
V = Peripheral speed of armature in centimetres per second,

$$\therefore \beta = \frac{4{\cdot}4 \times 10^8}{115 \times 1{,}110} = 3{,}460.$$

Ampere-turns required for commutating-pole gap...	660
Ampere-turns per pole on armature	2,100
Ampere-turns allowed for iron path	300
Total ampere-turns on commutating pole	3,060

With ordinary radial pole construction, using only two auxiliary poles, the ampere-turns required for each pole would be at least 3,060 + 660 = 3,720; whereas with the improved design 3,000 ampere-turns were ample, the commutation being perfect. The magnetic leakage in this machine was not more than 7 per cent. Sectional views of the motor are shown in fig. 3.

Results similar to the above have been found in several small machines constructed by the writer. The commutation in all cases was perfect, and the brush position was not nearly as sensitive as in the ordinary commutating-pole machine. The saving in material is a great deal more than one would expect at first sight; in some cases the saving

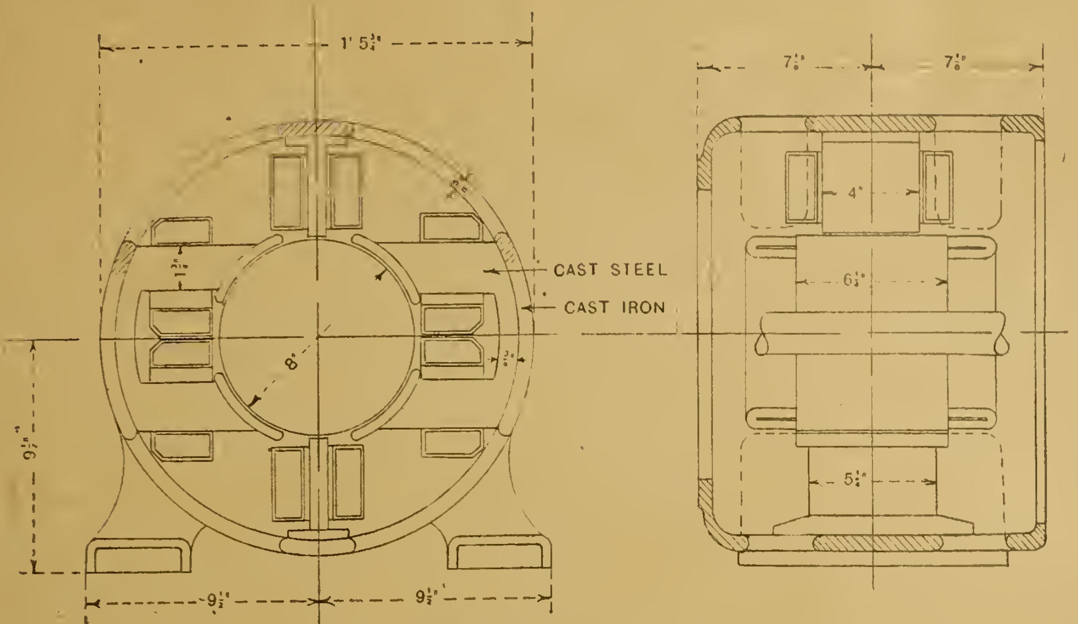


Fig. 3.—Sections of 12-b.h.p. Motor.

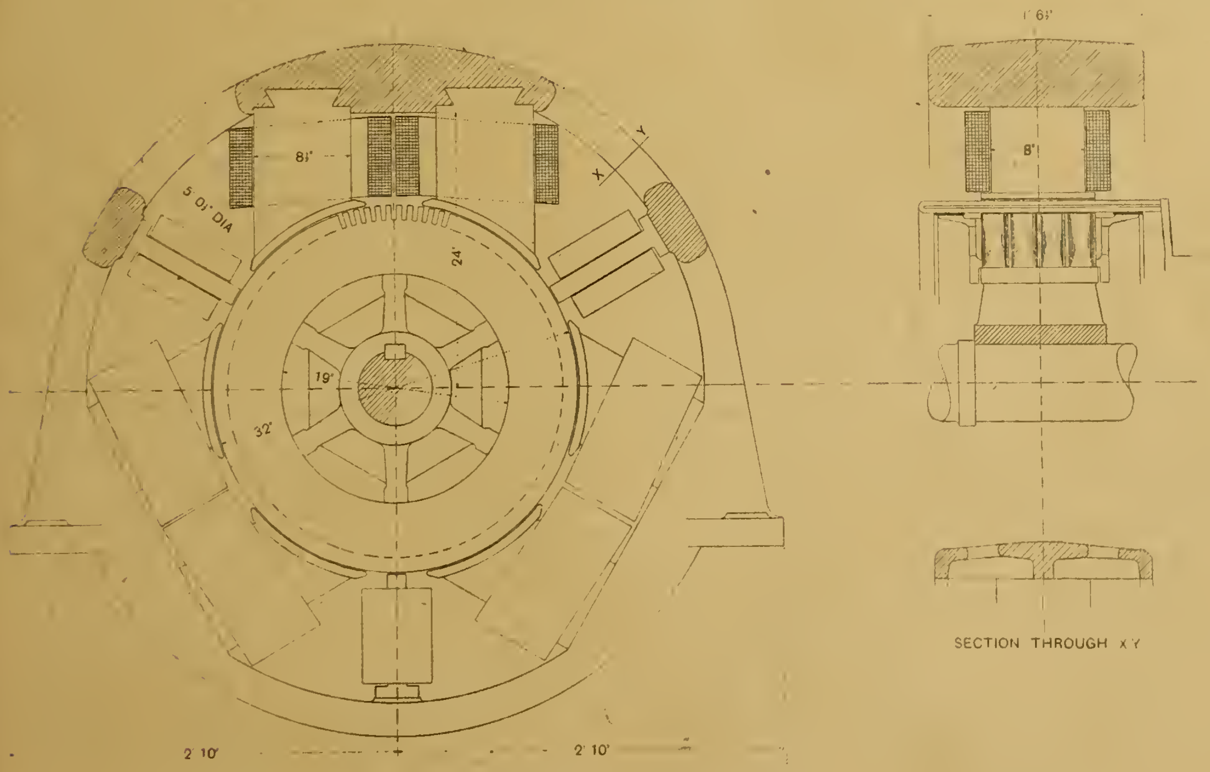


Fig. 4.—Design for 200-kw. Dynamo.

amounts to 20 or 30 per cent. on the total cost of effective material.

Proceeding on the lines shown, I have roughed out a design for a 500-volt 200-kw. dynamo, running at 400 r.p.m. (fig. 4). Probably, for the final design, it may be desirable slightly to modify some of the details. The figures given, however, will serve as an indication of what may safely be anticipated in the larger sizes.

500 Volts, 400 Amperes, 400 r.p.m.

Number of poles	6
Diameter of armature (external)	32
,, ,, (internal)	19·5
Gross length of armature...	10 in.
Number of ventilating spaces	3
Width of vent	⅜
Net length of armature	8 in.
Number of slots	104
Width of slot	·46 in.
Depth ,, ...	1·31 in.
Number of conductors	416
Size of conductor	·15 in. × ·50 in.
Current density, amperes per sq. in.	2,680
Number of commutator sections	208
Diameter of commutator...	22 in.
Effective length of bar	6½ in.
Flux (megalines)	6·18
Density in armature	12,200
,, teeth	21,500
,, air-gap	8,700
Ampere-turns required at full load (per pole) ...	8,000
Main-field watts	1,850
Mean length of turn	42 in.
Weight of copper (pounds)	616
Length of commutating pole	6 in.
Width ,, ,, ...	1½ in.
Commutating-pole watts, total	570
Weight of commutating-pole copper (pounds) ...	150
Resistance of armature (warm)	·0335 ω
Armature C²R watts	5,420
,, hysteresis	2,900
Total armature watts	8,320
Cooling surface (outside)...	2,110 sq. in.
Watts per sq. in.	3·94
Weight of armature copper (pounds)	302
,, ,, disks	1,000
,, cast-iron in magnets	2,800

Weight of wrought-iron in magnets	1,500
„ laminated shoes	155
„ field copper	766
Cost of armature copper	£12·6
„ „ disks	15·2
„ magnet cast-iron	12·5
„ „ wrought-iron	5·7
„ „ shoes	1·6
„ „ field copper	31·9
Total cost of effective material ...	£79·5
Reactance volts (calculated)	4·8
Volts per section	14·4
Armature ampere-turns per pole	7,000
Armature-core loss	2,900
„ C^2R loss	5,420
Total field loss	2,420
Brush friction	470
„ contact	812
Bearing, windage, &c.	1,400
Total loss, watts	13,422
Efficiency at full-load	93·8 %

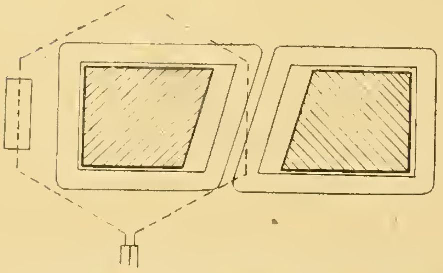


Fig. 5.—Method of Improving Ventilation of Field Coils.

Constructions based on the writer's design should be particularly applicable where large calculated reactance voltages are concerned, as (as before pointed out) in virtue of the main field coils being disposed as described, the effective reactance volts must be considerably less than the calculated figure.

In a turbo-dynamo an additional compensating winding could, if required, be easily arranged. The windings would pass through the pole-pieces as usual, the sides, or free portions, passing the commutating poles. It would not be necessary for the free portions of the compensating winding to pass through the space occupied by the main coils.

It is apparent that in carrying out this design several constructional modifications may be made. In fig. 5 is shown diagrammatically a method of improving the ventilation of coils in the interpolar space. This is done simply by placing the coils at a slight angle to the axis of the armature core. This enables one to provide a space between these coils, and should not to any great extent lower their effectiveness in facilitating commutation.

Probably, too, a better distribution of flux would result if holes were provided in the pole-shoes, as shown at E E E E, fig. 1—there certainly is a tendency towards increased density at these tips.

Radio-dermatitis.—A further operation has been carried out upon Mr. H. W. Cox, owing to the continued progress of the disease, which has not been confined to his hands and arms. Mr. Cox's arm was amputated above the elbow on the 13th inst., and since then his progress has been favourable. As one of the pioneers over whose lives a blight has been cast by their pursuit of X-ray research, Mr. Cox has our profound sympathy, as well as, we are sure, that of our readers.

Rifle with Electric Sights.—According to a Consular report, a German engineer named Issel has adapted "a telescopic searchlight containing a small electric lamp" to a rifle, so that the user can take aim at distant objects in complete darkness. Details are wanting.

A PENNSYLVANIA ELECTRIC LOCOMOTIVE.

A locomotive of more than ordinary interest, one of 24 on order, has recently been tested on the Long Island Railway by the Pennsylvania Railroad, which company's trains it is intended to handle into New York station. The mechanical work was carried out at the company's Altoona shops, and the electrical equipment has been supplied by the Westinghouse Co., East Pittsburg.

The locomotive is of the articulated type, each half carrying its own motor, and being mounted on four 68-in. drivers and a four-wheel swing bolster truck with 36-in. wheels. The two sections are complete in themselves, being duplicates, but are permanently coupled and designed for driving from either end. Each motor weighs, without gears, 45,000 lb., and is rated normally at 2,000 h.p., with forced ventilation, if required by continuous operation.

As will be seen from our view, the motors drive by cranks at 90°, through a system of coupling rods on to the driving wheels, the arrangement resembling at first sight steam practice, but substituting the constant torque of the motor for the intermittent action of the steam cylinder. The centre of gravity approximates to that of the high-speed steam locomotive.

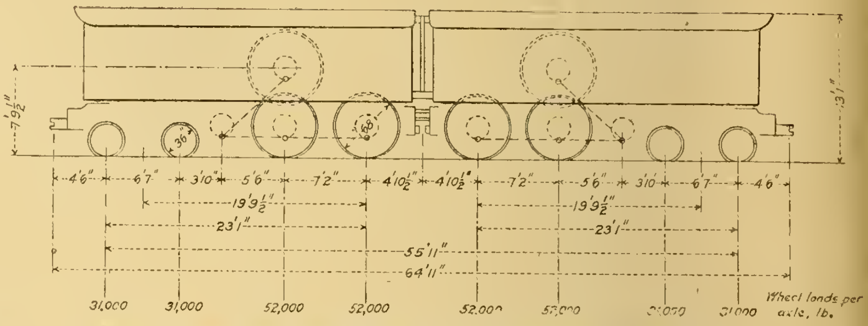
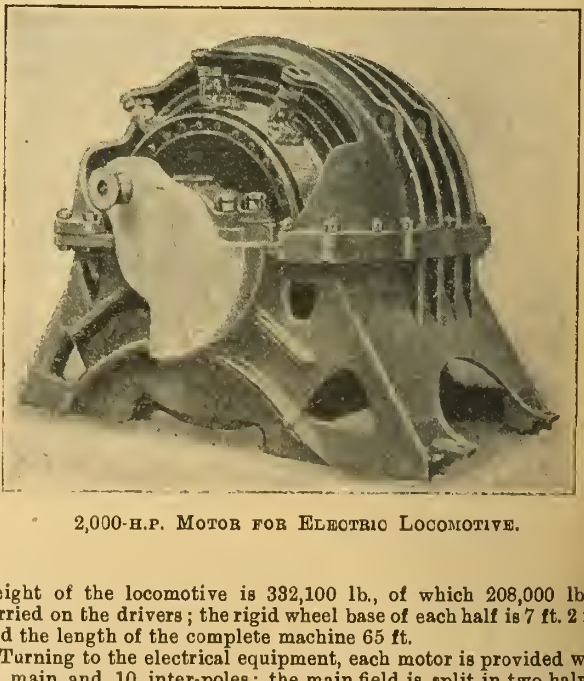


Diagram showing Arrangement and Dimensions of Pennsylvania Electric Looomotive.

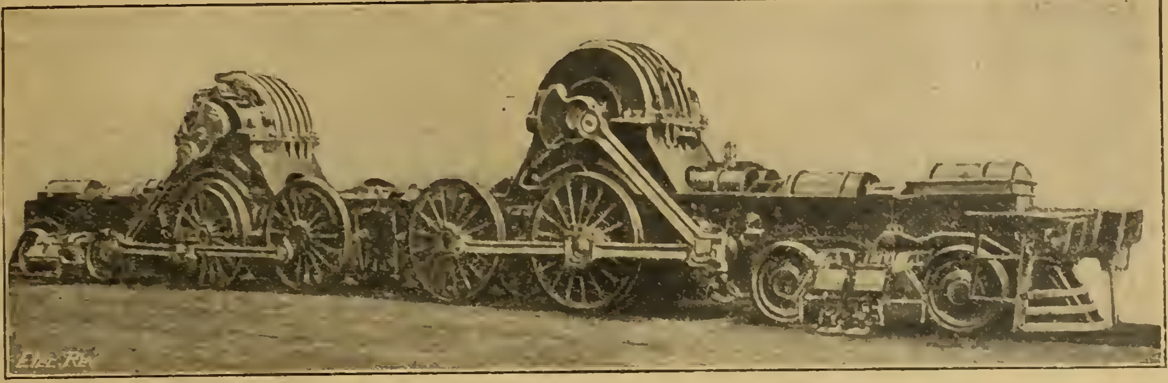
According to the *Railway Gazette*, which published the views here given, the starting requirements of the locomotive are unusually severe, as it will be called on to start a train of 550 tons trailing load upon the tunnel grades under the river, which are approximately 2 per cent.

The guaranteed tractive effort is 60,000 lb., and the normal speed with load upon a level track is 60 miles per hour, although the locomotive is capable of a speed in excess of this. The total weight of the locomotive is 332,100 lb., of which 208,000 lb. is carried on the drivers; the rigid wheel base of each half is 7 ft. 2 in., and the length of the complete machine 65 ft.



2,000-h.p. Motor for Electric Locomotive.

Turning to the electrical equipment, each motor is provided with 10 main and 10 inter-poles; the main field is split in two halves, both being used together in slow speed operation, and one of them shunted in control. The armature is relieved from excessive driving strains by the interposition of a novel friction clutch between the spider and motor shaft. The motors operate on 600-



View showing Motors coupled to Driving Wheels, Pennsylvania Electric Locomotive.

volt direct-current, each half-unit being fitted with two pairs of rail shoes, also with a small pantograph collector mounted on the cab, for use in the yards.

The motors are controlled on the Westinghouse shunted field system; electro-pneumatic switches actuated by air from the brake compressor, and operated by magnets controlled from a master controller, provide for regulating the fields by shunting and cutting out a section of the winding, in addition to series-parallel grouping. The bridging system is used for passing from series to multiple connections, and the motor fields are arranged to be reversed for changing the direction of rotation, reversing being by means of unit switches.

A master controller is placed in each of the cabs and arranged for operating two or more locomotives from any one controller. The resistances are of sufficient capacity to enable a locomotive to run with one motor out of service. Duplicate small storage batteries are provided on each half-unit for energising the control circuits. On an official test over a 6-mile course, the first locomotive hauled a 6-car train at an average speed of 63 miles an hour.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"High Pressure" writes:—"The following case has come under my notice:—A company supplying electrical energy for lighting and power purposes received an application form for the supply of power, duly signed, but without any particulars as to the purpose for which it was intended to be used. From private sources the supply company in question had information that the power was to be used for driving a gas compressor for high-pressure gas lighting, which would displace an installation of arc lamps already in use. The company refused to accept the application. Are they within their rights in doing so? I should perhaps mention that the supply company is working under a provisional electric lighting order. I should be very pleased to receive your comments on this question."

⁂ The point raised is one of some difficulty. It has been met and dealt with in a modified form in this column on former occasions. In order to answer it, it is necessary to consider the obligations imposed on supply companies by statute. In the first place, it is clear that a company must supply to all consumers in their district without fear or favour. By Sec. 19 of the Electric Lighting Act, 1882, "where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the order . . . . every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." Again, by Sec. 20, the undertakers must not show any undue preference to any authority, company or person. Subject to these provisions, a company may make such charges for the supply of electricity as may be agreed upon. All the foregoing principles apply to the supply of electricity for power as well as for lighting. Now, there is nothing in the statutes which would authorise any company to make any inquiry into the objects to which the electricity supplied for power is to be devoted. It is true that many companies supply at different flat rates for special classes of consumers. But supposing there is a charge advertised of 2½d. per unit for motive power generally, there does not seem to be anything to compel the consumer to disclose the objects for which he intends to use the power. Coming now to the facts of the present case, there does not appear to be anything to warrant the company refusing to supply power for an indirect motive. It must be admitted that there is no actual decision of the Courts to support this view, but it is impossible to see whither one would be led if the contrary view were to prevail. A company might object to supply current to a man who was using a motor-generator with a view to lighting his premises at motor rates; that would be a colourable evasion of the law. In the circumstances detailed by "High Pressure" there does not appear to be anything fraudulent on the part of the consumer.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendment.

AUSTRALIAN COMMONWEALTH.—The Government, in the *Gazette* of September 18th, publish a Customs By-Law (No. 66, of September 16th) laying down the conditions for the admission of high-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps, into the Commonwealth of Australia under item 160 (B) of the Customs Tariff of 1908.

It is provided that, unless they comply with the following conditions, such engines shall not be admitted under the above tariff item, which provides that they may be admitted free of duty when the manufacture of the United Kingdom, but otherwise are subject to a duty of 5 per cent. *ad valorem*:—

(*a*) The engine must be of the vertical reciprocating type, and must be provided with forced or splash lubrication.

(*b*) The working parts of the engine must be enclosed in an oil-tight case or chamber.

(*c*) The engine must be mounted, or for mounting, on the same shaft, or be coupled, or for coupling in one line by means of couplings, with an electric generator or a pump, so that the engine and the generator or pump will run at the same number of revolutions per minute.

(*d*) The number of revolutions per minute at which the engine is constructed to run continuously, when developing its maximum brake horse-power, must not be less than the number of revolutions per minute represented in the speed curves of high-speed engines shown in the schedule attached to the By-Law, for the given brake horse-power, according as the engine is of the single, two or three-crank type.

It is, however, provided that when an engine complies with conditions (*a*), (*b*) and (*c*), and is normally constructed to run at a standard speed not less than that defined or represented in the said speed curves, but, owing to the special requirements of the electric generator or pump with which it is, or is to be, directly coupled, must be run at a lower speed, such engine will be admitted under tariff item 160 B upon the production to the Comptroller-General or a State Collector of Customs of satisfactory proof that the engine is a modification of a standard type the normal speed of which is not below that defined or represented in the said speed curves.

The importer is further required to satisfy the Comptroller-General or State Collector of Customs that the engine complies with the foregoing conditions, and that it will only be used for direct coupling to an electric generator or to a pump.

The French Lamp Duty.—The scheme for the revision of the French import duties, which is now engaging the attention of the Chamber of Deputies, provides for an increase of the present high duty on metallic-filament lamps from £7 to £10 per cwt. In this connection a German electrical correspondent states that the French makers of incandescent lamps will be in error if they assume that the proposed Customs augmentation will diminish foreign competition and enable them to obtain a corresponding advance in prices. On the contrary, he remarks that the large German works which at present export metallic-filament lamps to France, will doubtless erect branches in France after the introduction of the prohibitive duty, and that they will then offer more serious competition to French industry. As an instance of how little the glow lamp industry requires a high protective duty, the correspondent mentions that the metallic-filament lamp branch has been very favourably developed in Germany, notwithstanding the relatively low duty of £2 per cwt.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,711. "Automatically-operated switch, for use with cranes and other machinery operated or controlled by electrical means." G. E. Pearson. November 8th.

25,718. "Improvements in magnetic compasses." Kelvin & J. White, Ltd., and F. W. Clark. November 8th.

25,719. "Indicating connectors and regulators for electric circuits." N. Hosgood. November 8th.

25,733. "Improvements in and relating to electric fuse fittings." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) (Application for Patent of Addition to No. 8,263/09.) November 8th. (Complete.)

25,734. "Improvements in the electrical propulsion of ships." Siemens Bros. Dynamo Works, Ltd., and M. Kloss. November 8th.

25,757. "Improvements in and relating to telephones and the like." H. O. Quinn. November 8th.

25,785. "Improvements in alternating current dynamo machines." Hon. C. A. Parsons and A. H. Law. November 8th.

25,795. "Hollow brick lamp which can be lit or illuminated by either the ordinary gas mantle or electric bulbs and used for lighting the names of streets or advertising purposes." J. W. Shephard and G. Brown. November 9th.

25,822. "Improvements relating to metallic conduits for electric conductors." B. L. Myer. November 9th.

25,882. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 9th. (Complete.)

25,883. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 9th. (Complete.)

25,887. "Improvements in automatic telephone systems." W. A. Yewen. November 9th.

25,889. "Improving the quality of metallic-filaments." H. Kuzel. (Date applied for under Sec. 91 of the Act, December 21st, 1908, being date of application in Germany.) November 9th. (Complete.)

25,896. "Improvements in and relating to electric selective devices especially applicable to telephone systems and the like." American Automatic Telephone Co., and C. L. Goodrun. November 9th. (Complete.)

25,920. "Novel or improved flexible protection for electric cables and the like purposes." E. L. Pease. November 10th.

25,962. "Improvements in electrical mercury switches operated by a vehicle passing along a railway." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt.-Ges., Germany.) (Application for Patent of Addition to No. 6,073 of 1905.) November 10th. (Complete.)

25,972. "Improvements in and relating to homopolar electrical machines." R. H. Barbour. November 10th.

25,973. "Improvements in and relating to homopolar electrical generators and motors." R. H. Barbour. November 10th.

25,989. "Improved method of and means for producting electrical oscillations." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. November 10th.

26,005. "Improvements relating to the ventilation of electric motors." H. A. Mavor and Mavor & Coulson, Ltd. November 10th.

26,006. "Improvements in or relating to incandescent electric lamps." H. J. Jaeger. November 10th. (Complete.)

26,021. "Improvements in or relating to electric conduit joints and joint boxes." W. R. Sykes and V. J. Cooke. November 10th. (Complete.)

26,036. "New and improved switch and circuit-breaker for high potential circuits." J. N. Kelman. November 10th.

26,046. "Improvements in and relating to polyphase alternating current commutator machines." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, November 11th, 1908, being date of application in Germany.) November 10th. (Complete.)

26,051. "Improvements in switching arrangements for electric stone-cutting and stone-drilling machines." R. Rohde. November 10th.

26,088. "Improvements in switching devices for use in connection with electric lighting or power." W. C. Kirwan and K. Quaney. November 11th.

26,099. "Improvements relating to the support of electrical conductors or cables." T. G. Noble. November 11th.

26,146. "Improvements in and relating to dynamo-electric machines." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, November 12th, 1908, being date of application in Germany.) November 11th. (Complete.)

26,167. "Improvements in and relating to electric cells and the method of using same, and in the application to certain articles of electric light." P. C. Pace, L. Hunter and A. E. Lamkin. November 12th.

26,250. "Improvements relating to electric cables." Siemens Bros. and Co., Ltd., and W. Dieselhorst. November 12th.

26,251. "Improvements in and relating to electric furnaces." J. Harden. November 12th. (Complete.)

26,266. "Improvements relating to electric furnaces." J. Harden. November 12th. (Complete.)

26,269. "Improvements in telephone exchanges." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, November 14th, 1908, being date of application in Germany.) November 14th. (Complete.)

26,289. "Improvements in automatic electric switches." T. Ferguson. November 13th.

26,322. "Improvements in controllers for electric tramcars and the like." H. J. E. Sayer and C. Freeman. November 13th.

26,347. "Improved current collector for electrically-propelled vehicles." Willy-Kohler. (Date applied for under Sec. 91 of the Act, May 1st, 1909, being date of application in Germany.) November 13th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Receiving Installations for Wireless Telegraphy. W. Burstyn. 15,854. July 20th.

Means for Observing the Condition of the Sparking Plugs and the Explosions in Internal-Combustion Engines specially applicable for Motor-Cars, Motor-Cycles, and for similar purposes. A. J. Riley. 16,328. August 1st. Post-dated March 1st, 1909.

Arrangements for Storing and Distributing Alternating Currents of Electricity. A. M. Taylor. 22,044. October 19th.

Electric Railway System. W. Robinson. 22,227. October 20th.

Electric Batteries. Basset. 22,236. October 20th. (Date applied for under International Convention, October 31st, 1907.)

Overhead Conductor Gear for the Propulsion of Vehicles Electrically. British Insulated and Helsby Cables, Ltd., and J. W. Astley. 22,418. October 22nd.

Electric Arc Lamps. S. C. Mount. 22,454. October 22nd.

Method of and Apparatus for Controlling the Voltage of Dynamo-Electric Machinery, especially applicable to Variable-speed Generators. W. Stansfield and J. W. Hatt. 22,500. October 23rd.

Means for Supporting Electric Lamp Brackets or the like on Walls. J. J. Rawlings. 23,053. October 29th.

Systems of Electrical Distribution by Alternating-Current Transformers. J. S. Peck. 23,064. October 29th.

Means of Transport for Portable Electrically-driven Pumps for Fire Brigade or for other purposes. W. A. Stevens. 23,328. November 2nd.

Electrolysis of Liquids. J. Billiter. 24,594. November 16th.

Electric Switches. G. Sweetser. 27,213. December 15th.

1909.

Stage Arc Lamps and other Similar Lamps. J. F. Walters. 15,532. January 30th.

Insulating Former-Wound Coils. Siemens & Halske Akt.-Ges. 16,985. September 29th. (Date applied for under International Convention, July 21st, 1908.)

Arc Lamps. T. L. Carbone. 17,448. July 27th. (Date applied for under International Convention, November 9th, 1908.)

Flame Arc Electric Lamps. Siemens Schuckertwerke Ges. 18,328. August 9th. (Date applied for under International Convention, August 11th, 1908.)

Sparking Plugs for Internal-Combustion Engines. W. V. Williams. 2,984. February 8th.

Prepayment Electricity Meters. G. Hookham and S. H. Holden. 3,217. February 10th. (Application for Patent of Addition to No. 2,769, 1908.)

Portable Electric Lamp Fittings. L. A. Williamson. 3,836. February 16th.

Electric Signalling and Ringing Key. M. S. Conner. 4,270. February 22nd.

Electrically-driven Rotary Pumps. A. S. Mallinson. 4,928. March 1st.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 6,281. March 16th.

Automatic Electric Block Signal Systems. H. W. Price. 6,289. March 16th.

Electric Street-Car Indicator. H. E. Fisher. 6,818. March 22nd.

Process for the Manufacture of Non-Carbon Electric Incandescent Filaments of Refractory Metals or their alloys. W. Heinrich. 7,092. March 24th.

Electric Glow Lamps. F. Farber. 7,913. April 2nd.

Electrical Apparatus for Locking Levers, Operating Railway and other Switches, Signals, and the like from a Distance. Soc. Ch. Legrand et Cie. 8,168. April 5th. (Date applied for under International Convention, April 9th, 1908.)

Train-Controlling Means on Electric Railway Systems. W. Robinson. 9,623. April 22nd. (Application, under Rule 13, for the date of October 20th, 1908.)

Section Insulator for Electric Tramways. J. C. Russell and A. P. Lord. 11,210. May 12th.

Arc Lamp with Conducting Supporting Member. B. Duschnitz. 11,578. May 17th. (Date applied for under International Convention, September 22nd, 1908.)

Arc Lamp in which the Feed of the Electrodes is Effected by the Action of the Current at the Point of Support. B. Duschnitz. 11,579. May 17th. (Date applied for under International Convention, June 30th, 1908.)

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges. 14,239. June 17th.

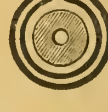
Control of Polyphase Motors and the like. British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges.) 17,370. July 27th.

Telephone Exchanges. Siemens & Halske Akt.-Ges. 18,456. August 10th. (Date applied for under International Convention, October 2nd, 1908.)

Telephonic Apparatus. E. A. Graham. 21,002. September 14th.

New Processes at Siemens's Works, Woolwich.—The students attending Mr. Kilburn Scott's lectures at the Northampton Institute, Clerkenwell, recently visited Messrs. Siemens's works at Woolwich, and were shown several novelties.

The Stannos wire-making machine is only about 2 ft. long, and it consists of a spiral tube into which the insulated wire and a flat strip of tinned copper about an inch wide is fed. The interior of the spiral tube is so shaped that the flat strip is pressed round the insulation twice, thus—



There is no seam in the finished product. The two layers of copper form one tube by being sweated together as the wire passes over half-a-dozen Bunsen burners.

The enamelling process is being used for wires for instruments varying from ·004 to ·02 in. diameter, but there is no reason why in time larger wires should not be successfully treated. The process is certainly a great advance on the old double cotton and silk covering. The wire to be covered first passes through a bath of japan, and then travels through a stove about 10 ft. long, heated to 650° F. At the other end it again goes through some japan, and then travels back through the stove. This is usually repeated three times, giving a thickness of $\frac{1}{1000}$th of an inch, but, of course, more enamel can be put on if necessary. Experiments were made to show that when the copper is permanently stretched the enamel stretches as well. The insulation is so good that the wire has been successfully employed for mine exploders.

In the cable department the students were shown the first submarine telephone cable to be fitted with Pupin coils. The cable is three-core, and a self-induction coil is wound along each core for a few feet at intervals of several miles. The amount of self-induction is adjusted to exactly neutralise the capacity of that part of cable it is intended to take care of.

THE
ELECTRICAL REVIEW.

VOL. LXV. DECEMBER 3, 1909. No. 1,671.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

ELECTRICITY v. GAS FOR TRAIN LIGHTING.

OF all the uses to which electricity is particularly well adapted, there are few that are more conveniently and appropriately served by that agent than the lighting of railway trains. As we pointed out some years ago, in connection with one of those periodical disasters which cannot be averted even by the utmost exercise of engineering skill and foresight, one of the most valuable attributes of electric lighting for trains is its complete immunity from fire risk. In the instance to which we refer, the horrors of the collision were intensified manifold by a conflagration resulting from the use of gas for lighting the train, which rendered the rescue of some of the victims impossible. It is bad enough to be battered and maimed, without the added torture of roasting to death, before the eyes of one's helpless relatives and friends.

It is almost unnecessary to remind our readers that the inspectors of the Board of Trade have more than once pointed out the dangers of gas lighting, and have strongly recommended the use of electricity for train lighting. In the interests of the passengers, it is to be hoped that at no distant date the Board will insist upon the universal adoption of the electrical system throughout the British railway systems, and we have no doubt that this course will eventually be followed. Unfortunately the Board must wait upon public opinion, which usually is not aroused until some frightful calamity has compelled its attention.

There is another factor, however, which acts much more quickly, and much more effectively, than such considerations as the interests of passengers, the influence of the Board of Trade, or the pressure of public opinion: and that is, the interests of the railway companies themselves. One way of bringing this home to them was recently exemplified in striking fashion on a French railway, where gas was employed as the illuminant. As the result of a derailment, a number of mail vans were set on fire by escaping gas; 12 postal employés were seriously burnt, the mails were completely destroyed, and the vans were reduced to ashes. The value of the registered letters and post-office orders destroyed amounted to more than £24,000, apart from the cost of the vans. On another occasion, two new cars caught fire whilst leaving the depôt, through an escape of gas, and were destroyed; each of them cost £2,800. Thus in a short period the railway company lost £29,600, a loss wholly and solely due to its choice of gas instead of electricity for lighting. The company is liable to suffer similar losses at any time, and it is difficult to realise how any railway manager in his senses can accept this risk for the sake of a slight supposed advantage in running cost, which may or may not be justified by the facts.

Yet, to our astonishment, we have recently learned that one of our most important British railways is contemplating the wholesale adoption of gas lighting, although it has spent hundreds of thousands of pounds on the installation of electric lighting on its trains. The latter, it is true, was carried out on a system which, though the best of its kind at the time, is now regarded as primitive and wasteful; but to bring the equipment up to date would have been less expensive by far than to scrap the whole system and to substitute gas lighting, to say nothing of the risks which, as we have shown, inevitably attend the use of the latter. What, then, is the reason for this step?

We find that the ostensible cause of the change is the introduction or revival of the system of carrying compressed coal-gas in tanks on the trains; this is rendered possible by the use of inverted mantles, which consume much less gas than the old-fashioned burners, and thus can be supplied from tanks of reasonable size (about 50 cb. ft. for 12 lamps). Hitherto, it has been necessary to use oil-gas, at much greater cost, and apparently it is the possibility of utilising coal-gas, which can be obtained ready-made at any siding, that has attracted the attention and distorted the judgment of the managers.

Leaving on one side the unquestionable advantages of electricity on the score of safety from fire risk, is it the fact that it is inferior to gas in point of cost? We have made it our business to inquire into this question, and have obtained authoritative data as to the actual cost of lighting with compressed coal-gas and inverted mantles, as used upon a certain French railway. Taking the cost of gas at 4s. 6d. per 1,000 cb. ft., and assuming that the mantle maintains its full candle-power throughout its life, the cost per candle-power-hour is about 0·01d. In English towns the cost of gas will be in the neighbourhood of one-half the price given, and this correction would reduce the total cost per candle-hour by one-third; but against this can be set at least an equal falling-off in the average candle-power of the mantle, which leaves the cost per candle-hour, under British conditions, at 0·01d. The weight of the storage tanks and pipes amounts to considerably over a ton for an installation of 12 lamps of 25 c.p. each, and they add some 4 sq. ft. to the transverse section of the coach offering resistance to the air.

On the other hand, using metallic-filament lamps, which have a life about 10 times that of the gas mantles, and maintain their candle-power practically unaltered throughout their lives, and allowing outside figures for the depreciation of plant, interest on capital, maintenance, and cost of additional fuel used on the locomotive, the total cost per candle-hour of an electric lighting system on modern lines does not exceed 0·011d. Charging stations are done away with; any coach can go anywhere, at any time, and no loss of time is incurred in charging. The weight of the equipment for the same duty is less, and the air-resistance is reduced. The lamps, instead of having a minimum candle-power of 25 c.p., can be of 10 c.p., or less, and can be distributed or arranged so as to give the best results, or put in series to give a dim light when passengers wish to sleep. By adopting recent improvements, the cost of the system can be materially reduced below the figure quoted—which, in fact, is in excess of actual results obtained on British trains.

We claim, therefore, that not only for its safety, but also for its economy and convenience, the electric system is far in advance of even the most up-to-date system of gas lighting, and we believe that any railway company that adopts the latter is committing a grave error, which will be remedied only at great cost to the shareholders. In America the tendency to-day is to abandon gas in favour of electricity. We have reason to believe that confirmation of our statements will shortly be forthcoming from an independent quarter of the highest authority, and we strongly urge those responsible for the choice of system to hold their hand until they have absolute proof of the identity of the best system of lighting.

ELECTRIC TRACTION ON BRITISH RAILWAYS.

From time to time considerable attention has been drawn to the remarkable number of railways, both on the Continent and in America, on which electric traction is being applied. Compared with this the British railways, as far as the application of electricity is concerned, appear to have reached a condition of complete stagnation. Leaving out of consideration the "Tube" systems of London, which are, after all, only possible with an electrical system, there is amazingly little work being done or even projected in the electrification of railway lines. The sum total of our achievements comprises some 40 miles on the Lancashire and Yorkshire, about the same on the North-Eastern, 50 miles on the London Underground Railways, 10 miles on the Midland, a few miles on the Mersey Railway, and nine miles on the Brighton system. The adoption of electricity between Liverpool and Southport, which has led to the complete suppression of the steam locomotive, has been attended with conspicuous success, and let it be noted that this is no glorified tramway system, but is a real and live example of electricity applied to fast and heavy traffic. Equally notable have been the results on the section of the North-Eastern system between Newcastle-on-Tyne and Tynemouth. But notwithstanding that every penny spent in these pioneer examples has been amply justified, the railway authorities of the country do not appear to have been influenced in the least degree. No doubt the working results created at the outset a mild interest, but this appears to have been in the main followed by cold indifference, for it must not be forgotten that six years have gone by since the electrical systems were instituted on the two lines mentioned. What is the reason that so little has been done by the railway companies in face of the successes quoted? On all hands the directors of railways record and deplore the falling away of traffics, due, we are told, to the incursions of the ubiquitous electric tramways; but what are they doing to stem the serious inroads into their revenues? Except in two or three cases, we are afraid, the answer is nothing.

For the moment we are in no wise concerned in the application of electricity on main lines; that is a problem too remote for immediate consideration, but we are deeply interested in the possibilities of electricity for local and suburban service, and it is in this direction, one notes with regret, that so little activity prevails. Yet in season and out of season the advocates of electric traction have never slackened in their efforts to establish the fact that only by electrical means was it possible to regain and retain that local traffic which is so easily diverted by the attractions of the electric tramway. We are told that the railway companies are awaiting the results of the single-phase system on the Brighton line before committing themselves to a policy which will entail heavy expenditure. While deliberation is often highly desirable, it is possible to carry it to excess; and in regard to electric traction, we are emphatically of the opinion that the railway companies are not taking advantage of the material which is ready to their hands. Whether the system on the Brighton line is a conspicuous success or a comparative failure is quite beside the point. If it proves everything that the introducers claim, it will still be unsuitable for some lines, and should it fall short of anticipations, it would by no means sound the death-knell of single-phase traction. That the Brighton experiment has had a good deal to do with the hesitancy on the part of the railway authorities in this country must be admitted, but we are strengthened in our view that their attitude is unjustifiable by the almost daily developments which are taking place in Germany and the United States on every system of electric traction. In other words, the crystallised experience of other countries is that both single-phase and direct-current systems have their appropriate uses. At any rate, the potentialities of either system do not appear to have curtailed in any way the enterprise of foreign railways with regard to electric traction. In our view, it is just as absurd for English railways to mark time in respect of electrical working for fear of future developments, as it would be for them to decline to carry out extensions on the present system of running rails on account of the possibilities of the monorail. The financial side of the subject, that is, the capital expenditure, has been brought forward as an argument against immediate electrification; it is true that the railway companies of the country are already facing enormous commitments for widenings, stations, and rolling stock, but important though these are, we suggest that none of them is so potent a factor in the future of railway management as a well-conceived scheme of electric traction. The advantages have been written in letters of gold, and not by mere enthusiasts, but by sober-minded managers of railways who are concerned not with the scientific features of electric traction, but with its revenue-earning capacity. For a period there were clamourings for the results of electrification on the Lancashire and Yorkshire and North-Eastern; these are, and have been for some time, open to all the world, but they appear to have made little impression, if we are to judge by the inactivity which exists. We admit that we are laying a somewhat serious indictment at the door of railway directors and officials, but what are we to think when proof upon proof has been offered of the efficacy of electricity, and yet suburban lines show steadily falling receipts?

We have no desire to be misunderstood in our attitude on this subject. It would be idle to suggest that electricity will provide a panacea for all the ills from which suburban and short-distance services suffer, and it would be absurd to think that electric traction can be applied with success under every condition of railway working; but without making any invidious selection, there are, without doubt, many hundreds of miles which would benefit from electrical working. Nor, as we have already indicated, is it necessary to wait for the results of an experiment, which at the best can only prove its usefulness under certain conditions, for again it should be repeated that there has been accumulated during the past six years a vast amount of knowledge on the subject of electrically-operated railways, and these results are at the disposal of those who care to use them.

Now that the Brighton Company's system has been opened for traffic, we hope that even this last excuse for procrastination will shortly be removed, and that the matter will be taken up with energy by the managers of our suburban railway systems, so that the reproach of inertia and vacillation which rests upon them may be dispelled. We venture to suggest that a Committee be formed at as early a date as possible, to go into the whole question and to draw up definite conclusions as to the merits of the respective systems, with a view to clearing the ground for rapid progress in the future.

On Tramway Fares.

A good many small tramway undertakings, and probably some of the larger ones, which have experienced a difficulty in making both ends meet financially, will watch with close interest the experimental use of the "fair fare" system of tramway fares on the B.E.T. group of tramways, which will come into use in the New Year.

The "overlapping stage" system of charging is, like many other things, more in the nature of a practical compromise than anything else, and we question whether any tramway undertaking which possesses adequate earning capacity will be inclined to risk a change unless the travelling public absolutely demand it. The "overlapping stage" system, especially when 1½d. sections are introduced, appears to have met the average case very satisfactorily. The B.E.T. Co.'s undertakings and many small tramway concerns are, however, up against the difficult problem of obtaining that small fractional increase in fare from the passenger which makes all the difference between success and failure; and under these circumstances, a proposal of the kind embodied in the "fair fare" system should be welcomed, even by the travelling public, who, if they pause to consider the matter, must admit that the principle of a fair day's pay for a fair day's work is as applicable to a tramway undertaking as to an individual.

So far as one can judge from the pamphlet issued by the British Electrical Federation, the proposal will benefit many passengers—always assuming that the existing 1d. stages are not seriously altered—and the tramway undertaking will have to rely on the somewhat problematical surplus farthings or checks carried by the passenger, and on his cupidity, to get its own back.

The proposal appears to us in the nature of an experiment, suggested, presumably, by the peculiar conditions existing on the B.E.T. Co.'s lines, but not necessarily ending in their favour. The "fair fare" pamphlet, however, and the reflections which it makes on the "overlapping stage" system of fares, call to mind one real difficulty in connection with the latter, *e.g.*, the matter of through bookings over adjoining systems where the latter afford routes of considerable length.

Such cases exist, although they are not common; and they appear to us to exceed the limit of efficient fare collecting with overlapping stages, especially if the route is at all well patronised and ½d. sections are provided. In a case with which we are acquainted there are some 70 ½d., 1d., 1½d. and 2d. stages, not to mention those for values up to 4d., and this on a 7-mile route; but, as through bookings exist over an additional 7 miles of an adjoining tramway, the task which confronts the conductor can be easily imagined. It seems fairly evident that 6 or 7 miles of thickly-populated route represents the limit with the average conductor, and if extended bookings are necessitated by reason of over-running or transfer junctions, then some other system than that of overlapping stages must be introduced.

The Contract System of Charging.

Thursday evening last week, which saw the opening meeting of the I.E.E.—as regards ordinary business—will be remembered for its business-like procedure and the excellent discussion which took place as a direct result. All credit is due to the new President for his able conduct of affairs, and to Mr. Dykes for his brief and self-denying summary, which allowed ample time for a profitable discussion.

The supply of electricity is a many-sided subject, and, naturally, unanimity of opinion was out of the question, but so far as one could judge from the discussion, the authors made out a very good case for a simple contract system.

After the dismal forecasts which we have heard as to the depredations of the metal-filament lamp, it was quite refreshing to hear Mr. Wilkinson's avowal that at Harrogate during the past seven months the units generated were only 2 per cent. down as compared with a similar period last year, and this despite the fact that the cream of the business has been obtained. On the other hand, we happen to know of engineers who are not so happily placed, although they admit an increasing lamp connection.

Several speakers apparently misinterpreted the authors' suggestion to let the small (*i.e.*, short-hour) consumer go, and cultivate the more profitable ones, into an intention not to supply the former; any would-be consumer can, of course, demand a supply, even for one lamp, but that does not constitute a reason for hunting up such consumers, to the neglect of more profitable business.

One well-known engineer, who figured prominently in municipal supply work some years ago, expressed his total disagreement with the contract demand system. He considered that a sliding scale was the only equitable system of charge. However, the proof of the value of the authors' and other special systems of charging is surely their ability to attract profitable business; if they can accomplish this they are undoubtedly a commercial asset, which the engineer cannot afford to ignore.

At the time when the authors read their last paper on a similar subject, in April last year, we remember that Mr. Long's assessment tariff was credited with some 800 consumers at Norwich—many of them doubtless merely having changed over—and taking into account the strenuous competition which exists between modern illuminants, it is surely a point in favour of the contract demand system that the authors have been able to arrange for over 10,000 lamps to be supplied under this arrangement in the near future.

A remark by Mr. Hirst as to the benefit accruing to the central station by reason of the reduced power consumption of the metal lamp on peak loads, reminds us that the new lamp can claim credit for the introduction of improvements in plant, such as machine stokers for cheaper fuel, condensers, oil engines for taking peak loads, &c., which would almost certainly have been deferred, or possibly not undertaken at all, unless dire necessity had arisen for economising all round.

Free Apprenticeship in Central Stations.

A GOOD deal has been written lately both in the technical and in the lay Press on the subject of apprenticeships, and there appears to be a desire to revive the old-fashioned kind of apprenticeship, or rather to adapt the old-fashioned apprenticeships to modern conditions. It remains to be seen to what extent the proposal will be successful. Meanwhile the Heston and Isleworth Council, whose electric lighting venture has not hitherto been a conspicuous success, have launched out on original lines of their own. Their proposal, in short, is to offer free apprenticeships, or to give it the more highly sounding term, free pupilships, in their electric light department, to lads attending the secondary schools in their district. We presume that it will be the duty of the chief engineer to father these lads, and to train them up in the way they should go, so that later on they will be able to bud out as fully blown electrical engineers. We do not know if it is proposed to increase the remuneration of the chief engineer for the additional duties involved, but in view of fact that the station will in future be run principally by unpaid labour, we shall watch with interest the future financial results which it is to be hoped will show to better advantage than those hitherto returned.

Business Systems and Economy.

ONE of the few ideals which business men can find time to cherish is to secure a perfect system for the operation of their own particular business. Much has been said, and rightly so, of the importance of this question. Indeed, the danger now rather seems that, with some people, system amounts almost to a mania, and the results are hardly justified by the means employed. It will scarcely be questioned that the one essential to a good system is simplicity. This being admitted, the actual present state of affairs should be looked at in order to see whether this axiom is always borne in mind.

It is found that while many firms, often those of long standing, use the same system—with little or no modern innovations—as that with which they started, yet there are many more who may perhaps be likened to the alchemists of old, in that they seek something which is more or less a myth. Reform after reform is introduced, our American cousins and their methods are assiduously studied, occasionally too much so, and one scheme after another is rejected in the search for the ideal. At the least the scheme in operation is subjected to endless alteration and supposed improvement. The ostensible objects in view are to reduce the possibility of error, and to obtain an almost automatic effect in the whole routine. Much work is thus often duplicated over and over again, and the first-named object is defeated by the very means adopted to secure it.

Further, to counteract the additional cost of extra staffs, wages are reduced to a minimum, the consequences of which are two-fold. First, the employer obtains an article not altogether satisfactory, because he requires it to be cheap. Secondly, a certain restlessness is invited among employés, which results in the employer having what may be called a "floating" staff. As an instance of this, we have heard of a concern which in four years passed no fewer than 28 men through one of its offices, the normal staff of which is from 10 to 12. The outcome of such a system cannot be described as satisfactory.

Maximum efficiency can only be obtained when a machine runs constantly in perfect order, and, therefore, it seems that when a system is found to be even fairly workable, and at the same time simple, it should be retained. Nothing with any elaborate detail, however carefully supervised, can give better results than a system founded upon a plain fundamental basis. A similar effort should be made to retain the men who give satisfaction, because they are part and parcel of the system. Surely a business with a staff consisting of a small but efficient and responsible body of men is much better than one with a large staff, the units of which go through their routine with much of the automaton about their whole movements. Initiative, which is the soul of business, is in the one case given fair encouragement, and in the other it is stifled and choked by the very atmosphere in which it should thrive.

Electrical Driving of Textile Factories.—The following letter, received as we go to press, further corroborates our unfavourable opinion regarding the Report of the Bradford Committee:—

"As Members of the Special Committee of the Bradford Engineering Society appointed to consider the Electrical Driving of Textile Factories, we desire to protest against the recently published document described as a Report of the Committee.

"Several portions of this document have been published without our knowledge or approval, and without an opportunity being given to the Committee as a whole to discuss it. It does not represent the views of the Committee, and is in many respects misleading.

"The impression that this document gives—viz., of being the outcome of careful inquiries and exhaustive tests, is erroneous; it represents the results of preliminary discussion among the Members of the Committee, and of two tests which were by no means exhaustive.

"We therefore desire to disassociate ourselves from it.

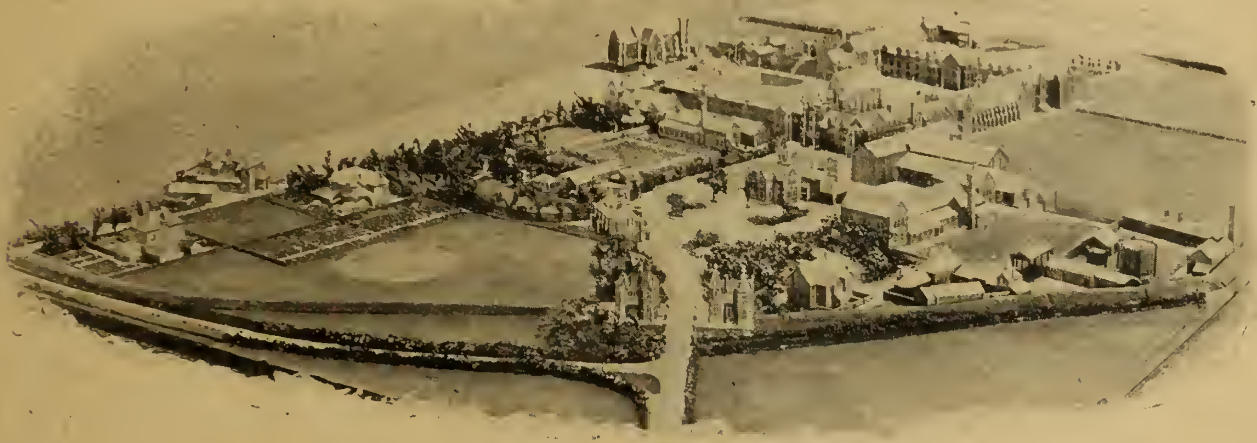
"Yours, &c.,

"(Signed) H. ELLIS. T. ROLES.
H. A. JONES. C. W. SALT.
R. POHL. W. B. WOODHOUSE."

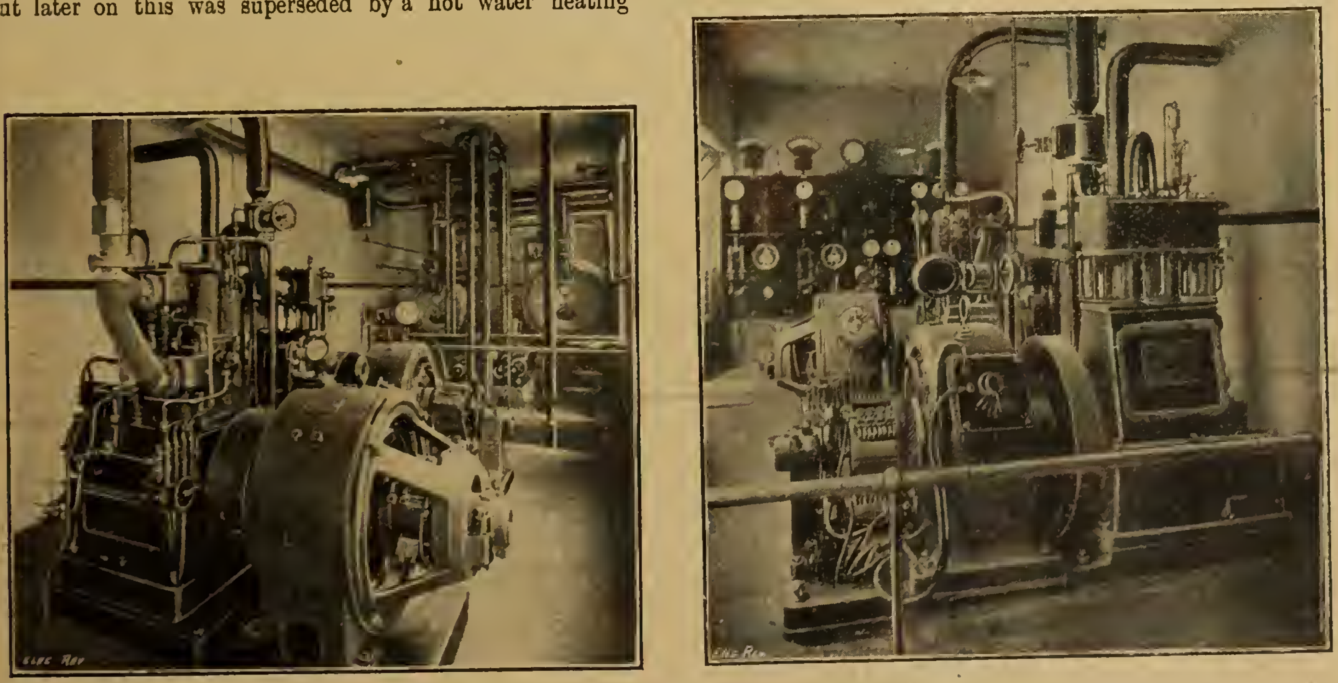
ROSSALL SCHOOL LIGHTING.

An interesting scheme has recently been carried out at Rossall School, Fleetwood, Lancs., comprising electric lighting and power, hot water heating, and hot water supply. This installation contains several novel features, including a new system of electric-light wiring and a combination of lighting, heating and hot water supply for the baths, lavatories, &c.

Rossall was founded as a public school in the year 1854, and right up to 1909 was lighted throughout with gas, supplied from a private gasworks on the premises. At one time the buildings were heated by steam from a Lancashire boiler (7 ft. × 28 ft.) in the present engine-house buildings, but later on this was superseded by a hot water heating system for the majority of the buildings. Separate heating boilers were put in for this purpose at intervals round the school buildings, and the hot water supply for domestic purposes and baths was taken from back boilers placed in the house room fireplaces. The "gravity" system of heating and hot water supply from back boilers proved, however, to be most inefficient, the amount of coal and coke consumed being enormous in proportion to the results obtained. At the same time, the system of gas lighting was also considered most unsatisfactory from several standpoints.

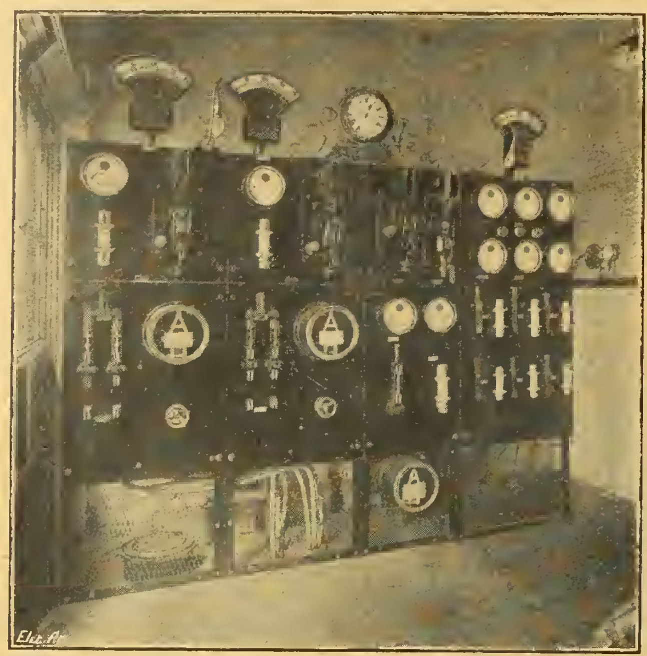


Bird's Eye View of Rossall School, Fleetwood, Lancs.



Views in the Engine House, Rossall School.

At the beginning of this year the Council considered the question of electric lighting, and retained Messrs. Lacey, Sillar & Leigh, consulting engineers of Westminster and Manchester, to advise fully on the steps which should be taken to render both the heating and lighting efficient. The engineers in their report advised the Council to install a steam-driven dynamo for electric light and power which would be supplied with steam from the existing Lancashire boiler, the exhaust steam from the engine being passed into calorifiers for the heating apparatus and hot water supply. The Council adopted this scheme and gave instructions for the preparation of plans, specifications, quantities, &c., for the electric lighting of the whole school, including over 1,500 lights, the necessary generating plant, the pipe mains, &c., for the heating and hot water supply, and all apparatus. Tenders were obtained, and that of Messrs Siemens Bros. was accepted. The contract was placed with this firm on July 22nd, and it was a condition that the work should be completed within six weeks in order that everything should be quite ready for the boys on their return on September 17th. The speed at which the work was carried out may be imagined from the fact that, with the exception of some 60 or 70 lights, the installation was ready for use on September 6th.



The Main Switchboard, Rossall School.

The generating plant consists of one 25-kw. steam-driven dynamo, one 25-kw. petrol-driven dynamo, a battery and main switchboard. The steam engine is of the vertical enclosed type by Messrs. Belliss & Morcom, running at 500 r.p.m. The dynamo is a compound wound machine by Messrs. Siemens. The petrol engine and dynamo are of the British Westinghouse Co.'s make, and will be used as a stand-by plant. Both dynamos are direct coupled to the engines. The accumulators comprise 62 cells, by the Chloride Electrical Storage Co., having a capacity of 720 ampere-hours. The main switchboard, of enamelled slate, consists of four panels, one for each dynamo, one battery panel and one feeder panel. Each machine panel is provided with a change-over switch for shunt and compound running. The battery regulating cells are controlled by means of an automatic switch, by Messrs. Bertram Thomas. The governor for this switch is connected to one of the feeder points in the main cable system, and thus maintains the correct voltage on the feeders automatically.

The cable system consists of two ring mains, each ring being supplied by two feeders taken from the main switchboard in the engine house. One ring main runs through the corridors of the masters' houses round the quadrangle, and the other provides for buildings extraneous to the main block, such as the museum, married masters' houses, lodges, cottages, farm buildings, workshops, swimming bath, post office and tuck shop, gymnasium and sanatorium, &c. In each house or building a connection is taken to a switchboard, from which sub-mains are run to distribution boards. The feeders and main cables are paper-insulated and lead-covered, and, where possible, are cleated to the walls of the corridors through which they run. In places where it was necessary to take them underground, paper-insulated and lead-covered and armoured cable was laid direct. The ring main which feeds the buildings, apart from the main quadrangle, consists of bare copper wire run on poles.

The whole of the sub-circuit wiring has been carried out with "Stannos" wire, which has just been put on the market by Messrs. Siemens Bros., and this has been run on the surface of the walls and ceilings. The wire used is No. 3/20 S.W G., insulated with rubber and covered with a tinned double copper sheath. The outer sheath is used for the return circuit. Special fittings have been provided for the connections at distribution boards, ceiling roses, wall switches, &c. This section of the contract was carried out by the Wardle Engineering Co., as sub-contractors.

In some portions of the school special lighting fittings have been provided. The chapel is lighted by means of standards and corona fittings in real bronze, which were made by Messrs. Veritys. The large school, dining hall, and masters' common rooms are lighted by "Sun" fittings with three lamps each.

The heating and hot water supply section has been installed by Messrs. Dargue, Griffiths & Co., as sub-contractors. Separate calorifiers have been provided for heating and hot water supply. These are installed in the engine house, and are connected to the exhaust pipe from the engine; they also have live-steam connections through a reducing valve. Flow and return pipes are taken from the calorifiers round the school buildings, and these are connected to the existing hot-water pipes in the houses. The longest run for flow and return pipes is approximately 600 yards. The heating apparatus has been connected up to the old heating boilers in such way that the latter can be used, if necessary, as a stand-by. The calorifier and mains for hot water supply are all of copper. The water is circulated by means of two Worthington pumps in the engine house, one for each system. A tank has been fixed in the Clock Tower to act as feed and expansion for both heating and hot-water supply systems, and is connected to the town's mains through a ball tap. The condensed steam from the calorifiers runs through traps to a hot-well, and is used for boiler feed. A grease separator is provided to separate the oil from the exhaust steam.

Interior of the Chapel, Rossall, showing the Tantalum Lighting.

The Lancashire boiler previously supplied steam for an engine which drove the laundry machinery and for the cooking apparatus in the kitchens, &c. It now provides steam for the main generator and for the heating and hot-water supply systems, and therefore, in addition to the work which it has hitherto done, it is providing the lighting and heating of the whole school. The coal which it consumes is only 4 or 5 tons a week more than under the old conditions, and the whole of the gas coal, the coke for the heating boilers and coal for the old hot-water system are saved. The labour on the gas producers, &c., is also dispensed with, and no extra hands are required in the engine house, since the control of the whole installation is centralised at this point. In addition to the economies which this centralised system has effected, the lighting is most satisfactory, as also is the heating of the schools, and practically an unlimited supply of hot water is provided for baths and domestic purposes.

The whole contract was completed in a most efficient manner, and all the apparatus was in full working order when the boys returned on the first day of the winter term.

His Honour O. L. Leigh Clare, Vice-Chancellor of the Duchy of Lancaster, has personally interested himself in the work throughout, and since they have been in operation has taken most careful records of the working expenses. His opinion of the results obtained may be gathered by the following extract from a report recently prepared by him for the School Governors :—

"Assuming the figures in the accounts for 1907 and 1908 to be accurate, the saving should be well over £600 a year with three times the efficiency."

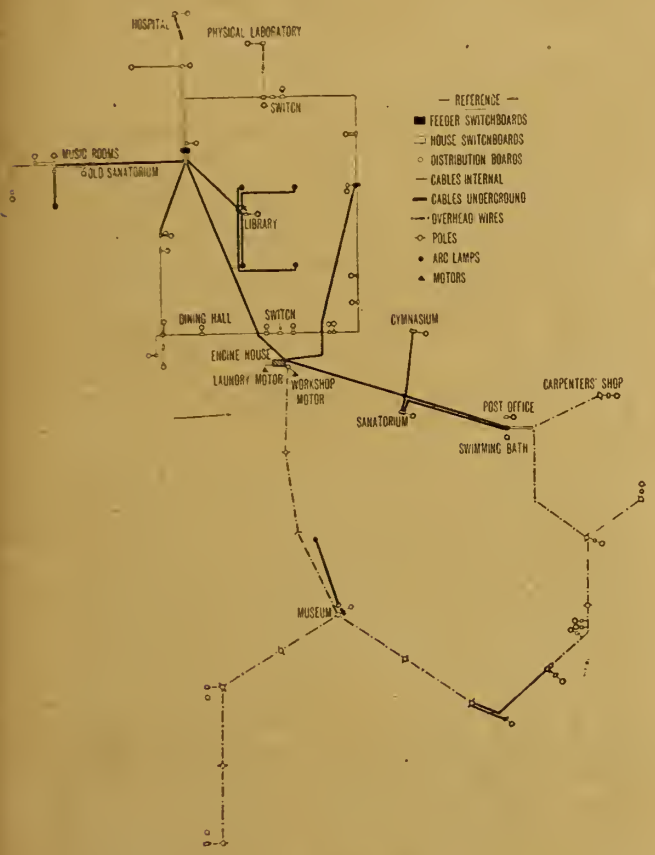


Diagram showing the Electrical Distribution, Rossall School.

SOME RECENT PATENT CASES.

[FROM A LEGAL CONTRIBUTOR.]

The enormous expense of patent litigation might be expected to cause a falling off in this very important class of business in the courts. But it is not so. Patentees and companies owning patents still seem to find it worth their while to fight things out at length. In the result, the law reports for the past legal year disclose a number of cases which have involved the decision of important principles.

It may be useful to refer to some of the more important of these.

The case of Crosthwaite Fire Bar Syndicate, Ltd., *v.* Senior, 1909, 26 R.P.C., 713, involved an interesting point with regard to a patent for fire-bars. It appeared that in 1900 a patent was granted for "improvements in fire-bars for furnaces." One of the claims was for "constructing a furnace grate of a series of transverse bars, which, when together in position, form tubes or passages through which air or air and steam may be forced and distributed in fan-shaped jets uniformly through the fuel." In 1907 a patent was granted for improvements in the fire-bars, the subject of the patent of 1900. The improvements consisted in forming the bars with the air passages, not, as in the earlier patent, partly in one bar and partly in the next adjacent bar, but wholly in the one bar, the passage being completed by the flat side of the adjacent bar. In an action for infringement of both patents, it was proved that the plaintiffs' bars possessed greater utility, in that they never became so hot as to allow of the adherence of clinker, which result had never been obtained before. The defendants contended that the coolness of the bars was due, not to their special form, but to the fact that they were placed closer together than it had been customary for fire-bars to be placed ; that bars having a form similar to that of the plaintiffs' bars had been used before, and that the invention was wanting in novelty and subject matter. It was held that the patent of 1900 was valid and had been infringed, but that the patent of 1907 was invalid for want of subject matter. On the first patent, judgment was given against two of the three defendants, and the action was dismissed as against the third defendant on the ground that he had not been a party to the infringement. On the second patent, judgment was given against the plaintiffs.

In the case of Bosch's Patent, 1909, 26 R.P.C., 710, the grant of a patent for "Improvements relating to shuttle armatures for dynamos," was opposed on the ground that the invention had been claimed in the specification of a patent of prior date. The Comptroller-General held that a claim, including the making of a shuttle armature of non-magnetic material, should not be restricted to a claim for the materials specified by way of example only, and [following the decision of the Attorney-General in another case] that it included the use of non-magnetisable steel which had been selected by the applicant. The grant was, therefore, refused, and the refusal was confirmed by the Attorney-General. The following principle was enunciated in the case :—"A patent may be granted for selecting the best material, the suitability of which was not previously known, the test being whether the selection involves an invention." It may be mentioned, however, that in a case heard last year (Deutsche Gasglühlicht Aktiengesellschaft's application, 26 R.P.C., 101) it was held that the selection of best conditions for a process may not be subject matter for a patent, when the process has been previously patented.

The case of Thompson's Patent, 1909, 26 R.P.C., c. 673, raised an interesting point as to the power of the Court to grant an extension of a patent. It appeared that in 1888 a patent was granted for a mechanical fuse for causing the explosion of shells, and indicating the number of revolutions performed and distances traversed by projectiles. In 1902 the Privy Council extended the patent for seven years. In the present year the patentee asked for a further extension. The Crown admitted that the invention was meritorious and that the patentee had not been adequately remunerated, but contended that the Court had no power to grant a further extension. This view was adopted by Mr. Justice Parker, and the application was dismissed.

In another case (*re* Johnson's Patent (No. 2) 1909, 1 Ch. 114) Mr. Justice Parker laid down certain rules as to the prolongation of patents which are of considerable interest. Sec. 18 of the Act of 1907 provides that the Court, in considering whether or not the term of a patent should be extended, "shall have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case." The Court must, therefore, consider the nature and importance of the disclosure made in the specification to the public, and for that purpose questions of novelty and subject matter are necessarily material ; and it is the duty of the petitioner for an extension of term to bring to the notice of the Court all that may in any way affect the judgment of the Court in those matters. But if, after hearing the evidence of the petitioner's witnesses, there is, in the opinion of the Court, a *primâ facie* case for upholding the validity of the patent in respect of novelty and subject matter, the Court need not, as a general rule, investigate the matter, it being always open to an objector to challenge the validity of the patent in proceedings more appropriate for that purpose. Again, for the purpose of considering whether a patentee has been adequately remunerated, profits on his corresponding foreign patents, as well as on his English patents, must be taken into account, and some allowance ought also to be made for profits which will, in all probability, be received in respect of both before their expiration. It is incumbent on a patentee, who petitions for an extension of his patent, to prove that he has done all that he could do to launch his invention on the British market. He ought also to state all facts which are within his knowledge, and which it is obviously material that the Courts should know. Finally, when the Comptroller opposes the extension of a patent on the ground that the trades of this country will, if the patent is prolonged, be put at a disadvantage, compared with the traders of some other country, proper statistics or other information ought to be supplied to the Court as to the nature and extent of the competition which is feared.

Most of the cases which have arisen in connection with the new Patents Act of 1907 have already been fully dealt with in these columns. There is one, however, which seems to deserve special mention. We refer to Kent's Patent, 1909, 26 R.P.C. 666. There an application was made to revoke a patent for mills for pulverising or granulating, on the ground that the patented article was manufactured exclusively or mainly outside the United Kingdom. The patentee did not contend that the machine was not manufactured exclusively or mainly abroad, but urged that there was adequate manufacture, or that there were satisfactory reasons for deficiencies in this respect. At the date of the application one machine had already been made in the United Kingdom ; a second machine had been commenced (which was completed shortly before the hearing), although parts of these machines had been imported ; and a third had been taken in hand. The present demand in the United Kingdom did not exceed two machines per annum, and the manufacturers here were prepared to turn out 10 or 12 machines per annum if required. The Comptroller-General held that there was a manufacture in this country sufficient to meet the demand, and that sufficient reasons were given for the absence of a more extensive manufacture. He therefore dismissed the application and gave the patentee 30 guineas costs. The following general principle was enunciated : "In revocation cases under Sec. 27 of the Act of 1907, the only question as to price is whether the price charged by a patentee is a *bona fide* one and not adopted for the purpose of checking and diminishing the demand for the article made in the United Kingdom. If the price charged by a patentee for a machine made in the United Kingdom were higher than that charged for a machine supplied from abroad, a *primâ facie* case for suspicion would arise."

The mere use of a patented article may raise a presumption that it is the product of an infringing manufacture. In one case (Saccharin Corporation *v.* National Saccharin Co., Ltd., 26 R.P.C., 654). The owners of three patents relating to processes used in the manufacture of saccharin brought an action for infringement, complaining of eight casks of saccharin which had been imported into England and consigned to the defendants. The price at which it was sold showed that it must have been manufactured by the patented processes. The defence was that the saccharin in question might have been made by processes in respect of which the patents had expired, but the defendants gave no evidence to indicate the source from which the saccharin in question had been obtained. They only said that a guarantee had been given to them that it was not made under the patented processes.

The case of Flour Oxidising Co., Ltd., *v.* J. and R. Hutchinson, 26 R.P.C. 599, is only of general interest by reason of the following extract from the head note to the case which appears in the Official Reports. "It is the duty of the Court not to upset a patent on merely theoretical objections. If there is a statement which may be substantially true, but which is doubted on scientific theory by scientific witnesses, the Court ought to be very careful to be satisfied that the objection made is a real objection, and not merely the opinion of a scientific man, but it is incumbent on the patentee to adduce evidence sufficient to satisfy the Court that there were good grounds for granting him his monopoly."

A REGRETTABLE INCIDENT.

"Uncle Remus," said the little boy, "What's a regrettable incident ?"

"Shoah, sonny, you don' know what am a regrettable incident an' youah de fus-bes' scholah in de class ? Why, a regrettable incident am a—am like what de German Emperor am always fixin' up, or—see hyar, sonny, I'll tell yo' a story ter show what am a regrettable incident."

The little boy settled himself down with a sigh of content, and fixed his eyes on Uncle Remus's face, as the old negro told the following story :—

B'rer Rabbit, he run de 'lectric light stashun in Pushoe, which am a risin' subbub. One ebenin' he see de eart' lamp go bobbit-bob, an' he don' take no notice, don't B'rer Rabbit, c'ase he see dat before. Den he hear de dynamo go "Oongh"—des like dat—an' he 'llow dat B'rer B'ar he use his 'lectric toofpick. Den de machine go "Oongh !" again, an' B'rer Rabbit he sez, sezee, "Guess B'rer B'ar bin eatin' a berry tough pineapple dis time. He got de seeds in his molar !"

Den de dynamo say "O-oooo-ngh !" an' B'rer Rabbit he jump up offen de stool, an' he say, "My Laws ! Dat am a dead short !"

An' den de eart' lamp go bobbity-bobbity-bobbity-bob, an' de dynamo, it say "Oongh-a-oongh-a-oongh-a-o-ooooaaaar !" an' B'rer Rabbit he reckon dat he was in fer trouble. De lights began ter go down an' down, an' de load came up-an'-up-an'-up—an' B'rer Rabbit he screams ter de engine driver, "Fer de Lan's sake, run up de spare set !"

An' w'en he got her in, dere was two of dem bofe saying "Ooongh-a-ooooaaaar !" an' de steam began ter drop, an' B'rer Rabbit he wipe his brow, an' he sez, sezee, "My grashus. Dis am terrible !" So he run round hisself, did B'rer Rabbit, an' he got another engine in, an' he watch all de needles goin' hard over, an' he didn't know what was de matter or where de trouble was, c'ase his system, it was linked up solid ebberywhere.

An' he look down town, he did, an' he see a cloud ob smoke. An' he sez ter hisself, sezee, "I reckon Mis' Goose hes got her fir plantation on fire. Et looks big enough, shoah !"

Des den up comes B'rer Dog in a terrible passhun, an' he shouts, "W'at yoah doin ob, B'rer Rabbit ! Shut yoah station down !"

"Wat for ?" sez B'rer Rabbit.

"Shut et down, an' don't ask queschuns ! Yo' hab blown up de High Street, an' frown a pavin' stone right inter B'rer B'ar's tummy, an' you hab set fire ter B'rer Tarrypin's house, an' its burnin' like billyoh !" sezee.

Den B'rer Rabbit, he run in an ketches holt ob de stop valves, an' it was a massy he did so, fer des den de short went off, an' up went de engines—up an' up an' up—ter six thousan' rebberlooshuns a minute !

Well, sonny, dere was a terrible fuss. Dey tuk it before de p'leece, an' Judge Owl, he sit in de chair, an' all de jury dey look berry indignant, an' B'rer B'ar he giv evidence dat he'd bin hit in de tummy wid de pavin' stone, but dat he didn't bear no malice. But B'rer Tarrypin he carried on terrible. He said dat his 'ouse an' 'ome had bin burnt down, an' his wife an' children were starvin', an' he wanted five hundred pounds outer B'rer Rabbit.

B'rer Rabbit, he say he couldn' help it, an' dat he allus tested fer faults by raisin' glory fire, but de jury dey censure him fer his negligence, an' tell him he was a nuisance, an' dat he mus' pay de five hundred pounds.

An' B'rer Rabbit, he am pooah ter dis day.

"Was the fire the regrettable incident, Uncle Remus ?" asked the little boy when he had recovered from the old man's impressive ending.

"Laws, no, sonny ! Dat am in de or'nary course ob nature. De regrettable incident was de five hundred pounds.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Corpuscular Theory of Fuses.

It is, doubtless, common knowledge to many of your readers that most incandescent substances emit corpuscles. This is notably the case in the so-called "Edison Effect," where corpuscles are shot off the carbon filament in a glow lamp. Again, in the case of platinum, it is shown that the corpuscles shot off in a unit of time vary with—

$$A\,\theta^{\frac{1}{2}}\,\epsilon^{-\frac{\omega}{\theta}},$$

where θ is the absolute temperature.

Now, according to the corpuscular theory of matter, these corpuscles tend to keep atoms or molecules together, and, accordingly, one would expect that, if such a "law" as above held up to the fusing point, the fusing current would vary with the number of corpuscles emitted, and consequently with $\theta^{\frac{1}{2}}$, provided the factor $\epsilon^{-\frac{\omega}{\theta}}$ was approximate unity.

According to Kempe's Law—

$$c = \frac{\pi}{2}\,\frac{d^{\frac{3}{2}}\,\epsilon^{\frac{1}{2}}\,\theta^{\frac{1}{2}}}{s^{\frac{1}{2}}},$$

where d is diameter, ϵ is emissivity constant for the temperature, and s specific resistance.

It would seem, therefore, that there is an intimate connection between the fusing current of a wire, and the "saturation current" for the temperature. Referring to Sir J. J. Thomson's book, "Conduction of Electricity through Gases," page 169, we find the following remarks:—"The emission of corpuscles from the atom must play a very important part in the decomposition of the molecules of a compound by heat, if the forces which bind the atoms together in the molecule, are mainly electrical in their origin."

It appears, therefore, that a fuse disintegrates because its atoms will not "cohere" owing to the corpuscles which bind them being lost.

This leads to an interesting speculation which I hope to deal with elsewhere.

W. H. F. Murdoch.

London, *November 27th*, 1909.

The Steady Job.

With your permission I would venture to offer a little criticism on the article in your issue of the 19th inst. by "A. P. C."

I take it that the essence of his argument may be roughly put thus: If things are made too easy for one, a state of lethargy, mental and moral, is induced, and all valuable effort is choked out of existence.

With this I cannot but agree; all experience of past and present alike tells us that is so, but what I would direct attention to is the extension of the argument into almost a plea for placing each man—for his own true weal—in such conditions that only by the utmost strenuousness may he be assured of a living, and, even then (if his powers are not of the highest) that may be taken from him.

I beg leave to suggest that, however attractive "A. P. C.'s" ably-put case may at first glance appear, his system is not by any means perfect. He, doubtless, is a very acute man, consumed with energy and zeal, and one who will not be denied the giving to the world of his very best. All honour to him. He knows he is one of the best, and this knowledge preserves him immune from any fears as to his means of livelihood, however severe the conditions of life may become. Then he says, "All these men around me who are less gifted than I am, deserve to be spurred up. Their inferiority to me is quite evident, but they shall be given—like the Hebrews of old—no straw, while the tale of their bricks must be undiminished." "A. P. C." would go on (and here I quote his actual words), "some would suffer . . . . some would fall and be trampled on, but the real men (that is, the 'A. P. C.'s') would rise to greater heights."

Now, I venture to say—however much I agree with the hidden kernel of "A. P. C.'s" argument—that all this is on radically wrong lines. No means have yet been discovered of bringing all men up to one standard, and I think it not only right in itself, but in the interests of the State, that different conditions should be allowed different people in the struggle for existence. To advocate one hard and fast set of conditions for all alike, thinking that by the survival of the fittest a millennium of perfection will dawn is, I think, just a misconception of what life should mean.

There are many who may flourish under severe conditions, as they would under almost any other conditions; there are others whose best is produced only under the severe conditions, and who deteriorate when those conditions are relaxed; and there are yet others who, from various causes, may under severe conditions go under altogether, and the good in them (for there is good in almost every man) be lost to the community; they will only flourish under a fostering influence, and where the conditions of life are not the most exacting.

A man may be a wonderful mathematician and a scientific investigator, and yet be of such a highly nervous temperament as to be kept by it far from the fighting line. Apply "A. P. C.'s" system to such a one, and make him fret about the security of his position; the result is he is more or less paralysed, and the best that is in him is lost to the world, and he, poor wretch, is punished into the bargain. On the other hand, the man much less highly endowed mentally but without the nervous disability would come to the top. This, surely, would be the survival of the fittest gone wrong.

"A. P. C." speaks of the sinking of self, and so forth; but, while he condemns one form of selfishness, his remedy appears but the application of another. I venture to say that the whole of his argument rests on a basis of unalloyed selfishness—the curse of modern and ancient times. The idea of killing off the inefficients is nothing new. Ages ago the Roman Parliament had a measure under consideration for ridding the State of those unable to actively serve it. All old men too old to bear arms were to be killed. That was the way the Romans would have settled the old-age pension business. The Roman said that every man unfit to be a soldier, every woman not in vigorous health, every child born deformed, was a burden to the State, or everyone not in sufficient vigour of health to be a producer was a burden to the State, and therefore they tried to pass that law. This was the high-water mark of Roman civilisation, and the Roman then, like "A. P. C." now, was fearful that the weak would hold back the strong. Rome decided the then new doctrines as to strength in weakness, and lived for self, and Rome died. Similarly, I believe, the spirit of commercialism which enthrones self-interest suprême in one's life must, when sufficiently absorbed by the majority, make as surely for our death as a people as did selfishness long ago in Rome.

I hold no brief for indulgence, slackness, and the choosing of the path of least resistance in life, but my contention is that "A. P. C.'s" system is not only wrong *per se* but, in addition, would tend to defeat the very object he apparently has at heart.

P. H. C. Prentice.

London, E.C., *November 25th*, 1909.

I hold entirely with what "A. C. Circuit" says under the above heading, and quite agree with him that "A. P. C.'s" so-called "minor philosophy" is balderdash.

Is it not every right-thinking man's object in life to make suitable provision for himself and his dependents? And, if in his later years he finds the "steady job" the better for that purpose, why should he not apply his earlier experience to his benefit? What is a "steady job" but a position in which experience and sound judgment are necessary qualifications: and if specialisation is valueless, to what are due all our greatest inventions? Certainly not to the gallivanting "jacks-of-all-trades" which "A. P. C." upholds. He says the Government and municipal authorities are particularly bad offenders. I can at least speak for municipal authorities and assure him that personal keenness and general efficiency are as necessary qualifications in municipal departments as in any other business concern.

Is "A. P. C." confusing the "steady job" with the old "*soft* job?"

J. P. F.

Birmingham.

As I believe you have received further criticisms of my article on "The Fetish of the Steady Job," I shall be glad to have the opportunity of replying to them all at a later date. In the meantime, however, I would ask "A. C. Circuit," whose irresponsible and incoherent letter appeared in your last issue, to read my "pseudo-philosophy" with a little more care, when he will see that he has entirely missed my point.

A. P. C.

November 27th, 1909.

Institution Proceedings.

Hundreds of helpless members like myself must be thanking you for your recent leading articles about the Institution of Civil Engineers. Outsiders have no conception of the way the Institution is managed, and I very much doubt whether our self-elected Council would feel gratified to hear the candid opinion of the members on the subject.

In your issue of to-day you refer to the absurd secrecy about the proceedings. I remember at the last annual meeting, how a member got up, and in a moderate and reasoned speech advocated the admission of the Press. His resolution was duly seconded. That was all. The chairman never put it to the meeting at all, but calmly ignored it. I don't think anyone was surprised; we are used to these little things, particularly after the special meeting previously held to consider the purchase of a new site. You no doubt recollect the circumstances. Nothing in the nature of an explanation of the need to raise the fees was vouchsafed to the members before the meeting, and when some of those present moved that the voting be deferred until the statement of the Council had been communicated to the four or five thousand members concerned, who were not present, this was negatived on account of the urgency of the case. And then we heard that the site could not be purchased at all. The whole thing was a scandal; there is no milder word for it.

The question of the reading or non-reading of papers at meetings is a minor matter. Let us be able to get our papers first. Every other Institution but the Civils hands papers to the members as they enter, but in Great George Street, on the stroke of eight, one of the various assistant secretaries puts down a few papers, often less than a dozen, on the Council table. Then there is a sort of obstacle race over the benches, and the fortunate ones secure a copy at the expense of their dignity, and shins. Surely the Institution can afford a few more copies, and have them presented at the door.

Personally, I have utterly given up hope of reform. Membership of the Institution still has a professional value about equivalent to the subscription, but this is growing less as the activity and vitality of the body increasingly decay. The only chance of reform lies in giving the members the power to nominate members of Council in the same way as the sister Institution at Storey's Gate does. Till we have this, the discredit attaching to the Institution belongs to those who manage it, and not to the members. Meanwhile, Sir, I beg you to continue your good work.

Member.

I would like to endorse your remarks in the leader entitled "Publicity," anent the rule of the Institution of Civil Engineers prohibiting publication; it is equally bad for members as well as the public. I was unable to attend the reading of the papers on "Electric Railways," also the discussion; the result is that I cannot read either the papers or the discussion for at least another three or four months; the *Proceedings* are published quarterly, and are generally some months behind in point of time.

I strongly agree with your correspondents who advocate the sending of proof copies of papers to members in advance as a matter of course, and abolishing the unnecessary waste of time in reading them at the meetings.

I hope the Council will respond to the desire for this reform.

Another Assoc. Mem. Inst.C.E.

I am very glad that you have so strongly called attention once more to the absurd practice of reading papers at the Institution, and so wasting time that might be far better employed in discussion. I entirely agree with your remarks and those of Mr. Farrar, and while on this subject would like to ask why the meetings close at 9.30 or 9.45 at the latest. One would have thought that when an important paper was being discussed the meeting might very well be prolonged to 10.30. This certainly occurred to one when Mr. Rider was unable to make a verbal reply to his critics.

H. Joseph,
Resident Engineer.

Dorking Electricity Supply,
November 29th, 1909.

The First Telephone Switchboard.

Will you kindly inform me: *When* and *where* the first telephone switchboard was erected in *England?*

Mr. Poole states in his book that the *first* telephone switchboard was fitted in Manchester. Until this was pointed out to me I was firmly under the impression that *Coleman Street* held this honour.

W. E. B.

[The exchange at Coleman Street was mentioned in our issue of September 15th, 1879.—Eds. E.R.]

Single-Phase Motors.

Referring to the interesting letters on the above subject, I think the following facts should be brought before your readers to correct a widespread error respecting the flexibility of D.C. motors.

I quite agree that we have alternating-current motors that behave excellently both on full load and when reversed, of which the Bandy motor is a particularly good example.

Mr. A. O. Buckingham, however, is apparently not aware that D.C. motors can be started and reversed on full load without excessive flow of current. I refer chiefly to the well-known Lacy D.C. motor, in which commutator sparking under any load or current within its proper voltage does not exist.

I shall have pleasure in submitting curves showing the maximum current taken by the motor when—

1. Started on full load without external resistance
2. Reversed " " "

if desired, to prove my statements.

The "scrapping" of D.C. plant is surely unnecessary when manufacturers are turning out adaptable motors of this description.

Fred. J. Turquand.

Protection of Tramway Trolley Standards.

In connection with this important question, there is one point which "Inquirer" did not touch upon in his letter to your columns in last week's issue.

Many tramways run with their trolley ropes tied to the car trolley standard, and the removal of the trolley from the wire in the event of the standard being alive becomes still more difficult, if not impossible.

"Inquirer" referred to the dangerous time that might easily elapse before the conductor could get to his back platform and pull down the trolley. A car crowded with passengers in the gangways and the conductor away from his back platform issuing fares explains this.

Consider now the position of the trolley rope being tied to the standard. On the standard becoming alive, a passenger gets a shock, and immediately there is a panic among the other passengers. The conductor would stand a poor chance of expeditiously getting near the standard. Meantime, the passenger, if held by the shock, is suffering from its effects.

Now assume the conductor can get access to the standard. He has then to untie the rope from the charged standard, and I affirm that there is not one conductor in ten who would tackle this job, assuming that everything is wet.

That this would be the case is quite obvious, and to my mind still further emphasises the necessity of adopting such means as will prevent the trolley standard from becoming electrically charged.

P. J. Pringle,
Borough Electrical Engineer and Tramways Manager.

Burton-on-Trent, *November 29th*, 1909.

ELECTRICITY IN THE MODERN HOME.

We congratulate the South Metropolitan Electric Light and Power Co., Ltd., upon the efforts that they are making just now to educate the residents in the newer parts of their wide area of supply in the convenience of electricity in its various applications in the modern home. "Electra House," 111, Bromley Road, has been opened as a model electrical home and it is to serve as a permanent exhibition, with the idea of popularising the use of electricity for all domestic purposes throughout the company's area, but more particularly in the large residential district which is being opened up in the immediate vicinity. The house which is quite new, and occupies a prominent corner position in the main road, forms one of upwards of 2,000 residences of a similar class now being erected on the Forster estate, the rentals ranging from £40 upwards. It contains three reception and five bedrooms, with the usual etceteras. There is no mere show-room effect produced, for the house is actually occupied by a self-denying electrical enthusiast, and every domestic operation where practicable, is carried out by means of electricity, thus saving an enormous amount of work and adding very materially to the comfort and convenience of the occupants. All lighting, heating and cooking, as well as the supply of hot water, is carried out electrically, and there is an electrically-operated vacuum cleaner, flat irons, a sewing machine, boot and knife-cleaning machines, and so forth. No gas or coal will be used for any purpose whatever. Water is heated in kettles and jugs or in larger vessels where a greater quantity is required, while boiling water is available in the scullery, the lavatory, and the bathroom. In addition to the electric ovens, the kitchen is equipped with several electric irons. There are also heaters for large quantities of hot water, hot plates for boiling water, stewing or frying in ordinary utensils, a couple of electric grills and a "Tricity" cooker. A treadle sewing-machine has been converted to electric drive and is in daily use; and in the scullery are electric knife cleaning and boot-polishing machines, as well as an electric geyser for the immediate supply of small quantities of hot or boiling water. Luminous radiators and convectors are in the hall and in every room.

In the bathroom a "Therol" water-heater is installed. The "Daisy" electric vacuum cleaner can be connected to any lamp-holder; electric fans are fitted for ventilation; and there are curling-tong and shaving-water heaters, an egg boiler, a coffee percolator, an electric dinner gong, a hat ironer, a bed warmer, cigar lighters, food warmers, hot-water jugs, portable electric lamps, and so forth. A novelty that will doubtless appeal very greatly to the public is a regulating device for turning down the light. Telephones are fitted in every room, while a complete installation of Lowne electric clocks, controlled from a master pendulum in the hall, is being provided for. The lighting throughout is carried out exclusively with the latest forms of metal-filament lamps. The fittings have been chosen to harmonise with the styles of decoration, and comprise a variety of pendants, brackets, floor and table standards, to suit the pockets and requirements of every class of consumer. A special feature is made of Holophane glass reflectors. Visitors can obtain many useful hints as to the most effective and economical manner in which to light their houses. The manufactures of some thirty odd firms are represented in the building, and the installation was carried out by Messrs. Rowland & Halton, Ltd.

We were afforded the privilege of an inspection of this interesting residence last week, and we are sure that if only the public, as they come to inspect the newly-built houses on the estate with a view to renting them, can be lured into Electra House, they will become useful and satisfied consumers of the South Metropolitan Co. There was no lack of visitors during the closing days of last week, the publicity given to the matter in the Press having made many curious. To our mind the chief problem is that of getting the people to come and see, after that "seeing is believing" and doing too. There must be a spider on the watch for the—well, not the fly, but the probable resident—perhaps that has been ararnged with builders' agents and others on the estate; also must there be an aggressive and intelligent effort on the most modern publicity lines. By the medium of these measures the company should have little difficulty in convincing the may-be hesitating visitor of what he ought to do. Let us hope that the existence of a gas-fitted show-house a few doors farther round may help the electricity company,—"Look here on this picture—there on that." The company never has been able to earn more than a merely complimentary dividend on its ordinary stock. In its "untilled soil," if we may so describe the newly-built-on parts of its area, where gas has not got to be "turned out," because it has never been in, we believe there lies one of the great hopes for a prosperous future for the company.

LEGAL.

Stephens v. Dowsing Radiant Heat Co., Ltd.

This case came before Mr. Justice Channell and a common jury in the King's Bench Division last week. Miss Mary Jane Stephens, of Russell Road, Crouch End, claimed against defendants to recover damages for injury sustained, as she alleged, by the negligent treatment of the defendants' servants in their administration of the high frequency electrical treatment.

A "Compleat" Electric Kitchen.

Mr. Marshall Hall, K.C., and Mr. W. Jardine, were for the plaintiff, and the defendants were represented by Mr. Norman Craig, K.C., with Mr. J. E. Walker.

In opening the case, Mr. Marshall Hall said that the plaintiff, who was living with her brother, had occasion to consult Dr. Langford for indigestion. She suggested an electric bath as a remedy for the trouble, and the doctor, consenting, recommended her to go to the Dowsing Heat Co. Miss Stephens went to one of the company's establishments, and the matron suggested that she should not have an electric bath, but the high-frequency treatment instead. This was the system of passing an electric current of high voltage but low amperage through the body of the patient, who had to be placed on an insulated couch; electrodes were placed in her hands, and the electric current passed. The administration was by an apparatus which required the greatest possible care. After again consulting her doctor, Miss Stephens agreed to undergo the treatment, and went to the Dowsing establishment in York Place. There she was placed upon a specially-constructed insulated couch, and the electrodes were placed in her hands. The moment the electricity was applied, she complained of sharp pains in the left instep and the right leg. The nurse, however, did not shut off the current, but merely told the patient there was nothing wrong, and the treatment was continued. On returning home her leg felt worse, and an examination showed that she was suffering from severe electric burns. Acute dermatitis was subsequently set up, and the lady's life was endangered, and she had not yet completely recovered her health. On investigation it was found that the skirt which she was wearing was trimmed with a tinsel braid which contained a certain amount of metal, through which a contact was created with her body. It was contended by counsel that when Miss Stephens complained of pain, the current should have been shut off, and the operator should have ascertained what it was that caused a normally painless treatment to have an abnormal and painful result.

Miss Stephens, in her evidence, bore out counsel's statement, and said that the pain of the burning was agonising, and she repeatedly complained to the attendant who told her there was nothing wrong. After she had somewhat recovered she went to the manageress of the Institution in which she had been treated, and told her what had happened; and the manageress received her story with incredulity.

Dr. Chas. Harris Langford said that it was he that plaintiff consulted about taking the high frequency treatment; and he consented, knowing that properly administered the treatment was a very good thing.

Dr. Lewis Jones, who said he was in charge of the electrical department at St. Bartholmew's, described the wounds on plaintiff's limbs, and said the burns could have been caused by a circuit connected by means of the metallic filaments in the braid if the dress were lying on the leg as it would be.

If you were administering current and had omitted to see the braid on the first application of the current, what would you have done on notification of intense pain?—I should have stopped the current to see if there was anything wrong.

Normally administered, asked Mr. Marshall Hall, K.C., should there be any pain?—No, and I always warn my patients to tell me if any pricking is felt.

Under cross-examination by Mr. Norman Craig, K.C., Witness said it was not usual to make patients take off their clothes when this "high-frequency" treatment was being administered. Personally, he thought the treatment ought not to be given except in the presence of a medical man, but he knew it was a good thing, and that medical men recommended people to go to these institutions. He agreed that there were differences in individual susceptibility to sparking.

Mr. Norman Craig, K.C., argued for the defence that there was no ground for the charge of negligence against the defendants. A state of things had arisen which it was impossible to understand even now, and which could not have been foreseen.

Nurse Crossfield, who administered the treatment, denied that plaintiff made any complaints of pain as she alleged.

Dr. Wilfrid Harris, of Wimpole Street, said that if you lay a piece of metallic braid on your leg while electric current is passing through the body, there will be sparks, though the braid does not touch earth. He had not been aware of the point until that morning, when he made the experiment. Such sparks were distinctly unpleasant, but not very severe. Under cross-examination, Witness said it was not possible for the braid to have got into contact with the pole in the apparatus.

His Lordship, in summing up, after directing the jury as to the legal aspect of the case, said that the real question was whether the injuries were the result of unavoidable accident or the result of negligence on the part of the operator. It might have been that the lady had unfortunately been the means of a discovery of something in science which was not known before, and if the defendants' agents had not been negligent in their treatment, they could not be held to be liable for the injuries which resulted from it. The defendants had undertaken to administer the treatment to the plaintiff, but in that undertaking they did not guarantee to be successful, nor did they guarantee that there would be no accident. They did not guarantee that something that had never happened before would not happen to the plaintiff. But what they did undertake was to apply proper and reasonable care and proper and reasonable skill. A mere error of judgment would not be sufficient to make them liable in damages, but if they were careless in the use of the process they would be liable. In this case, no one was able to say how the unfortunate accident happened. The lady was at first incredulous about her injuries, and so was one of the doctors, which was only natural under the circumstances. No one was very much inclined to believe at once that something had happened which was contrary to experience, and the jury must not be prejudiced against the defendants by any language which the lady might have used at the time. There must have been some sparking, but nothing which had previously occurred could account for it. It was thought that the metallic braid on the lady's dress had something to do with it, and as to that the jury would have to say whether they thought there had been negligence on the part of the defendants' operator in not having notified that the metallic braid might be dangerous Everybody acquainted with the subject ought to have known that if they had a metallic braid getting into contact with the other pole of the electrical machine they would create damage. There was no evidence that the machine was not of a perfect character or that it was not properly fenced off so as to prevent anything coming in contact with it. There were differences of opinion as to whether the metallic braid might have come into contact with the other pole, and one of the medical witnesses was of opinion that the contact might have produced the sparking, but no one would have supposed that that would have been sufficient to have caused burns such as those from which the plaintiff had suffered.

The jury, after an absence of an hour and a half, returned a verdict for the plaintiff, with £60 damages.

Judgment was entered accordingly, with costs.

His Lordship said there was nothing to complain of with regard to the defendants, the occurrence having been more the result of an accident than anything else.

Rating of Electric Cables.

At Durham Quarter Sessions, before Judge Greenwell, on the 24th ult., an important rating appeal was heard, brought by the Cleveland and Durham Electric Power Distribution Co., against the Assessment Committee of the Lanchester Union, in respect to the rating of electric cables in the parish of Medomsley. Mr. Ryde and Mr. Simey were for the appellants, and Mr. Elliott, K.C., and Mr. Mevnell, for the respondents.

Mr. Ryde said the rate appealed against was made in April, 1908, and the appellants were rated at £99 gross, and £82 10s. net, for underground cables and poles for carrying overhead cables at certain parts in the parish of Medomsley, in the Lanchester Union. In form the charge was a very small matter, but the company had taken the appeal as a test case. Originally, it was intended that the whole of the cables should be underground, and they were so laid. It was a colliery district, and subsidences had occurred that had damaged the cables, and, as a result, the cables had to be carried overhead for a great part of the length. In consequence, some part of the outlay by the appellants in laying cables underground had been thrown away. The total outlay on underground cables was £2,522, and of that sum £1,278 was spent on cables now useless and abandoned, and £795 on cables now in use. In substitution for cables disused the company had spent for pole lines, £312; the total cost spent from first to last was £2,834, and the total cost of what was now in use was £1,107. Counsel pointed out that the company in their business of supplying electricity to customers made no profit, but an absolute loss. Quoting cases from the High Courts, he contended that a certain hereditament in a parish, a portion of which was used for profit-making, could only be rated on the profit made. In the present case the company were not making any profit, and, therefore, were not liable to be rated.

Mr. Elliott, for the respondents, argued that if the particular portion of the cable in Medomsley was essential to the working of the whole undertaking, then it was liable to be rated.

The Court dismissed the appeal with costs.

British Westinghouse Co.'s Arbitration.

In the Court of Appeal, Lords Justices Moulton and Farwell had before them on Tuesday, the case of in *re* an arbitration between Coates and the British Westinghouse, &c., Co., on an appeal by Mr. Coates from an order of Mr. Justice Sutton in Chambers.

Counsel, for the appellant, said that the order appealed from was one refusing to appoint an arbitrator under Sec. 5 of the Arbitration Act. An originating summons was taken out for the appointment of an arbitrator under an agreement dated January 1st, made between a company called the Société Anonyme Westinghouse, and the appellant Coates. That agreement provided for the appointment of Mr. Coates as agent for the sale of certain apparatus which that company had the right to dispose of. That contract the foreign company assigned to the British Westinghouse Co., the present respondents.

Lord Justice Moulton said that they could not decide on such an application as that, that there had been a novation. To establish that an action must be brought.

Lord Justice Farwell concurred, and the appeal was accordingly dismissed, with costs.

Tramway Rating.

At Preston Quarter Sessions on Monday judgment was given in the case heard before Mr. Worsley-Taylor, K C., at Preston on October 21st. The question for discussion was whether or not a length of tramway, rated at £467, should be treated as a railway, and rated as such at one-quarter the full rateable value.

Mr. Sutton had contended that if the Blackpool and Fleetwood Co. was entitled to an exemption, every tramway in the country would be treated as a railway.

Appellants, in 1904, successfully appealed before the Court of Appeal at the House of Lords against the tramroads being rated at full value, and accordingly the tramroad was rated at one-quarter the full rateable value, but respondents continued to rate the tramway at the full value, relying on the decision in 1892, in the case of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority.

Both parties in the present case, said Mr. Worsley-Taylor, admitted that the Swansea case was binding unless it had been overruled. Appellants contended that it had been overruled by the 1904 appeal, and also by the case of the Wakefield Corporation *v.* the Wakefield and District Light Railways Co. In that case it was held that a straight light railway which was in physical fact distinguishable from a tramway was a railway within Sec. 211 of the Public Health Act. The present case, contended Mr. Taylor, was of very serious importance, for if it was held that the tramway was to be rated at one-fourth only, the decision must govern the rating of the whole of the tramways, and so disturb the basis on which local authorities and tramway undertakings had proceeded since the Swansea case.

The Bench were of opinion that the Swansea case had not been overruled, and the appellants' contention therefore failing, the appeal must be dismissed with costs.

Mr. Taylor consented to state a case.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Wimperis Accelerometer and Gradient Measurer.

Messrs. Elliott Bros., Century Works, Lewisham, are putting on the market a simple instrument designed by Mr. H. E. Wimperis, for indicating by direct reading the rate of acceleration or retardation of the vehicle on which it is carried. It consists of a horizontal copper disk with an eccentric centre of gravity, and controlled by a light spring. Magnetic damping is provided, and the instrument is so compensated that accelerative forces in any direction but that under test are neutralised. It can be used for a variety of measurements, including the tractive effort of locomotives or motor cars, brake horse-power when running, the value of gradients, &c. When measuring the acceleration due to the driving force, the reading is independent of the effect of gravitational forces.

Igranic Pillar-Type Panels.

A new series of ironclad motor-panels has been brought out by the Adams Manufacturing Co., Ltd., of Bedford, some of which are illustrated herewith. Fig. 1 shows a panel equipped with motor starter, shunt regulator, ammeter, and d.p. circuit-breaker. The starter is of the sliding-contact type, and can be provided for ordinary starting duties up to 35 h.p. at 100 volts, and 50 h.p. at 200 to 500 volts, or with a heavy-duty starter up to 60 h.p. at 100 volts, and 100 h.p. at 200 to 500 volts. The circuit-breakers are interlocked with the starter, so that the circuit is always made and broken on the easily renewable sparking contacts provided with them. These are protected by powerful magnetic blow-outs, thus reducing the sparking to an absolute minimum at these times. Further, the interlock is such that should the circuit be opened through failure of voltage, excess load, or any other cause, it is impossible to reclose it until all the starting resistance is first reinserted in the motor circuit.

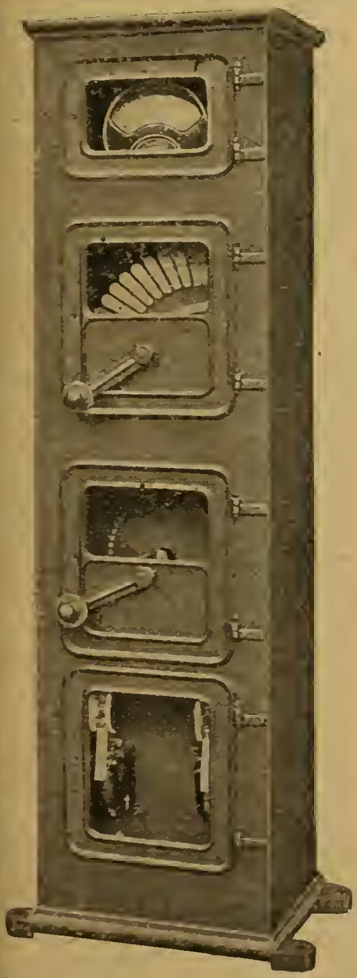


Fig. 1.—Starting and Regulating Panel.

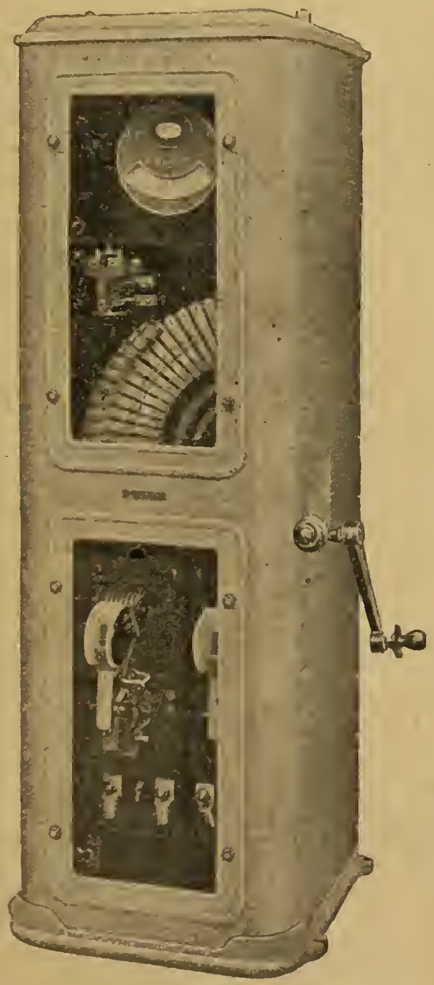


Fig. 2.—Starter with Slow-Speed Gear.

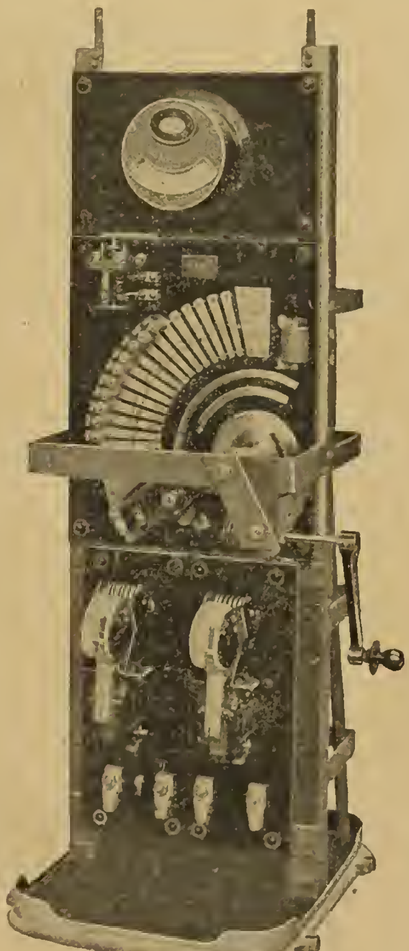


Fig. 3.—Interior of Geared Starter.

The switch parts are mounted on substantial slate bases, fitted to an angle-iron frame, which is in turn totally enclosed in an iron housing, provided with cast-iron top and base, and with glazed doors over the front of the apparatus and inspection doors at the back, so that the resistance can be examined with ease.

The circuit-breakers have not to be operated by means of a separate handle, but at the same time they give exactly the same effect as the ordinary loose-handle circuit-breaker. The first movement of the contact lever completes the circuit of the coil which operates these breakers, and thus causes them to close.

Figs. 2 and 3 illustrate a somewhat similar type of panel, with slow-speed worm gear. This is not really an essential feature when the circuit-breakers with overload are provided, for if the starting resistance were cut out too rapidly, the consequent excess current flowing through the armature would cause the overload device to trip the circuit-breakers and necessitate the starting lever being brought back to the initial position before the circuit could again be closed. Adjustment of the overload, therefore, can be made to limit the speed of cutting out the starting resistance. When, however, it is desired to have this additional refinement, it can be fitted with a step-by-step motion, which, by a continuous rotary movement of the operating lever, causes the contact lever to jump from step to step, giving a slight pause on each.

Catalogue "B" illustrates and describes a few of the standard types of panels, but they can be made to give any combination that may be required.

The "Torque" Banding.

An improved system of banding for lathes and machine tools has been put on the market by the patentee, Mr. C. McD. Cheeld, Hilltop Works, Thorpe-le-Soken, Essex. It consists of stranded cord, dressed with compound, and provided with a novel and ingenious fastener, as illustrated below. The head on the end of the hook is inserted between the strands, and the wire ring is then compressed tightly over the strands round the neck of the fastener, making a permanently secure and neat connection between the cord and the fastener. A great advantage claimed for this banding is that, by twisting the cord before hooking the fasteners together, the cord can be lengthened or shortened over a range of 1½ in. to the foot, giving great facility for adjustment to suit stepped pulleys or to take up slack. The fastener is no larger than the cord, so that it runs easily over the pulleys.

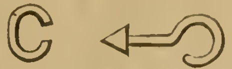


Fig. 4.—"Torque" Band Fastener.

Dugdill's Shade Fixer.

A simple device has been brought out by Messrs. John Dugdill and Co., of Failsworth, Manchester, for holding the shade-ring when fixing a shade on a lamp-holder. The difficulty of this operation has been greatly increased by the adoption of specially deep shades with metallic-filament lamps, rendering the use of such an implement almost unavoidable. The shade fixer is practically a pair of tongs, with specially shaped jaws which fit any of the

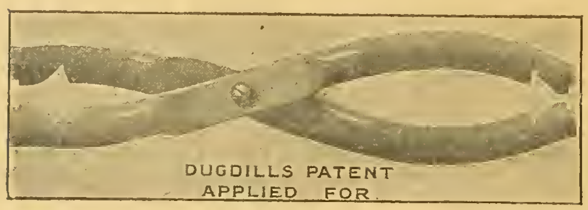


Fig. 5.—Dugdill's Shade Fixer.

standard lamp-holders; it can also be had double-ended, as shown, the second pair of jaws being made to fit miniature lamp-holders.

The Wilkinson Economic Electric Stove.

An ingenious electric stove has been devised by Messrs. F. A Wilkinson and Partners, Ltd., of Harpenden, Herts., the construction of which is of extreme simplicity. The body consists of an earthenware cylinder, into which the other parts—a plain disk, and a block with a spiral groove formed in its surface, both of earthenware—are laid. In the groove is the heating element, a spiral of nickel or other wire, and the terminals come opposite holes in the outer cylinder. Over the heating element is laid a grating of expanded metal, held in place by a polished ring and three screws.

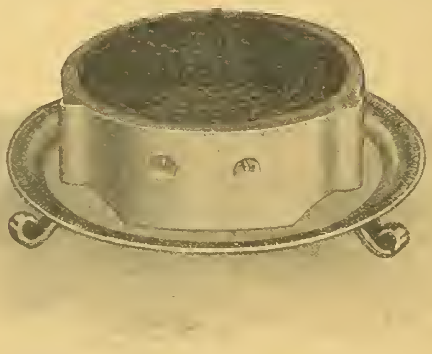


Fig. 6.—Wilkinson Economic Stove.

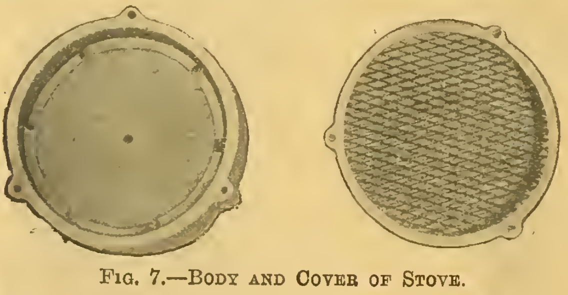


Fig. 7.—Body and Cover of Stove.

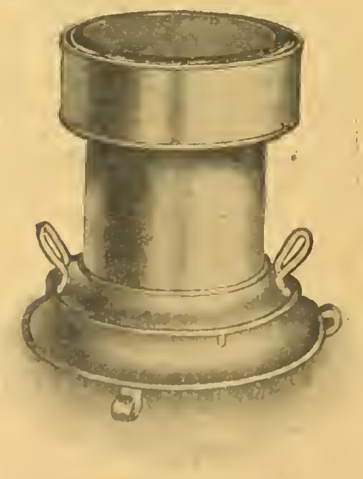


Fig. 8.—Combined Radiator and Stove.

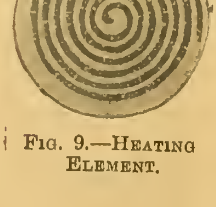


Fig. 9.—Heating Element.

The whole can be mounted on an aluminium tray as shown in fig. 6. The stove is suitable for boiling, toasting or frying with ordinary household utensils, or it can be inverted and used for grilling. The heating element attains a bright red heat, and has a life of 1,000 hours; it can be renewed at small cost, and is made for any voltage from 100 to 250 volts, a.c. or d.c. The stove is also available for use as a radiator, and can be mounted in an aluminium stand as a combined radiator and stove (fig. 8). The special features of the device are its small cost, high efficiency, and facility for cleaning—all the parts can easily be dismounted and washed. It should be extremely useful in connection with the cooking and heating campaign that all progressive station engineers have begun or are contemplating.

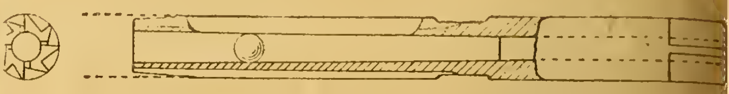


Fig. 10.—"Loewe" Expansion Reamer.

The "Loewe" Expansion Reamer.

A neat expansion reamer is being put on the market by Messrs Ludw. Loewe & Co., Ltd., 30/2, Farringdon Road, E.C. As will be gathered from the section, fig. 10, the expansion is produced by a hardened steel ball in the taper bore; the grooves have longitudinal slits to give the necessary elasticity, The reamer can be expanded at any particular point, or (by using two or more balls) over a greater length. As the bore is taper, it is easy to remove the balls. The reamers are made to standard sizes from $\frac{1}{16}$ in. upwards, and, owing to their simple construction, are inexpensive.

TRADE STATISTICS OF BRITISH INDIA.

The following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1909, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1908, are added for purposes of comparison, and notes of any increases or decreases are given:—

15 rupees = £1.

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Lampware.—			
From Great Britain ...	10.15.000	10.92.000	+ 77.000
,, Germany	6.41.000	5 55.000	— 86.000
,, Austria	5.62.000	4.42.000	— 1.20.000
,, United States ...	3 08.000	2.67.000	— 41.000
,, Other countries ...	1 63.000	85.000	— 78 000
Total ...	26 89 000	24.41.000	— 2.48.000
Other hardware, except enamelled ware.—			
From Great Britain ...	1.42.03.000	1.39.71.000	— 2.32.000
,, Germany	30.50.000	22.74.000	— 7.76.000
,, Belgium	11.62.000	10.69.000	— 93.000
,, Austria	3.38.000	2.91.000	— 47.000
,, United States ...	7.57.000	6.88.000	— 69 000
,, Other countries ...	7.53 000	7.57.000	+ 4 000
Total ...	2.02.63.000	1.90.50.000	— 12.13.000
Brass, wrought.—			
From Great Britain ...	7.15 000	7.05.000	— 10.000
,, Germany	1.23.000	2.51.000	+ 1.28.000
,, Austria	82 000	70.000	— 12.000
,, Other countries ...	3.68.000	2.06.000	— 1 62.000
Total ...	12.88 000	12.32.000	— 56 000
Copper and copper ware.—			
From Great Britain ...	1.43.66.000	1.71 97.000	+ 28.31.000
,, Germany	33.47.000	52 67.000	+ 19.20.000
,, Belgium	4.56.000	18.05 000	+ 13.49.000
,, Italy	3 98.000	4.37 000	+ 39.000
,, Austria	1.22.000	1.70 000	+ 48.000
,, Japan	16.68 000	20.36.000	+ 3 68.000
,, Other countries ...	2.78.000	3.02.000	+ 24.000
Total ...	2 06.35.000	2.72.14.000	+ 65.79.000
Iron wire.—			
From Great Britain ...	1.61.000	1.33.000	— 28.000
,, Germany	1.08.000	54.000	— 54.000
,, Belgium	6.77.000	3.82.000	— 2.95.000
,, Other countries ...	1.30.000	1.09.000	— 21.000
Total ...	10.76.000	6.78.000	— 3.98.000

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Steel plates and sheets.—			
From Great Britain	89.79.000	75.59.000	— 14 20.000
,, Germany	12.34.000	21 30.000	+ 8.96 000
,, Austria	22 61.000	27.91.000	+ 5.30.000
,, Other countries ...	22 000	24 000	+ 2.000
Total ...	1.24.96.000	1.25.04.000	+ 8.000
Steam engines (except locomotives).			
From Great Britain ...	1.21.43.000	96 38.000	— 25.05 000
,, Belgium	2.73 000	1.25.000	— 1.48.000
,, Other countries ...	2.07 000	3.29.000	+ 1.22.000
Total ...	1.26.23 000	1.00.92.000	— 25 31.000
Electrical machinery.—			
From Great Britain ...	23.28.000	30.43.000	+ 7.15.000
,, Germany	94 000	64 000	— 30.000
,, Belgium	2.41 000	38 000	— 2.03 000
,, Italy...	57.000	68.000	+ 11.000
,, U.S A.	2 16.000	2.92.000	+ 76.000
,, Other countries ...	35.000	42.000	+ 7.000
Total ...	29.71.000	35.47.000	+ 5 76.000
Mining machinery.—			
From Great Britain ...	7.27 000	11.84 000	+ 4.57.000
,, Germany	41 000	2.000	— 39.000
,, U.S.A.	7.000	50.000	+ 43 000
Total ...	7.75.000	12.36.000	+ 4.61.000
Machinery, other (except textile and agricultural).—			
From Great Britain ...	1.99.56.000	1.87.08.000	— 12.48.000
,, Germany	8.15.000	8 96 000	+ 81.000
,, Belgium	2.88.000	9 54 000	+ 6.66 000
,, U S.A.	7.90.000	8.40.000	+ 50.000
,, Other countries ...	2.03.000	3.20.000	+ 1.17.000
Total ...	2.20.52.000	2.17.18.000	— 3.34.000
Railway carriages, &c.—			
From Great Britain ...	3.09 24.000	3 85 55.000	+ 76.31.000
,, Belgium	4 28.000	7.30.000	+ 3.02.000
,, Other countries ...	1.20.000	65.000	— 55.000
Total ...	3.14.72.000	3.93.50.000	+ 78.78.000
Locomotives and tenders, and parts thereof.—			
From Great Britain ...	1.74 49.000	1.37.35.000	— 37.14.000
,, Germany	30.000	24.000	— 6 000
,, Other countries ...	14.000	25.000	+ 11.000
Total ...	1.74.93.000	1.37.84.000	— 37.09.000
Rails and fishplates.—			
From Great Britain ...	80.59.000	1.07.23.000	+ 26.64.000
,, Germany	2.57.000	3.34 000	+ 77.000
,, Other countries ...	4.00.000	2.32.000	— 1.68.000
Total ...	87.16 000	1.12.89.000	+ 25.73.000
Glass lampware.—			
From Great Britain ...	1.10.000	91.000	— 19.000
,, Germany	3.96 000	2.49.000	— 1.47.000
,, Austria	2.72.000	2.29.000	— 43.000
,, Other countries ...	1.30.000	93.000	— 37.000
Total ...	9.08.000	6.62.000	— 2.46.000
Electrical instruments, apparatus, &c.—			
From Great Britain ...	44.30.000	42.25 000	— 2.05.000
,, Germany	1.95.000	1.68.000	— 27.000
,, Belgium	96 000	63.000	— 33.000
,, Austria	45 000	19 000	— 26.000
,, United States ...	1.12.000	80.000	— 32.000
,, Other countries ...	30.000	27 000	— 3.000
Total ...	49.08.000	45.82.000	— 3.26.000
Scientific, &c., instruments.—			
From Great Britain ...	12.61.000	15 17.000	+ 2.56.000
,, Germany	46.000	1.02.000	+ 56.000
,, United States ...	56 000	56.000	—
,, Other countries ...	78.000	1.48.000	+ 70.000
Total ...	14.41.000	18.23.000	+ 3.82.000
Telegraph construction materials.—			
From Great Britain ...	28.000	1.23.000	+ 95.000
,, Other countries ...	1.000	8 000	+ 7.000
Total ...	29.000	1.31.000	+ 1.02.000

In addition to the foregoing, the following were imported as Government stores:—

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	16.82 000	20.20.000	+ 3.38.000
,, Germany	22.000	2 000	— 20.000
,, United States ...	29.000	8 000	— 21.000
,, Other countries ...	7.000	5.000	— 2.000
Total ...	17.40.000	20.35.000	+ 2 95.000
Machinery.—			
From Great Britain ...	26 06.000	37.21.000	+ 11.15.000
,, Germany	79 000	54 000	— 25.000
,, United States ...	5.000	57.000	+ 52.000
,, Other countries ...	16.000	2.000	— 14,000
Total ...	27.06.000	38.34.000	+ 11.28.000
Iron wire.—			
From Great Britain ...	3 52.000	76.000	— 2.76.000
Steel plates and sheets.—			
From Great Britain ...	10.49.000	7.20.000	— 3.29.000
,, United States ...	—	1.000	+ 1.000
Total ...	10 49.000	7.21.000	— 3 28.000
Railway carriages.—			
From Great Britain ...	90.34.000	2.57.93.000	+ 1.67.59 000
Locomotives.—			
From Great Britain ...	82.50.000	1.10.44.000	+ 27.94.000
Rails.—			
From Great Britain ...	56.69.000	37.59.000	— 19.10.000
,, Canada	—	3.32.000	+ 3.32.000
,, Belgium	18.000	—	— 18.000
Total ...	56.87.000	40.91.000	— 15.96.000
Telegraph construction materials.—			
From Great Britain ...	15.22.000	9.46.000	— 5.76.000
,, Belgium	49.000	4.000	— 45.000
,, Other countries ...	1.000	1.000	—
Total ...	15.72.000	9.51.000	— 6.21.000

THE CARE AND WORKING OF ECONOMISERS.

[COMMUNICATED.]

The Green's type of fuel economiser is nowadays universally used in connection with the Lancashire boilers employed at large electric power stations, but, notwithstanding its extended use in this connection, much ignorance exists on matters affecting its maintenance and upkeep, and many points are frequently overlooked in regard to its working, the neglect of which at times involves considerable risk, if not actual danger.

Fuel economisers, like steam boilers, are very liable to deterioration, unless carefully and skilfully attended, to both when at work and at rest. It is a great mistake to suppose, as many do, that serious explosions cannot occur with them. The vertical pipes, it is true, owing to their small diameter, are capable of withstanding high pressures, but being of cast-iron, they are not unduly strong, and when it is remembered that they become corroded both externally and internally, it will be at once apparent that they may become so thinned and weakened in course of time as to be quite unable to withstand the pressure to which they are exposed. An economiser full of water at a temperature of about 300° F., contains a vast amount of potential energy. Should there be any sudden escape of water and consequent reduction of pressure through the failure of a single pipe, the water would, to a large extent, instantly flash into steam, the shock of which might be sufficient to rupture other pipes until the whole of the economiser was blown to pieces. More than one disastrous explosion has occurred in this way, illustrating the danger to which these vessels are liable, and hence the great importance of regular attendance and inspection, and a proper knowledge of the correct methods of working.

External corrosion is probably the most common form of deterioration of fuel economisers, and it is usually brought about in the following way :—

The comparatively cold feed at the inlet end of the economiser keeps the bottom boxes and the lower parts of the pipes cool. As the hot gases come into contact with the cold surfaces, the vapour they contain becomes condensed on the cold parts and leads to external wasting. If the fuel used contains much sulphur, sulphur dioxide and sulphur trioxide will be present in the products of combustion. These gases, in combination with water, form sulphuric acid, which has a most powerfully corrosive action on the metal surfaces, and causes very rapid wasting.

The lower the temperature of the entering feed water, the greater, of course, will be the accumulation of moisture, and consequently the extent of the wasting of the pipes and bottom boxes. For this reason, the feed water should not be allowed to enter the economiser at a temperature of less than 90° F.

If the temperature before entering be raised to 100°, trouble from external wasting is not likely to be experienced to any serious extent, although, in some instances, much wasting has occurred when the temperature has been raised to as much as 120°.

Some coals contain a large percentage of moisture, and where such fuels are used it is important that the temperature of the feed water be raised well above 90° before being passed into the economiser.

When the pipes are found to suffer from external wasting, it is advisable to raise the temperature of the feed water before it enters the economiser, even if this is already as high as 100°. Generally, however, when external corrosion is taking place, although the temperature is above 100°, a special investigation ought to be made, as it is probable that some other cause is responsible for the mischief.

Leakage at the various parts will sometimes lead to external wasting of the pipes and boxes. When any part is found to leak, it should be given immediate attention. If, for instance, leakage takes place past the cap joints, these should be remade at the first opportunity. The cap bolts must not, under any circumstances, be tightened up whilst the economiser is under pressure. Only recently a man was killed in doing this when the economiser was at work, the cap being blown violently into his chest.

Special care must be taken to prevent moisture getting into the flues, the soot pit, or any part of the setting, as this, especially when present about the seatings, is very liable to set up external corrosion. Waste water from any of the valves, for example, should not on any account be allowed to drain into the flues or soot pit, but should be carried well away from the economiser.

The action of the scrapers is also responsible for wearing away the outer surfaces of the pipes in course of time.

Usually the lower ends of the pipes and the bottom boxes at the inlet end of the economiser will be the parts most severely wasted, as it is at these parts that the feed water is coldest, and the condensaton therefore greatest. The extent of the wasting may be ascertained by callipering the remaining external diameter of the pipe.

Economisers also become wasted by internal corrosion when the feed water is corrosive. Unfortunately such wasting is very difficult to detect, as a satisfactory examination cannot be made owing to the small diameter of the pipes.

All that can be done in the way of making an inspection for the purpose of detecting internal corrosion is to lower a lighted candle down the pipes, after first clearing these of scale and deposit. When it is suspected that much wasting has taken place internally, it will be necessary to ascertain the remaining thickness of metal, especially if the parts are also externally wasted. This may sometimes be done by callipering the inner and outward diameters of the pipes. A better plan is to drill a hole through the wasted part, so that the actual thickness may be seen. In really bad cases, it may be desirable to withdraw a pipe and break it up, in order that some idea of the general condition of the economiser can be obtained. An hydraulic test is sometimes advisable, the test pressure which should be applied being from one and a half times to twice the ordinary working pressure.

Where the caps opposite the top ends of the pipes are of the external pattern, it will be necessary to regularly examine the bolts and cross-bars, as these gradually become weakened by internal wasting.

The Board of Trade now recommend that each vertical pipe be inspected once each year, as well as each cap bolt where the external caps are provided. It is not sufficient to examine only a few pipes annually, and from these judge the condition of all others. It is, of course, seldom practicable to open out all the pipes at one time, and in such cases the engineer-in-charge should make a practice of removing a certain number of caps each week or each month, making sure that the whole of the pipes have been inspected during the year.

It is most important that the tubes be kept well cleaned and scraped both on the fireside and the water side. Soot is a very bad conductor of heat, so bad, in fact, that it is sometimes used as a non-conducting covering, and if allowed to accumulate on the outer surfaces of the pipes it materially impedes the transmission of heat from the furnace gases to the feed water in the economiser, leading to inefficiency in working. Hence the scrapers must be kept in good working order, any broken ones being renewed without delay. They should be made to traverse almost the whole length of the pipes.

Similarly, if scale be allowed to accumulate inside the pipes, the efficiency becomes impaired. Accumulations of scale are objectionable also because they lead to overheating, followed in some instances by fracture of the pipes. Hence each pipe should be regularly washed out, the length of time which should be allowed to elapse between each cleaning time depending on the amount of scale-forming matter contained in the feed water. The economiser should also be blown off by opening the blow-out tap for about a minute each day, so that any sediment in the bottom boxes will be blown out. The opening of the safety valve, which should be done every day for the purpose of testing and seeing that it discharges freely, also removes sediment from the upper parts of the economiser. The scale ought never to be allowed to accumulate to a greater thickness than $\frac{1}{8}$ in.

Leakage of air into the flues is a common cause of inefficient working, for every pound of cold air introduced into the flues, carries away with it a certain amount of useful heat. It is, therefore, important to frequently examine all parts where there is any possibility of air passing into the flues. The leakage may be tested by means of a lighted candle, the flame of which is drawn inwards with the air.

It is advisable to regularly examine the working parts of the economiser, so that defective working may be detected and remedied.

Grease must be kept away from the chains to prevent these slipping on the pulleys.

Every fuel economiser ought to be provided with two thermometers, one on the inlet pipe and one on the outlet pipe. By means of these the efficiency of working may be tested. When the difference of temperature between the inlet and outlet water is found to fall, the economy is being reduced for some reason, and an examination should be made to ascertain the cause. A fall in the temperature difference of 10° F., means a loss in economy of approximately 1 per cent. It is, of course, necessary to observe the thermometer readings frequently.

In some of the old types of Green's economiser having external caps resting on conical seats, difficultly was often experienced in loosening the caps from their seatings. Efforts to do this have in many instances resulted in fracture of the top boxes. The operation is a somewhat difficult one, and should always be carried out carefully.

The working of fuel economisers, as already remarked, is attended with many dangers, to avoid which certain precautions are necessary.

One of these is the liability to flue gas explosions. The top of the economiser chamber is situated above the level of the dampers, and hence there is a tendency for explosive gases or mixtures to accumulate there.

The explosions are brought about in the following manner: When the fires are banked at stopping times, unconsumed coal gas is distilled from the coal, and passes along the flues, collecting in the top of the chamber. When the fires are again broken up a quantity of air is admitted, which passes along and mixes with the unconsumed coal gas, thus forming an explosive mixture.

The breaking up of the fires causes the flames to ignite the mixture, a flue gas explosion being the result.

Flue gas explosions have been responsible for several disastrous economiser explosions. The shock produced when the mixture explodes has been sufficient to break some of the cast-iron pipes, which in turn have led to other pipes fracturing, until the whole economiser has been blown to pieces.

To avoid the accumulation of explosive mixtures after the boiler has been standing with banked fires, the dampers should be opened for a short time before stirring up the fires.

This allows a quantity of air to sweep through the flues and carry away any accumulated gas, so that an explosion is then impossible.

Flap doors are sometimes fitted into the top of the chamber, which open in the event of a flue explosion, and minimise the severity of the shock.

Much danger is incurred whenever the water is allowed to remain stationary in the pipes whilst the hot gases are passing through the economiser flues. When this is the case, the water gradually gets hotter until steam is generated. The level of the water in the pipes becomes lowered, allowing the latter to get overheated and so seriously weakened that fracture is very liable to follow. In addition to this, there is the danger of "water hammer" action taking place, which occasionally bursts the top feed pipe. The steam formed in the pipes comes in contact with the water on the other side of the outlet valve from the economiser when the valve is opened, thus causing the water hammer action.

When steam is being raised first thing in the morning, the water will be stationary in the economiser if the engine and the feed pump have not been started.

Should the hot gases be passed through the economiser flues, danger will be incurred in the manner indicated. To avoid this danger, the products of combustion should always be passed through the by-pass or reserve flue until the pump is started and the water set in motion. This prevents the formation of steam in the pipes through the economiser becoming too hot.

Irregular feeding should be avoided as far as possible. Where, however, it is necessary to work an economiser intermittently, a portion of the hot gases should be passed through the reserve flue to minimise the risk of the water being evaporated into steam.

Steam ought never to be allowed to form in the pipes. Apart from the danger which it involves, much difficulty will in all probability be experienced in feeding the boiler, as the steam forms a cushion against which the water has to be forced. The economiser outlet valve should not be closed during the night time.

Although it is generally found necessary to load the safety valve on the economiser to a higher pressure than that on the boiler, owing to the pressure caused by pulsations of the pump, or water ram action, &c., yet it should not be loaded so much in excess of the load on the boiler safety valve as is sometimes found to be the case.

It is common knowledge that a valve to resist water pressure generally requires a heavier weight than would be required to resist steam pressure of the same intensity. It is probably this fact which accounts for the excessive loading of economiser safety valves occasionally met with. The loading should not be more than 20 lb. above the boiler safety valve load, though it is not uncommon to find it nearly twice as much. If the valve leaks the remedy is to re-grind it, instead of putting additional weights on to keep it tight.

The feed supply should be regulated at the inlet valve to the economiser, and not at the boiler feed valve. If the regulation is effected by the boiler feed valve, there is always risk of obtaining a pressure in the economiser greatly in excess of that in the boiler, whereas by regulating the feed by means of the inlet valve to the economiser the pressure in the latter need never exceed the boiler pressure.

Special care should be taken to see that the economiser inlet and outlet valves are opened before starting the feed pump (or the injector), as in the event of either of these valves being closed when the pump is set working, either the latter will be pulled up or else the pipes will burst or the joints be broken. The object of a feed relief valve, which must not be confused with the safety valve, is to prevent the pipes from bursting or the joints being broken in this way, and it is always advisable to have one of these valves attached.

A maximum registering pressure gauge ought also to be provided, as any excessive pressure will be indicated by it. When undue pressure is registered the cause should always be investigated. It may be due to one of the valves having been closed when the pump is started, or to the fact that there is no air vessel on the delivery side of the pump.

Not only should each safety valve be tested by hand daily, but it is desirable to occasionally take it asunder and thoroughly overhaul it if found necessary.

It will be gathered from the foregoing remarks that fuel economisers are not only liable to become weakened and deteriorated, but that their working may be attended with a considerable amount of risk. The importance, therefore, of placing them in charge of competent and reliable men cannot be too strongly urged, and as a further precaution, it is always advisable to have them regularly examined and inspected by some independent expert, such as an inspector of one or other of the leading boiler insurance companies. Under such conditions, their working life would be largely increased, whilst at the same time accidents and explosions would be of very rare occurrence.

BUSINESS NOTES.

Consular Notes.—Bolivia.—In a recent report H.M Consul at Sucre reports that the electric lighting installation in that town was inaugurated at the end of the year 1908—exactly one year after the time stipulated in the municipal contract. Though the whole installation bears some evidence of having been carried out with the greatest possible curtailment of expenses, it may be justly said, when hitches cease to occur, that the town is well lighted. Altogether some £20,000 has been invested, calculated to yield about £4,000 annually in the immediate future, but as the monopoly is for 30 years some £20,000 more ought to be spent to make it efficient. For lighting private houses and establishments the standard price for electric light is 3 bols. 50 cents (5s. 7d.) per month per 16-C.P. lamp. Where a light is required to burn every night this is, light for light, cheaper than petroleum or candles. Where several lights are required in one house a considerable reduction is made, thus, for an establishment that has ordered 100 lights, the price is 2 bols. (3s. 2d.) per 16-C.P. lamp. For motive power there is a great opportunity. The electrical energy is derived from water-power at a generating station on the River Cachimayo, about 8 miles from Sucre. It is transmitted at a very high voltage to the edge of the town, where it is transformed and distributed over the whole network of low-pressure wires. The mains are uncovered wires running parallel to and along the streets on poles about 15 ft. high "and somewhat dangerously near to the balconies of the houses." The unforeseen circumstances which delayed the full equipment of the public service were considered by the municipal council as being sufficiently fortuitous to warrant their waiving the heavy penalty which should have been imposed on the contractors according to the terms of the contract. Some of these circumstances, as well as the numerous obstacles which still impair the regular supply of light, are worth mentioning as showing the nature of the difficulties which have to be carefully considered when undertaking public works in this country.

In the first place, the machinery, which could not be reduced to the requisite limit of weight (300 lb.) for carrying on mules, commenced to arrive at Huanahuaca in the wet season, when carts could not be run. When, eventually, the roads were repaired, the whole system of forwarding traffic had broken down at Huanahuaca, and no-one could cope with the ever-increasing quantity of goods brought up by the railway. The effort of the contractors to get their machinery through resulted in a better organisation all along the route from Rosario to Sucre. An indispensable part of the machinery was found to be missing; a new piece was cabled for, and meantime a substitute was manufactured at the works of the Huanchuaca Co., which was not altogether satisfactory. Some part of the dynamos also had got wet, and could not be made to work. The supply of wooden posts for carrying the overhead wires was not equal to the extraordinary demand, with the result that much delay was caused. More than 800 of these posts were required, of quina-quina wood or eucalyptus, 8 ft. long × 5 in. × 6 in., and they had to come from a long distance. It may be observed that these posts are unsightly and cannot last long, and that British manufacturers might consider if they could not produce cast-iron posts at less than 6s. 8d. per 8-ft. length, that would better suit the purpose. In the Department of Santa Cruz and the eastern provinces, however, wood is much cheaper, its value being about equal to the cost of cutting it. Other difficulties became apparent after the electric light was working, owing to some of the peculiarities of the rivers on the Bolivian uplands not being properly appreciated. Their enormous erosive powers were underrated, for when the volume of water increases tenfold during the summer floods, the rivers completely fill the narrow ravines in which they are hemmed, destroying their own banks and the artificial barriers erected thereon. In the present case the inlet and sluices were solidly constructed, but being below the low water level, each successive flood obstructed them with tons of sand, boulders, and tree trunks and other *débris*. Until experience evolves some means of dealing with the caprices of the river, an auxiliary oil or steam engine must be used to keep up a continuous current, nominally during about 120 days, constituting the worst part of the rainy season, but practically less than half the time, which is all that would be found necessary. The fact is that light must be supplied during every night for 30 years, and the penalty for each night that it fails, besides the discredit, is £8. There is no reason why any firm erecting a factory in Sucre should be altogether dependent on the electric light company for its motive power. The monopoly of this concern extends only within the urban district, and many other generating stations can be erected on other parts of the same river to supply energy for works situated just outside the town.

Live Trolley Standards.—Referring to the liability of the trolley standard to become alive through some accidental cause, with consequent danger to passengers, the British Thomson-Houston Co., Ltd., of Rugby, have drawn our attention to a system which they have introduced to prevent accident from this cause. This arrangement ensures that immediately the trolley standard becomes alive, an audible signal will be given by the ringing of a special type of electric bell, and simultaneously by the lighting up of two red lamps fixed above the car platforms. These signals are independent of each other, so that the failure of one cannot interfere with the proper working of the other. This system is entirely automatic in action, and does not require a battery or any mechanical gear for its operation, nor does it in any way interfere with the running of the car. The provision of two distinct, independent and automatic signals, one audible and the other visible, fully meets with the recommendation of the Board of Trade. An interesting feature of the system is the construction of the leakage indicator or bell, which is designed to work on 500 volts. This special type of bell, as may be seen from the illustration, is completely enclosed in a metal case and adapted for fixing under the canopy, where its warning can be instantly heard by the driver or conductor. The B.T.-H. leakage indicator has been in successful use for the last five years on the tramways at Scarborough and Leith, and also at Dunfermline.

B.T.-H. Alarm Bell.

Robertson Fire Brigade Successes.—As the result of the 11th Annual Tournament of the London Private Fire Brigades Association, which was concluded on the 27th ult. at the Headquarters of the London Rifle Brigade, Bunhill Row, E.C, the Robertson Electric Lamps, Ltd, Fire Brigade was successful in winning the "Nestlé" Challenge Cup, for the Championship of the United Kingdom (for the best aggregate times for wet drills by teams of three and five men); the "Marshall" Challenge Cup, for the championship of the London Private Fire Brigades Association (for the best aggregate times for dry drills for one and two men, wet drills by teams of four men, and scaling ladder and hand-pump drills by teams of five men each); the "Dewar" Challenge Shield—for four men wet drill. We understand that the winning times constituted a record in any drills of this class.

Places of Worship and Electric Lighting.—A correspondent says the trustees of a score of chapels in and around Bolton have put down on their business agendas for the next quarterly meeting, the question of adopting electric lighting.

Meter Approved.—The B. of T. has approved of meter No. 369,278 deposited by the Electrical Co, Ltd., on June 12th, 1903, and known as the Electrical Co.'s single-phase alternating-current watt-hour meter, typo L.J.

Electrical Works in Russia.—A special dispatch from St. Petersburg to the *Financial News* reads as follows: "The use of electricity in Russia is still somewhat limited. There are only 30 cities possessing an electric tramway system, and of the 80 cities lighted by electricity, 40 have their own electrical works, the supplies in the remainder being provided by private enterprise. The following figures show that the electrical undertakings in Russian cities are very remunerative. The net profits of the works of the City of Vilna were 83,851 roubles, or 50 per cent.; Wolvgda, 18,078 roubles, or 39 per cent.; Minsk, 14,849 roubles, or 35 per cent.; Nicolaieff, 34,554 roubles, or 33 per cent.; Orenburg, 38,064 roubles, or 44 per cent.; Poltava, 28,642 roubles, or 49 per cent.

Trade with Sweden.—"Why not extend your trade connections with Sweden?" is the question which the Swedish Chamber of Commerce in London is asking British manufacturers and merchants. Comparatively few English firms send travellers to Sweden, whereas German travellers are there in abundance. The Swedish Chamber of Commerce, 5, Lloyd's Avenue, London, E.C., of which His Majesty the King of Sweden is a patron, have several departments which give facilities to firms wishing to establish Anglo-Swedish trade connections, and also a Credit Information Department, through which the interests of members are safeguarded. Lately a Special Intelligence Branch has been added to the Chamber, which circularises to the members particulars *re* trade openings and new markets, &c.

Catalogues and Lists. — Messrs. Cowans, Ltd., Springfield Lane, Salford, Manchester. — Illustrated card giving prices of their low-tension oil circuit-breakers and switches.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Illustrated leaflets containing descriptive particulars of a newly completed line of control apparatus for squirrel cage induction motors. They deal respectively with types "P" and "O P" auto-starters for motors of from 1½ to 200 h.p., 100 to 600 volts; main, reversing and direct starting switches for d.c. and two or three-phase motor circuits (up to 70 amperes on 1,000 volts); two, three and four-speed starters; star-delter and series-parallel starters for two and three-phase motors.

The British Prometheus Co., Ltd, Salop Street Works, Highgate, Birmingham.—New season's catalogue (34 pages) of electric heating apparatus. The Prometheus convector principle is first described, and a fine assortment of artistic designs of convectors and luminous radiators occupy the remainder of the book, some new Adams' designs being included. Among interesting novelties we observe an imitation log-fire in which convector elements are employed, and the imitation logs themselves are illuminated; also a circular four-lamp beaded radiator, the colouring of which we should think produces a very good effect. All the designs in the book are admirably printed, and prices are set forth.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, E.C.—We have received a novel showcard of large dimensions (38 in. × 26 in.), on which are mounted actual samples of the "Parlyphone," which has been completely remodelled. As shown in the accompanying illustration, the reception room instrument, finished in cream and nickel, and the kitchen set, finished in black and nickel, are illustrated in their appropriate surroundings. The showcard is accompanied by a booklet, No. 157, giving particulars and prices of the apparatus, for ringing one way, as shown, or both ways, and various accessories, as well as diagrams of connections. This forms, we believe, an entirely new departure in showcards. We hope the example will be followed by the manufacturers of radiators, lamps, cooking apparatus and turbo-generators. The parlyphones, of course, speak for themselves; we have put one into use, and find it quite satisfactory.

A Novel Showcard.

The Crosthwaite Fire-Bar Syndicate, Ltd., York Street, Leeds.—Pamphlet containing illustrations of, and information relating to, the Holehouse and Crosthwaite patent water-cooling plants, for electricity and other works. Large drawings appear of exhaust steam turbo-generating installations with patent barometric condenser, and with patent low-level jet condenser.

Messrs. Spagnoletti, Ltd., Goldhawk Works, Goldhawk Road, London, W.—Interesting wall calendar for 1910, on which a number of pictures in colour appear showing the excellent service that can be rendered in the different departments of the house by the "Therol" system of electric heating. The calendar does not contain the name of Spagnoletti, but refers the reader to "The Manager, Electric Supply Station," for full particulars.

The Tudor Accumulator Co., Ltd., 119, Victoria Street, London, S.W.—Sixteen-page pamphlet, in which is given an illustrated account of the T.A.C. system of electric train lighting.

Messrs. Archibald J. Wright, Ltd., Leyton Green Road, London, N.E.—Several new lists, which are of seasonal interest just now in view of the present-giving occupation which we shall all find so pleasurable before many weeks are past. A large variety of electrical goods and scientific and mechanical novelties are covered in a 32-page catalogue; pocket, flash and other lamps and a number of small electric toys are set forth in a leaflet; further circulars give prices of armature stampings, the "monowatt" metallic-filament lamp, and a list of trade discounts.

Union Electric Co., Ltd., Park Street, Southwark, S E.—Advance copy of list No. 91 (of a size suitable for the overcoat breast pocket), wherein are given in the course of 64 pages of very neatly arranged and well illustrated matter, full particulars, pictures and prices of the company's manufactures—motors, dynamos, arc lamps, switchgear, meters and other electrical apparatus for all industrial purposes.

The Bryant Trading Syndicate Ltd., Horsell Road, Highbury, London, N.—Four-fold leaflet relating to the claims of the British "Metalite" incandescent electric lamp. Four interesting pictures are intended to illustrate the four stages in the advance of lighting —200 years ago, the candle; 150 years ago, the oil lamp; 100 years ago, gas lighting; 1908, "Metalite" lamps. We will not vouch for the accuracy of those dates, but the pictures well serve the object of the firm.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Illustrated leaflet relating to the "Economic" electric stove suitable for 100 to 250 volts and for A C. or D.C. circuits. It also shows a combined polished aluminium radiator and stove.

The Electrical Co., Ltd., 121—5, Charing Cross Road, W.C. —Two illustrated lists in their usual form, one showing and giving prices of motor starters for continuous-current motors; the other particularising a number of accessories such as lampholders, tumbler switches, adapters, and so on.

Mr. George Ellison, Warstone Lane, Birmingham.—Price leaflet of mill type ironclad switches and fuses.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—20-page catalogue (No 301) just issued for the 1909-10 season, containing particulars of the various types and sizes of "Efesca" metal-filament lamps that they have in stock. Comparative information is given as to the running cost of "Efesca" and carbon lamps, for the use of contractors and dealers in educating consumers up to the current-saving qualities of the lamps. Particulars appear of the reduced prices for "Efesca" auto-transformers. Members of the trade can have copies of the list on application.

Mr. G. Wuthrich, Norfolk Street, Strand, W.C.—12-page illustrated descriptive list relating to the Oerlikon portable, electrically-driven hand-drilling machine for D.C., single, two and three-phase A.C. Prices and data are tabulated.

The Brush Electrical Engineering Co., Ltd., 106-112, Belvedere Road, London, S.E.—8-page price list of Brush "Metallum" (Colloid-Tungsten) lamps. Illustrations appear of both pear and round shaped bulbs, and of a number of adapters for series lamps, cluster and shop window fittings and shades.

Trade Announcements.—Messrs. Tetley & Co., of Salford, have been appointed sole agents for Lancashire and Yorkshire by the Electrical Apparatus Co., Ltd., Milford Works, Queen's Road, Battersea, London, for the sale of their motor starting and control gear.

The business of The Bell Telephone and Electric Co., of Great Smith Street, S.W., has been acquired by Messrs. Frederick Hodgson & Co., of 24, Queen Victoria Street, E.C., and will in future be carried on under that name.

The Cowper-Coles Engineering Co., Ltd., now have their new works at Willesden in full working order, where they are making some of their specialities such as pumps, injectors, and valves, for the circulation of corrosive liquors, a new form of sand blasting machine for the removal of scale and oxide from iron and steel, machines for welding aluminium, centrifugal filters and atomisers.

Bankruptcy Proceedings.—Harry Graham, electrician, &c., Albion Street, Huddersfield.—In this case the first meeting of the creditors was held last week at Huddersfield, when it was decided that Mr. E. Netherwood, chartered accountant, and Mr. G. W. Smith, chartered accountant, should be joint trustees, a Committee of Inspection being also appointed. The liabilities were stated at £1,252, and the assets were estimated to realise £895. The failure was ascribed to losses on contracts, and to creditors pressing.

Samuel Emerson Smith, electrical engineer, 271, High Street, Lincoln.—The adjourned public examination of this debtor was held last week at the Sessions House, Lincoln, before Mr. Registrar Stephen. The liabilities were put at £125, and the assets were expected by debtor to realise £220. Replying to further questions by the Official Receiver, debtor stated that in 1904 or 1905, A. C. Smith & Co. executed an assignment; he had said to the best of his knowledge that the liabilities were about £400, and he would be surprised to hear that they amounted to over £720; he would not say they did not amount to so much, because he did not know. The Official Receiver said that in his last examination, debtor said that an offer was made to the trustee to sell as a going concern, and that it would pay about 15s. in the £ to the creditors, but debtor now said that he did not know the dividend was only between 1s. and 2s. in the £. Debtor was then examined with regard to Smith's Electrical Co., and eventually the Official Receiver asked that debtor be ordered to supply a cash account of his receipts and payments for the three months preceding the date of the receiving order. The case was again adjourned, debtor being requested to furnish the required particulars.

Dissolutions and Liquidations. — Bradford Electrical Engineering Co., Ltd., 56, Manningham Lane, Bradford. — A meeting of the shareholders was held on Monday afternoon at the offices of Mr. J. Herbert Haley, Incorporated Accountant, at 29, Tyrrel Street, Bradford, when a statement was presented showing the condition of the company's business. After some discussion it was resolved that the company could not, by reason of its liabilities, continue its business, and that the company should be wound up voluntarily under the provisions of the Companies' Consolidation Act, 1908, and Mr. J. Herbert Haley and Mr. George Edgar Corfield, incorporated accountant, of Balfour Street, Finsbury Pavement, London, should be appointed liquidators for the purposes of such winding up. The statement is not yet complete in details, but the liabilities are stated to be about £1,200, and the assets are described as substantial.

Adams-Randall Telephone Patents Co., Ltd.—At a meeting held at Dashwood House, E.C., on November 23rd, it was resolved to wind up voluntarily, with Mr. W. H. Parker as liquidator. A meeting of creditors will be held on December 8th.

W. A. Meadows & Co., electrical engineers, Hanley and Longton. —Messrs. W. A. Meadows and J. Cartlidge have dissolved partnership. Mr. Meadows will attend to debts and continue the business.

Messrs. Walker & Vickery, electrical engineers, 16, Widemarsh Street, Hereford.—Messrs. R. E. Walker and C. J. Vickery have dissolved partnership. Mr. Vickery attends to debts.

Headland's Patent Electric Storage Battery Co., Ltd.—A meeting is to be held at Finsbury House, Blomfield Street, E.C., on January 4th, to hear an account of the winding up from the liquidator, Mr. G. Dundas Price.

We learn that Mr. E. Skinner is retiring from the firm of Berry, Skinner & Co. The business will be carried on under the same name by Mr. Herbert Berry.

Charge of Stealing.—Before the Lord Mayor of London on Tuesday, A. J. Page and F. A. Clerk, both described as electricians, of Edmonton, were sentenced to three months' hard labour for being concerned in stealing and receiving from Queen Victoria Street, E.C., Osram lamps valued at £17 15s. 7d., the property of the General Electric Co., Ltd.

Stolen Cable.—William Beckett and Alfred Clark, two respectably-dressed men, were charged at the Hull Police Court with stealing about 1 cwt. of electric lighting cable belonging to the Hull Corporation. Both prisoners were fined £5 and costs, or in default 30 days' imprisonment.

Book Notices.—*Technical Dictionary in Six Languages.* Vol. 5. Railway Construction and Operation. By A. Schlomann. London: Archibald Constable & Co., Ltd. 1909. Price 12s. net.—The appearance of the fifth volume of the Deinhardt-Schlomann series will be welcomed by all who have experienced the advantages of using its predecessors. We have previously spoken so often and so highly of this invaluable series that it should suffice for us to draw attention to this new volume, without further explanation than to say that it is a verbal and pictorial dictionary of technical terms, limited strictly to the subject defined in the title. Rolling stock is treated of in a separate volume, and electric power plant has been dealt with in Vol. 2. There is a section on electric railway installations and another on signalling. We commend the work to our readers as the very best of its kind.

The Motor Manual. London: The Temple Press, Ltd. Price 1s. 6d. net.—The fact that "The Motor Manual" has reached a twelfth edition is sufficient testimony to the fact that it meets the proverbial long-felt want. The aim has been to produce a handbook that shall give the veriest novice in motor matters an insight into the many details comprised in a modern motor-car. The subjects dealt with cover the whole field of motoring, such matters as car construction, carburation, ignition by means of both accumulators and magnetos, clutches, change-speed gears, road wheels, tires, &c., all receiving attention within the 272 pages which the book contains. The text is well illustrated by clear drawings and sketches, the additions in this direction being one of the *raisons d'être* of the new edition. The work is, however, not confined to technical matters, for any motorist contemplating a tour either at home or abroad in his car will find a good deal of useful information within its pages. Other sections which have been expanded to meet new conditions are found in the chapters dealing with ignition magnetos and the electric lighting of motor vehicles. From the point of view of imparting a good deal of valuable information to non-technical motorists, there is no question that the manual should continue to meet with a large sale, for it is not only written in language that can be readily understood, but its price is within the reach of almost everyone. If we have any suggestion to make, it is that an alphabetical index might usefully be incorporated in the next edition; while the beginner in motoring will probably read the book chapter by chapter, he will, when he meets with difficulties during the course of his motoring career, want to turn quickly to the page dealing with the particular trouble that he thinks his engine or car is suffering from, a task which would be facilitated by the index that we suggest.

"Electricity." By H. M. Hobart. London: A. Constable and Co., Ltd. 1909. Price 6s. net.

"Fortschritte der Elektrotechnik," 1908. Parts 3 and 4. Berlin: Julius Springer. 1909. Part 3, Price 10 M.; Part 4, Price 15 M.

Revision of South African Railway Rates.—We learn from the Natal Government Agency that as from January 1st next the preference on railway rates from Delagoa Bay to railway stations in the Transvaal between Germiston and Klerksdorp inclusive will be reduced in favour of Durban as follows:—

	s.	d.	
Intermediate class by	2	11	per ton.
Intermediate "B" class by	1	3	"
In rough, rough "B" and "C" classes	2	1	"
Imported produce, fencing, fertiliser classes ..	0	10	"

This is in addition to the reduction effected on July 1st last, which was as follows:—

	s.	d.	
Intermediate classes by	2	11	per ton.
Intermediate "B" classes by	2	11	"
Rough goods "B" and "C" by	2	1	"
Fencing, fertilisers, imported produce by.. ..	0	10	"

The intention of the further reductions is to divert a portion of the trade at present travelling by Delagoa Bay, it having been found that the reduction made on July 1st last was insufficient to accomplish that object. Attention is directed to the advantage of consigning goods *viâ* the Port of Durban, as the effect of the further revision in rates is that the difference in favour of Delagoa Bay will be only 4s. to 5s. per ton, after allowing for the additional shipping freight and expenses at the latter port, which difference is outweighed by the superior facilities for wharfage, handling, trucking and transportation of consignments of all descriptions at the Port of Durban. Full information will be supplied on application to the Commercial Agent, Natal Government Agency, 26, Victoria Street, S.W.

Arc Lamp Lowering Gear.—The London Electric Firm, of Croydon, have recently booked a number of contracts for their "Patent One Working Part" arc lamp lowering gear. These include:—

87 for the St. Marylebone Borough Council, consisting of single and double swan necks, and centre carrier gears, for Oxford Street and Upper Regent Street.

72 for Ealing Corporation, consisting of swan necks and centre carriers on traction pillars, and on lamp pillars with tank transformer bases.

80 for the Swansea Corporation, comprising swan necks, trolley arms, and span wire gears.

The centre-pole gears are "Converted Lyres."

S.M. Electromagnetic Clutch.—The Sosnowicer Iron Works have had a 1,200-h.p. clutch on a three-high rolling mill running at 350 r.p.m. for 10 months, and have just given a repeat order to Messrs. C. E. Lugard & Co. for a clutch of 1,400 h.p. at 200 r.p.m. to be fitted to another of their mills.

Cape Colony.—Messrs. George Findlay & Co., of Cape Town, have recently opened a branch establishment at Oudtshoorn, for the supply of electrical and mechanical engineers' requirements. This is in anticipation of the electric light supply which is expected to be shortly inaugurated.

Christmas Boxes.—We have received from the Town Clerk of Keighley a copy of a resolution which was passed by the Town Council in August last, as follows:—"That all officers and employés of the Corporation be strictly forbidden to accept any gift of any description from tradesmen or others supplying goods or selling property to, or doing work for, the Corporation. Any person who is found to have violated this rule shall, *ipso facto*, forthwith cease to hold his appointment. That a copy of this resolution be sent to all persons and firms who now or may hereafter have an account with the Corporation in respect of the above matters." The Town Clerk notifies that any tradesman or other person as aforesaid offending against the above rule will be liable to be debarred from entering into any future contract with the Corporation.

Installation Contracts.—Among the installation contracts which are occupying the attention of Messrs. Tredegar and Co., of Westminster, are the following:—Austin Friars, large block of offices; St. James's Street, large block of flats; Spurr Street, ditto; St. James's Street, new premises for Messrs. Rumpelmayer; Marina Hotel, Barton; Charterhouse Square, new premises for Messrs. J. J. Smith; Norwood car-sheds, London County Council; and installations including plant at the following:—Alexandra Hospital, Clandon; High Clandon, Guildford; Hollybank, Wootton; Blatchingdon House, Seaford; Crelash, Heathfield; Halehourne, Chobham; Ewell Grove, Ewell, &c.

Carbide Agreement.—According to *Affärsvärlden*, an international syndicate has at last been formed to regulate the production and sale of calcium carbide, with offices in London and Nuremberg. The French and Italian works are not included in the syndicate, but arrangements have been made with the French firms for the purpose of preventing competition.

Burnley.—The electrical work in connection with the New Palace Theatre and Hippodrome, erected in Leeds Road, Nelson, has been carried out by Messrs. J. Batty & Co., of Burnley, and the Electrical Name and Numerical Sign Co., London, has fixed the electrical signs.

LIGHTING and POWER NOTES.

Aberdare.—The L.G.B. has sanctioned the borrowing of £17,000 by the U.D.C. for the provision of an electricity supply and a refuse destructor.

Ashton-in-Makerfield.—The Park Lane Co-operative Society has asked the U.D.C. for permission to take a supply of electricity from the South Lancs. Tramway Co., and, in the event of refusal, that it be given a supply by the Council. The matter has been referred to a Committee.

Aston Manor.—The mains are to be extended at a cost of £825, so as to supply the Villa Street and Nursery Road districts.

Australia.—The Sydney (N.S.W.) Council is experimenting with incandescent and arc lamps, with a view to determining the relative cost for street lighting purposes.

A publicity branch has been formed in connection with the electric supply department.

Barking.—A L.G.B. inquiry was held on November 24th into the application of the U.D.C. for a loan of £2,500 for electricity purposes. The sum was made up as follows: Excess expenditure, £745; new plant, £750; transformers, £250; mains extensions, £250; house services, £200; public lighting extensions, £200; meters, £105. There was slight opposition with regard to the sum applied for on account of excess expenditure.

Bexhill.—The Council has ordered 300 Osram lamps for street illumination. The working of the new cooling tower and the old condenser has resulted in the cost of production being reduced to ·44d. per unit, or exactly half what it was two years ago when Welsh fuel only was used. It is anticipated that still better results will be obtained when the new condenser is at work.

Blackburn.—A "shopping festival," which concluded on Saturday evening, and for which the Corporation offered special terms for the consumption of electricity, resulted in no fewer than 6,300 equivalent 8-c.p. lamps being specially fixed for the week.

Bridlington.—The T.C. has received from the L.G.B. sanction to a loan of £5,057 for extensions at the electricity works.

Brighton.—The Lighting Committee has recommended the Council to approve of a wiring scheme, under which a firm of contractors will provide all the wiring and fixtures free of expense, risk or responsibility to the Council, consumers to be charged 1d. per unit above the ordinary lighting rate. The extra 1d. under the scheme is to go to the contractors for the purchase of the installation by the owner of the premises wired. When the consumption reaches 240 units per point installed, the fixtures will become the property of the owner.

Burnley.—Owing to the abnormal demand for electricity meters, the loan of £500 sanctioned by the L.G.B. in 1908 to cover expenditure on meters for the next three years, has already been overspent. The Electricity Committee, instead of applying further to the Board, has instructed the engineer to debit the cost of meters to revenue account until further notice.

Caerphilly.—The U.D.C. has recently transferred its powers under a prov. order to light the district electrically to a local company which is, under the agreement with Council, authorised to light the whole of the district, with the exception of the Town Ward. The company is proceeding to connect the Aber Ward—comprising the mining villages of Ahertridwr and Senghenydd, with a population of over 20,000—with its system.

Callan.—The lighting of the workhouse by electricity occupied the attention of the Guardians at the last meeting, and a Committee has under consideration a scheme formulated by Mr. Lamh, of the Munster Electrical Co., who has a scheme in hand for the electric lighting of the town.

Canada.—Owing to an accident at the power house of the Winnipeg Electrical Co., the electric supply in the city has been cut off, and many factories and elevators have had to cease work. The tramways are giving a restricted service.

France.—The Parisian public must be somewhat tired of the joking propensities of M. Pataud, secretary of the Electricians' Union.

It is reported that on the occasion of the visit of the King of Portugal to the Opera on November 30th, 15 minutes before the commencement of the performance, the stage electricians received notice to strike unless their pay was increased to the same level as the stage hands.

Under the circumstances the managers of the Opera wisely agreed to sign a "contract," but as the men are employés of the Edison Co., and not of the Opera, it will be evident that the so-called contract is void.

Dublin.—The L.G.B. has sanctioned several amounts of of the loan of £253,428 asked for by the Corporation for various improvements in the Irish capital and suburbs. These amounts include £75,000 for electrical extension—that is, £34,210 for new works and £40,790 for work already completed.

Fife.—The first of the four 300-H.P. suction gas engines at the Rosyth naval base has been set in motion, and portions of the outworks are now lighted by electricity. When the power station and the engines are completed, comparatively little steam power will be used.

Haslingden.—At the Council meeting on November 25th, it was stated that the provisional order for the supply of electricity by the Corporation expires at the end of next February, and that as it has several times been renewed the B. of T. now intimates that it will not renew it beyond the date of expiry, unless it is shown that it is being utilised. In these circumstances the Corporation is making inquiries with a view to ascertaining if a reasonable number of people will take current for lighting or power.

London.—Marylebone.—In order to push the sale of apparatus having 100 per cent. load factor, the Council has approved of a tariff of 1d. per unit on same. The general manager of the electricity undertaking has been authorised by his Committee to expend £60 during the ensuing year upon literature produced by the Associated Municipal Electrical Engineers (Greater London) through their Publicity Committee. It is explained that this is not a subsidy, as the literature would be produced by the department in any case, but at a greater cost and at much greater trouble. The General Purposes Committee has agreed to have new fittings and additional wiring at the Town Hall; also electric radiators in the positions where gas stoves are now. Last year's account for electricity and gas amounted to £157, of which £30 was for gas. The cost under the new scheme will be £167, of which £24 will be for electric heating. For the small additional cost, the candle-power of the lighting will be increased nearly 2½ times. The cost of the installation is estimated at £137.

Hornsey.—The Council has decided that the rates for energy to be charged for motors used for the purpose of driving gas compressers be in each quarter 13s. 4d. up to 20 units, and for each unit over 20 units, 6d. In the case of Therol heaters the charge for a 200-watt heater is to be 7 guineas per annum, and *pro rata* for other sizes, provided the current is used for the purpose of the heaters only.

Hampstead.—With a view to encouraging the use of electricity for heating and power purposes in private houses, the Lighting Committee has been authorised to enter into agreements with occupiers on a basis of £8 5s. per KW. per annum (payable in advance) for the maximum demand required for lighting houses throughout with electric light, together with 1d. per unit for all current supply, for whatever purpose it may be required.

Mansfield.—The T.C. has decided to give an abatement of 10 per cent. to consumers of electricity through slot meters. The mains are to be extended at a cost of £250, in order to supply energy to the new rescue station in York Street, Mansfield Woodhouse.

Merthyr Tydfil.—In spite of the refusal of the L.G.B. to assent to the proposal of the B.G. to substitute electricity for gas for lighting the workhouse, the Guardians have decided to have included in all future specifications for new buildings the wiring of the same for electric lighting.

Middlesbrough.—The T.C. is seeking powers to deal in and to let out on hire electrical fittings and apparatus.

St. Austell.—The U.D.C. has accepted the tender of the Electricity Co. for public lighting for three years. The tender was £179 4s. 6d. per annum against £269 for gas.

Sheffield.—The T.C. has decided to apply for a prov. order for electric lighting for the parish of Tinsley.

Spalding.—The B. of T. has revoked the 1905 prov. order.

Tipperary.—The Board of Guardians has had under consideration the lighting of the workhouse by electricity, Mr. L. J. Lawless, M.I.E.E., Dublin, having been engaged to prepare a scheme.

Trowbridge.—The B. of T. has revoked the Trowbridge Urban, Bradford-on-Avon Urban and Rural order of 1904.

Widnes.—The T.C. is seeking a prov. order to alter and amend the orders of 1901 and 1904. A new compulsory area of supply is scheduled, and power is sought to supply in bulk both inside and outside the borough, and to lease the powers to the Salt Union, Ltd., or any other company.

Wimbledon.—A charge of 2d. per unit is to be made for energy supplied to tradesmen for the purposes of Christmas decorations, provided their premises are wholly lighted by electricity supplied by the B.C.

Wolverhampton.—A L.G.B. inquiry was held on Friday, last week, into an application by the Corporation for sanction to borrow £10,000 for the purposes of the electricity undertaking. Mr. C. E. C. Shawfield, the Corporation's electrical engineer, remarked that advantage was being taken of electricity as a motive power, and added that the profit per unit on the output was one-tenth of a penny. The Inspector observed that this was a small profit, and did not admit of a reduction in price without putting the Corporation on the wrong side. Mr. Shawfield replied that if undertaking was run by a company, they would, after setting aside a sufficient sum for depreciation, be able to pay a dividend of 6 per cent.; and very few electric lighting companies in the country were so sound as the Wolverhampton Corporation's undertaking. At the Inspector's suggestion, it was decided to increase the loan applied for to £15,000, and the town clerk said the necessary resolutions to this effect should come before the Council meeting in December. Details of the proposed expenditure were given, after which the inquiry closed.

TRAMWAY and RAILWAY NOTES.

Australia.—The report on the working of the N.S.W. Government Railways and Tramways for the quarter ended September 30th last, shows that 155 miles of tramways are open, 5,157,600 car-miles were run and 46,745,626 passengers were carried. The revenue amounted to 1s. 0¾d., and the expenses to 10¾d. per car-mile.

Blackpool-Fleetwood.—The appeal of the Blackpool and Fleetwood Tramroad Co. against the Fleetwood U.D.C. and Improvement Commissioners as to the rating of the company's track as a tramway instead of a railway, has been dismissed at the Preston Sessions. The Court consented to state a case.

B.E.T. Tramways.—An innovation in the form of a new system of fare collecting is to be introduced on the tramway systems controlled by the British Electrical Federation, in the New Year. The idea is to replace the present method of overlapping stages by a system under which the route is divided up into equal ¼d. sections, which will be indicated to the passenger by painting black or white bands round the poles and numbering them according to the section. The tickets will be printed with alternate dark and light sections numbered to correspond with the route sections, and in different colours to distinguish the denominations. The minimum fare is to remain 1d., and on many routes the long-distance fares will be on the basis of more than four sections for 1d. In order to get over the difficulty introduced by the use of the ¼d., it is proposed to issue books of ¼d. tickets.

Burnley.—The covered-top cars have proved so successful that the Corporation is to have others converted. The covered cars are almost a ton heavier, but the new truck provided for them has been responsible for a reduction in the energy consumed by the cars.

In proceeding from Rosegrove to Burnley, an electric tramcar on November 25th failed to take the points properly. The front bogie took the wrong points but the back one took the right ones, with the result that the car swung practically across the street. The rear portion of the car struck a brewer's dray, and both tramcar and lorry were damaged.

Continental Notes.—Switzerland.—Plans are being prepared in respect of a projected electric tramway between Basle, St. Jacob, Liestal and Sissach.

Germany.—An electrical motor-hearse has recently been put in service at Stahnsdorf, near Berlin.

Dublin.—A deputation recently waited on the directors of the Dublin United Tramways Co., with a view to inducing the company to extend its system into Blanchardstown, Castleknock and Cabra.

Edinburgh.—The Corporation Tramway Committee has sent to a sub-committee for consideration two schemes for electric tramways to Queensferry. The latest proposal was submitted from a company, for which Messrs. Deas & Co. are agents. The route is from Queensferry Street *via* Belford Bridge.

Ilford.—At the last meeting of the District Council the Tramways Committee recommended that the new tramway manager's commencing salary be £300 per annum, rising by annual increments of £25 to £400. Councillor Sheat said that they proposed to appoint an electrical engineer with workshop training. He would have to be a good manager and organiser. Councillor Stroud said that at present they had no expert engineer to answer questions at, say, a Board of Trade inquiry after a bad accident. The recommendation was carried.

Liverpool.—Authority has been granted by the Electricity and Tramways Committee for the building of an experimental tramcar capable of providing 20 per cent. more inside accommodation than is available in the present class of car. The new car is to be built at the Corporation's Lambeth Road works, and it is hoped thereby to mitigate the inconvenience of "strap holders."

London.—Parliamentary notice has been given of a Bill for the construction of an electric railway linking up the District terminus at Wimbledon with Sutton, and passing through Merton, Morden, Carshalton and Cheam. The Sutton terminus will be in the Brighton Co.'s station, with a view to providing for interchange of traffic. The Brighton Co.'s train connection between Sutton and Wimbledon is notoriously bad, slow trains requiring 72 minutes for the 5-mile journey.

L.C.C.—The proposals in regard to through-running between Aldgate and the East and West Ham and Leyton Councils' systems, which were referred to in our last issue, have been adopted by the L.C.C.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee on November 25th a letter was read from the B. of T. suggesting that a conciliation board should be formed on lines similar to those adopted by the L.C.C. for the purpose of dealing with the grievances of the employés. The Committee did not adopt the suggestion, as it considered that the men's grievances were not of so serious a nature as to necessitate the formation of such a board. A large number of the men have decided to withdraw their labour if their complaints are not remedied, but the actual decision to strike is held in abeyance.

Portsmouth-Hayling.—The Light Railway Co. has applied to the Light Railway Commissioners for an order to revive and extend the period limited by the order of 1905.

TELEGRAPH and TELEPHONE NOTES.

American Combine.—It is rumoured that the amount of shares acquired by the American Telegraph and Telephone Co. in the business of the Western Union Telegraph Co., was 4 to 5 millions sterling, out of the 20 millions stock of the latter, probably with voting rights on an additional amount.

Cable Repairs.—Jamaica-Porto Rico, repaired November 25th; Paramaribo-Cayenne and Cayenne-Salinas, repaired November 29th.

Canadian Telegraph Rates.—The Board of Railway Commissioners has peremptorily forbidden the Canadian telegraph companies to put in force the new rule respecting code words, mentioned in our last issue.

Extension of Patent.—Notice is given in the *London Gazette* that Mr. Marconi intends to apply for the extension of Letters Patent No. 12,039, of 1896, on January 15th, 1910; notices of opposition to the application must be lodged in the Chancery Division of the High Court of Justice on or before January 14th, 1910.

Nottingham.—In view of a proposed transfer of the headquarters of the North Midland District engineering staff to other centres, a deputation recently waited on the Postmaster-General, who, it was understood, decided to remove the clerical staff only, leaving the whole of the electrical engineering staff and workshops at Nottingham. It turns out, however, that this was a mistake, and only the sectional staff will remain.

South Africa.—The Natal Government is placing an order with the Marconi Co. for the establishment of a station at Durban, with a range of 350 miles. It is proposed that stations should be erected on the Cape coast at Saldanha Bay, Cape Agulhas and Port Elizabeth. Steamers equipped with the system will be in communication with land two days before they reach Cape Town or Durban.

Turkey.—Renter announces that the Commission charged with the examination of the tenders for the establishment of a telephone system in Constantinople has pronounced in favour of the Anglo-Franco-American group, composed of gentlemen connected with the National Telephone Co., Ltd., and the British Insulated and Helsby Cables, Ltd., both of London; the Western Electric Co., of Chicago; and the French Thomson-Houston Co. The choice of the Commissioners is subject to the approval of the Minister of Finance, but that is considered to be certain.

Wireless Telegraphy.—According to an American Consular report, the Russian Government has decided to send an official of the Telegraph Department to the United States, for the purpose of making arrangements with some American wireless company so that communication may be established between the United States and the wireless station to be built at Kamchatka.

It is reported that the Marconi Co., in return for a licence to erect a station at Johannesburg, offers to compete with the cable companies by accepting messages at 1s. a word, instead of the present 2s. 6d. rate. A 20-years' licence is asked for, and the Marconi directors are prepared to insert a clause in the contract to the effect that the station shall become Government property at the end of that period.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—Year's supply of colliery stores, for Powell Duffryn Colliery Co. F. Hanford, secretary, 101, Leadenhall Street, London, E.C.

Aberdeen.—The Corporation Electricity Department invites tenders for the supply of ironmongery, brass, lead and tin work, wrought-iron tubes and fittings and other stores. J. A. Bell, electrical engineer, Millburn Street.

Australia.—Melbourne.—December 6th. 230 A.C. and 160 D.C. electricity meters for the Council. See "Official Notices" November 19th.

Melbourne.—December 8th. 4,508 yards of single-conductor lead-covered cable, and 1,500 yards three-core lead-covered cable. See "Official Notices" November 26th.

Melbourne.—December 13th. 50,750 incandescent lamps for the City Council. See "Official Notices" November 26th.

Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

March 16th, 1910.—A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Perth.—December 14th. Battery material, telegraph instruments, telephone switchboards, lead-covered cable, and measuring instruments for the P.M.G., Perth. Apply Commonwealth Offices, 72, Victoria Street, S.W. Time is short.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

January 31st.—The municipal authorities of Waremme are inviting projects for the establishment of a central electric station in the town.

Cape Town.—January 5th. The Corporation require tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Durham.—December 13th. Stores, including electric fittings, for the Trimdon Grange Colliery Co. (Walter Scott, Ltd.), Durham.

Eccles.—E.L. fittings for Beech Street Schools, for the Borough Education Committee.

Edinburgh.—December 6th. Electric lighting installation at the refreshment rooms, blood-treating house, &c., in connection with the Corporation's new slaughterhouses at Gorgie. F. A. Newington, electrical engineer. Deposit £1 1s.

Govan.—December 13th. Turbo-alternator, rotary converters, and high-tension switchboard for the Electricity Committee. See "Official Notices" to-day.

India. — Lucknow.—December 31st. The Municipal Board invites proposals for the supply of electrical energy, coal or oil gas. See this column for October 29th, and an article in our issue of November 19th.

London.—Stepney.—The Council is about to invite tenders for a complete system of coal and ash handling plant, consisting of riverside electric crane and grab, weighing hopper, gravity bucket or telpher type of conveyor, and auxiliary plant. Pending the carrying out of this work, an electric hoist, at £62, is to be obtained from Lambie, Wrigley & Co., for the removal of ashes from the basement at Blyth's Wharf.

Southwark.—38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" to-day.

L.C.C.—December 14th and 15th. Overhead electrical equipment for the construction on the four-wire system of electric traction from Woolwich to Eltham. Electric light and bell wiring and fitting for the Poplar Divisonal offices for the L.C.C. See "Official Notices" to-day.

Llwynypia.—December 10th. Electrical accessories and fittings for six months, for the Cambrian Collieries, Ltd., Glamorgan Coal Co., Ltd., and the Naval Colliery Co., Ltd.; General Offices, Llwynypia, Pontypridd.

Manchester.—December 13th. Wiring and complete E.L. installation (about 700 lights), at Harpurhey Baths; City Architect, Town Hall, Manchester, (Returnable deposit, £2 2s.)

Middleton.—December 7th. Coal for the Corporation electricity works; Mr. S. Pauls, electrical engineer.

Poplar.—December 8th. Electric fan and fittings for the Workhouse Laundry. See "Official Notices" November 26th.

Prussia.—December 7th. The Prussian State Railway authorities at Dortmund are inviting tenders for the supply of two electrically-operated coal-loading cranes.

Roumania.—December 10th. The municipal authorities of Bucharest are inviting tenders for the establishment of a central power station for the supply of the current required for the electric tramways and for electric lighting purposes on the outskirts of Bucharest, as also for the establishment of a sub-station in the centre of the town.

Russia.—March 14th, 1910. The municipal authorities of Samarkand are inviting tenders for the concession for the construction and working of eight kilometres of electric tramways in the town.

Spain.—December 10th. The municipal authorities of Tabernas (Province of Almeria) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

The Direccion de Telegrafos has been authorised to acquire 400 kilogrammes of covered wire, 20 metres of type B cable, and 4,000 metres of aerial telephone cable, with 28 conductors.

December 15th.—Urban telephone system of Gijon for 15 years. Deposit £110. Local representation. Fuller information in *Board of Trade Journal.*

CLOSED.

Algeria.—The Post and Telegraph authorities in Algiers have just given out contracts as follows:—

La Société des Trefileries et Laminoirs du Havre.—10 tons of galvanised iron wire 3 mm. dia., at 310 fr. per ton, and 150 tons ditto 4 mm. dia., at 300 fr. per ton.

La Compagnie d'Electricité, of Paris.—Fifty tons of copper wire 2½ mm. dia., 30 tons ditto 3 mm. dia., 55 tons ditto 3½ mm. dia., and 80 tons ditto 4 mm. dia., at 2,150 fr. per ton.

Bolton.—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the purchase of scrap copper, and that of Messrs. W. Hamer & Co. for the purchase of scrap brass, scrap lead and burnt iron.

Burnley.—The E.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the supply of 450 yards of ·25 sq. in. cable and 900 yards of ·5 sq. in. cable for £454.

Canada.—TORONTO.—Another example of what British firms are doing in Canada, is the placing of the order by the city of Toronto, for four pumps each to deliver 13,500,000 gals., and four each to deliver 16,000,000 gals. in 24 hours, with Jens Orten Böving and Co., of London, E.C. The pumps will be somewhat similar in design to the two pumps each to deliver 100,000 gals. per minute, which this firm are supplying to the Alexandra Docks, Newport, (Mon.). In the design of these large units, Messrs. Böving & Co. derive useful information and practice from their work in connection with water turbines. It will be remembered that another of their recent orders for Canada was for five turbines each of 5,300 H.P, and two of 450 H.P. for the city of Winnipeg.

Contracts for a new power plant were given out at Bracebridge, Ont., a few days ago. The construction of the general works of the hydro-electric development of Wilson's Falls, Muskaka River, consisting of dams, coffer dams, rock excavation, concrete walls, foundations, &c., was awarded to Canadian Contracts Co, Ltd., Toronto, for $19,341; hydraulic machinery, including 1,100-H.P. turbine, 35-H.P. turbine, governor penstock, to Wm. Kennedy and Sons, Owen Sound, Ont., at $3,100; for the electrical machinery, including generator, exciter, switchboard, &c., the Canadian General Electric Co., Toronto, $5,724. There were a large number of tenderers in each of the three classes. At Ottawa the contract for the 10-circuit repeater switchboard and storage battery was awarded to the Northern Electric Co., of Montreal, for $8,497.

Dundee.—Messrs. Thermit, Ltd., have received an order for one of their complete rail grinding outfits for the Corporation Tramways.

East London (South Africa).—Messrs. Thermit, Ltd., have received an order for the necessary material and appliances for the welding of 500 joints in connection with the extension of the tramways, also for one of their rail grinders (Mattinson's patent).

Falkirk.—The offer of Mr. Cuthberton, Falkirk (£136), has been accepted for the electric light installation in the Falkirk High School extensions.

Hull.—The tender of Messrs. A. Bannister & Co. for the supply of coal was accepted by the E.L. Committee, at 8s. 3d. per ton. This, it was pointed out, was an increase of 2d. a ton on last year's price. Mr. Lofthouse remarked that it would make a difference of about £300 a year to the committee. The engineer commented that the price of slacks would continue to go up until people went back to hard coal. A considerable quantity of slacks was being exported for manufacturing purposes.

London.—ADMIRALTY.—The Electrical Apparatus Co., Ltd., has secured the Admiralty contract for Admiralty pattern No. 624 enclosed fuses, up to December, 1911. This is in addition to contracts for other fuses placed with the firm by the Admiralty two months ago.

STEPNEY.—The B.C. Electricity Department is purchasing 50 tons of moulded pitch from Messrs. Crow & Sons for £75.

L.C.C.—The Fire Brigade Committee received tenders as follows for the electric wiring and fitting of two fire stations:—

WATERLOO ROAD STATION.

G. E. Taylor & Co.	(accepted)	£209.
W. J. Fryer & Co.		222.
Tilley Bros.		226.
W. Leonard & Co.		240.

CAMBERWELL NEW ROAD STATION.

John Barker & Co., Ltd.	(accepted)	£140.
W. J. Fryer & Co.		168.
Pinching & Walton		176.

MARYLEBONE.—The B.C. has accepted the following tenders:—

Lea Recorder Co.—One Lea recorder, £70.

Crompton & Co.—One Crompton direct-current converter, £195.

Salford.—The T.C. has accepted the tender of Messrs. Bertram Thomas (Manchester) to supply and fit electric bells at Seedley Baths for £50 10s.

Shanghai.—The lamp contract mentioned last week was only part of that given out by the Shanghai Municipal Council. The agents of the General Electric Co., Ltd., in Shanghai, secured the order for 11,625 Osram and 4,850 Robertson lamps.

Sydney (N.S.W.).—Following the discussion in Sydney as to the type of turbines to install for the extensions, the final selection has fallen on Willans & Robinson turbines, and on Dick-Kerr alternators, at £44,547. Two units of 4,000 KW. each, running at 750 R.P.M., are to be installed. The prices included a 400-KW. unit in addition to the two 4,000-KW. units.

Wallasey.—The contract secured by Messrs. Imeson, Finch & Co., Ltd., to which we have already briefly alluded, is for the supply of material in connection with the Council's tramway extension of 3½ miles. It includes the supply of 326 poles, 7½ miles of trolley wire, and the necessary crossings, bonds, ears, &c.

Walthamstow.—The U.D.C. has accepted the following tenders for coal for the electricity undertaking:—

Rickett, Smith & Co.—750 tons of Ammanford coal, at £1 per ton.

A. Blackmore & Co.—750 tons of Yniscedwyn coal, at £1 0s. 5d. per ton.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, December 3rd. At the Technical College, Glasgow. Discussion on "The Training of an Electrical Engineer," led by Messrs. F. A. M'Gowan and G. G. Cree.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, December 7th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Electric Cranes," by Mr. A. L. Hawes.

Institution of Civil Engineers.—Tuesday, December 7th. At 8 p.m. Paper on "Marine Propulsion by Electric Motors," by Mr. H. A. Mavor.

Association of Engineers-in-Charge.—Wednesday, December 8th. At 7.30 p.m. At St Bride's Institute, E.C. Paper on "Recent Developments in Impulse Steam Turbines," by Messrs K. Andersson and E. Meden.

Saturday, December 11th. At 1.30 p.m. Visit to the Woolwich works of Messrs. Siemens Bros. & Co., Ltd.

Institution of Electrical Engineers (London).—Wednesday, December 8th. At 7.30 p.m. At the Hotel Cecil. Annual dinner.

Thursday, December 9th. At 8 p.m. At the Institution of Civil Engineers. Paper, "Notes on Methods and Practice in the German Electrical Industry," by Messrs. L. J. Lepine and A. R. Stelling.

Physical Society.—Friday, December 10th. At 8 p.m. Annual exhibition.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, December 6th.—"A" Company. Technical drill, 6.30 to 9.30 p.m.

Tuesday, December 7th.—"B" Company. Technical drill, 6.30 to 9.30 p.m.

Wednesday, December 8th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, December 9th.—"C" Company. Technical drill, 6.30 to 9.30 p.m.

Friday, December 10th.—"D" Company. Technical drill, 6.30 to 9.30 p.m.

Saturday, December 11th.—"C" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station, 3 p.m. Dress: Service dress with putties; belt, frog and arms; knife, fork, and toilet requisites will be carried in haversack; great coat will be worn overall. Tickets will be issued at the railway station by C.S. M. Paris.

(Signed) P. H. CAMPBELL Capt. R.E. and Adjutant,
For O.C. E E., L.D,

NOTES.

National Electrical Manufacturers' Association (Incorporated).—The next Committee meeting of this Association will be held at Balfour House, Finsbury Pavement, E.C., on Tuesday, December 14th, at 2.30 p.m.

Concert.—A smoking concert was held on Wednesday last week to celebrate the fifth anniversary of the inauguration of the Smethwick Electricity Supply. It was held by the staff of the Smethwick and Oldbury Electric Light and Power Supply. A number of power-users in the area were represented, and Mr. Reilly (Muntz's Metal Co.) occupied the chair. During the interval the chairman proposed "Success to the Smethwick and Oldbury Electric Light and Power Supply." He mentioned that they started at the power station five years ago that day with one consumer, and they supplied 900 units; on the day of the concert they had 300 consumers, to whom they had supplied 31,000 units. He hoped that next year their consumers would be largely increased, and that they would sent out 60,000 units daily. Mr. R. W. Cramp, the general manager, in responding, said that in view of the anticipated increase, they were preparing to nearly double their plant.

Electrical Football League.—The second annual concert and distribution of trophies and medals takes place on Saturday, December 11th, at Brook Green Works. Hammersmith, by kind permission of the directors of Messrs. Robertson Electric Lamps, Ltd. We are informed that an excellent programme is being arranged.

Inquiries.—Correspondents wish to know where resistance wire of nickel-chromium can be obtained, and the composition of alundum; the makers of Gilsonite asphalt; makers of wire frames for silk shades; makers of appliance for measuring current density in different parts of a secondary cell.

Parliamentary.—Royal Assent.—Last week the Royal Assent was given to the Electric Lighting Act, 1909, and to the Colinton Tramways Order Confirmation Act.

Electric Searchlight Carbons.—Mr. Carlile asked Mr. McKenna, the First Lord of the Admiralty, on Wednesday whether the Admiralty purchased the greater part of the carbon for the electric searchlights of warships from Germany, and whether, in the event of the foreign supply not being available, manufacturers in this country would be able to meet a sudden demand. Mr. McKenna said the answer to the first part of the question was in the negative. The whole of the carbons purchased by the Admiralty for the searchlights of H.M. ships were made in this country. The answer to the second part of the question was in the affirmative.

The Japan-British Exhibition.—We have already done our utmost to impress upon British manufacturers the importance of their devoting very serious attention to the opportunity that will be afforded them next year of bringing their names and their products under the notice of the many Japanese and other foreign visitors who are expected at the Anglo-Japanese Exhibition at Shepherd's Bush. The importance of the event commercially has already been recognised by such firms as Messrs. Armstrong, Whitworth & Co., Messrs. Vickers, Sons & Maxim, Messrs. Platt Bros. & Co., and many others who have booked large allotments of space at the exhibition. It is hoped that there will be a good response from electrical and allied engineering firms who desire to promote new business relations on their own behalf, and in the interests of the entire industry to co-operate in making the demonstration a thoroughly representative one of British machinery and apparatus. In the Machinery Hall the exhibits are to be purely British. For years Japan has bought very largely of our mechanical products. In all other portions of the buildings at the Great White City, in 1910, Japan will be demonstrating her commercial and intellectual progress, as well as her naval and military achievements. As Count Mutsu, Councillor of the Japanese Legation in London, has publicly declared: "Naturally, we shall try to invite your attention to some of our products, as yet unfamiliar to you, a knowledge of which may be to your interest and advantage, and if possible, to give an impetus to our exports to Great Britain, which are less than a quarter of your exports to us, and only one-fifth of our exports to the United States. Moreover, in doing this, we have the satisfaction of not competing with your home industries, seeing that the principal items of our exports to you—various species of rice, silk, copper, &c.—are articles which do not interfere with your own productions. We are not concerned with our exports alone, but with the other side of our trade with you."

Institution and Lecture Notes.—King's College Engineering Society.—The sixteenth annual dinner of the King's College Engineering Society took place on Saturday night at the Trocadero Restaurant; Prof. Capper occupied the chair, and the guest of the evening was Dr. Fleming, of University College.

Institution of Municipal Engineers.—The roll of the Institution now stands at 641 members and 92 students, making a total of 733.

The "Contract Demand" System.—The following letter has come to hand as we go to press:—

"I gather from your leader in this week's Review that the limiter system of charging for electric light is somewhat of a novelty in the old country, at which I am surprised, as it has been extensively used on the Continent for many years past. I venture to think, therefore, that the following information may be of interest to those who contemplate its introduction. Here, electric light is essentially the poor man's light; and no doubt this is partly due to the *à forfait* (contract) system of charging. During the last six months we have in this town connected 59 new installations of less than 10 (equivalent) 8 c.p. lamps apiece, and of these 10 have one 8-c.p. lamp only.

"Our charge per 8-c.p. lamp is 1s. per month for shops using the light till 10 p.m., and 1s. 5d. per month for all-night use. Apartments are only accepted at the all-night rate, as in their case control is difficult.

"Without a contract system it would be impossible to cater for these single-light consumers, because even with a 3-ampere meter (for which we charge 5d. per month) the rental would increase the cost of the light by 40 per cent., while the cost of consumption, if paid by unit, would probably largely exceed the contract price, as most of these small installations are long-hour consumers.

"Then the saving in capital expenditure is no small advantage—the cost of a limiter being 7s. or 8s., as against 37s. for a meter—while there is no expense in meter reading.

"Many companies, in addition to the limiter, have all the lamps sealed into special holders, the lamps having a different size of socket for each candle-power; but these are unnecessary complications as a good limiter can be depended on to cut out a 10-c.p. lamp, if set for an 8-c.p. The type of limiter which we use now exclusively, acts also as an automatic switch in case of a short circuit, thus saving the expense of a fuse.

"I shall be interested to read Messrs. Handcock and Dykes's paper.

"W. A. Brodie, M.I.E.E.

"San Remo, Italy.
"*November 29th*, 1909."

The limiter system is not new in this country, but has been very little used here. The prices obtained by Mr. Brodie would make our station engineers very happy; clearly, he has not to compete with gas at 2s. 2d.!

New Company.—As we go to press the Electrical Co., Ltd., inform us that the A.E.G. have disposed of their installation and consumers' business to a new company called A.E.G. Electric Co., Ltd., and that from January 1st the Electrical Co., Ltd., business will again be strictly wholesale, and they will confine themselves to the electrical trade exclusively, dealing only with electrical contractors, electric supply companies and electrical wholesale houses. All other business, including installation business, has been transferred to the A.E.G. Electric Co., Ltd.

Appointments Vacant.—Electrical fitter for H.M. Dockyard, Sheerness (34s.). Junior shift engineer for Bexley tramways department (27s. 6d.). Switchboard attendant for Eccles electricity works (24s.).—See our advertisement pages.

Manchester Engineering Exhibition.—The International Trade Exhibitions, Ltd., ask us to state that there is no foundation whatsoever for the rumour that the General Engineering Exhibition, of which they were appointed organisers at a meeting held some months ago, has been abandoned. The Exhibition will take place in the spring of 1911 in Manchester, and will last for six weeks. A special building will be erected early next year, which will be more than double the size of any existing Manchester building. Exhibitors will participate in the profits. The organisers will send out particulars early next year.

European Water Powers.—The *Elektrotechnische Zeitung* has made a partial estimate of the hydraulic power of the various European countries. According to it the horse-powers at the turbines available for nine months of the year are as follows:—

In the United Kingdom	963,000
Germany	1,425,900
Switzerland	1,500,000
Italy	5,500,000
France...	5,857,000
Austria	6,460,000
Sweden	6,750,000
Norway	7,500,000

Spain's position is not indicated, but it is probably between those of Italy and Switzerland. The horse-power of the United States is estimated at 150 millions.

Electric Power in Tasmania.—Addressing the members of the Royal Colonial Institute on Tuesday last week on "The Resources and Future of Tasmania," the Hon. J. McCall (Agent General) said that the vast water power available, which at present is only used in connection with the electric lighting scheme for the City of Launceston and a few minor works, promised to add great wealth to the country. There was a Bill before the State Parliament at the present moment to confer upon a company the right to harness the waters of a river into which the surplus water of three of the mountain lakes was to flow, to generate electricity for use in the treatment of complex ores and for other purposes. Mr. Rahbek, who was specially employed by the Government to investigate and report on the water power of the State, reported that from these particular mountain lakes there could be obtained 82,000 actual horse-power. There was nothing to stand in the way of Tasmania's becoming a great manufacturing centre, with her cheap power and healthy conditions for the people to work under.

Unemployed Plant.—Mr. I. J. Watson has drawn the attention of the *Financial News* to the large amount of unemployed plant installed in electric central stations. No less than 37 per cent. of the plant is "spare," the difference between the total capacity and the maximum demand being 293,000 kw., valued at £6,000 000. Undoubtedly the method of the future, says the journal, is to link up our town generating stations, and so avoid the necessity for multiplying spare plant. Mr. Watson takes a district surrounding Manchester as an example, and shows how, by merely joining mains, an additional 25,000 kw. could be undertaken without purchasing any new generating plant.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. W. S. Hind, of the sales department of the Marylebone undertaking, has been appointed assistant sales manager, at £4 per week without commission.

The Electricity Committee of the West Bromwich T.C. has recommended that the salary of the electrical engineer (Mr. W. A. Jackson) be increased from £300 to £350 per annum as from July 1st last.

Mr. Allan Smith, of the Stamford staff of the Urban Electric Supply Co., who is leaving for Newcastle-on-Tyne, has been presented by his colleagues with a clock in leather case.

Mr. F. S. Hinings, of the Leeds Corporation Electric Lighting Department has been appointed chief junior assistant in the Commercial and Consumers' Department of the Birmingham Corporation Electric Supply Undertaking.

General.—With reference to our note of last week regarding an appointment at the steel works of Messrs. Beardmore, of Glasgow, we learn that Mr. F. G. Johnson was recently appointed to be lighting superintendent of the works. Mr. J. Arthur Sykes is the firm's chief electrical engineer. We have pleasure in making this correction.

Mr Frank Sydney Paterson has resigned his seat upon the board of Johnson & Phillips, Ltd.

Mr. W. G. Scott, for some years resident engineer with the Brush Electrical Engineering Co, Ltd., at present with Messrs R. W. Blackwell & Co. on the London, Brighton & South Coast Railway electrification contract, which has just been completed from Victoria to London Bridge, has been appointed overhead superintendent to the above railway under Mr. E. J. Houghton, chief electrical engineer to the Brighton Railway.

Mr. Herbert E. Mitchell, for many years chief engineer and manager of the late consulting practice of Messrs. Medhurst and Brewer, Victoria Street, has opened an office at 5, Victoria Street, Westminster, where he will continue to practise in consulting engineering work.

Our readers will regret to learn that Mr. E. Kilburn Scott, a well-known electrical engineer and contributor to the Electrical Review, was knocked down by a taxicab while crossing the Strand on Monday evening. He was conveyed to King's College Hospital, and as the result of inquiries, we are pleased to state that his condition is not so serious as was reported in the daily newspapers. We hope that Mr. Scott will have a speedy recovery and soon be about his accustomed duties again.

We congratulate Mr. Duncan Watson on his election to a seat on the Marylebone Borough Council. Electrical contractors, at any rate, will watch the situation with added interest.

In the offices of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, on Monday last, 29th ult., Mr. Benjamin Bishop was presented with an illuminated address, accompanied by a handsome and useful present, on the occasion of his having completed 50 years' service in the Silvertown works. The chair was occupied by Mr. Christian H. Gray, one of the principals of the firm, supported by Mr. P. M. S. Brodie, the works manager, and a large gathering of heads of departments and staff. The presentation was entrusted to Mr. William Wilson, one of Mr. Bishop's oldest colleagues, who remarked that the meeting was celebrating an auspicious event in honouring their esteemed and excellent fellow-clerk and comrade on his jubilee of service for the firm. Mr. Wilson closed a comprehensive and reminiscent speech by congratulating the recipient on his splendid health after such long service, adding that an occasion of this description was an object-lesson showing the amicable and friendly relations that existed, not only amongst the staff, but between employers and employed. Mr. Brodie endorsed the remarks of the previous speaker. Mr. G. K. Willsher also added a few remarks. Mr. Bishop, in responding, recalled his first appearance at the Silvertown Works, and gave some interesting details of his career. He expressed his personal gratification at Mr. Christian H. Gray's presence, and also that of so many old friends. Mr. Stables proposed a hearty vote of thanks to the chairman, which was received with acclamation. The chairman, in responding, remarked that, on having listened to the various speeches which had been made, he could only come to the conclusion that Mr. Bishop was held by his fellow-workers in the same high esteem that he felt for him personally.

NEW COMPANIES REGISTERED.

Electroscopes, Ltd. (105,933).—This company was registered on November 15th, with a capital of £4,000 in £1 shares, to erect and maintain premises for use as a skating rink, electric theatre or other public place of entertainment, &c. The subscribers (with one share each) are:—J. C. Genge, Hill View, Fanfare Road, Coulsdon, gentleman; G. Fabbro, 158, Falcon Road, Clapham Junction, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five: the first are G. Fabbro and J. C. Genge. Registered by J. F. Kelly, The Homestead, Sutton.

Silicaware, Ltd. (106,004).—This company was registered on November 18th, with a capital of £63,000 in £1 shares, to acquire interest in any patents relating to processes and apparatus for melting and electric furnaces, and for electrical fusing, refining and refractory purposes, to adopt an agreement with Dr. Wolf Burckhardt and others, and to carry on the business of manufacturers of, and dealers in, such furnaces and apparatus, and as fusers, refiners and moulders of silica, and ceramic substances, manufacturers of, and dealers in electrical appliances and apparatus, crucibles, &c. The subscribers (with one share each) are:—J. Schaefer, Hoechst am Alain, merchant; D. Franz Wolf-Burckhardt, Biebrich a/Rheim, chemist; E. Henss, Soden, i/Tannus, merchant; K. Huessener, Ravenscourt, Twickenham, merchant; P. F. Rouse, 85, Gracechurch Street, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are D. Wolf-Burckhardt, J. Schaefer, E. Henss and K. Huessener; qualification, £500; remuneration of J. Schaefer, £75 per annum, to be increased to £250 when more than 19 per cent. is paid on the ordinary shares. Registered by Cruesemann & Rouse, 85, Gracechurch Street, E.C.

Derwent Valley Electric Power Co., Ltd. (106,045).—This company has just been registered with a capital of £2,000 in £1 shares, to carry on the business of an electric power supply company in all its branches. The subscribers (with one share each) are:—P. C. Smith, 7, St. Helen's Place, E.C., solicitor; N. P. W. Brady, 7, St. Helen's Place, E.C., solicitor; A. S. Chetwood, 7, St. Helen's Place, E.C., solicitor; R. W. Fiddes, 18, Leyton Park Road, Leyton, clerk; G. E. Bird, Chestwood Cottage, The Vale, Hampstead, N.W., clerk; H. W. Martin, 41, Stanlake Road, Shepherd's Bush, W., accountant; W. R. Payne, 129, Elmhurst Mansions, Edgeley Road, Clapham, S.W., clerk. Registered without articles of association. The first directors are N. P. W. Brady and A. S. Chetwood. Registered by Minet, Pering, Smith and Co., 7, St. Helen's Place, E.C.

Ferabin Lamp and Electrical Accessories, Ltd. (106,073) This company was registered on November 23rd, with a capital of £15,000 in £1 shares, to adopt an agreement with A. Wedekind for the acquisition of the benefit of a certain existing invention, and to carry on the business of electricians, gas and mechanical engineers, manufacturers of and dealers in lamps and electrical accessories, suppliers of electricity, &c. The subscribers are:—J. S. Sommer, 20, Bucklersbury, E.C., merchant, 250 shares; A. E. Rice, 20, Bucklersbury, E.C., secretary, 1 share; L. Ridout, 26, Dorset Square, N.W., electrical engineer, 250 shares; J. W. W. Agnew, Lyndale, Turnpike Lane, Hornsey, iron merchant, 650 shares; J. G. Riadore, 100, Piccadilly, W., gentleman, 200 shares; W. H. Herod, 17, Frinton Road, Stamford Hill, 1 share; H. J. Wright, 69, Black Boy Lane, Wood Green, N., engineer, 1 share. Minimum cash subscription £1,550. The number of directors is not to be less than three or more than seven; the first are J. S. Sommer, L. Ridout, J. W. W. Agnew, and J. G. Riadore; qualification 200 shares; remuneration after 5 per cent. dividend has been paid, £50 each per annum and 5 per cent. of the surplus profits, divisible. Registered office, 266, Mansion House Chambers, 11, Queen Victoria Street, E.C.

Madeira Electric Lighting Co. (1909), Ltd. (106,123)—This company was registered on November 25th, with a capital of £30,000 in £5 shares, to acquire from the Receiver for the debenture-holders of the Madeira Electric Lighting Co., Ltd., the concession granted to the said company by the Municipal Corporation of the City of Funchal, Madeira, to acquire from the said Receiver the property and assets of the said company under an agreement dated July 23rd, 1909, and to carry on in Funchal aforesaid the business of an electrical supply company in all its branches. The subscribers (with 50 shares each) are:—H. Hirst, 71, Queen Victoria Street, E.C., electrical engineer; H. Kahn, 75, Lombard Street, E.C., merchant; G. T. Moody, Lorne House, Dulwich, doctor of science. A. I. S. Basen, 71, Queen Victoria Street, E.C., engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. Hirst, G. T. Moody and H. Kahn; qualification (except local advisory director), 50 shares; remuneration as fixed by the company. Registered office, 75, Lombard Street, E.C.

CITY NOTES.

Allgemeine Elektricitäts Gesellschaft.

The report of the directors for the year ended on June 30th, 1909, states that the company had extremely abundant funds at disposal, also during the recent critical period in the money market. The danger of an electricity tax had been averted, and illuminating articles only were taxed as from October 1st, 1909, but electrical sources of light had now been so greatly improved that notwithstanding the tax, considerable economies were possible, as compared with former times. As to electric railways, the Minister of Public Works was disposed in principle to grant a concession for an inter-urban line between Cologne and Dusseldorf, for which the company exerted itself as far back as 1904, in conjunction with a friendly firm. The Electrical Bank (Elektro-Treuhand Gesellschaft) formed in November, 1908, had reserved the beginning of activity to a later period in view of the provisional postponement of large works by private enterprise. The volume of the turnover in the past year had never previously been recorded, a fact which was all the more noteworthy as the sale prices were depressed, and the results could be regarded as wholly satisfactory. As the open reserves alone had been increased to £2,500,000, and, therefore, reached one half of the share capital, and as the situation of business had recently improved, the directors had been induced to raise the dividend from 12 to 13 per cent. As in all previous years, the distribution was effected without drawing upon the inner reserves, or the profits from the sale of securities. The company employed 33,056 persons on July 1st, 1909, as compared with

32,035 on the corresponding date in 1908, and the increase rendered it necessary for extensions to be made in all the works, which would mostly be completed in the new financial year. Excepting the motor-car factory, which suffered from the general depression in this branch, the works for the construction of steam turbines, high-tension apparatus and metallic-filament lamps had developed favourably beyond expectation. The accounts show the following results for the past year, the figures for 1907-8 being added for the purpose of comparison:—

	1908-9.	1907-8.
Share capital	£5,000,000	£5,000,000
Gross profits	933,600	891,700
Administrative expenses ...	25,490	23,370
Taxes	82,000	64,300
Depreciation provision	23,400	20,900
Net profits...	819,200	796,500
Reserve fund	63,300	50,000
Bonuses to officials, &c.	32,500	30,000
Pension fund	32,500	80,000
Dividend	650,000	600,000
,, per cent.	13	12

The output of the dynamo works comprised 47,351 machines and transformers of a total of 912,374 kw., as contrasted with 47,726 and 993,842 kw. and 43,953 and 854,543 kw. in the two preceding years respectively. Orders for large machines were less numerous than formerly, but the demand for small and medium sizes increased. Dynamos and motors of large dimensions and outputs were carried out for water-power, winding, electro-steel and rolling mill installations. Interesting innovations were the parallel switching of alternating-current stations of varied periodicity, adjustable A.C. motors for spark telegraphy, and high-speed motors for the direct driving of compressors for variable quantities of air; also direct-current machines of medium output with sparkless commutation and economic utilisation of material, rotary converters with auxiliary poles and machines for the welding of rails and for foundries. Equipments for tramways had lost their former importance since the requirements in this respect appeared to be substantially satisfied. On the other hand, new types had been developed for city, overland and main lines, and large locomotives on the company's alternating-current system had been constructed both for home and abroad. The number of locomotives delivered was 184, as compared with 146 in 1907-8, and the arrival of fresh orders was satisfactory.

The report proceeds to state that the turbine factory was fully employed, and the value of the product again increased, although the sale prices were considerably reduced. New orders were also satisfactory, and the construction of turbine blowing engines had been undertaken on the presumption that this branch would offer a sufficient market. The turbines for three torpedo boats had been delivered, and the trials of the boats had yielded brilliant results. Numerous orders for units up to 18,000 H.P. had already been received, and a large building was being completed to deal with the large sizes efficiently. After referring to the apparatus factory, the micanite factory and the railway signal factory, the report mentioned that the Oberspree cable factory worked up 19,573 tons of copper, or only 600 tons less than in the year of greatest production, and large quantities of cables had been delivered for working pressures up to 20,000 volts. The extraordinary fall in the price of aluminium had rendered possible the use of this metal for the telephone service, as well as for heavy currents. The deliveries of carbon-filament lamps from the lamp factory were about on the level of the previous year; and considerable quantities of metallised carbon filaments were also supplied. The metallic-filament lamp had reached a high stage of perfection, and sales had increased almost three-fold and were further advancing. As to light and power work, the requirements of the ironworks, notwithstanding the ordering of fewer large dynamos and motors, still reached a noteworthy figure, as the leading works continued to endeavour to combine scattered sources of production and reduce the cost of energy by the installation of large units working economically, and they gave preference to steam turbines as compared with the limits placed on the size of gas engines. The superiority of electrical driving of rolling mill trains seemed to have so far been recognised that the company had equipped 200 trains, representing more than 250,000 H.P. The inland mining industry also manifested reserve, the orders being mainly limited to equipments for the maintenance of shafts, and out of the 26 orders for main shaft winding plant obtained during the year, 23 were for foreign mines.

Apart from the work carried out for the Berlin Electricity Works, the company undertook central station and extension works during the year of a total output of 161,415 H.P., as contrasted with 153,450 H.P. in 1907-8, and the length of the cables and conductors laid was 858 miles. Similar work was in progress representing 328,860 H.P. and 560 miles, as against 203,225 H.P. a year ago. Among the completed orders was that of 22,500 H.P. for the Victoria Falls and Transvaal Power Co., and a further order for 150,000 H.P. for the same company had been received in association with a friendly company. The report, in referring to electric railways, remarks that the Prussian State Railway Administration had ordered the equipment of 17 further alternating-current motor-coaches for the suburban traffic from Blankenese, *via* Hamburg, to Ohlsdorf, making a total of 96 equipments supplied to this railway. A proof of the increasing introduction of the alternating system on railways lay in the beginning of orders for locomotives, One locomotive was being built of 600 H.P. for the Prussian State, one of 1,600 H.P., for the Chemins de Fer du Midi in France and a similar one for the Berne Alpine Railway Co., in Switzerland. Other alternating lines mentioned are the sections Carlsruhe—Herrenalb, Pamplon—Sanguesa, in Spain; Naples—Piedimonte, in Italy; Padua—Fusina; and the South London line of the London, Brighton and South Coast Railway. The working of storage battery cars satisfied the Prussian State railways who had ordered 10 further equipments, and also three benzol-electric coaches, after making lengthy trials with the first of this type. Tramway business was restricted almost entirely to extensions of existing lines, but the operation of suburban railways by means of high-pressure continuous current was beginning to develop with good prospects. The order for the equipment of the Frankfort local railway was being carried out in conjunction with a local electricity company.

The report further deals with the company's investments and transactions in securities, &c. It is mentioned that the book value of the securities, apart from those acquired as temporary investments, such as Imperial and Prussian loans, &c., yielded interest of 9·71 per cent. which would be brought into the new financial year. The increase in the bank credit by £1,271,000 to £2,965,000 was connected with the sale of securities and the payments made on the £750,000 of 4½ per cent. debenture bonds issued in July, 1908, whilst 4 per cent. bonds of £1,824,900 were previously in existence. The pension fund capital stood at £400,400 at the end of the financial year, and the legal burdens imposed by the sick, invalid and accident insurance involved an expenditure of £53,170 during the year.

Richard Hornsby & Sons, Ltd.—The directors recommend a dividend on the ordinary and new shares for the year ended September 30th, at the rate of 6¼ per cent. per annum, placing £10,000 to reserve. £5,084 is carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended October 29th, 1909, were 686,302, compared with 530,850 units in the corresponding four weeks of 1908.

United Electric Tramways of Monte Video, Ltd.—The directors have declared an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares of the past half year.

Phospor-Bronze Co., Ltd.—Petitions for the winding up of this company were before Mr. Justice Swinfen Eady in the Companies' Court on Tuesday last. Mr. Clawson, representing the petitioner, stated that arrangements were being made with the creditors, or at any rate, negotiations were going on, and with the consent of all parties, he asked that the matter might be allowed to stand over for a fortnight in order to permit the negotiations to come to a head. His Lordship sanctioned an adjournment for 14 days.

Canada.—According to the Toronto correspondent of Canadian Agency, Ltd., application has been made at Ottawa for the incorporation of the Quebec Railway, Light, Heat and Power Co., which will include the following companies: Quebec Railway, Light and Power Co., which operates the city and suburban electric railway services and supplies electric light and power and controls the Montmorency Power Co.; the Quebec Gas Co., in which Toronto and London, Ont., capitalists are interested; the Frontenac Gas Co., which is a competing concern controlled by American capital; and several power companies, including the Jacques Cartier, the Seven Falls, and the Canadian Electric Power Companies. The details have not yet been completed.—*Financial News.*

Provincial Tramway Co.—It is stated in the *Times* that the directors recommend, subject to final audit, for the year ended September 30th, a final dividend of 4s. per share, making 7s. for the year. They have set aside £8,000 for reserve and depreciation in respect of various undertakings, the property of the company, and £500 towards writing off the expenses of the issue of debenture stock. The amount brought forward was £3,060, and £2,686 will be carried forward.

Continental.—BELGIUM.—The report of the Compagnie Belge d'Electricite Siemens-Schuckert, of Brussels, for the last financial year shows a net profit of £1,624; a dividend at the rate of 7 per cent. is being declared as compared with 6 per cent. in the preceding 12 months.

GERMANY.—The Rheinische Schuckert Gesellschaft für Elektrische Industrie, of Mannheim, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

The balance-sheet of the Siemens & Halske Co., of Berlin, for the last financial year, shows a net profit of £571,450; a dividend of 12 per cent. is being declared, as compared with only 11 per cent. for the preceding 12 months.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—£75,000 6 per cent. cumulative preference stock.

Shawinigan Water and Power Co.—Further issue of £205,507 4½ per cent. perpetual consolidated mortgage debenture stock.

Prospectus.—*Dennistown (Krian, F.M.S.) Rubber Estates, Ltd.*—An issue of 100,000 shares of £1 each has been offered for subscription.

British Columbia Electric Railway Co., Ltd.

The directors' report for the 12 months to June 30th, 1909, says that the gross receipts show an increase of $339,699, or 17 per cent., and the net earnings, including income from investments in subsidiaries, and after charging renewals, show an increase of $18,792, or 5·6 per cent. over those of the preceding year. From June 30th, the close of the financial year under review, up to October 31st last, there has been a still further increase in gross earnings of $231,961, or 32 per cent., and in net earnings of $98,086, or 28 per cent. From January 1st, the company, in pursuance of its long-established policy of allowing the public to share in its prosperity by treating them in the most liberal manner possible, spontaneously reduced its charges for electric light by about 17 per cent. The rates now charged compare favourably with those of the largest cities of Canada. Various reductions in railway fares and charges have also been made during the year. It was anticipated when these reductions were put into force that they would involve considerable diminution of profits, but the increase in the volume of business has more than compensated for the reduced charges, and the above-mentioned satisfactory results are shown for the whole year. The following charges have been made against the revenue account of the year, viz.:—Provision for renewals maintenance (from which £16,675 has been deducted for adjustments and expenditure on renewals during the year), £36,448; bonus to employés, £9,684; amount added to capital amortisation fund, £2,018. Net profit for the year, after making the above deductions, £163,306. Add balance brought forward from last year, £4,974 = £168,280. The following are deducted: Interest on debentures and debenture stock to June 30th, 1909, £39,889; dividends already paid—on 5 per cent. cumulative perpetual preference stock for the year ended June 30th, 1909, £20,000; on preferred ordinary stock for the year ended June 30th, 1909, £24,000; and on deferred ordinary stock for six months to December 31st, 1908, £20,000 = £103,889, leaving available for further distribution and reserves, £64,391. From this the directors have decided to recommend the payment of a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months to June 30th, 1909, making 8 per cent. for the year, £20,000; to transfer to reserve fund, £37,330, and to carry forward to next account, £7,061. There has been deducted from the reserve fund the sum of £25,268, representing the difference between the net amount realised by, and the par value of, £500,000 4½ per cent. debenture stock issued in November, 1908, and there has been added to the reserve fund £10,000, representing the premium on £100,000 5 per cent. preference stock and £100,000 deferred ordinary stock issued in June, 1908. After the transfer now recommended by the directors as above, the reserve fund will stand at £160,000. The number of lights in use at June 30th, 1909, was 347,026, an increase for the year of 59,402. The number of passengers carried during the year was 25,183,739, an increase for the year of 3,855,559. From the foregoing figures, it will be seen that the company's business has again increased very largely during the year. Although the directors have every confidence that the business will continue to increase steadily in the future, they point out that the extraordinary increase in earnings of the last few months is attributable partly to exceptional causes. The Exhibition at the neighbouring City of Seattle has attracted thousands of tourists, who have visited Vancouver and Victoria, besides which the great salmon run (which occurs every fourth year) has this year largely increased the earnings of the Lulu Island branch.

The great influx of settlers into the Province of British Columbia is indicated by the fact that the permanent population of Vancouver City alone is now reliably estimated at over 100,000. As a natural and necessary result of this growth, which the directors, after most careful examination of conditions, are satisfied will continue, the company is extending its railway system and general undertaking as the interests of the country and the public requirements of the public demand. The new lines of railway may not prove immediately remunerative, and must be expected to increase the ratio of expenses during the next two or three years, but they will undoubtedly in time develop a very valuable business. During the year £286,182 has been spent in extensions and improvements. Very satisfactory progress has been made with the construction of the Fraser Valley branch to Chilliwack (65 miles), and it is estimated that the first section, 21 miles, to Cloverdale will be open for traffic towards the end of this month, and a further section, 22 miles, to Abbotsford will be in operation towards the end of January, the whole line being completed and in operation some time during the spring of next year. The opening of this line is eagerly looked for by the settlers in the districts through which it runs, and the prospects of traffic are good. Various extensions of the company's system in the districts adjacent to Vancouver and New Westminster have been undertaken, aggregating altogether about 31 miles of railway. The company has also built a short new branch line from Victoria City. When these extensions are completed, the company will be operating 164 miles of line.

In view of the demand for electrical energy, an increased supply of water power in the future has had to be considered. The directors, acting on the highest scientific advice, have authorised the construction of a new dam of greater height at Lake Coquitlam, and also the enlargement of the tunnel between Lake Coquitlam and Lake Buntzen. It is estimated that this will enable the plant at Lake Buntzen to be gradually increased to about 62,000 H.P., which should satisfy the requirements of Vancouver and the neighbourhood for years to come. At the present time the plant at Lake Buntzen is capable of generating 22,500 H.P., and an additional unit of 10,500 H.P., which is in course of erection, will be available within a few weeks. It has also become necessary to increase the supply of power for the City of Victoria, but before undertaking the large capital expenditure for this purpose the directors entered into negotiations with the city, which have resulted in a satisfactory agreement, protecting the company from municipal competition. The development of a large water power on Jordan River is now in progress, and the directors are advised that it will when completed adequately meet the requirements of the City of Victoria for many years to come, while it will also enable the company largely to extend its business.

The construction of the new freight sheds has been completed. Plans are also being considered for new terminal buildings which will be in every way worthy of the City of Vancouver and of the company. They will, moreover, enable considerable economics to be effected in the general administration of the company's business.

It has also become necessary to largely increase the company's equipment for the construction of rolling stock. The output from the company's existing workshops is satisfactory, both as to quality and cost, but with the present accommodation it is quite impossible to produce the new rolling stock required, or to deal efficiently with the requisite overhauling and repairs. The directors are, therefore, considering the advisability of moving the car shops to a more convenient and commodious site and of erecting workshops of large capacity, built and equipped in the most modern manner.

The directors regret to announce that the Sumas Reclamation Scheme, to which they referred in their last report, has had to be abandoned, as after a prolonged and careful examination, based on extensive test works, the revised estimates of cost proved to be prohibitive.

It is with great pleasure that the directors record their very high appreciation of the efforts made by the officers and staff in British Columbia, and their satisfaction with the excellent relations which continue to exist between the company and its employés.

In pursuance of the board's policy of maintaining a close personal supervision of the company's business, two of the directors, Mr. T. Blundell Brown and Mr. A. C. Mitchell-Innes, have spent several months in British Columbia inspecting the company's property and studying local conditions. Their reports fully confirm the favourable opinions already expressed as to the future of the province and of the company's undertaking.

The directors deeply regret to record the death of Mr. R. K. Sperling, who had been associated with the company from its inception, and to whose clear judgment and devotion to its affairs in its earlier days the company is greatly indebted. The vacancy thus created has been filled by the appointment of Mr. A. C. Mitchell-Innes, who was one of the company's first directors.

Adelaide Electric Supply Co., Ltd.

The directors' report for the year ended August 31st, 1909, states that with the sanction of the preference and ordinary shareholders, the unissued balance of 3,000 preference shares were issued during the year at a premium, the bulk of the shares having again been allotted to local applicants in Adelaide. The premiums received on the issue, amounting, less brokerage, &c., to £993, have been applied in reduction of suspense account. The profit and loss account shows a credit balance for the year of £24,260. After payment of the dividend on the preference shares for the half-year ended February 28th, 1909, there remains, including the amount carried forward from the previous year, an available balance of £20,831, which the directors recommend should be applied as follows:—To dividend on 30,000 6 per cent. preference shares for the half-year ended August 31st, 1909, paid on September 1st, 1909, £4,500; to dividend at the rate of 6 per cent. per annum on 26,065 ordinary shares for the year ended August 31st, 1909, £7,815; to amount to extinguish suspense account, £1,507; to amount transferred to depreciation account, £1,000; to amount transferred to dividend equalisation account, £5,000; to balance carried forward, £1,009—£20,831. During the year, a further sum of £40,156 was expended on capital account in the provision of additional land, buildings, plant and mains. The company's mains have now been carried into the majority of the extensive residential and manufacturing districts surrounding the City of Adelaide. The directors are glad to say that this policy of energetic development of areas promising a reasonable demand for electric light and power, is being fully justified by results. The temporary supply of power to the Adelaide Municipal Tramways Trust was commenced in March last, and is being maintained satisfactorily. The directors recommend that a portion of the profits during the continuance of this supply be transferred to a dividend equalisation account. The following table sets out in detail the progress made by the company during the past three years:—

Date.	Lighting in 8-C.P. lamps.	Motors in rated H.P.	Total connections in 8-C.P. lamps.	Total units sold.
August 31st, 1907 ..	56,964	1,431 H.P.	102,756	1,384,178
August 31st, 1908 ..	71,138	1,837 H.P.	129,922	1,666,974
August 31st, 1909 ..	91,338	2,369 H.P.	167,146	2,073,550*

* Excluding traction units sold to the Municipal Tramways Trust.

Castner-Kellner Alkali Co., Ltd.—Presiding at the annual meeting held at Cannon Street Hotel on 25th ult., the Right Hon. G. W. Balfour congratulated the shareholders upon the financial statement. The net profit, after the usual expenditure on maintenance, amounted to £134,154, before deducting debenture interest and depreciation. It represented an increase of £18,000 over the net profit of the previous year. The increase arose on almost every product that the company turned out. The net balance available was £117,711. They had raised the amount put to general depreciation from £30,000 to £35,000. They were carrying £25,000 to the general reserve fund started last year. They were paying a further 9 per cent., making the dividend 14 per cent. for the year, carrying forward £15,840. He saw no reason why the accounts for the current financial year should not be equal to those now presented. The chemical trade seemed to be improving.

Mackay Companies.—The directors have declared a quarterly dividend of 1¼ per cent., or at the rate of 5 per cent. per annum, on the common shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Ino
Aberdeen	Nov. 24	2,280	— 85	25	36,686	— 845	..	..
Ayr	,, 27	330	— 30	28	9,618	— 125	8	..
Bath	,, 24	1,225	— 55	47	36,371	+ 1,315	..	..
Belfast	,, 26	6,970	— 119	33	181,807	— 5,193	37	..
Birkenhead	,, 28	1,850	— 173	34	37,054	— 554	18·63	..
Birmingham Corp.	,, 20	13,184	+ 406	34	221,893	+ 6,479	56·5	..
Blackburn	,, 24	2,058	+ 63	35	38,962	— 1,212	13·97	..
Blackpool	,, 25	678	..	..	48,637	+ 4,102	..	..
Blackpool-Flectw'd	,, 27	418	— 52	21	21,836	+ 1,372	..	..
Bolton	,, 21	4,315	+ 87	34	79,788	+ 214	26	..
Bournemouth	,, 24	2,451	— 88	34	59,410	+ 332	21·72	..
Bradford	,, 20	9,108	+ 424	33	165,692	+ 5,221	54·81	..
Brighton	,, 28	1,392	— 87	35	35,408	+ 1,580	9·5	..
Bristol	,, 26	9,901	+ 406	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Nov. 19	423	— 20	46	10,109	— 112	3·65	..
Barnsley	,, 19	330	— 9	,,	7,784	— 384	..	..
Barrow	,, 19	406	— 9	,,	10,749	— 594	5·37	..
Cavehill	,, 19	118	— 8	,,	3,998	— 100	..	..
Devonport	,, 19	668	— 245	,,	17,015	— 4,469	8·85	..
Gateshead	,, 19	1,964	+ 3	,,	45,945	— 525	11·25	..
Gravesend	,, 19	384	+ 38	,,	9,764	— 3	6·5	..
Greenock	,, 19	998	+ 67	,,	25,729	+ 1,466	7·25	..
Hartlepool	,, 19	432	+ 42	,,	10,919	— 103	6·72	..
Kidderminster	,, 19	173	+ 13	,,	4,998	— 167	..	..
Leamington	,, 19	275	— 77	,,	8,203	+ 157	..	..
Merthyr	,, 19	359	— 81	,,	9,719	— 121	2·9	..
Metropolitan	,, 19	11,910	+1,171	,,	288,072	+21,746	22	..
Middleton	,, 19	559	— 1	,,	15,502	— 934	8·5	..
Mid. Joint Com'tee	,, 19	11,317	+ 315	,,	264,106	— 871	..	..
Oldham—Ashton	,, 19	1,094	+ 58	,,	25,967	— 1,173	9·13	..
Peterborough	,, 19	203	+ 3	,,	5,504	— 430	5·31	..
Potteries	,, 19	8,781	+ 156	,,	82,934	— 484	29	..
Rothesay	,, 19	71	— 14	,,	9,772	+ 126	2·75	..
Southport	,, 19	430	— 32	,,	13,360	— 425	8·17	..
S. Metropolitan	,, 19	1,431	+ 42	,,	87,035	— 557	..	..
Swansea	,, 19	1,879	+ 49	,,	45,105	+ 1,407	12·5	..
Tynemouth	,, 19	308	+ 30	,,	11,415	+ 835	3·75	..
Weston-s-Mare	,, 19	70	+ 6	,,	7,065	+ 397	3	..
‡Worcester	,, 19	450	— 17	,,	12,955	— 134	5·75	..
Wrexham	,, 19	175	— 9	,,	4,553	— 193	..	..
Yorks. Wool. Dist.	,, 19	1,851	+ 157	,,	42,680	+ 360	17	..
Miscellaneous	,, 19	379	+ 29	,,	9,697	+ 228	..	..
Burnley	,, 27	2,211	+ 134	..	..	..	..	..
Burton-on-Trent	,, 28	454	— 26	35	9,310	— 241	6·63	..
Bury	,, 28	1,928	— 162	34$\frac{4}{7}$	40,965	— 881	22·6	..
Cardiff	,, 20	3,964	— 19	34	75,452	+ 1,110	..	..
Carlisle	,, 27	255	— 62	47	7,783	— 427	..	..
Chatham and Dist.	,, 25	1,593	— 51	47	38,799	+ 1,599	14·98	..
Cork	,, 25	773	— 108	47	21,207	— 627	9·89	..
†Croydon	,, 12	1,580	+ 346	..	51,783	+ 4,316	11·25	4·75
Darlington	,, 27	360	— 29	35	6,482	— 487	..	..
†Darwen	,, 19	229	+ 5	33	8,406	+ 135	4·36	..
Dover	,, 20	303	— 9	34	7,454	— 419	4·75	..
Dublin	,, 26	9,305	— 147	..	119,174	+ 1,864	54·25	..
Dundee	,, 24	2,145	— 75	27$\frac{4}{7}$	32,975	— 657	15	..
East Ham	,, 27	1,736	+ 3	34½	35,043	+ 4,315	8·52	·77
Exeter	,, 26	478	— 39	35	11,898	+ 566	..	..
Glasgow	,, 27	30,943	—2,247	..	436,429	— 7,801	94½	5
Hastings	,, 25	1,392	— 27	..	..	..	..	..
†Huddersfield	,, 20	1,525	+ 105	33	56,422	+ 2,365	28·5	·5
Hull	,, 27	5,052	+ 269	34	89,391	+ 3,310	14·5	1·5
Ilkeston	,, 24	230	— 4	34	4,685	— 245	..	..
Ipswich	,, 27	597	— 2	35	14,343	+ 143	10·5	..
Kilmarnock	,, 20	253	— 25	27	4,022	— 148	4·25	..
Lancashire United	,, 24	2,259	— 118	47	62,009	— 766	..	..
Leeds	,, 20	12,836	+ 478	33	231,025	+ 6,170	..	..
Leicester	,, 27	4,057	+ 109	..	..	..	..	..
Leith	,, 20	1,037	+ 84	27	16,901	+ 2,099	..	..
Liverpool	,, 20	20,902	+ 219	46	497,183	— 1,758	..	..
‡L.C.C.	,, 13	75,685	+6,143	..	1,206,557	+52,302	..	..
London United	,, 20	9,814	— 838	..	285,813	—28,943	..	..
Lowestoft	,, 27	308	— 4	9	1,446	— 10	3·5	..
Manchester	,, 27	27,446	—1,000	35	521,827	— 7,666	..	..
†Newcastle	,, 20	3,710	— 137	..	131,185	— 1,339	14·5	..
Newport	,, 20	1,168	— 56	34	22,403	— 312	14·5	..
Oldham	,, 28	3,033	— 685	35	65,370	— 4,564	23·75	..
Pontypridd	,, 27	758	+ 16	34½	14,384	+ 1,065	5·5	..
Portsmouth	,, 27	3,071	— 94	35	75,007	+ 2,252	14·5	..
Preston	,, 24	1,263	— 93	..	..	..	..	..
Rotherham	,, 25	1,077	— 97	34	20,253	— 1,049	10	..
Salford	,, 22	8,339	— 140	33$\frac{5}{7}$	155,073	— 4,854	..	..
Sheffield	,, 28	10,856	+ 268	35$\frac{2}{7}$	199,890	+ 1,348	..	..
Southampton	,, 24	1,763	— 92	34	87,206	— 369	..	..
Southend-on-Sea	,, 24	704	+ 5	34	19,293	+ 2,526	..	..
South Shields	,, 27	1,008	+ 16	34$\frac{3}{7}$	19,708	— 40	..	..
Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 24	789	+ 25	21	9,254	+ 829	..	..
Wallasey	,, 27	1,468	— 114	34½	82,476	+ 688	..	·22
Walthamstow	,, 27	1,048	+ 19	35	28,302	+ 436	9	..
West Ham	,, 18	4,306	+ 195	33	78,572	+ 4,791	15·25	·43
Wolverhampton	,, 24	1,597	+ 85	34	28,693	— 1	14·25	1·75
Baker St.-Waterloo	,, 27	6,910	+ 725	21	65,270	+ 1,585	4·25	..
Con. London Rly.	,, 27	11,730	+ 192	21	110,196	—48,077	6·32	·55
Char. +, Eus. Hamp.	,, 27	7,895	+ 970	21	78,680	+ 8,240	7·75	..
City & S. Lon. Rly.	,, 28	6,758	+ 516	21	65,856	+ 2,360	7·3	..
Dublin-Lucan Rly.	,, 26	201	— 13	21	3,182	+ 58	7	..
G.N. and City Rly.	,, 27	2,988	+ 102	21	28,044	+ 151	3.5	..
G.N., P'y. & Brmtn.	,, 27	12,385	+1,265	21	111,780	+ 4,455	9·25	..
L'pool Overh'd Rly.	,, 28	2,547	— 84	..	80,804	— 26	6·8	4·8
Llandudno-Col. Bay	,, 26	214	— 4	52	14,212	+ 2,196	..	..
Mersey Railway	,, 27	4,149	+ 284	21	40,955	+ 1,662	4·5	..
Metropolitan Rly.	,, 28	84,007	+1,564	..	338,400	— 8,949	24·5	..
Met. District Rly.	,, 27	21,599	+2,114	21	206,756	+10,658	24	..
Anglo-Argentine	,, 25	82,298	+8,382	..	1,854,401	+111,678	..	..
§Auckland	,, 5	18,452	+1,157	44	149,958	+13,607	22·8	1·38
Bombay (B.E.T.)	Oct. 28	5,861	— 142	42	108,278	+ 5,447	..	..
§Brisbane	,,	16,775	+1,865	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 27	6,814	+ 219	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Oct.	8,539	..	..	88,078	..	20·5	..
Madras	Nov. 15	1,869	+ 220	..	27,088	+ 1,156	..	..
§Melbourne	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Nov. 26	2,810	+ 47	..	65,876	+ 838	28	2·4

* Compared with the corresponding period of 1908. † One week only.

‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

WITH a breath of hope in money getting cheaper, the Stock Exchange atmosphere has become more clear, and business to some extent has revived, carrying prices with it. Unfortunately, the political tension acts like a drag upon activity, and the average business man curses both parties alike for setting up their differences in the commercial arena. He demands why, in the name of reason, matters vital to national welfare cannot be explored, discussed and argued on some higher plane than the platform of mere party politics, where, in the clash of strife, the unloosing of bitterness and the trifling with truth, the public weal plays a very subdued accompaniment to the chorus of contention.

Reverting from the mundane to the germane, it may be said that electrical issues are steadily firm, without especial feature. The printing presses pour out more and ever more prospectuses of new rubber companies.

A severe slump in copper shares has followed reports that the suggested United States combine of copper companies may fail to come to cohesion. A recovery in Consols has helped in a slight degree the prices of Home Railway stocks.

Underground Railway stocks were almost strong for a few days, but the firmness did not last. Metropolitan Consolidated and District Ordinary, however, have retained part of their improvements. The opening of the Brighton Company's newly electrified section for traffic this week has helped the Deferred stock to a rather better level. Great Northern and City Preferred fell into further disgrace, and went back to 15s. The Debenture stocks of the Tube amalgamating lines are unchanged, and Underground Electric Railways of London issues show no alteration.

London United Tramways Debenture stock continued to slide, a further 2 points being knocked off the price this week; the stock has changed hands as low as 63½. British Electric Traction second Debenture rose 1, and the shares have held their recent rises. The company's scheme for farthing fares is, at all events, novel. The foreign tramway issues are generally good. Anglo-Argentine Fours show a gain of ½, and Auckland 5 per cent. Debenture has hardened to 104½. British Columbia Electric Railway stocks are slightly easier. Rios declined a shade to 94½. Kaministiquia Power 5 per cent. gold bonds are better.

Continued improvement in Smithfield Markets Electric Supply Ordinary shares is the feature in their own department, the company having secured an extension of their concession to 1972. The price has put on 10s, and stands now at 30s. middle, having more than doubled in less than a fortnight. "City Lights" are ⅛ down, bringing their lower price just under par. The South Metropolitan has opened an "electric house" in its district, designed to illustrate the manifold uses to which electric power may be applied in ordinary domestic matters. The idea appears to be excellent, and capable of extension. In the provincial list, Hove shares have slipped back again to 7, while Newcastle-on-Tyne Preference at 4½ are 5s. better.

Investors are having pressed upon their attention more particularly three classes of shares at the present time—rubber, rinkeries and electric theatres of different kinds. The latter cater for the million, and on a small capital, a well-managed concern in a populous district can do extremely well. It is very necessary, however, that capitalists should make searching examination of the prospectuses of such concerns, which must, in the nature of things, be highly speculative, depending as they do upon the whim and passing fancy of the multitude, for whose benefit some competitive form of entertainment is bound to be provided sooner or later.

Considerable dealings in Babcock & Wilcox Ordinary have left the shares $\frac{1}{16}$ better at 4⅝. Beyond this, the manufacturing list is quiet, and there are no quotable movements of importance. Rubber shares keep very steady, and the result of the fluctuations of the past week has been to advance prices in the majority of cases. And still the new companies come!

Telegraph stocks and shares are somewhat irregular. Eastern Ordinary, with a gain of 2½, shows the largest movement, Eastern Extensions remaining at 12. Great Northerns are good, and Western Telegraphs are ⅛ up. The dividend of 20s. has been deducted from West India and Panama Second Preference, which reflect it in their price of 8½. The First Preference at 9 are *ex* 6s. dividend. Anglo-Americans moved down a trifle. Telephone descriptions are inactive. Telephone of Egypt 4½ per cent. Debenture came into a little prominence in connection with the rise in most Egyptian industrials, and American Telephone Capital stock eased off a point. New York 4½ per cent. Telephone Bonds, now fully paid-up, stand at 98, which is 2½ premium on the issue price. National Telephone Deferred put on ½. There is no alteration in Marconi shares.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Nov. 23rd.	Closing Quotations Nov. 30th.	Business done week ended Nov. 30th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3½— 4	3½— 4	77/6	70/-	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146 —148	145 —147	147½	146½	—1	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	60 — 63	60 — 62	..	..	— ½	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	100 —101	101	100	—1	5 18 10
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21⅞— 22⅛	21⅞— 22⅛	22	21⅞	..	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	102½	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾— 8⅛	7¾— 8⅛	..	..	..	4 18 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 89½	87 — 89	88	87	— ½	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅜— 9⅛	8⅜— 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 8 11
60,710*l*	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13 — 13½	13 — 13½	..	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126½—129½	129 —132	131¾	129	+ 2½	5 6 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84½— 86½	85¾	85	+ ½	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102⅜	102	..	8 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12 1/16	11¾	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	8 16 11
200,000*l*	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	8 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10⅛— 10⅝	10⅛— 10⅝	10⅝	..	..	5 8 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13½	..	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28½— 29¾	29½— 30½	30	29 17/32	— ⅛	5 18 10
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51 — 53	51 — 53	..	..	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	96 — 98	93 — 95	..	..	..	4 1 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— ⅞	¾— ⅞	16/-	..	..	6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	107	..	..	5 10 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	120½—122½	121½	120½	+ ½	5 2 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 17/32	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98½	..	..	8 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅜	100⅛	..	8 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87 — 89	87½— 88½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	8 18 5
11,889*l*	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red, ...	100	4½%	4½%	4½%	4½%	100½—102½	101 —103	..	..	+ ½	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 15/16— 7 3/16	6 15/16— 7 3/16	7⅛	..	..	5 10 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5 7/16— 5 11/16	..	..	..	4 8 4
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜— 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	8 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	12¼ — 13¾	13⅜ — 13⅞	13 11/16	13½	+ 1/16	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	103½	..	..	8 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	11/16— 13/16	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	9 — 9½	8¾— 9⅛	..	..	— ¼	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	9 — 10	8 — 9	..	..	—1	16 13 4
80,000*l*	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Nov. 23rd.	Closing Quotations Nov. 30th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	91/3	89/4½	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,800,000	5	..	..	..	..	4¼— 4½	4¼— 4½	..	..	..	5 11 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	4 %	90 — 91½	90½—92	91⅞	90¾	..	4 7 5
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	103 —106	..	..	+ 1	4 14 4
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4 7/16— 4 11/16	4⅝— 4¾	93/9	92/6	+ 1/16	4 8 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	8 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	19/9	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅞	3⅜— 3⅞	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	143 —148	146	144	—1	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	123½	121½	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	106 —109	108½	106⅝	—1	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102½ -104½	103½	..	..	4 6 2
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅜— 1	⅜— 1	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2½— 2⅞	2½— 2⅞	55/7½	51/3	..	5 6 8
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	84½	..	..	5 14 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	60 65	61½	59½	+ 2½	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6½	6⅛ — 6½	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 — 106	..	..	..	4 4 11
304,940*l*	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,916,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 13 10
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	† Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000*l*	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½— 5	4½— 5	..	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	101½	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10 — 10¾	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼— 5⅝	5¼— 5⅝	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	5/9	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 5/16— 2 9/16	2⅜— 2½	44/9	43/-	..	5 12 3
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	61 — 63	61 — 63	..	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 — 46	..	..	..	5 8 8
1,480,000	City and South London Railway	Stock	1¾%	2⅛%	2⅛%	1½%	29½— 30½	29½— 30½	30¼	..	..	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 98	90 — 98	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Nov. 23rd.	Closing Quotations Nov. 30th.	Business done week ended Nov. 30th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	3/32— 7/32	5/32— 9/32	..	..	..	34 5
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	..	..	..	8 6 8
807,895	Do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	23/9	..	..	10 4 0
35,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Crd. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Crd.	5	15%	15 %	15%	15 %	12 — 12¾	12 — 12¾	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5⅛— 5½	5 11/32	5 5/16	.	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	104 —106	..	..	—2	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¾ — 16½	15¾— 16½	15 13/16	15 25/32	..	6 1 3
87,500	†Liverpool Overhead Railway, Crd.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅜ — 2⅞	2⅜— 2⅞	50/-	..	..	13 0 10
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	66 — 69	63 — 66	63½	..	—3	6 1 8
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	36¼— 36¾	36½— 37	37¼	36⅜	+ ¼	1 7 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 — 66	64 — 66	65¼	64¼	..	4 3 4
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	15½— 16	16 —16½	16¼	15⅞	+ ½	Nil
891,337	Metropolitan Electric Trams., Crd.	1	..	..	..	4½%	19/32— 11/16	19/32— 11/16	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16— 13/16	11/16— 13/16	15/-	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	95	94½	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —128	125 —127	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	91¾	91¼	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	86½	..	..	5 3 6
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½ — 36	34½	..	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	.	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100 —101	..	..	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87¾	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	31 — 33	31 — 33	32	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	¼ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	1¾ — 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	74 — 79	72 — 77 xd	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Crd., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	6½— 7½	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	6½ — 7½	..	..	..	4 13 4
8 ,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 — 100	96 — 99	..	..	—1	4 0 10
60,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅝— 4⅛	3⅝ — 4⅛	..	..	..	6 1 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼— 4¾	4¼— 4¾	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 6 11
415,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 - 101	98 —101	..	..	..	3 19 3
49,436	Chelsea Electricity Supply, Crd.	5	6 %	4½%	4½%	4½%	3⅜ - 3⅞	3⅜— 3⅞	70/-	68/1½	.	5 16 2
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	.	..	4 7
70,595	City of London Elec. Lighting, Crd. 40,001—110,595	10	6 %	6 %	6 %	6 %	10 — 10½	9⅞ - 10⅜	10 3/16	9⅞	— ⅛	5 1 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾ - 12¾	12¼	..	..	4 12 1
400,000l	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 6
50,000	County of Durham Electrical Power, Crd.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞ - 3⅜	2⅞ - 3⅜	..	..	..	7 8 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½ - 95½	..	..	..	5 4
40,000	County of London Electric Lighting, Crd. 1—40,000	10	5 %	5 %	5 %	5 %	7½— 8	7½— 8	7 11/16	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝ - 11⅛	10 15/16	..	..	5 7 10
100,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
100,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100¼	100	..	4 9 1
80,000	Edmundson's Electric Corporation, Crd. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	½— ¾	⅝— ⅞	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ - 4⅞	4⅜— 4⅞	..	..	..	5 12 1
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞ - 5⅜	..	..	..	4 13
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7 — 7½	6¾— 7¼	..	..	..	5 13 4
$1,3 6,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	100 —102	101 —103	102¼	102	+1	4 17 1
41,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	7⅛	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
1 1,000	London Electric Supply Corporation, Limited, Crd.	3	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	32/6	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4¾— 5¼	4⅞— 5¼	..	..	..	5 17 1
332,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	92 — 95	93	..	—1	4 4 3
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3¾— 4¼	3¾— 4¼	..	..	..	5 17 8
78,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½— 82½	80½ — 82½	81⅞	81½	..	6 1 3
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71 — 75	71½— 73½	..	..	..	4 13 4
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	103 —106	103¾	103⅛	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	84 — 86	84 — 86	85	85⅜	...	5 16 3
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	98 — 100	..	..	—1	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13½	12½ — 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	6 7/16	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1½— 1⅝	1½— 1⅝	31/9	31/-	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32— 1 7/32	1 3/32— 1 7/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Crd. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
30,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	7⅛	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅞ — 1⅛	1⅜ — 1⅝	..	..	+ ½	Nil
55,000	South London Electric Supply, Crd.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Crd.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜ — ⅞	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	⅞— 15/16	⅞ — 15/16	18/9	..	..	5 6 8
110,000	Westminster Electric Supply, Crd.	5	18 %	12 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	8 7/16	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅞— 5¼	5 — 5½	5 3/16	5⅛	+ 1/16	4 1 1

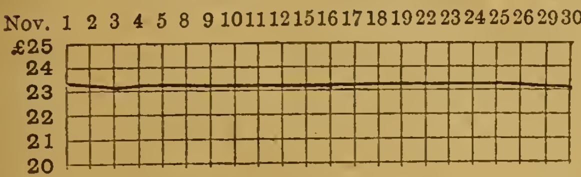
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909

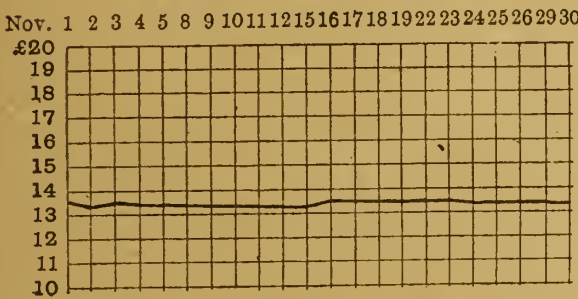
METAL MARKET.

Fluctuations in November.

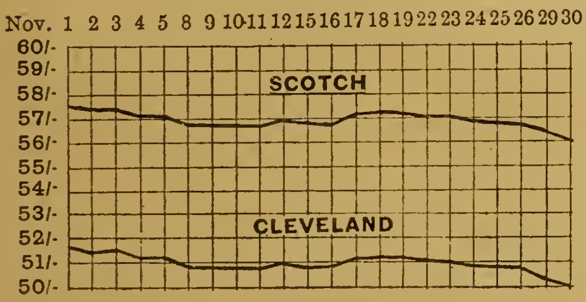
SPELTER (G.O.B's.).



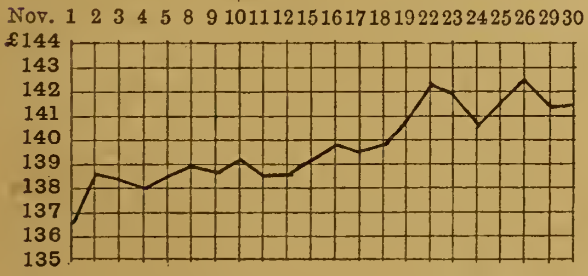
LEAD (ENGLISH).



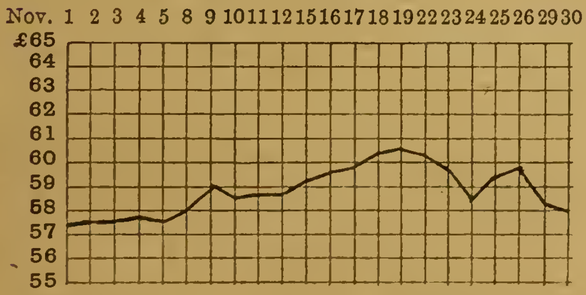
IRON.



TIN.



COPPER (G.M.B's.).



Electric Steel in Canada.—Negotiations have been completed for the erection at Welland, Ontario, of a big electric steel plant by a concern incorporated in Canada under the name of the Electric Steel Co. of Canada, with head office at Toronto. Work on the initial building will begin shortly. The daily output is expected to be 1,000 tons, and a site of 50 acres has been secured. The plant will be ready before the opening of navigation. This will be the first electric smelter in Canada for commercial purposes. The electric smelter which was operated at Sault Ste. Marie two years ago was run by the Government for experimental purposes, under the direction of Dr. Haanell.

ON THE ACTION OF AERIALS IN DIRECTED RADIOTELEGRAPHY.

By R. E. NEALE, B.Sc. (Lon.), A.C.G.I.

According to Mr. J. Zenneck, in the *Physikalische Zeitschrift*, if one considers the bent aerial of Marconi (fig. 1), it is impossible to explain its directive properties if one admits that the earth is a conductor. In fact, in this case the image of the antenna may be regarded as constituted by a second aerial of the same radiating power situated as in fig. 2. At long distances one would imagine that the actions of the two horizontal portions would neutralise each other, so that only the action of the vertical part remains to be considered; this is clearly the same in every direction. Hence one cannot thus explain the maximum radiation in the direction A C. By taking account of the imperfect conduction of the earth, however, the explanation of the phenomenon becomes simple.

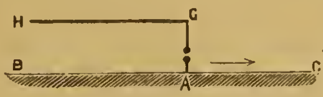


Fig. 1.

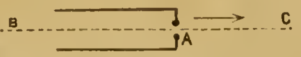


Fig. 2.

It is known that in such a case as this the waves E (fig. 3) are not propagated perpendicularly to the earth, but are inclined at an angle α in the direction of motion. It follows from this that Poynting's vector Σ, representing the flow of energy, will be inclined relatively to the earth as indicated, fig. 3.

On the other hand, since this energy emanates from the transmitting aerial, one would expect it to follow the path indicated in fig. 4, and that, near the sending aerial A, it would have direction A X also inclined at an angle, more or less acute, with regard to the surface of the earth.

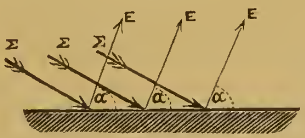


Fig. 3.

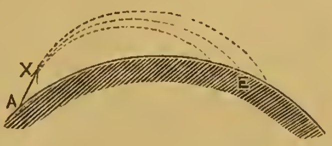


Fig. 4.

Next considering a bent antenna A G H (fig. 5):—According to the above reasoning, which is quite general, the energy emissions in directions A C, A B are represented by the vectors A X A Y, and in order to determine whether the bent aerial has any directive properties, it is sufficient to compare the two energy fluxes so determined.

It is at once evident that for points P, Q sufficiently distant along directions A X, A Y respectively the effects of conductors A G and G H are additive as regards P, but differential as regards Q (Seen from P the currents in the two portions A G, G H of the aerial have the same sense, whereas, seen from Q, they appear of opposite signs.) Now the energy available at P and Q, provided A P and A Q are sufficiently great, is proportional to the square of the field strength (electrostatic and magnetic alternately), due to A G, G H at these points.

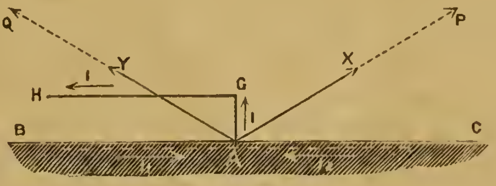


Fig. 5

The energy available at P is, therefore, considerably greater than at Q (owing to the above additive effect), and hence the range of operation is greatest in direction A C, a result of theory which is perfectly confirmed by practice. So far no account has been taken of earth currents; these currents may be divided as at I_1, I_2 (fig. 5) for the purposes of the present consideration. The action of I_1 is clearly to reduce that of the conductor H G, while I_2 aids the effect of the latter.

Since I_1 is always $> I_2$, the action of earth currents is in general to impair the directive properties of the antenna, and by placing in the earth a conductor, connected to the aerial, and pointing in direction A C, one would expect an increase in the directive power of the system (owing to the relative increase of I_2). This beneficial effect has been experimentally confirmed.

According to the author it is possible to explain the directive properties of systems, other than Marconi's bent aerial, in precisely similar manner. A complete mathematical treatment of the problem is hardly possible on account of the complex conditions obtaining.

THE JUNIOR INSTITUTION OF ENGINEERS.

Summer Meeting in the Midlands.

The distinction of bringing into existence the first local section of the Junior Institution of Engineers has been gained by the members at Birmingham. In recognition of the success of their efforts the Council determined that the week's summer meeting of 1909 should be held in the Midlands, with Birmingham as a central rendezvous, although Leamington was chosen for headquarters.

On the morning of August 14th the official reception by the Mayor of Leamington took place in the Corporation's Royal Pump Room; a tour of inspection was made of the various baths and appliances, &c., which are available, and all the machinery and plant was shown. The high-tension D'Arsonval Gaiffe apparatus naturally attracted great attention. Current for it is supplied by a 13-kw. dynamo, which is also used for electric lighting and power throughout the buildings. The afternoon was spent in a visit to Warwick Castle. A close examination of the celebrated Warwick Vase, which is denied to the ordinary visitor, was much appreciated.

The strictly technical part of the programme opened in Birmingham on the following Monday morning, one division proceeding to Messrs. Gillott & Sons' steel pen manufactory at Hockley, while another visited Messrs. Muntz's Metal Works, French Walls, under the guidance of Sir Gerard Muntz. At the pen works all the processes of manufacture were explained. The slitting is accomplished by means of shearing machines, so delicate in their operation that it is possible with them to place six distinct slits in the width of an ordinary point.

The variety of purposes for which Muntz metal is employed, as exemplified by the numerous articles forming the output of the French Walls works, was most striking. The works cover about 11 acres of land. The original works were a part of the Soho Foundry, where James Watt developed and perfected his first steam engine. An aluminium foundry now forms an important part of the works, castings for motor-cars being produced. As early as 1892 the company determined to concentrate all their power plant in one central electric and hydraulic power station, and clear away all the small separate units. This conversion occupied four years and was based on the most modern practice.

Mr. George Tangye showed his interest in the visit of the Institution to Birmingham by kindly arranging for the members to be shown over the James Watt Museum adjoining Messrs. Tangye's works, and Watt's attic workshop at Heathfield Hall, now the residence of Mr. Tangye. Needless to say the young engineers felt honoured at these opportunities of doing homage to the memory of their great master. The original letter books of the firm of Boulton and Watt were seen, dated 1775, also original drawings by James Watt illustrating different types of early condensing engines, and there were numerous patent specifications, and quaintly worded reports.

The programme for the following morning took the form of an invitation from the Birmingham Local Section to visit works at Redditch and to a complimentary luncheon in the Masonic Hall. The party motored from Leamington, through delightful scenery, and on arrival at Redditch inspected Messrs. Shrimpton & Sons' needle manufactory and Messrs. J. Warner & Sons' fish hook, fishing rod, and fishing tackle works. At the luncheon the chairman of the local section, Mr. F. S. Pilling, M.I.Mech.E., presided. One or two appropriate toasts followed, during which the gratification felt by the members of the local Section in taking part in the welcome of the Institution to the Midlands was expressed. and the acknowledgments of the guests were conveyed by Mr. F. R. Durham, the chairman. The afternoon was occupied in honouring the various objects of Shakesperian interest at, and in the neighbourhood of, Stratford-on-Avon.

On Wednesday the programme comprised a visit to the new buildings of Birmingham University, the works of the Austin Motor Co. and those of the Birmingham Small Arms Co. A fleet of motor-cars, kindly provided by the Austin Co., met the party on their arrival at Birmingham, for their conveyance to the University and use throughout the day, a compliment which was much appreciated. Prof. F. W. Burstall, M.A., head of the Mechanical Engineering Department of the University, received the members in the Great Hall, and, aided by Mr. Kipps, of the Electrical Engineering Department, showed them round, pointing out the very many features of engineering interest to be observed in the equipment of the extensive buildings. The colossal horizontal 300-ton testing machine, made by Messrs. W. & T. Avery, Ltd., naturally attracted considerable attention. Some idea of its magnitude may be gathered from the statement that the maximum length for tension specimen is 28 ft.; for compression, 30 ft.; and span for bending, 20 ft., and that the overall dimensions of the machine are: length, 68 ft.; height, 13 ft.; its width varying from 7 to 12 ft. The wedge grips can take specimens $3\frac{3}{8}$ in. diameter, or 6 in. by $2\frac{1}{2}$ in. flat. The electrical engineering department is equipped with machines and apparatus of different types, giving both direct and alternating current of various voltages, &c. The power station supplies electricity, gas, and steam to the main buildings, and is also equipped as a heat laboratory.

The section of the party visiting the Austin motor-car works found the inspection of great interest. These splendidly equipped works are capable of dealing with all the operations necessary in the production of the car throughout, not only of the chassis, but of the body and fittings complete. The demand for the vehicles has been such that during the past two years the area of the works has had to be more than doubled.

At the works of the Birmingham Small Arms Co., at Small Heath, the members had shown to them the ingenious machinery used in the manufacture of rifles and cycle components. The workshops contain over 5,000 machines, the bulk of which are self-feeding and semi-automatic, whilst both cycle and gun departments have their own sets of automatic machines for screw making and small components.

Thursday was devoted to Coventry, Messrs. Herbert's tool works and the Triumph Cycle Co.'s Works being visited in the morning, and Messrs. Rotherham's watch factory and the Corporation gas works in the afternoon. The well-known tool works were founded by Mr. Alfred Herbert in 1889. The development of the firm has been continuous and rapid, and at the present time 1,500 men are employed. The various machines turned out are manufactured in quantities, no special tools other than those required on the plant being built.

At the Triumph Cycle Works the members found no difficulty in fully occupying the two hours allotted to the visit; indeed, the contents of the various shops proved so interesting that some reluctance to leave was shown at the conclusion.

The two divisions which had been formed for these visits united afterwards at the Masonic Hall as the guests of the Triumph Cycle Co., with Mr. A. Friedlander in the chair. After luncheon, several complimentary speeches were made, and, dividing again, one party proceeded to Foleshill to inspect, under the guidance of Mr. F. W. Stevenson, M.Inst.C.E., the engineer to the gas department, who designed them, the gas works of the Coventry Corporation, whilst another group were shown over Messrs. Rotherham & Sons' watch factory and motor accessories works. The part that electricity is playing in connection with the manufacture of gas was well exemplified at Foleshill. In the retort house, containing 256 retorts of the horizontal type, were seen two Fiddes-Aldridge simultaneous stoking machines, driven by electric motors. The electric generating plant consists of two sets of 75-h.p. gas engines and dynamos, the power house constituting quite a prominent feature in the works. The watch factory visited dates back to the year 1750, and possesses a high reputation amongst the Coventry works. A fine factory has been equipped for the production of English lever watches of the finest quality and finish. It was pointed out that there are some 1,400 distinct operations in making a Rotherham watch, and some 73 assembling processes. In addition to watches, a large quantity of motor fitments are also turned out.

Messrs. Cadbury Bros.' celebrated cocoa and chocolate manufactory at Bournville was visited on the following morning, Friday. The engineer welcomed the members on arrival, and arranged for the features of engineering interest, of which there are many, to be shown, the power house and refrigerating plant receiving particular attention. It appears that the Institution is the first technical body that has been so privileged, a compliment duly acknowledged by the chairman in speaking at the luncheon to which the members were subsequently entertained by the firm. For the afternoon there were visits to Messrs. Elkington's electro-plating works, and the crystal glass works of Messrs. F. and C. Osler. It may be added that the electro-plating and electro-depositing departments are believed to be the largest and most completely furnished in the world.

On Friday evening the Institution's summer dinner was held at the Great Western Restaurant, and was well attended, a number of local members being included in the gathering. The chairman presided, and amongst the guests were Mr. W. Deakin, President of the Birmingham Association of Engineers; Mr. Kipps, of the University; Mr. R. Kirton, Mr. Thos. Berridge, Mr. F. J. Bywater, and Mr. F. S. Pilling.

On the following morning the electrical signalling apparatus, installed by Messrs. Siemens Brothers at Snow Hill Station for the Great Western Railway Co., was seen, Mr. L. M. Ferreira explaining its construction and operation; and afterwards the Summer Lane generating station of the Birmingham Corporation's Electricity Department was visited under the guidance of the resident engineer, Mr. Kemp.

With this electrical visit the programme for the week closed, leaving impressions of time very agreeably spent, and recollections of many courtesies extended by those through whose ready assistance the arrangements for it had been made. May the Junior Engineers experience many another such summer assembly.

PROCEEDINGS OF INSTITUTIONS.

The Present Aspect of Electric Lighting.

By H. W. Handcock and A. H. Dykes, Members.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London*, *November 25th*, 1909)

Since we wrote our paper on "Electricity Supply and Metallic-Filament Lamps," two years have elapsed. Extraordinary progress has been made by the lamp makers in the interval. In an installation of 653 lamps, one of the first to be fitted with transformers and 25-volt lamps, in April, 1908, the original 100-volt carbon-filament lamps were replaced by 10-c.p. 25-volt tungsten lamps. Careful note has been kept of the number of lamps renewed since then, from which it appears that, including breakages, the average life has been 1,280 hours, although they are frequently over-run.

In another case, 105-volt lamps of 25 and 32 c.p. were substituted for the original carbon lamps. At the end of 1,083 hours of actual use, out of 980 lamps by various leading makers installed, 70 per cent. were still burning. Individual lamps under test conditions have shown far better results, but the above figures are a fairly reliable indication of what may be expected under ordinary conditions.

The price of wire lamps has also been reduced, and the 100-volt 25-c.p. lamp which two years ago cost 4s. is now listed at 3s. Having regard to the longer life of the new lamps, they are thus but little more expensive than carbon lamps. At least one well-known maker has now succeeded in producing a 16-c.p. 24-watt lamp for 200 volts, which, we are informed, will be on the market very shortly at the price of 5s. We have had some of these lamps in actual use for some months past with very satisfactory results, and we have seen in operation a 10 c.p. 200-volt lamp taking only 15 watts.

In our 1908 paper we ventured to suggest that the effect on those stations relying on a purely lighting load would be disastrous unless some steps were taken to alter the method of charging.

The results of the past two years have only served to strengthen us in our belief that the flat-rate system fails to meet the conditions that now obtain, and that only by the adoption of some system which secures to the undertaking a definite minimum return from each consumer based on the rate at which he contracts to take energy can purely lighting stations be profitably run.

In one station of this kind serving a London suburb, a large proportion of the consumers were "free wired." The price of current was 5½d. per unit for this class of consumer, and a deficiency charge was made in addition of 1d. per unit for every unit by which the consumption was less than 18 units per lamp per annum.

Last year it was decided to allow such consumers to have transformers and metallic-filament lamps, it being stipulated that no lamps of less than 16 c.p. would be supplied. At the same time the terms were altered to a fixed wiring charge of 2s. per annum per lamp installed and 5d. per unit for energy consumed.

The results are instructive. In the case of those consumers who have taken advantage of the new arrangement, it is found that formerly their lamps averaged 12 c.p. and their consumption per lamp installed was 15·6 units per annum.

This gave a revenue per lamp connected (averaging 12 c.p.) of:—

	s.	d.
15·6 units, at 5d. (as for privately wired consumers)	6	6
Meter rent	0	4½
Wiring rental (deficiency charge + ½d. per unit) ...	0	10½
	7	9

Some of them have not been changed over for a complete year yet, but assuming that the uncompleted quarter of the year will bear the same ratio to the earlier part as in previous years, the results due to the change will be—

Average candle-power per lamp, 16.

	s.	d.
Average consumption, including transformer losses, 9 8 units	4	1
Meter rent	0	3
Wiring rental	2	0
	6	4

In spite, therefore, of the wiring rental being increased, in spite of an increase in the illumination of 33 per cent., the inclusive receipts per lamp have fallen from 7s. 9d. to 6s. 4d.

The reduction in consumption is obviously greater in the case of privately wired consumers, on whom no restrictions can be placed as to the minimum candle-power of the lamps they use, and it may be taken as certain that in future the consumption per lamp installed amongst this class will be of the order of 6 to 7 units, whilst in many cases it will fall to as low as 3 or 4.

Even at 8d. per unit a 10-light consumer having a total consumption of 30 units per annum cannot be remunerative.

In the district from which the above instances are taken the price of gas is 2s. 6d. per 1,000 cb. ft., and it was found that in small premises the cost for lighting only, exclusive of cooking, but including the meter rent, averaged 12s. 2d. per gas burner per annum, whilst many were as high as £1.

Surely there is something wrong when, in the same district, electricity yields only 4s. 4d. per lamp and gas 12s. 2d.

In most cases a 25-c.p. 30-watt metallic-filament lamp will satisfactorily replace an ordinary gas burner such as is normally in use. For domestic purposes the 25-c.p. electric lamp is a satisfactory unit of illumination, and if it is more economical than the so-called 60-c.p. gas light, the consumer will take it. Given a proper method of charging, this can be done in such a way as to prove very remunerative to the electric light undertaking.

With the flat-rate system of charging the long-hour consumer at present uses gas. One reason for this is that, owing to the loss made by the electric light undertaking on the short-hour consumer, it is necessary to keep up the price all round, and the competitive illuminant benefits.

Let such a consumer use gas or candles, and let us concentrate our efforts on the long-hour man, who gives us a greater number of working hours over which to earn interest on our capital. At the moment it is generally the other way round, and electricity is given the unremunerative short-hour lamps *because the present tariffs make the cost of long hour lamps too high.*

In the case of the suburban station mentioned above, the standing charges per kilowatt of consumers' demand amount to £17, and the running costs to 0·4d. per unit. Assuming that, under a system devised to attract a different class of consumer, as many as 80 per cent. of the lamps installed come on the peak (the average in the district at present is 30 per cent.), the standing charges per 30-watt lamp would be—

	s.	d.
£17 × 20 × 30 × 0·8 ÷ 1,000 =	8	2
If the lamps were used for 400 hours, the running charges would be 400 × 30 × 0·4 ÷ 1,000 =	0	5
Total	8	7

If they were used for 2,000 hours, the running charges would be—

$$2{,}000 \times 30 \times 0{\cdot}4 \div 1{,}000 = 2\text{s.},$$

or a total of 10s. 2d. Whether the lamps be used for 400 or for 2,000 hours, therefore, only makes a difference of 1s. 7d.

The difference in cost is so little, and the business advantages, from the point of view both of the station and of the consumer, of a fixed charge are so great that we consider it preferable to make a fixed charge per lamp per annum, irrespective of the number of hours during which the lamps are used.

It obviously does not pay to go to the expense of putting in a meter, providing a staff to read it and keep it in repair, and a staff of clerks to make out the accounts, in order to check such small variations in revenue, more particularly if the relative importance of the standing charges be still further increased by the station supplying the interior wiring.

It may be objected that if there be no meter and no restrictions, the consumer will waste the commodity. If the objection were valid, the present system of water supply in London would be an impossibility. It must not be forgotten, further, that the longer the lamps are used the greater the cost to the consumer of lamp renewals, which thus acts to a certain extent automatically as a check.

As the station is charging per lamp, it must obviously also have some check on the consumer in order that he may not, for instance, substitute a 100-c.p. lamp for the 25-c.p. lamp allowed for. We prefer to do this by using special lamp-holders such that only lamps which are sold by the station or its agents can be used. The consumer who comes back too often for lamp renewals will thus be detected and dealt with accordingly, if it be found that he is wasting current.

Taking the average life of the lamps at 1,200 hours, they would use in that time, say, 36 units per 25-c.p. lamp. This at 0·4d. per unit represents 1s. 2½d., and where the station sells the lamps, the profit on their sale would to a great extent automatically compensate for the wastefulness of any of its consumers.

It is obvious, therefore, that even with a wasteful consumer the station could not lose much, and a meter can, if desired, be put in to check in special cases any consumer suspected of wilful waste. For the reasons above set forth, we believe that all stations having normally low running costs could, with great advantage to themselves, supply the long-hour consumer, who at present generally uses gas, at a fixed charge per lamp per annum, which would be well below what he is at present paying. A fair average price, inclusive of wiring rental, appears to us to be 12s. per 30-watt lamp per annum for a continuous supply, and 10s. per annum for a "dusk to dawn" supply.

This system we call the "contract" system, to distinguish it from the "contract demand" system.

The proposal is, of course, by no means new, but it was practically an impossible one as long as we were restricted to the carbon-filament lamps. The introduction of the wire lamp and the great reduction in the running costs during the past few years have, as we endeavour to show, entirely altered the position. Credit must be given to Mr. Wilkinson, of Harrogate, for being one of the first to appreciate the altered position of affairs, he having introduced into his district the principle of charging small consumers a fixed sum of 11s. per lamp per annum.

A few months ago, in a suburban district where at the moment there were no electric light mains, a small house and a small shop were "free wired" at our suggestion. The living rooms had a single 25-c.p. wire lamp fixed close to the ceiling, which we find gives a very pleasant light in all parts of the room. The smaller bedrooms had a 10 or 16 c.p. light.

A canvasser was sent round the neighbourhood asking the inhabitants to inspect the installation, and on calling they were informed that the electric light company would wire their houses free of initial expense in a similar manner to that before them, and make an inclusive charge of 10s. per lamp per annum to cover the wiring rental and the right to use the lamps as required *from dusk to dawn, and during periods of unusual darkness.*

The canvasser was only employed for a short period, but he secured signed applications for some 2,000 lamps.

We are of opinion that in the future purely lighting stations will, in order to secure the necessary large number of new consumers, be absolutely forced to undertake the wiring of houses and to supply lamps—in fact, to sell *light*, and not electrical energy. By this means any improvement in the efficiency of the lamp will be of benefit to the stations and not, as at present, a loss to them. It is all-important that the cost of wiring should be reduced, and that the cost of services be brought down also. On A.C. systems some form of concentric wiring with earthed outer is not only the cheapest, *per se*, but enables considerable economies to be effected in other directions. Only single-pole switches and fuses are required, and the insulation of the one pole can be abolished or reduced to a very small amount. Since the advent of the wire lamp a large number of concentric wiring installations with earthed outer have been put in, using a double-wound transformer, so that the supply mains are absolutely distinct and separate from the interior wiring.

The cost of a double-wound transformer is now so low that the saving on the first cost of the lamps is sufficient in most cases to cover it, whilst the saving in renewal of lamps, coupled with the efficiency of the lower voltage lamps, amply suffices to meet the cost of the magnetisation units. Hence the difference in cost of wiring due to the use of one wire instead of two is pure gain.

There is nothing to prevent the whole terrace of houses from being wired from a single transformer fixed on the outside wall of the building, thus making one service supply a large number of houses.

The wiring can, by adopting one or other of the new systems, be brought down to 10s. to 12s. per light, or, say, 1s. 3d. per annum for upkeep, interest and sinking fund.

We have seen above that even where the standing charges amount to £17 per KW. of consumers' maximum demand, a figure which is not likely to be exceeded by many stations, and allowing for 80 per cent of the lights installed being on at once, a 30-watt lamp can be supplied for from 8s. 7d. to 10s. 2d., or, including the free wiring, for 9s. 10d. to 11s. 5d. per annum. It is not likely that the average burning hours will be as high as 2,000, so that it is evident that an ordinary long-hour consumer can be supplied under these conditions for a sum not exceeding 10s. to 12s. per 30-watt lamp. As it is not proposed to put 30-watt lamps in the smaller rooms, a 10s. inclusive charge would in many cases be amply justified.

Particularly with a small alternating-current station, great economies can be effected if a supply be only given from dusk to dawn, the station being shut down during the daytime, and provisions are made under the Board of Trade Regulations whereby consent to this may be obtained. By using internal combustion engines, current can be quickly turned on in the case of fog or unusual darkness, under which conditions a supply is given.

In three districts for which provisional orders have been recently obtained, it is proposed to work on this plan, and the necessary consents have in each case been given by the local authority.

Whilst in most districts it will pay a man with only a few lights to use electricity at the above price, the man with 50 lamps would find the charge too high.

To meet this difficulty, we put in a limit indicator, ask the consumer to switch on the maximum number of lamps he wishes to use at once, and charge him, say, 12s. per 30-watt lamp, calculated on the number to which the limit indicator is set, and 2s. per lamp on the remainder to cover the wiring charges. He thus settles his own diversity factor and is charged accordingly.

This enables him to put in lamps where he naturally would not use them if he had to pay full price on all lamps, and at the same time obviates the absurdity one so often sees, viz., a station providing capital for free-wired lamps which do not even pay the annual wiring charges.

We venture to think that the future of electric lighting lies more especially amongst those consumers whom gas has hitherto claimed entirely as its own.

Comparing the present proposals with the conditions obtaining only three years ago, what do we find? The standing charges of the station and mains per unit of candle-power capacity have, by means of the wire lamp, been reduced by nearly two-thirds; by using double-wound transformers, interior winding becomes single wire instead of double; a main lead consisting of a single No. 18 wire can, at 100 volts, supply all installations of 20 16-C.P. lamps or under; the old double-pole distribution fuseboard is replaced by a single 5-ampere fuse; the meter becomes a memory of the past; a single service supplies a terrace of houses, and electric light commends itself to all long-hour consumers on the score of price independently of other considerations.

Appendixes are added giving typical gas consumers' accounts, and estimates for the capital cost, and working results of small electricity works run on the lines suggested.

Mr. George Wilkinson (Harrogate), who opened the discussion, said he had been struck by the idea that the authors had written the paper from a company's or profit point of view, rather than from the municipal standpoint. In many cases it was true that the new lamp had reduced the station output, but at Harrogate, where they had replaced half their carbon lamps by metal-filament ones, the past seven months' station output was only 2 per cent. down, as compared with the same period in the previous years. During October he had added 622 new lamps, and he, personally, did not fear as to the future. The demand indicator system was too complicated for the small consumer, and the authors had come to the same conclusion as himself, that it was necessary to have a fixed price per lamp. At Harrogate, where this system had been tried, the demand indicator consumer paid on the average 7s. 7d. per lamp per annum, and the flat-rate consumer average 7s. 6d., the fixed-charge consumer was charged 11s. per lamp per annum, based on eight hours per day burning. He thought the wisdom of this charge was proved by the authors' figures. The consumer paid in advance, this being necessary with small houses, and he had only three simple conditions to conform to, viz, that he uses the light only in the evening or when it is dull; that he uses the supply for lighting only; and that the apartments shall not require artificial lighting during the daytime. In connection with his scheme he had had some difficulty in finding a suitable current limiter for from two to six lamps: he was able to get houses wired at 8s. 6d. to 9s. per point, and the tenant paid 5s. 6d. per point for lamp, shade, &c. The house services were now costing from 50s. to 60s. each, including the cost of the limiter, and the rental of the houses supplied was approximately 7s. 6d. per week

Mr. R. Pierce (Cambridge) said he found it difficult to reduce the cost of wiring, including the lamp, below £1 per point. As the total revenue per lamp in many cases was only 3s. (and his company worked at a profit), it seemed that in the case of good consumers, it would be easy to reduce the charges below that stated. The metal lamp certainly brought in new consumers; he had connected 6,000 30-watt lamps recently, due to the cheapening of the light, and considered that the new lamp would be advantageous in the end.

Mr. W. R. Cooper suggested that screw sockets might be used in connection with the authors' proposals, with a view to ensuring that lamps were not changed. There was a great drawback in using only 25 volts on house circuits, in that there was no chance of adding heating appliances, &c. He was sure that metal lamp prices would continue to fall, and it seemed that if it were possible to use 100-volt circuits and overhead transmission in certain districts, it would much facilitate cheap supply. It was a common mistake to use metal-filament lamps with clear globes, as the high intrinsic brilliancy of the filament rendered some protection to the eye necessary.

Mr. C. H. Wordingham said that nothing had been added to Dr. John Hopkinson's paper on charging, which showed that a sliding scale was the only equitable system of charging. He entirely disagreed with the authors' contract demand system, as he considered it wrong to charge a fixed price per lamp. From experience, he knew that there were many difficulties in the working of a contract system, and Mr. Wilkinson's agreement seemed to place too much confidence in human nature. As it was illegal to prescribe any particular burner, he thought this portion of the scheme would have to be reconsidered. He had installed in his own house 25-volt metal lamps, and these had been in use for two years, the first one burning out only last week; it paid well to use transformers and low-pressure lamps. He couldn't agree with the proposal for restricting the supply to certain hours of the day, as it appeared to him a primary consideration to have continuity of supply, as in the case of gas and water.

Mr. A. H. Seabrook said that it was true that various systems were derived from the Hopkinson system of charging, but many engineers had fallen from grace and adopted the flat rate; he quite agreed with the authors' system. He had found that it was impossible to get the shopkeeper, for instance, to light his window till midnight with the flat rate system of charging, but it was quite possible on a contract demand system. The authors' proposals were, however, not sufficiently far reaching, as they neglected the important auxiliary uses of electricity. It was not sufficient to rely on the meter reader or similar employé as a medium for furthering the use of the supply one must send a responsible man round. In the case of Marylebone, which has a properly organised sales department, the new business in the way of adding to and modernising installations amounted to £250 a week, despite the very recent introduction of the scheme.

Mr J. S. Dow said he understood that the low C.P. lamp was not being favoured by people who had used high C P. lamps. It was right to sell "light," but it appeared to him that the consumer required some guarantee that he got what he bargained for, and it was necessary to provide means of showing that the lighting was what it was represented to be. He understood that in a certain German town they were using small transformers in the lampholders, and this would safeguard against changing lamps.

Mr. K. A. Scott-Moncrieff said he had no fear of the ultimate effect of the metal lamp, and he believed in a day load. He thought there was a necessity for a contract demand system for day-load lighting in small towns, while in the evening a metered supply could be given. Regarding the authors' estimate for a 10,000-light plant, he would not care to deal with 240 KW. by three 100-KW. gas engine sets; he also suggested a preference for four-wire three-phase distribution as against single-phase. The paper took him back 20 years with its references to alternating current, house transformers and contract demand.

Mr. F. Risch said the old idea was to cheapen the supply, but now that they had economical lamps there appeared to be an outcry against the small consumer, although the latter could demand both a supply and a meter if he so desired. He thought there was not much in paying more for a supply just because one knew what one was going to pay (a remark which he subsequently discounted by saying that the gas people had done very well out of slot meters). He considered that the small consumer would be wanted in a few years when heating apparatus became efficient, and it was not right to penalise him now.

Mr. Hugo Hirst said there was no reason for panic on the score of reduced output; the big candle-power lamps were very popular and had proved excellent competitors of gas. He thought there must have been a big saving at the stations owing to reduced peak loads.

Mr. Handcock, in replying, pointed out that it was not proposed that the contract system should be used exclusively, but he thought that the metal lamp had brought along new conditions which could be met by some such system of charging as suggested. It was not a question of turning over existing consumers, but of attracting new ones; by small and big consumer were intended short and long-hour consumer respectively, and the latter were sufficiently profitable to enable one to dispense with meters. In considering the possibility of carrying out in practice a contract system, it must be remembered that the E.L. Acts enabled one to enter into an agreement with the consumer, providing he was given the right to a supply on the flat rate system at the price mentioned in the provisional order (frequently 7d. or 8d. per unit). This also applied to the lamp he must use; it also appeared that having signed the agreement determining the lamps to be used, a consumer using a larger lamp would be stealing energy and thus commiting a felony.

The President (Dr. Kapp) said that a similar system to the authors' was in use at a small place in Italy, where he had lived, but there was no limiting device, only a meter, which registered if the contract demand was exceeded. This system proved very satisfactory in use, and he hoped the authors' system would be equally so. He understood that they were putting in 10,000 lamps on their system.

Telephones.

By L. E. Wilson.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, November 16th*, 1909.)

Twenty one years ago there were 1,400 subscribers here and about 5,000 subscribers in the metropolis. Now the 103,287 exchange stations on the National Telephone Co.'s system in London as at January 1st this year originate 590,000 calls per day, and in Manchester the number of exchange stations has increased to 20,000, giving 138,000 calls per day.

"Speed" is essentially the telephone engineer's maxim, and a few seconds saved on each call approaches gigantic proportions in the aggregate; consequently even the expressions employed by the operators are regulated, and co-operation, or team-work as it is called, is now used extensively, and reacts favourably on the service.

In spite of the strides made, full advantage is not yet taken by the public of all the facilities a telephone service offers, and this is not due to any technical difficulties. The telephone service is the most rapid, cheapest, and most direct channel for information, and this channel should be open both ways, and the intelligent study of the best method of handling telephone calls is of wide importance; as a rule the subscriber is only alive to the delay *he* actually experiences, and is not interested in any irregularity occasioned by his own methods.

The "engaged number" question is open to great misunderstanding, and a glance at a characteristic curve showing the number of calls which have to be dealt with during the various hours of the day will, in a measure, convey the reason.

The rise and fall in calls, as shown by this curve, indicates a tendency to crowd the day's work into about two hours in the morning and about two in the afternoon, and this tendency is more pronounced in exchanges serving strictly business localities. This characteristic explains many engaged numbers, but engaged calls are chiefly caused by an insufficient number of lines. The subscriber is usually only interested in outgoing calls, and for this reason it is difficult to get the inward traffic recognised, although it is not at all in his interests to neglect his inward traffic. The "engaged number" provides ineffective work at the exchange on some 23 per cent. of the total number of calls; to the subscriber it means lost time and lost or delayed business.

At one time it was customary to allot 50 or 60 subscribers to each operator, a system manifestly far from ideal. To-day the method is to apportion equally the amount of work, relying upon mutual assistance or teamwork to provide for unequal capabilities of the operators, and to prevent an accumulation of calls at individual operators' positions. The work is apportioned on the basis of calls, not lines. To obtain this result, records of calls are taken periodically, and the lines on the switchboard distributed as required. The most important branch of the telephone service is not electrical in character, and the engineer who has persistently devoted his life to the higher side of the art, finds it necessary to acquire also considerable commercial knowledge. The traffic side provides a vast field for intelligent investigation, and the function of the telephone engineer which, a short time ago, was to install lines and build switchboards, is now associated with business and commercial questions controlling the position and size of the exchange, the possible growth, the lay-out of the outside plant and size of the switchboard, distribution of the work, the rate of calling, the character and destination of the calls, and other similar matters which involve the expenditure of huge sums of money.

The introduction of 24 volts pressure on telephone lines brought prominently to the front the question of insulation, and taking 1,000 lines under old conditions, on a wet day 40 per cent. tested under 100,000 ohms; the use of the Sinclair-Aitkin leading-in insulator, which introduces a dry section between the leading-in cable and the outside wire, raised the insulation considerably, and under the same atmospheric conditions, only 23 per cent. proved to be under 200,000 ohms. An investigation of low insulation and the cause sub-divided the responsibility, as follows:—

Outside lines including the leading-in wire ...	37 per cent.
Window terminals	37 "
Office wiring	19 "
Instruments	7 "

After receiving individual attention, no line tested under 7 megohms. It does not necessarily follow that speech transmission was inferior under the old conditions, although with the transference from open to underground wires insulation difficulties almost disappear.

Manchester possessed one of the first paper cable systems; in the first installation there were 153 pairs of wires in a 2½-in. cable, and now cables containing 800 pairs of wire in the same diameter are used.

The introduction of common battery working places all complication at the exchange, where a skilled staff is available, leaving a minimum amount of work for the subscriber to accomplish, with simplified equipment. The less the subscriber has to do, the better for the service, for he is strikingly incompetent as an operator.

The subscriber's instrument has also made real progress, and the general excellence of the design and workmanship makes it difficult to suggest further improvements. The same progress is not so generally noticeable in the domestic or private telephone; the retention of the obsolete types of instrument is unfortunate, and whether this is due to inexperience or the borrowing of ideas, the same errors are perpetuated, and the consequent difficulty of maintenance brings the industry into disrepute.

When attention is once aroused, no doubt the ingenuity and enterprise of the manufacturers will speedily find methods to increase the efficiency of this class of telephone.

A glance at the common-battery standard instrument will show the great improvements and modifications in favour of low maintenance costs, and there is apparently no reason why these features should not be introduced in other types. For small installations it is not always advisable to install a common-battery equipment, but the time has now arrived when the advantages of a common-battery system should be universally appreciated; but unless manufacturers take in hand the necessary educational work, opportunities will, for the time being, be lost and obsolete systems installed.

The advantages a common-battery system offers may be subdivided under the headings of line, instrument and switchboard:—

(*a*) The common-battery instrument dispenses with the local battery and generator. The simplified instrument consisting of bell, receiver, induction coil and transmitter, with the addition of a condenser, supplies all requirements, and the act of taking off and replacing the receiver gives a definite "call" and "clear" by making and breaking the circuit for direct current from the exchange battery.

(*b*) *Line.*—The line is practically under permanent test, and faults are automatically recorded.

(*c*) *Switchboard.*

1. Responsibility is concentrated to quite 80 per cent. efficiency.
2. Automatic calling is provided.
3. Automatic supervisory signals are provided for both the calling and called subscriber, showing the operator the state of the connections.
4. Uniformity of speech is provided by eliminating the local battery's variation in voltage.
5. Saving in space on the switchboard is of great importance.

In a common-battery system accumulators are usually employed, but there is no reason why suitable primary cells of low resistance should not be used for small plants.

Generally speaking, the telephone has yet to be properly developed in connection with floor-to-floor messages, and there is still preference for needlessly wearing out the staircase, calling heads of departments away from their work, banging doors, and general disturbances; all these objections can be eliminated and an immense saving effected by making it a rule to telephone. The cost of installing a private telephone apparatus may amount to anything from £1 to £8 per station, depending upon the type of installation and the quality of the apparatus, but the cost of maintenance should amount to a small item, provided the apparatus is carefully selected and installed.

It is not unusual for the average number of calls per station to exceed 10 calls per day, and if we consider a typical equipment where 50 instruments are installed this means 500 calls and conversations daily. Reckoning the value of the conversations at the very low rate of ½d. each, it follows that the actual value of the traffic in the installation amounts to no less than £312 10s. per annum, the actual cost of the installation being slightly over £200, and the cost of maintenance about £15 annually.

When we consider, in addition, the great saving in time and improved discipline, it is easy to see how the telephone call may be made a most valuable money saver, but the equipment must be suitable for its work, efficiently installed and efficiently maintained.

Mr. W. Aitken, referring to the status of the telephone engineer, said that it was beginning to be recognised that the telephone engineer's work was very serious, very scientific and full of detail. On a 10,000-line exchange, there would be practically one million spring jacks, which had to be wired up so that there were no faults. The work had to be done in a very perfect way, because faults were so difficult to get at. Mr. Wilson blamed manufacturers for designing 1,000-ohm bell coils and generators with 500 ohms resistance to put in connection with an internal installation with a line resistance of a few ohms. The manufacturers would be very pleased to design apparatus that would be suitable for internal installations, but, unfortunately, the consulting engineers frequently specified certain things which had, of course, to be supplied. The manually-operated multiple switchboard was beginning to be found too cumbersome, and there was a leaning towards automatic systems. With an automatic system they would be able (as the system was a "trunking" or cross-connecting system) to divide the subscribers' lines into smaller units, and an accident to one unit would then only affect a comparatively small number. With regard to arresters, serrated arresters should never be used; the carbon arrester should be adopted. One of the most interesting features of common-battery equipments was the small exchanges. It was the practice for some little time to draw current over the direct line, and feed extensions from the same circuit; current was now supplied over feeder wires.

Mr. Morshead referred to the annoyance of ineffective calls, and spoke of the possibility of a system of storing calls on similar lines to the signalling arrangements employed on the London Underground Railways, whereby trains were dealt with in consecutive order.

Mr. T. Plummer said, with regard to the education of subscribers, he thought it would be of considerable advantage to subscribers if they put a responsible person in charge of the telephone instead of the office boy. The period between 10 and 12 was also the "peak" of the load in connection with trunk calls. At the Manchester trunk exchange, which was the largest in the world, the trunk calls between 10 and 12 a.m. daily amounted to 10,000. Of these 4,000 originated in Manchester, and 6,000 were for Manchester—originating at outside places. Between 11 and 12 this fell off to 8,000, of which the outgoing calls were 3,000 and the incoming, 5,000. The great improvement in the manufacture of paper-core cables was partly brought about by the agreement made in 1905 between the Post Office and National Telephone Co., under which certain standards were laid down—for example, that the combined efficiency of the subscriber's line and junction should not exceed so many miles of standard cable, having a conductor resistance of 88ω per mile of loop and wire-to-wire capacity of 0·054 microfarad per mile, with insulation of not less than 200 megohms between each wire of a pair. This had enabled the company to reduce the weight of conductor in subscribers' cables within a short distance of the exchange to 6½ lb. per mile, which represented the minimum size from a mechanical point of view, apart altogether from its electrical efficiency. In London he believed the National Telephone Co. had at one time a junction exchange, but experience showed that this was not satisfactory, and the arrangement was abandoned, direct junctions being put through from the different exchanges in the metropolis. In the new "City" exchange recently opened by the Post Office in London, there was no multiple on the subscribers' board at all. It was found that the number of junction calls in London formed such a very high percentage—he thought over 80—that the subscribers' multiple was abandoned altogether on the local board. All calls which came into the City exchange had to be transferred on outgoing junctions, or, for subscribers on the same exchange, they went across the room to an incoming junction board, and in that way got onto the subscribers' multiple. There was a fortune awaiting any man who was able to bring out a decent telephone cord. There was no reference in the paper to the very important question of increasing the efficiency of telephone cables by means of inductance coils, as suggested by Pupin. The Liverpool-Manchester 100-lb. conductor air-space telephone cable had been under experimental treatment by the Post Office for some six years past. The cable was 38·5 miles in length, and the first sets of coils, inserted at mile intervals, although increasing the efficiency of the cable, gave rise to trouble through loss of insulation at the leading-in points. About two years ago, however, further experiments were made and improved types of coils were fitted, one with an inductance of 100 millihenrys and the other 133 millihenrys, at 3-mile intervals. The unloaded cable had an efficiency represented by 17 miles of standard cable, whilst the loading at 3 miles intervals had reduced it to about 9 miles with terminal losses, or about 5 miles when the cable wires were extended so as to overcome these losses. The results had been so satisfactory that the new 208-wire telephone cable just laid between Liverpool and Manchester contained conductors of 70 lb. per mile only, and these would be loaded at intervals of about 2½ miles.

Mr. F. D. Latimer said that the diameter of 2·55 in. for a cable having 800 pairs would be quite correct for 10 lb. conductors, not 6½ lb. as quoted; an 800-pair cable with 6½-lb. copper, constructed to comply with the National Telephone Co.'s specification would have a diameter of approximately 2·3 in. The greatest number of pairs with 6½-lb. copper which could be enclosed in a lead sheathing of 2⅝-in. external diameter and with a maximum mutual capacity not exceeding ·08 mfd. per mile would be 1,200. In the City of Liverpool the first cable installed accommodated only 41 pairs of 20-lb. copper; it was the first length of dry-core air space cable laid in Europe, and was run through the Mersey Tunnel in 1891 by the National Telephone Co. for the purpose of connecting Liverpool and Birkenhead. It was still in position and working.

Mr. A. Whalley said that up to five or six years ago practically the whole of the equipment of the common battery exchanges was made abroad, but there were two or three firms in this country, including the owners of foreign patents, which had laid down plant, and everything could now be made in this country. The Post Office was to be credited with a large share of this encouragement of British industry. It appeared for the moment, however, as though the manufacturing capacity had overtaken the demand, partly because of bad trade, and partly, perhaps, because the National Telephone Co.'s property would be taken over by the Post Office in two years or so, and the company's expenditure was consequently curtailed. The number of employés engaged in this country in making telephone exchange equipment and instruments was between 3,000 and 4,000, and to keep them properly occupied orders should average about £10,000 per week, or at the rate of £500,000 per year. He was afraid that not much more than one-third or one-quarter of that amount might be ordered next year according to present signs. The standards adopted had set a high mark of quality and efficiency, and every important manufacturer in this country could now supply to these standards. While in America they had an output of telephonic apparatus many times greater than ours, no universally accepted standard had so far been adopted there. The delays in using the exchange telephones were, perhaps, more than anything due to the office boy controlling the instrument. In the States it appeared the custom for every man in a responsible position in any business to have a telephone on his desk, and anyone could get through to him direct at once. As regarded the use of private telephones in works, &c., the annual cost should be below £2 sterling per instrument per annum. If the saving of time to each employé provided with a telephone was only 5 per cent.—and it would be much more—this meant that a wise business maxim was that in every large office or works, each employé who was paid £100 a year salary should have a telephone on his desk.

Mr. A. R. Bennett, in a written communication, said that the first telephone exchanges to be kept open all night in this country, and, so far as he could ascertain, in the world, were the Douglas Street and Hillhead Exchanges in Glasgow, and the date was January 1st, 1881. The Glasgow continuous service was a success from the first night, and led to a notable increase in the subscribers to the Commercial system. Probably London was the last place of importance in the kingdom to give an all-night service. As late as 1895 new switchboards for many thousand subscribers were fitted in Berlin and other German cities without any provision being made for night service; and other Continental countries were just as backward. Without doubt many lives and much property had been saved by the existence of night telephones.

Mr. S. J. Watson (chairman) said that if users would pay greater attention to the loss of time which must occur through their own methods, all subscribers would benefit by the improved service.

Mr. Wilson, in reply, said that the inter-communication telephone of above 10 lines was not a complete success. In his mind, there was no doubt that the automatic switchboard would come, and probably develop as a feeder to large exchanges. With regard to calls being stored up, the principle applied to telephone calls means that one's line would be engaged, and nobody else could get one whilst waiting, which was a feature not to be encouraged. Oxford Court served its purpose; primarily it was a trunk exchange, and small exchanges not requiring many junctions always had connections to this central exchange, so if the direct junctions were engaged this channel was available. He thought that an air-space cable was in use before 1891. It seemed particularly unfortunate that the telephone industry should suffer because of the artificial conditions brought about through the Post Office arranging to buy a rapidly-growing business several years ahead.

THINKING IT OUT.

By J. H. W.

Engineers are for ever contending against innumerable small difficulties—commercial, mechanical, electrical or chemical—and some big ones. Very often these difficulties are tackled in a rather haphazard fashion, or else shelved until some member of the staff happens to suggest a way out of them, and the writer ventures to think that few people have a systematised method of mentally attacking them. A certain fitting is costing too much to make, or a particular machine is frequently coming in for repair. Have you a mental process ready to deal with the matter methodically and logically? If not, the present article is an attempt to supply one, or, at any rate, the outlines, which can be filled in to suit individual requirements.

The first step in tackling any problem systematically is to ascertain *exactly* what is wanted, and to *write it down*. This sounds very obvious and very easy, but it is by no means so easy to get all the requirements into a few short sentences, and this writing down will be found of immense value in crystallising one's ideas and getting at essentials.

The commercial requirements should be considered first. These always involve cost of manufacture, efficiency and durability, and may also include questions of appearance, compliance with Home Office or other regulations, and so on.

Next come the mechanical necessities; strength, weight, direction, range and speed of moving parts; questions of friction and lubrication; accessibility and means of take-up or renewal of wearing parts; any special qualities such as water-tightness or resistance to corrosion, and so on. It is impossible here to do more than hint at the most likely points. Each problem will suggest its own requirements, but make sure that while nothing essential is omitted, the list contains no unnecessary condition. Prof. Unwin used to employ a neat phrase in specifying the requirements of a design. He would say that to obtain such and such a result it was "necessary and sufficient" to do so and so. This is the thing to aim at, in a nutshell.

Next may be considered the electrical conditions to be complied with, if it be an electrical problem; conductivity and current-carrying capacity, insulation, magnetic flux, and so on. Finally, any chemical or special necessities of the case must be taken into account. Now, having prepared the specification, so to speak, to which you must work, the next step is to find a solution of the problem satisfying all the conditions or as many as possible. Here is where originality and experience come in. The latter is a question of time and opportunity; the former, though possessed in very varying degree by different people, can undoubtedly be cultivated and increased by use. Still, sometimes that idea we are searching for is very elusive, and little can be done to hasten its approach beyond a steady concentration of thought on the problem. A close study of the methods by which other people have attacked the same difficulty is often useful, if only as showing what to avoid; and sometimes the best points of several faulty designs, skilfully combined, will give the desired solution. On the other hand, there is a great danger of repeating the mistakes of others, of following in the rut; and this is, above all things, to be avoided. As an example of this, one may recall the early types of motor-cars, which were utterly spoiled because their designers slavishly followed the lines of horse-drawn vehicles. Always apply first principles to a problem, and let the design stand on its own merits without reference to past work, though this by no means implies that past experience should not be utilised to the utmost. The fact, however, that the difficulty under consideration has cropped up shows that past experience in that particular direction has been found wanting, and therefore a new line must be struck out. It is often very helpful to consider a similar sort of problem in quite another department. For instance, in considering the method of delivering current to a travelling crane, the methods used in electric railway and tramway work for delivering current to the motors by trolleys, ploughs, and so on, would be worth studying.

No doubt a number of solutions to the problem will present themselves, only to be quickly rejected as not satisfying some condition or other. However, let us assume that finally a scheme reveals itself which seems hopeful. It must be compared with the list of conditions to be satisfied, to see if it fulfils them all as far as possible, and if it passes this test it must be closely examined to see if it contains anything superfluous, or whether it can be simplified in any way. The essence of good design is simplicity, and if your scheme takes a complicated and roundabout way to achieve its end, you may be sure there is a better one lurking round the corner. In this connection it is a very useful habit to get into the way of *seeing* things mentally. Sketches will help, but you must have the thing fairly clear in your mind before you can make them, and the more vividly you can visualise the thing and see it working, the easier it will be to simplify and perfect it. And not only must one visualise the finished article, but also every step in its manufacture and assembly. Here again, if the processes involved are at all complicated, it is a very good plan to write down a list of the operations in order. This will often suggest a few modifications which will save some machinery or otherwise cheapen production.

The suggestions contained in this article may seem to deal chiefly with questions of design, and mainly to concern draughtsmen, but they are applicable, *mutatis mutandis*, to any sort of engineering problem, from the lay-out of a power transmission plant to the method of allocating to each job the time and material used; from the handling of a 50-ton electric steel furnace to the disposition of the lamps in a room. The big jobs can look after themselves. They are always carefully gone into—there is too much money involved for it to be otherwise; but the small things, that undue voltage drop here, that inefficient drive there, that second setting on the machine when, perhaps, one could be made to do, that item in the stores account which has been rising slowly for months past, for no obvious reason, or that squad of labourers who do not seem to be getting through the work they should—these are the things that often make the difference between loss and paying prices, and, therefore, need to be tackled systematically.

These remarks are not addressed to experienced engineers who may be taken to know and practise already the methods advocated, but to junior engineers, foremen, and all the rank and file of the trade. You are the people who come against the difficulties most intimately, and can best study their causes. Get into the way of thinking out problems systematically for yourselves; it pays. There are very few firms nowadays who do not encourage and advance those who show originality in overcoming difficulties and effecting small economies.

Finally, a few more words as to the trial and failure of new ideas. There is almost always a certain amount of prejudice and doubt to be overcome when any new thing is introduced. We all know the old foreman who has been 20 years with the firm, and strongly resents changes of any sort. Apart from this, a new method or a new tool requires use and practice before it will yield results fairly comparable with the old way. See that your new scheme gets fair trial over a reasonably long period, and do not be disheartened if all does not go smoothly at first. Probably all that is needed is a little humouring, or, perhaps, a few trifling alterations. Should the scheme, however, after patient trial, prove a failure, the sooner it is admitted the better; but even so, it will not be without value if the reasons for the failure are carefully studied. Tackle the problem afresh in the light of the new knowledge you have thus acquired.

THE POSSIBILITIES OF THE STEAM TURBINE.

[COMMUNICATED.]

In view of the great developments in steam turbine construction during recent years, it is very surprising that the possibilities and limitations of the steam turbine should still be so vaguely understood by a large proportion of engineers.

A few years ago many new designs were produced, for each of which was claimed some particular constructional or other advantage, with a steam consumption at least equal to that obtained by the Hon. C. A. Parsons in his well-known design, which was the first successful commercial machine, and which still maintains the lead in steam consumption under similar conditions of steam and vacuum.

Out of all these there are only two main designs left at the moment which offer any serious competition with the standard Parsons design, namely, the compound impulse type, with only one row of moving blades per stage, introduced by Prof. Rateau, and the Curtis compound impulse design, with more than one row of moving blades per stage.

The attractive features of these two designs are due to their possessing fewer possibilities of operating troubles, by reason of the greater clearances permissible over the blade tips.

The most important alteration the Rateau design has undergone is the increase in blade speed, which reduces the number of stages required, and enables them all to be got into one cylinder instead of requiring two cylinders, as in the original design. This point, in conjunction with the improvement in detail construction, has enabled it to attain a steam consumption closely approaching that of the Parsons type.

The Curtis design has had the four rows of moving blades per stage reduced to two per stage, and the number of stages increased from two to four or five. It has been stated that an improvement of 30 per cent. in the steam consumption is obtained with the latest design over that obtained with the machines built to the early designs.

The only objection raised to the Parsons design comes from the operating standpoint, and is due to the fear inspired by the small clearances required over blade tips and on dummy strips to maintain a low steam consumption. Experience has now proved this fear to be somewhat unnecessary, for many machines have been in long and continuous commercial service without any such troubles. The attractive features of large clearances, however, continue to induce great efforts to be made to bring the steam consumptions of the impulse types down to those obtainable with the Parsons design. With the view of combining the advantage of large clearances at the high-pressure, and consequently high-temperature end, and the better steam consumption of the Parsons, combination designs of Curtis at H.P. and Parsons at L.P. end have been introduced. Combinations of Curtis and Rateau or Zoelly have also been tried to improve the consumption, but as the best results of any pure impulse design have hardly reached that of the Parsons, it was only to be expected that the combination types would not be successful, although they may possess some mechanical advantages over the Parsons. As the steam consumption is of the first importance, however, the small clearances of the Parsons design will continue to be accepted as long as it maintains the lead in that respect.

Devices have been tried to improve the steam consumption of impulse turbines, which involve running with small clearances at various points. The introduction of small clearances at any point, however, nullifies the advantages possessed by the large blade tip clearance, and creates the same fear of possible trouble as with the Parsons, and, in addition, the likelihood of even worse results.

Should the standard Parsons design come into contact from any cause, it clears itself in the majority of cases with only a slight increase in steam consumption as the result, or, at the worst, with the loss of a few rows of blades, while even then the machine will continue to operate. Should an impulse turbine have the shaft seize up where it passes through the diaphragms, it is immediately placed out of service, while if packing devices are used, which will rub away without seizing, then the improved steam consumption due to them is lost, even if no other damage is done by the vibration set up.

The sole feature which has enabled the turbine so largely to supplant the reciprocating engine for driving electrical generators is due to the great increase in the size of the units now adopted. For 500 to 1,000-KW. sets the double-acting quick-revolution engine still remains a strong competitor, as regards both cost and steam consumption, while below 500 KW. the engine continues to hold its own. Above 1,000 to 1,500 KW. capacity the turbine holds the field. It is only when large capacities are required, and consequently large quantities of steam are being consumed, that the turbine gains the lead.

A high rate of R.P.M. is also imperative to the successful application of the turbine, and no design has so far been produced which has increased the field of application by reason of its lower speed. Special designs of air compressors, fans and centrifugal pumps have been produced for direct connection to turbines, but for the speeds and powers required for the direct driving of factories and the other manifold uses of a prime mover the turbine is hopelessly handicapped. The advantages gained in driving large generators, however, will prove of great service to the electrical industry, because the reduction in the cost of generating current, made possible by its use, will help materially to increase the number of motor-driven plants installed in place of the small steam or gas engine.

In marine work the turbine is limited to those vessels which require large powers to propel them at a high rate of speed, and in which a compromise can be made with the propeller R.P.M.

All these types of turbines have now had considerable and lengthy tests in commercial service, and there is no immediate prospect of any great strides forward being made.

Improvements in blading proportions and manufacture may slightly improve the steam consumption, but there is absolutely nothing in sight to substantiate the dreams and anticipations of the many people who, a few years ago, talked of the reciprocating steam-engine being shortly found only in a museum.

NOTES ON TRADE ABROAD.

Constantinople Telephones: A Noteworthy Success.

In our issue of October 8th, under the sub-title "Good Thing for Somebody," we emphasised the importance of the "very substantial and valuable concession" that was in the market in Constantinople for the provision and working of telephonic service. It is gratifying now to learn from dispatches to the daily Press that the concession has been awarded, by the Commission specially appointed to consider proposals, to Mr. Herbert Laws Webb, of London, whose name needs no introduction to our readers, and who is above all things known for his zeal in the interests of the progress of telephony—subject to the confirmation of the Turkish Ministry of Finance. It is stated that Mr. Webb was representing a very strong combination, composed of influential gentlemen connected with the National Telephone Co., the Western Electric Co., of Chicago, the British Insulated and Helsby Cables, Ltd., and the French Thomson-Houston Co. We congratulate Mr. Webb and the British-American-French group upon this success, and hope that information of the final approval will soon be received. We are encouraged to hope that the other electrical concessions which are shortly to be given out for Constantinople will also be as discreetly sought after, ensuring that, at any rate, a fair proportion of the resultant business will come to English factories. Constantinople, a city of nearly a million inhabitants, has neither electric lighting nor electric tramways, and both may be regarded as inevitabilities of the early future. Indeed, the position of the electric lighting concession is such as to demand the immediate attention of those who desire to bid for it. In a report recently sent home to the States by a Consul, it was stated, "The prospectus of an electric light plant . . . . will soon be prepared. The present antiquated horse-car system of the city has a franchise which will be in effect for a long time, but the company is willing to sell it, and a company which will change the system to an electric one will make money. The city being badly split up into several sections, Galata, Pera, and Stamboul being the three important divisions, a good tramway system would be popular. Every day there pass across the bridge between Galata and Stamboul at least 10,000 people. The length of the bridge is about one-third of a mile. Between Galata and Pera there is also a heavy daily passenger movement." Reference to earlier issues of the REVIEW will show that some months ago Sir Clifton Robinson and others were interesting themselves in the tramway matter.

From what we have said it will be observed that the Turkish Government, in awarding the telephone concession, are carrying out the wise policy recommended by Djavid Bey, the Minister of Finance, of entrusting to concessionaires the development of such enterprises, recognising that, with concessionaires of wide experience and high financial standing, the investment of the necessary capital and the application of the best engineering skill can be relied upon for the development of important services. We hope that the telephone success will give our manufacturers a great thirst, which will know no denial, for these lighting and traction concessions. Would not a combination of firms concerned with different sections of the electrical manufacturing industry, engineered probably on somewhat similar lines, be feasible in these cases also?

Electrical Notes from India.

One of our Indian correspondents writes as follows:—

"*Metal-Filament Lamps.*—These have now become popular on the Indian market, and a rapidly increasing business is being done. Native users are not slow to realise the undoubted economy resulting from their use, and this triumph of economic lighting can be seen in the smallest bazaar shops of Bombay, Calcutta and Madras, where it almost completely eclipses its older rival. Makers of metal-filament lamps have scarcely as yet, in spite of their persistent assurances to the contrary, produced a high-voltage lamp which is entirely reliable. Large consignments of 225-volt lamps have been imported, but the percentage of breakages during transit and very soon after being put on circuit is beyond all reason, and consequently many importers are shy of touching them, and users, too, are very sceptical. The less fragile 110-volt lamp, of various makers—English, German and American—is making great headway, and it is difficult to say at present which pattern is most popular. A belief holds ground that the last word has not been said yet in metal lamps, and that they will become not only cheaper, but more solid, reliable and sturdy and be able to stand the rough handling both in transit and of local native workmen.

"The comparatively high rates for energy, consequent on heavy establishment charges and other expenses of supply companies, has up to now militated against the general use of electric light and power by the middle-class and poorer native, who keenly discusses his probable monthly expenses before installing electricity. In one city, where the maximum-demand system of metering obtains, it was discovered, in some instances, that consumers, who had occasion to use all their lights and some temporary additions on festive occasions, simply piled crushed ice all round their maximum demand indicators to keep their registered demand normal.

"*Bangalore.*—This very go-ahead city of modern ideas is (says our contributor) an excellent example of what good street lighting can do towards improvement. Many miles of principal streets, both in the cantonments and in the native city, are lighted on the G.E. Co.'s (America) system of series low-voltage constant current metal lamps, energy being obtained from the Cauvery Falls power station many miles away. Most of the public buildings, hotels and private residences are electrically lighted, and every encouragement is held out to local manufacturers and machine users to adopt electric drive.

"It is not improbable that within a reasonable time the narrow-gauge railway connecting Mysore and Bangalore cities, a distance of 78 miles, will be converted to electric traction, as there is still a vast amount of water-power available at the Cauvery Falls. As the lion's share of the Mysore State electric equipment work has, up to the present, gone almost exclusively to America, it is to be hoped that if the above railway traction proposal becomes an accomplished fact, the work will be done by an English firm.

"*Nepal.*—An electrical engineer has been specially appointed from home on a three years' engagement to superintend the erection of the new hydro-electric scheme to light the capital, Khatmandu. This contract was arranged personally by H.H. the Maharajah through the India Office, when he was in England in 1908."

Bolivian Conditions.

In our "Consular Notes" to-day, there appear some interesting facts sent home by British Consul at Sucre, regarding affairs in Bolivia. An electric lighting plant was set going at Sucre a year ago, which was a year later than the municipality required under the contract, but the story of the difficulties that led to the delay, and the waiving of the penalties, is interesting reading to those who have dealings with some of these undeveloped parts of the earth. The same report contains much valuable information concerning the general trade conditions. Our Consul says that no new openings can be expected for British trade, until British exporters send out more travellers, or establish a British firm on the spot :—

> The men who carry the samples get the orders, and the German travellers are so over-whelmingly superior in numbers to the British that they get orders even for articles of exclusively British manufacture. If they can substitute German articles for them they do so, with British labels and imitation British trade marks, and only when this is impossible do they import from the United Kingdom. As regards the establishment of British commercial houses, it may be contended that the business is too small to warrant such procedure, but the Germans and others do it, and are said to make clear profits of from 10 to 20 per cent. The business can be started on the basis of an exclusive privilege of some staple article. Such houses generally have branches in Potosi, which is on the same line of transport, and where the business can be combined with the buying and exporting of minerals. This in itself is a profitable business, besides being of importance in connection with imports in that it tends to relieve the importer of the trouble result from a fluctuating exchange. Besides the competition of the German element in the district who, of course, favour German goods, British traders should be well prepared beforehand to cope with the serious competition of United States firms. The language spoken in the country is Spanish. In the banks, commercial houses and other places, English or French may, more often than not, be understood, but if an answer is required it will be given in Spanish. Ninety per cent. of all catalogues, price lists, &c, not written in Spanish are, for all intents and purposes, practically useless in the district. Packages and bales should be made with a maximum weight of 150 lb., for mule traffic, so that one package may be placed on either side of the mule, making a total load of 300 lb. Machinery and other goods which do not admit of being restricted to this weight, have to be transported on carts and should be timed to arrive at the ports of landing not later than the middle of November or not earlier than May, as the rains make the roads impracticable for carts during the intervening period. As regards the packing of goods, especially in the matter of breakable or damageable articles, for the interior of South America, such of the British packers as have experience in the matter know their business too well to need any hint, and exporters would be well advised to employ none but those packers. Neglect in this respect is the cause of many goods arriving in a useless state, the cases being reduced to matchwood and the contents lost. It must be borne in mind that on an inland journey, which may last several weeks, cases are exposed to a fierce tropical sun, heavy rains and numerous shocks by being dropped from the mule's back on unloading or by crashing against protruding rocks in the narrow passes.

It is true that the volume of electrical trade in Bolivia is not great, but it is a land which is very rich indeed, and as transportation facilities increase it will abound in opportunities, as we showed in one of our articles on "Neutral Markets of the World" (see Electrical Review, June 8th, 1906, Bolivia).

RAPID CABLE TELEGRAPHY.

We were recently privileged to enjoy a private view of the rapid system of handling telegrams which has been evolved by the Anglo-American Telegraph Co. in connection with their Stock Exchange traffic. The necessity for this will be understood when we explain that, owing to the difference in time between New York and London (five hours), the American exchange opens at 3 o'clock by London time, and the London exchange closes at 4 o'clock. There is, therefore, but one hour during which business is in progress in both exchanges simultaneously, and it is of the first importance that intercommunication between the two centres shall be as rapid, reliable and unfettered as it can possibly be made, in order that the transaction of business may be facilitated to the utmost.

Accommodation in the neighbourhood of the Stock Exchange is necessarily scarce and costly, and therefore the Anglo Co. formerly occupied a small office in a neighbouring building. Recently, however, the manager, Mr. J. H. Carson, succeeded in obtaining from the Stock Exchange authorities accommodation within the Exchange itself, and developed the system to which we have referred to the highest pitch attainable.

The space at the disposal of the company has been divided into a decoding room and an operating room. The former is occupied by the decoding clerks of the firms utilising the special service—necessarily a small number, on account of the limited space available. From this room pneumatic tubes convey the messages direct to the floor of the Stock Exchange or to Shorter's Court.

In the operating room the receiving and transmitting apparatus is arranged for duplex working, with Morse recorders, and communicates through repeating stations with Valentia, Ireland, whence the cables run to Newfoundland and on to New York. In the ordinary course one set of apparatus is in use, the other being held in reserve, with operators at all four instruments.

The procedure is very simple. The telegrams are short, being prices as they fluctuate on the New York Exchange; all free matter in the preamble is cut down to the lowest limit, and the address in most cases consists of a single letter. As each message is received and written down by ear (the recorder being in circuit only for the purpose of providing a permanent record) it is *instantly* handed to an attendant and passed rapidly through to the decoding room, whence it proceeds within a few seconds to its final destination. Two receiving operators are necessary at each instrument, as the loss of time in changing the carbon with which a duplicate is made would introduce delay—the instant that one message is through, the second operator commences taking down the next message, and this goes on continuously. In ten minutes we saw 200 messages come into the office—a splendid record of 20 per minute—and there seemed to be no prospect of the slightest relaxation of this high speed, which, we take it, is by far the quickest rate of receiving ever recorded. At the same time, of course, messages were being transmitted to Valentia on the same wire, and at the same speed.

To attain to this high-water mark of efficiency has naturally involved a great deal of organisation and experiment that does not appear on the surface, and Mr. Carson is to be congratulated on this unique demonstration of the capabilities of the trans-Atlantic cable system. It is interesting to note that no extra charge is made for the messages transmitted on this system.

In the course of our visit we were also taken round the main operating room of the Anglo-American Co., in their new building at 63, Old Broad Street. From this office special wires radiate to all parts of the country, and to the Continent; the main lines are worked with the Wheatstone apparatus. Rapidity of communication is the watchword of the company, and to this end every possible means is utilised. High-speed automatic punchers, for example, are installed at certain points of the system, and though faulty at first, have now attained a degree of efficiency which enables Mr. Carson to speak highly of their performance. Manual punching, however, at the terminal stations is preferred to the keyboard instruments now on the market, though the company will not fail to take advantage of these when they have reached a satisfactory stage towards perfection. Every message is carefully checked to ensure accuracy.

Comparing the splendid work done by the cables with the fitful performances of the wireless trans-Atlantic system, one cannot but feel that the epoch when the latter will displace the former—if ever—must be far in the future. Wireless in its own sphere is unexcelled; but in long-distance working it is not yet in the running with cables.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,406. "Improvements in and connected with electrically-driven centrifugal drying machines." W. A. Macfarlane. November 15th.

26,422. "Improvements in electrical switches." H. W. Cox. November 15th.

26,461. "Improvements in and relating to telephone mouthpieces." C. W. Clough. November 15th. (Complete.)

26,465. "Improvements in electric signalling apparatus." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, December 7th, 1908, being date of application in Germany.) November 15th. (Complete.)

26,466. "Improvements in rectifiers for high-tension alternating electric current." Siemens Bros. & Co., Ltd. (Siemens & Halske A.G. Germany.) November 15th. (Complete.)

26,470. "Improvements in and connected with electrical storage batteries." V. de Karavodine. November 15th.

26,486. "Improvements in method of and apparatus for controlling automatic electrically-operated lifts, hoists and the like." R. F. Baerlocher. November 15th.

26,492. "Improvements in the wiring of electric circuits." H. Leitner and W. H. Exley. November 15th.

26,510. "Improvements in the generation of electrical power for transmission, and speed regulation for electrically-propelled ships, railway and road locomotives, trains or similar vehicles and the like." W. P. Durtnall. November 15th.

26 530. "Improvements in or connected with casings for electrical appliances." Mavor & Coulson, Ltd., and S. M. Mavor. November 16th.

26 552. "Improved attachment for telephone receivers." L. Siegenberg, Jun. November 16th.

26,554. "Improvements relating to safety devices for use with fuse boxes and switch boxes." W. White. November 16th.

26 570. "Improvements relating to electric tumbler switches." C. W. Denny. November 16th.

26,577. "Improvements relating to electric telegraph systems and apparatus." W. Judd, B. Davies and A. R. Hardie. November 16th.

26,608. "Improvements relating to electrical machines." W. A. Price. November 16th.

26 631. "Improvements in and relating to electrical convectors or heating apparatus." S. H. Penning. November 17th.

26,649. "Improved electrolyte for use in electric batteries." New Ignition Syndicate, Ltd., and W. J. L. Sandy. November 17th.

26,683. "Improvements in galvanic batteries." J. E. Preston. November 17th.

26,687. "Improved method and means for actuating electro-mechanical fog signals for railways." G. Lowthian. (Application for Patent of Addition to No. 2,973 of 1907.) November 17th. (Complete.)

26,706. "Improvements in or relating to electric arc lamps." Korting and Mathiesen Akt-Ges. (Date applied for under Sec. 91 of the Act, November 23rd, 1908, being date of application in Germany.) November 17th. (Complete.)

26,732. "Improvements in attaching metallic filaments to the conducting wires of electric lamps." H. Leitner. November 17th.

26,758. "Device for cleaning incandescent electric globes or lamps." G. Garty and P. M. H. Potter. November 18th.

26 779. "Improvements in and connected with telephone transmitters." K. O. Leon and C. C. Lewis. November 18th.

26,807. "Improvement in current collectors for vehicles propelled electrically from an overhead conductor and travelling without a track." W. Kohler. (Date applied for under Sec. 91 of the Act, May 3rd, 1909, being date of application in Germany.) November 18th. (Complete.)

26 808. "Improvements relating to vehicles electrically propelled from an overhead conductor and travelling without a track." W. Kohler. (Date applied for under Sec. 91 of the Act, May 4th, 1909, being date of application in Germany.) November 18th. (Complete.)

26,831. "Improvements in sanitary telephone transmitters." M. Y. Calcutt and E. J. Brown. November 18th.

26,844. "Improvements in electric furnaces." A. Helfenstein. November 18th. (Complete.)

26,845. "Improvements in electric furnaces." A. Helfenstein. November 18th. (Complete.)

26 873. "Improvements in boxes for containing mantles used in incandescent gas lighting, incandescent electric lamps, and other fragile articles." A. H. Stevenson. November 19th.

26,898. "Improvements in the distribution of electric energy." A. E. Tanner and E. A. Claremont. (Date applied for under Role 13, April 8th, 1909. An invention comprised in Application No. 27,858 of 1908, dated April 8th, 1909.) November 19th. (Complete.)

26,899. "Four-way and off electric light switch." E. Bourne. November 19th.

26,907. "Improved current collector for electrically-propelled vehicles." W. Kohler. (Date applied for under Sec. 91 of the Act, October 4th, 1909, being date of application in Germany. Application for Patent of Addition to No. 26,347, 1909.) November 19th. (Complete.)

26,929. "Improvements in or relating to electric resistances." H. Korber. (Date applied for under Sec. 91 of the Act, November 30th, 1908, being date of application in Germany.) November 19th. (Complete.)

26,941. "New and improved rail for either electrically-driven or horse-drawn tramway lines." H. C. Girling. November 19th.

26,948. "Improvements relating to commutator bars in connection with the armatures used in dynamos and motors." J. Heys. November 20th.

26,984. "Improvements relating to the regulation of electric circuits such as the field windings of dynamo-electric machines and the like." W. Stansfield and J. J. Hatt. November 20th.

27,026. "Improvements in or relating to apparatus for electrically-controlling machine tools." A. J. Boult. (Felten & Guilleaume Lahmeyerwerke Act.-Ges., Germany.) November 20th. (Complete.)

27,033. "Improvements in apparatus and relating to apparatus and method for generating alternating currents." J. L. Milton. (Date applied for under Sec. 91 of the Act, January 30th, 1909, being date of application in United States.) November 20th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Wireless Electric Signalling. R. A. Fessenden. 20,005. September 23rd.

Hanger for Electric Trolley Wires. H. Schutte. 22,681. October 26th.

Primary Electric Clocks. T. J. Morday. 22,819. October 27th.

Trolley Wheels or Collectors for Electricity. E. M. Schollenberger. 22,951. October 28th. (Date applied for under International Convention, October 28th, 1907.)

Electric Switch Arrangements. M. B. Field and Ferranti, Ltd. 23,515. November 3rd.

Automatic Exchange Telephone Systems. F. Hildebrand. 23,888. November 7th.

Detachable Lock for Bayonet-Catch Electric Glow Lamp Holders. C. F. H. Bayly. 26,205. December 4th.

Ceiling Roses and the like for Use in Electric Circuits. F. G. Bazell and R. B. Verney. 27,729. December 21st.

Construction of Regulating Electric Switch. Veritys, Ltd., and W. G. Pipkin. 28,092. December 24th.

Galvanic Batteries. S. Beoko. 28,292. December 28th.

Controllers for Electric Motors. R. E. Baerlocher. 28,351. December 29th.

Electrolytic Devices Suitable for Use as, or in the Construction of, Switches, Recorders, Meters and other Apparatus. W. B. Thorpe. 28,561. December 31st.

Device for Automatically Switching-in an Auxiliary Source of Electric Current on Failure of the Main Supply. Chloride Electrical Storage Co. and A. Imbery. 16,285. July 21st.

Apparatus for Producing High-Frequency Electric Oscillations, more particularly applicable to Wireless Signalling. R. A. Fessenden. 18,130. September 2nd. (Date applied for under International Convention, September 16th, 1907.)

Wireless Signalling. R. A. Fessenden. 20,456. September 28th. (Date applied for under International Convention, October 10th, 1907.)

Method of and Means for Electrical Wiring. A. E. Lamkin and T. R. Nunwick. 23,413. November 3rd.

Electrically-Operated Tramway or like Points. G. H. Butterworth and E. Veevers. 23,546. November 4th.

Magnetic Power Transmission Gear. R. Lecoche. 23,796. November 4th. (Application for Patent of Addition to No. 15,780, 1906.)

Electric Current Interrupter. T. McClelland. 23,870. November 7th.

Construction of Electric Circuit Breaker. Veritys, Ltd., and W. B. Pipkin. 25,333. November 25th.

Boxes for Junctions, Testing, Inspection or Fuse purposes and the like, for use in connection with Electrical Cables and the like. H. R. Mansfield. 28,397. December 30th.

1909.

Fittings for Electric Incandescent Lamps. F. W. Suter. 430. January 7th.

Control of Electrically-operated Clutches. F. M. Green and Daimler Motor Co. (1904). 695. January 11th.

Telegraphy and Telephony by means of Hertzian Waves. F. J. Chambers. 2,330. February 1st.

Electric Time Switches. W. E Richter. 2,605. February 3rd.

Machines for Sheathing Electric Cables with Metal Sheathing. Witzeumann. 3,257.

Secondary Electric Clocks. J. Neale and E. Powell. 3,437. February 11th.

Construction of Telephone and Switchboard Lamp-Jacks. M. S. Conner. 4,630. February 25th.

Electric Indicators. A. Whalley. 5,040. March 2nd.

Receiving Instruments for Electric Telegraphy. T. Clark. 6,525. March 18th.

Control of Electrically operated Electric Switches. A. S. Cubitt. 7,113. March 24th.

Apparatus for Periodical Interruption of Alternating Electric Current. L. J. B. Drault. 9,502. April 21st. (Date applied for under International Convention, April 23rd, 1908.)

Electric Oscillation Detectors. G. W. Pickard. 10,772. May 6th. (Date applied for under International Convention, March 25th, 1909.)

Controllers for Polyphase Alternating-Current Induction Motors. B. G. Lamme. 14,579. June 22nd.

Trolley Wheels or Collectors for Electricity. G. Krebs & Gustav Krebs and Co., Ges. 15,895. July 7th.

Electric Contact Breakers for Use in Ignition Apparatus for Internal-Combustion Engines and the like purposes. J. A. Schneider. 17,436. July 27th.

Safety Apparatus to be used whenever Holes are Bored for Blasting Operations and when Fired by Detonation through an Electric Current. R. Harris. 225. January 5th.

THE
ELECTRICAL REVIEW.

Vol. LXV. DECEMBER 10, 1909. No. 1,672.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "Ageekay, London." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. Van Nostrand, 23, Murray Street. Toronto, Ont.: Wm. Dawson & Sons, Ltd., Manning Chambers. Paris: Boyveau & Chevillet, 22, Rue de la Banque. Berlin: Asher & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. Alabaster, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

SOCIALISM.

When Lord Rosebery entered upon the preparation of his fascinating work, "Napoleon: The Last Phase," he did so with the avowed object of laying a literary ghost. All of us are haunted by mental phantoms which we would fain set at rest; in the minds of many at this present juncture the spectre of Socialism occupies a prominent place.

Whither will it lead us? What effect will it have upon trade and industry? Is it "catching on" with the Labour Party and the Trade Unions? What can we do to prevent its further advance? These are questions which every man who has time to think, and anything to lose, is constantly repeating to himself.

Some admirable words which fell from Mr. Inglis in the course of his presidential address to the Institution of Civil Engineers fully justify a reference to Socialism. He pointed out that "labour is the beginning and end of engineering, and any interference with the application of labour to engineering undertakings at once affects the profession, and periods of stagnation are liable to result therefrom." "Nature's laws," he went on, "are definite in the physical world, and, so far as they are known, there is every reason to believe that they are equally exact in the economic or political world. But the treatment which many of our labour problems are now receiving at the hands of so-called 'leaders' cannot be reconciled with any nature treatment. . . . . Legislation which protects labour interests to the point of partiality, and which does not at the same time pay due regard to the interests of those who have to initiate enterprise and dispose of the products of labour, is proceeding in an illogical and impossible course, which can have but one ending."

Let us single out from among the avowed objects of Socialism, as advocated by its more extreme adherents, a few of those which must immediately affect the electrical world. Take the official Programme of the Social Democratic Federation. In the so-called "Utopia" which would be established were this body to have its way, there would be no indirect taxation. Instead, there would be a cumulative tax on all incomes and inheritances exceeding £300. Labour would be organised under public ownership and control on co-operative principles. Railways and electric light undertakings would be handed over to public ownership. No man would be allowed to work at any industry for more than eight hours a day, or 48 hours per week. There would be a minimum wage of 30s. a week for all workers; there would be public provision of useful work at not less than Trade Union rates of wages for the unemployed. There would be free State insurance against sickness and accident, and free and adequate State pensions or provision for aged and disabled workers. Upon public bodies would devolve the duty of providing healthy dwellings for the people.

A glance at the ideals which other Socialist organisations have set before them reveals "the same dog with a different piece of string." They are all based upon the assumption that the poor can be made richer by making the rich poorer; that individual effort shall be stamped out; that there shall be generally a levelling-down instead of a universal levelling-up.

It may be said, of course, that a programme so wild and extravagant can never become part of any scheme of practical politics; that the common sense of the nation would revolt against it, and so on. But look at it again! Some of the dreams of the Socialist have become realities.

The municipalities have to a large extent assumed control of the means of transit. The eight-hours day has become a reality in certain industries. Something very like a minimum wage has been established by the efforts of Trade Unions. The principle of supplying work for the unemployed has been recognised.

How, then, are the forces of the Socialist to be satisfactorily met? To be opposed to the doctrines which he inculcates is one thing, but to have the power of persuading the working man that he is grasping at a shadow when he allies himself with Socialism is another! The arguments advanced by the Socialist are captivating to the uninstructed.

The theory of at least one prominent Socialist writer is that within the capitalist system, and in the measure that the wealth of capitalists increases, the labouring classes must become continually poorer, more dependent, more ignorant, more degraded in intellect and character. But what are the facts? Within this very system, knowledge, and the desire for knowledge, have reached the lowest strata of society; crime has decreased, wages have risen, and material comfort has become much more common. The doctrine that the accumulation of capital necessarily tends to the disadvantage, slavery and misery of the operative classes, is clearly inconsistent with history, and is decidedly contradicted by present-day experience.

The indebtedness of labour to capital is enormous; its indebtedness to science and invention is also enormous, and it is wrong for labour to ignore this as it is for capital, science and invention to ignore their enormous indebtedness to labour.

In the electrical world, as in every other department of industry, there must be leaders of men. The leaders must have pluck and ability, and a sufficient command of capital to enable them to prosecute great enterprises. The outlay of capital may be unproductive for a considerable time; yet outlay of capital nearly always means employment of numerous workmen.

Of enterprises which are started a vast number are unsuccessful, yet the workmen connected with them get the ordinary wages current in the trade at the time. Many industrial companies pay in the course of a year neither interest nor dividend; but they all pay wages. These facts are often overlooked by the proletariat. The orator at the street corner has imbued him with the notion that the capitalist is battening on the labour of his workmen.

Socialists aim at freeing labour from what they regard as the tyranny of capital. "Plunder the rich" is the eternal cry. It may well be that some of the rich who make a bad use of their wealth are not entitled to much consideration; but, as Prof. Flint has written, "By all means let us condemn the 'wicked rich,' but let us be sure that it is the '*wicked* rich,' and only the 'wicked rich,' that we condemn."

But the workman who would plunder the capitalist is but feathering a shaft which would penetrate deep into his own heart.

The Socialist spends much of his energy in discrediting capital. He charges it with doing nothing for production, and represents it as being idle, inefficacious. He says that, consequently, labour deserves to have all, and that capital is not entitled to receive anything.

A little thought would seem to be sufficient to dispel these illusions. Take a simple illustration. Capital is spent on machinery. By the aid of machinery the people of Great Britain can do more work than all the inhabitants of the earth can do through the mere exertion of their unaided muscles. Who will deny that some of the credit of bringing about these happy results is due to capital?

The bulk of British wealth has had its source within the capitalist system itself; and is not—directly, at least—inherited plunder.

It is impossible to shut our eyes to the fact that the present tendency of the Trade Unions is to be led astray by the Socialist. And what will be the inevitable result?

The Socialist is unable or unwilling to learn the lesson inculcated by what has happened during the last few years as a result of the growing power and influence of the Trade Unions.

The masters have been taught to combine. Unable to resist the forces marshalled against them by the Unions, individual employers have sought the protection of their fellows by agreeing together on a course of action. A war upon capital only has the effect of making capital stronger and more united than before. The cry of the more extreme among the Socialists is for Communism and universal brotherhood! But these things cannot come about, save by revolution. In the meantime, so long as law and order prevail, the capitalist, and the groups of capitalists, are masters of the situation. Capital is not fixed and immovable. It can take unto itself wings and fly away. If the Trade Union, urged on by the Socialist, becomes more and more autocratic in its demands, the employer can seek unfettered labour in other lands, and no power as yet known to English law can stop him.

Institution Proceedings.

As we mentioned last week, Messrs. Handcock and Dykes's paper was read in abstract only at the London meeting of the I.E.E. We note with interest in the official announcement of the meeting to be held at Manchester on Tuesday next, to discuss a paper on German electrical methods, that the authors "will read an abstract only of their paper," and we congratulate the local Committee on this forward step, which, we are certain, will be welcomed by the great majority of the members. The next reform, we hope, will be the dispatch of advance proofs to all the members of the Local Section, not only, as offered, to those who apply for them. The postage would not cost a penny more, for the announcement of the meeting could be sent out with the paper for a halfpenny; but even if additional outlay were necessary, we feel sure that it would bear good fruit.

"What Nonsense!"

Our friends of the *Gas World* fall foul of the Catford "Electra House," which they describe as a monstrosity, that has "no place in the practical workaday world." They go on to say: "We are told that the estate is being covered with houses that will let at rents ranging from £32 to £55 a year, and we are expected to draw the inference that each of these houses will become a duplicate of 'Electric House.' *What nonsense this is!*"

We venture to italicise the comment, which so admirably characterises the remark which it follows. It was never for one moment suggested by anyone—except the *Gas World*—that any person would think of fitting up his house like "Electra House," which, as our contemporary innocently adds, is purely "a show place, where all cooking, heating, and lighting is done by electricity, regardless of cost."

An amusing feature of the matter is that the gas company's own "Gas House" is situated a couple of doors away. We have not suggested, however, that anyone would dream of living in such a place—that would indeed be a nightmare. It is an interesting, though pathetic, sight to see the various gas-burners in the South Metropolitan Gas Company's big show-window in a main road not far away being laboriously lighted, one by one, when dusk approaches. Where are those vaunted switches with which, we have heard, gas-burners can be lighted from a distance, just like electric lamps? We knew of one house where they were installed, but there the lamps are now lighted in the old-fashioned way. The imitation was hardly flattering—for it proved a failure.

Copper. The combination of producing, refining and selling companies, which has occupied the financial papers so much recently, appears now to be in a fair way towards accomplishment. According to the *Financial News*, the Cole Ryan Syndicate will supervise mining operations and delivery of the ore to the smelters; the smelting and refining of the ores will be done by the Guggenheims; and the disposal of the metal will be in charge of the Lewisohn interests, through the medium of the United Metals Selling Co. Messrs. Rothschilds, as representatives of the Rio Tinto, will be approached with an agreement. The Lake mines, however, will not join the confederation.

The proportion of purely American names in the above arrangement affords an assurance that the financial section of the business will be ably managed, and that the enterprise holds out prospects of commercial success. The result, according to the *Financier* (November 29th), is an increasing bull account in New York. The slight downward tendency of prices here does not coincide with this view of the case, unless the "nerves" which must ultimately affect the market have already set in.

Those who anticipate a revival of trade in England in the early part of next year, will, on general indications, be on the look-out for renewing stock at the present prices. As, however, the commercial world does not generally hold large stocks, but quotes on the price of metal at the time of order, it will probably prefer to continue watching the price in anticipation of the dips which will probably occur when the speculators for the rise take their profits. The *Financier* article says, with justice, respecting the aspect of affairs from this end, "The enormous stocks of copper, visible and invisible, will inevitably exercise a steadying effect on any upward movement."

These stocks, as shown by Messrs. Merton's circular, have assumed formidable proportions. Visible supplies for the end of November stand at 105,743 tons, and supplies generally are well ahead of deliveries; 50 tons have been reshipped to the States.

The increase in visible supplies is principally in stocks at English ports. The exports from the States for November are estimated (*Daily Telegraph*, November 24th) at 25,000 tons, against 23,660 for October. Comparing this with the visible supply figures, it will be seen that the market has still a considerable holding on the side of placidity.

Lead. With a steadiness worthy of its physical characteristics, lead has for some time maintained its price curve in a close approximation to the straight line. It appears to be honestly affected by brisk trade only, and out of reach of speculative troubles. Some interesting figures respecting this metal are given in an article published by the *Financial Times* in their issue of November 26th. We find that October's imports amounted to 15,236 tons, as against 15,236 tons in September, and 16,553 tons in August. The total for the ten months ending October, 1909, is 170,730 tons, as against 198,617 tons for 1908, and 167,075 tons for 1907. A trade combination, the International Lead Convention, certainly exists, but it controls little more than 25 per cent. of the world's total output.

The article referred to mentions that hopes of trade revival and consequent increase in price are entertained by producers.

Licensed Abuse. We were recently present in Court when a well-known engineer was giving evidence. He was the manager of a large works, and had gone to that position by request of the firm, having given up his private practice to do so. This fact was fastened upon by counsel as a basis for the insinuation that the gentleman in question had failed as a consultant and was, let us presume, therefore not worthy of credence. Now, in the first place, a man of exceptional ability may fail completely as a consultant simply from lack of work, for, contrary to popular belief, work does not pour in upon a man when he hangs out his shingle. And again, a good position with a manufacturing firm may be a quite sufficient excuse for dropping even a fairly remunerative consulting practice.

But be these things as they may, how long are engineers to submit to the coarse rudeness of legal men in respect of ordinary business moves and transactions, which are travestied and twisted to imply that something disgraceful or scandalous has been the moving cause? The same counsel was full of flouts and gibes and jeers in respect of a special appliance devised by another engineer, though the device had accomplished its intended purpose. By his long-winded prolixity, and the emphasising of points freely conceded by the other side, he must have involved in extra expenses alone more than the amount at issue between the contending parties. And only thus, apparently, can trade and commercial disputes be settled. Anything more ridiculous to the technical man than many of the questions of certain counsel it is impossible to conceive. Absolute non-acquaintance with the subject in hand, childish inability to comprehend the simplest explanation, and the wasting of time on unessentials that these produce, are all in the day's doings. But the worst feature is that the gentlemen of the wig and gown appear to regard it all as rather a good joke; that all in Court who may speak otherwise than when asked a question, are just those who know nothing of the matter in hand. And it is no unusual spectacle for these gentlemen to wrangle over three different parts of machinery, thinking all the time they are talking of the same part. It would be funny were not industry paying for it all. At this day, unless the sum in dispute is very large, neither side can hope to get back anything by going to law about it. The winner loses, and the loser loses doubly. The points which counsel emphasise are almost invariably of no real consequence; points which to an engineer are everything are passed by. If the bench were occupied by an engineer, and he were to examine the witnesses on both sides after they had each told their tale, he would in the course of half a day or a day deliver a judgment that would require many days of the ordinary legal procedure to arrive at, and the engineer's judgment would be better and fairer. It cannot be contended that the present system of taking expert evidence is sound. Experts are exposed to all manner of silly questions with the view of catching them tripping. The questions cannot be answered by yes or no, yet unless such a false answer is given the witness is insulted by counsel, who demands answers pat to the most ridiculous questions.

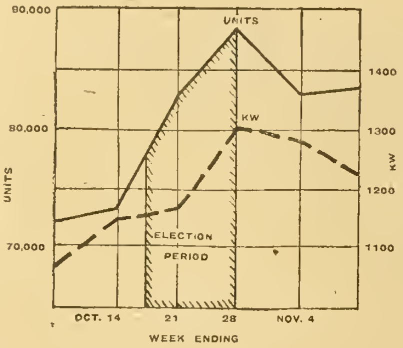
It is really time that this subject was taken into consideration by Chambers of Commerce with a view to the amendment of the whole procedure. It is indefensible that a judicial procedure that has grown out of criminal law procedure should be employed in industrial disputes. Prior to the industrial system of modern times we may suppose that Courts of Law dealt with little else than the vulgar crimes of robbery, murder and treason. But such Courts and their traditional Old Bailey bullying are not suited to modern conditions, and the abuse has grown to such a pitch that it has become a crying injustice.

TEMPORARY ELECTRIC SUPPLIES FOR ELECTIONEERING PURPOSES.

By L. B. HOGARTH A.M.I.E.E.

As the fate of the Budget has been sealed, we shall shortly be in the midst of a General Election. The attention of central station engineers may be drawn to the important part that electricity can take in the election campaign.

The ease with which metallic-filament lamps, flame arcs, electric lanterns, &c., can be applied should afford valuable means for improving the output of some of our smaller electric supply undertakings, especially in districts where there are vacant shops having the electric supply already installed.



During a recent by-election in a London borough, electricity was brought prominently into use, and although the campaign only lasted 10 days, the output of the generating station during that period was considerably increased, as is shown from the diagram.

Amongst the temporary connections to the mains were the following:—

Bioscope consuming 495 units,
Electric sign consuming 167 units,
Bioscope consuming 237 units,
Two poster display shops consuming 64 units, &c.

The services laid for the bioscopes were paid for by the consumers, whilst the sign and the poster shops were services already laid. All were charged at a flat rate of 3¾d. per unit. The safety and cleanliness of electricity render it specially suitable as a cheap and efficient illuminant for electioneering purposes.

TROUBLE WITH A SLIPPING BELT.

By DOUGLAS S. MARTIN.

Prettyboy knocked the ash out of his pipe. "Yes," he said, "there is a lot of humour in testing which the outside world wots not of. The suburban clerk on the Tooting tram hears the buzz of the motors, but he knows nothing of the funny things which Parker said when he was running those motors round in the shop, and burnt out his ammeter." He gazed meditatively at the ceiling.

"And though one might not think it," I observed, "there is a humorous side to a spanner really . . . . if you get it across the armature terminals in the right way . . . ."

Wilkins took his feet off the mantelpiece, and leaned forward in his chair.

"Do you remember old Nobby Wimpole's 100 kw.?" he asked, with a chuckle.

None of us did, so Wilkins gave us the yarn, which I set down here, very nearly in his own words.

One morning, about four years ago, the boss called Nobby Wimpole into his office. One glance at the boss's face told Nobby that an affair of importance was in the wind.

"Wimpole," the boss began, "there is something I want you to do. An official from the Admiralty is coming here to-day to see that 125-horse motor on load. I can't spare you the power house turbine. You have got to get 100-kw. out of the E.T.M.*!"

Nobby bowed his head. "I will try, Sir," he said.

"You will experience some difficulty. Your motor will be overloaded, and your belt will slip—but you must get your load. 100 kw. will about do it. You must get them!"

"I will get them, Sir," said Nobby simply. He lifted his head and squared his shoulders as if adjusting a burden to his back.

"It will be a difficult job, but you may rely upon me."

Cowcraft didn't care much for melodrama in his office, so he added rather curtly, "And lose no time, Wimpole."

"I go," said Nobby. And he went.

So Nobby collared a great tin of sticky maggie, shut down the E.T.M. set, put on his slops, and set to work. I reckon he about emptied that tin. He smothered it over the pulleys, and ladled it on to the belt. Then he picked his men, got the Admiralty motor out, wired it up, put in his meters, and started on his load.

A few of the curious ones had gathered round to see how high he would get. Nobby reached three-quarters without a sign of trouble, glanced round at the set to see how the belt was standing it, waved Bramble up on the tubs, and touched the hundred. Just kept it on for a few seconds to see if he was really there, and then pulled it down again.

A little buzz of cheering came from the assembled testers. Nobby had got 100 kw. out of the E.T.M.! Good old Nobby! And Nobby, who always reckoned he could do anything a bit better than anyone else, smiled his appreciation. The news was all over the place in five minutes. Engineers, hurrying through the works, wondered what the row was about. Navvies, pushing spiders along the shop, paused for a moment to glance at the youth who had succeeded in cajoling no fewer than one hundred large-sized kilowatts from their fastnesses inside the E.T.M. Nobby meanwhile stood there with the "alone-I-did it" look on his face.

Then he sent one chap up to Pullman, the engineer, to tell him that the Admiralty motor was on load, and he could bring the official down when he liked; and then he sent another chap to tell the boss; and the boss came up and told Nobby that he had done a smart thing; and Nobby said not at all, and all that sort of thing; and Bramble—aha, Bramble!

Bramble meantime was watching all this, and saw that the chance of his life-time had come. He had a grudge against Nobby Wimpole. A month before, on night-shift, Bramble had gone into work one evening in excellent spirits. Found he couldn't get any juice. Hunted for open circuits high and low. After two hours' hard swearing found someone had shoved a black wooden brush in his exciter, with the pig-tail stuck on and everything. Next day found out it was Wimpole. Bramble didn't love Wimpole much after that.

So while the chap was telling Pullman and the official to come down, Bramble went along to the traction board, and collared a bucket of railway grease. Soft, juicy grease. With a deft hand he applied it to the belt of Nobby's set. Smothered it over the pulleys, and ladled it on to the belt. Left it with about as much grip as Balaam on a donkey.

Pullman arrived with the official, and introduced him to the boss. The official said what a nice shop it was, and the boss said what a rotten summer we'd been having, and then they looked at the induction motor. They told Nobby to run it round. Nobby ran it round.

The official, flicking the dust from his coat, as if the whole thing bored him inexpressibly, asked if they would give him some load. He suggested 125 horse. Nobby looked delighted, and offered him a couple of hundred. No? Very good.

Nobby moved round behind the table, glanced at his cycles, placed one hand on his ammeter switch, and plugged load on. Brought up the field of his load generator a bit, and then suddenly, when he was taking only about 30 kw.

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* A d.c. motor fed from the works supply, and driving a 70-kw. alternator, which supplies current for testing induction motors.

from his machine, heard his belt squeaking. Couldn't understand it. Waved Bramble up on the tubs. Got about half load when the bally belt started flapping like a flamingo. Pullman & Co. all looked round, wondering what was up, and Nobby started getting feverish. He ran his fingers through his hair—couldn't make out what had happened. Saw that, anyway temporarily, he was done, so pulled off his load, and called out to Bramble to see if the E.T.M. belt was O.K. Bramble had a look, and informed Nobby that the belt was quite as firm as a couple of rocks, also observing that he (Nobby) had in the first case probably read his meters wrong, and fancied he had got his load when he hadn't. Nobby, looking hot, flushed and very sick, told Bramble to go to the devil. Cowcraft bit his lip, and the official looked shocked.

Wimpole, with blank despair in his heart and in his face, called out, "Are you right?" and banged on his load again. Bramble. with a horrible smile in his sleeve, jerked up the load. Nobby heard the dreadful flapping, and saw his ammeter needle floundering about between nothing and a quarter load. Through misty eyes saw the official fuming with impatience, and Cowcraft snorting with disgust. Fairly lost his head. Waved Bramble up blindly. Bramble, more than equal to the occasion, jammed the blessed plate right in. Deafening row from the belt, flapping and squeaking like mad . . . . and then suddenly a fearful crash . . . .

On the motor end the belt had worked its way right over the bearing; on the far end it slithered gradually to the outside edge, and came right away with the force of a thunderbolt . . . . fetched down a great shelf containing meters, portable testing sets, pliers, spanners, oil-cans . . . . Dirt, grease and bits of iron flying all over the place—the official with a couple of pints of best lubricant in his eye. . . . Nobby Wimpole, blubbering and babbling like a lunatic Chinaman, made a wild rush for the breaker; tripped up over a stool, sprawled full length, caught his foot in a rheostat lead, and fetched off his blessed motor field . . . .

Gentlemen, it has been my misfortune to assist in more than one general mess-up, but I've never heard the shop breaker come out with a lovelier crack than on that glorious day. And in the moment of Nobby's greatest mortification, Bramble came and knelt beside him, and with an arm around his neck, whispered lovingly:

"What's the price of wooden Morganite brushes now?"

WAGES ANALYSIS–CABLE-LAYING GANG.

By "INTERESTED."

The proper wages analysis of casual labour is an important item in connection with any undertaking, and one worthy of serious attention on the part of those in charge of this particular work. The total cost alone of any job is not sufficient information for an up-to-date company or works. Details are required of each part or section of the work, such as trenching, laying pipes or ducts, cable, &c., in order to enable more accurate estimates to be obtained in future cases. The more details available (within reason) when estimating the better chance one has to arrive at a close figure.

Following is a description of a method for allocating the time worked on each job to the proper headings, and one retained in use after a practical trial, which may prove useful to some readers. The case in mind deals with a "mains gang" employed in the streets, opening ground and laying therein pipes, conduit, cables, &c., for the purpose of distributing electricity, but the same idea could be applied in connection with other work where casual labourers are employed. Each job, or section of a job, is given a number so as to save a deal of unnecessary writing. Only two books are in use—or rather one book and a set of cards. They are the foreman's time book and the wages analysis cards. In order to make clear the written explanation below, the heading of a page of the book and one of the cards is given herewith:—

Daily Return of Workmen and Time for............day......

Name.	On.	Off.	On.	Off.	On.	Off.	On	On.	On.	Off.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	Total hours.	Remarks.

Mains Wages Analysis. Week ending..................19 .

J. O. No.	M.	T.	W.	T.	F.	S.	S.	Total hours.	Rate.	£ s. d.	J. O. totals. £ s. d.

Foreman's Time Book.—In this book the foreman enters the time every man commences and leaves off work, and throws out the number of hours worked by each man in one of the columns bearing at the top the number representing the particular work upon which the man has been engaged. Two of these books are in use at one time, yesterday's records being left in the office to-day in exchange for those which were inside yesterday. This arrangement allows the office staff time to extract therefrom particulars for the wages book and analysis cards. Should, however, the daily changing of the books prove to be impracticable, an arrangement could be come to whereby they were changed only once a week instead of daily. The drawback to the weekly change is that it means a busy day for the office staff at the week-end making up the wages of the men. The foreman obtains the job order numbers for proposed jobs from the office, or from the engineer in charge of the department, as the case may be, the procedure not calling for description here.

Wages Analysis Cards.—These cards are made up from the information given in the time books; the total number of hours spent on each section is worked out at the various rates and the amounts are extended to the proper columns, and the whole total balanced with the wages book weekly. The illustration given above will explain matters more fully than words. These section totals are in their turn transferred to the cost cards, whereon all the time and material used is collected together, so as to give the finished cost of the work—but that is another subject.

EXTENSIONS.

[COMMUNICATED.]

Events move apace, and now the financial stability of some few municipal electricity works seems to be seriously threatened; the somewhat peculiar position in which they are placed, owing to the necessity for replacements of plant, demands very careful attention on the part of the management. In a number of works a stage has been reached when some of the original installation must necessarily be scrapped or sold, in order to make room for more modern plant in larger units than the original ones. Where floor space is limited, the small plant installed at the commencement must "go" in order to allow for extensions, which can only be carried out by putting in plant considerably more powerful on the space originally occupied by the small units. The trouble is how to provide the cash to pay for the new goods. The annual repayments have proved to be insufficient, and, for various reasons, the rate of depreciation has been far greater than estimated.

In several instances, the loans obtained for the purchase of the installation in the first case were arranged to be paid off in annual instalments covering a period of 42 years. Now, although the plant has become of little practical value as an economical means of generating electricity, only about one-third of the loan has been redeemed to date, and the question arises as to which is the better way of obtaining money to pay for the new extensions. Should the whole of the remaining portion of the original loans be repaid and fresh capital taken up, or would it be preferable to pay for the new alterations and additions combined out of revenue account, and go on slowly paying off the old capital? The lending authority will not grant a new loan unless the remaining portions of the old one are redeemed. The position is peculiar, because there is not much in the way of precedent which can be used for guidance. Careful consideration of the possibilities in the future is required before a definite decision can be arrived at, and an intimate knowledge of the useful life of the machinery, &c., in use and that proposed to be put down is wanted. For this reason I think the question is one for the engineer or manager of the department to tackle, and not the borough accountant.

Whichever course is pursued, a heavy sum will have to be taken from the accumulated profits or reserve and depreciation accounts. Is the money in hand, or has most of the surplus in previous years gone to "relief of the rates?" Here is an instance which at once shows whether the undertaking has been deprived of money—now so vitally necessary—or whether the wiser policy has been adopted of putting by sufficient to provide for such contingencies as this.

In the event of the former course being followed, a smaller sum is required to pay off the remaining, say, two-thirds of the loans yet outstanding than if the latter course is taken, because the new plant about to be installed will necessarily possess a greater output, space for space, than the plant being ousted, and, of course, higher value. This appears to leave a balance in favour of the former method, but one must not lose sight of the fact that if another loan is taken up for the proposed extensions or replacements, the customary length of time allowed to-day for repayment is not nearly so long as was the case 10 to 15 years back, and, money being much dearer now than then, the interest charges will correspondingly be increased, and will prove in the end to be heavier than the remaining interest charges on the original loans, should they be retained. Looking only to the present, the first method is preferable, but the latter course seems to work out cheaper in the long run.

I am not going to offer a word in favour of either way, but intend to leave the matter for those more interested to argue over, as circumstances alter cases, and few stations are similar in this particular respect. The question is a ticklish one to answer, and one in connection with which councillors will do well to look after the future, and not allow the future to look after itself.

If this stage of things is reached after only 10 to 15 years' working, then in another 10 years the probability is that a much larger portion of the plant will want ousting in order to make space for other more modern and larger plant, because surely old plant standing idle whilst the cost is slowly being repaid cannot be profitable, no matter how the figures are twisted about. The conclusion drawn from the present state of the enterprise is that *all* profits must be retained until a good, sound, sensible reserve or depreciation fund is formed, and not even a sum representing 1 per cent. of the capital outlay (as arranged in the gas clauses of the Salford Corporation Bill by the House of Lords' Committee) should be taken from the department until more than sufficient is in hand to meet all possible emergencies.

THE RATIONALE OF PICTORIAL ADVERTISEMENT.

By T. W. COLE.

SUPPLY companies, electrical contractors and such like have recently been favoured with certain lamp-advertisement cards, sent to them for show purposes. The cards in question have been apparently designed with a view to catching the popular fancy. One may, in fact, imagine the gradual development of the idea in the lamp manufacturers' minds, from the time when it was first determined to appeal to the public, to the time when the good Mr. Hassall received approval of his designs. The line of reasoning that led to this series of pictorial displays was evidently something like this: Here is a general public, who know nothing about the technicalities of lamps. We want to interest them, to catch their eye, even in spite of themselves—we want, in fact, something "popular," ergo, we want something funny. Who can draw funny pictures? Who but Mr. Hassall! And forthwith Mr. Hassall receives a commission for designs, which presently mature into the cards now familiar to the trade.

Now, in speaking thus, we must not be thought to be disparaging Mr. Hassall's abilities for poster work. Quite the contrary. We do, however, criticise the faulty survey of the situation on the part of the lamp manufacturers which led them to contemplate using pictures of this type. There is, we think, at the root of it, a fundamental misconception. The lamp manufacturers have not realised the true end of advertisement. That end is not attained merely when attention is attracted. The indispensable part is still to come—the creating of an impression which shall link favourable associations with the article advertised. For instance, take a soap advertisement poster. Here we have, perhaps, a young lady of undeniable personal attractions, caught possibly at some advantageous moment of an unfinished toilet. The artist has seized the opportunity to emphasise the soft roundness of perfect health, the sense of skin, velvet to the touch. The eye is arrested by the picture, and takes in the name of the soap at the same time. The name henceforward takes to itself in the memory certain subtle associations with clean, wholesome healthiness, shell-pink complexion and such like. Suppose, on the contrary, the picture had been of the sallow-complexioned, anæmic, pointed-elbow variety of damsel, where is the good lady that would have risked using the soap? Coming to the case in hand, we have an advertisement card showing a family at dinner under the illuminating rays of the lamp advertised. The family are (to invert a phrase) honest but "poor"—poor in looks, poor in manners, the good wife holds her knife in her left hand, the little girl "points" (which well-behaved children are taught never to do), and the pater-familias sits in his shirt-sleeves. It is all very homely and comfortable, but——and here we come to the crux of the question. Electric light is undeniably something of a social hall-mark. It is a thing that began in the houses of the "carriage and pair" people. Thence it descended to the less-favoured but proportionately ambitious neighbours. Thence to suburbia with its characteristic genteel emulations. A good lady of the latter class, on her walks abroad, catches sight, perhaps, of the lamp-advertisement in question. The poor lamp becomes immediately associated with all that is repugnant. Her whole ambition in life is towards gentility, the very antithesis of the scene which this lamp so fondly illuminates. But anyhow, even outside this one point of view, seeing that the strong plea for the electric light is on the side of its æsthetic capabilities, on the grounds of its help towards refinement of decoration, would it not have been more to the point to have so designed the advertisement, as to have insensibly conveyed an impression in which such qualities were associated?

Or to pass to another of these advertisements, what could be more foreign to such impressions than the one wherein a good man of most inelegant figure is carrying on a cryptic conversation with his ill-mannered ill-proportioned gardener, who does not even trouble to affix a "sir" to his answer. One can hardly think that the lamps so advertised will benefit from the physical and intellectual vulgarity thus so ingenuously associated with them.

One might suggest that a book on psychology might be a useful adjunct to the publicity department of the lamp manufacturers in question, and that a marker be kept in the chapter about the transference of impressions, and the laws which govern association. A due regard to such principles would, we think, prevent the advertisements being drafted, which are by their nature so obviously self-defeating.

Nitrogen from the Air.—The construction of the first Swedish nitrogen works is about to be commenced, and should be completed by the spring.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

There is little of a sensational kind in the list of applications that have been filed at Westminster for the consideration of the Board of Trade and Parliamentary Committees in the next Session. They are indicated briefly as usual in the following :—

(*a*) Electric Light and Power.

Bath.—The Corporation is applying for the extension of its area of electric supply, within the rural district of Bath.

Bishop's Stortford, Harlow and Epping Gas and Electricity.—Amalgamation of gas companies; powers to supply electricity; agreements with local authorities as to supply.

Brixham.—Application by R. A. Lister & Co., Ltd., for an order to supply electricity in the urban districts of Brixham and the rural district of Totnes.

Brumby and Frodingham.—U.D.C. applying for prov. order to supply electricity.

Chesham.—Application by Chesham Electric Light and Power Co., Ltd., for extension of area of supply to include borough and part of rural district of Hemel Hempstead.

Chipping Norton Gas and Electricity.—New Company; Purchase of undertakings of Mid-Oxfordshire Gas Light and Coke Co., Ltd., and the Chipping Norton and District Electric Light and Power Co., Ltd.

Church.—U.D.C. is applying for prov. order for supply of electricity.

Cleveland.—U.D.C. is applying for electric supply in its district, and part of the parish of Walton-in-Gordano.

Dawlish.—Power to U.D.C. to transfer its 1903 E.L. Order to the Dawlish E.L. and Power Co., Ltd. Extension of time for works.

Derby.—The Corporation is applying for extension of its area, so as to supply electricity in the urban district of Alvaston and Boulton, and in a number of parishes.

Farnham.—The Farnham Gas Co., Ltd., is applying for the dissolution of the company, the incorporation of a new company to take over undertaking and to supply gas and electricity. Bulk supply of both gas and electricity; repeal of 1905 E.L. order.

Frimley.—Application by the U.D.C. for a prov. order.

Gorseinon.—Application by Gorseinon Electric Light Co., Ltd., for power to supply electricity within the parishes of Gowerton, Llandilo-Talybont, Loughor (Borough) and Penderry.

Hastings.—Corporation. Compulsory purchase of site of existing electric generating station. Power to sell, let, or hire electric fittings, &c., and other powers incidental to the electricity undertaking.

Havant Gas and Electricity.—Dissolution of Havant Gas Co., Ltd.; transfer to new company; lands for electric generating station; free wiring; supply in bulk.

London Electric Supply.—Application by L.C.C. to be constituted the purchasing authority for the undertakings of certain electrical companies.

Middlesbrough.—Further powers to Corporation regarding electricity supply, including powers to supply and hire meters, cookers and fittings.

Middleton.—Corporation. Further provisions concerning gas and electricity undertakings; free wiring; supply in bulk; supply to premises outside borough.

Ormskirk.—Corporation asks for alteration of 1900 provisional order; extension of time for laying mains in compulsory area; transfer to Ormskirk Electric Supply Co., Ltd.

Radcliffe.—Application for a provisional order by the Lancashire Electric Power Co.

Reading Electric Supply Co., Ltd., is seeking powers for extension of area of supply; supply in bulk within and beyond area; wiring consumers' premises, &c.

Runcorn.—Application for a provisional order for supply of electricity in Urban and Rural Districts of Runcorn is being made by G. H. Cox and H. J. Falk, of Colonial House, Water Street, Liverpool.

Runcorn and Weston.—Application for a provisional order by the Castner-Kellner Alkali Co., Ltd., Weston Point, Runcorn.

Sheffield.—Corporation is applying for power to supply electricity in parish of Tinsley.

Smethwick.—The Birmingham and Midland Tramways Co., Ltd., applies for power to repeal or amend the 1898 E.L. Order; to transfer the 1898 order to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Warrington.—Further powers to Corporation relating to gas and electricity undertakings; free wiring; supply in bulk.

Widnes.—Application by Corporation for alteration and amendment of 1901 and 1904 orders. New compulsory area. Transfer to Salt Union Co., Ltd., or other company.

Widnes.—Application by G. H. Cox and H. J. Falk (Colonial House, Water Street, Liverpool) for provisional electric supply order.

Yorkshire Electric Power Co.—Alteration and regulation of capital and borrowing powers of the company.

(*b*) Electric Tramways and Railways.

Baker Street and Waterloo Railway.—Subway at Oxford Circus. Agreements with other railway companies as to use of stations, &c. Various other powers.

Bradford Corporation.—Very numerous powers are applied for, from the extension of powers to carry goods on tramways, to run trackless trolleys, and to supply electricity in bulk outside the city, to the suppression of indecent literature.

Charing Cross, Euston and Hampstead Railway.—New short lengths of railway at Charing Cross and Victoria Embankment. Agreements with other underground companies. Powers as to capital.

Devonport and District Tramways.—Repeal or amendment of Acts. Power to British Electrical Federation, Ltd., to manage the undertaking as sole director or otherwise, &c.

Great Northern and City Railway.—Extension of time for completion of railway and subway authorised in 1902.

Halesowen Light Railways.—Application to Light Railways Commissioners by company, for extensions to railways.

Handsworth.—Application by U.D.C. for further powers in respect of electrical undertakings, including several new tramways.

Leeds Corporation.—Provision and running of trackless trolley omnibuses in Leeds, Armley and Bramley, and powers incidental thereto.

London County Council.—Construction of new and reconstruction of existing tramways. Extension of time for powers under 1903 Act.

London Electric Railway Amalgamation.—Transfer and vesting of powers and amalgamation of Baker Street and Waterloo; Charing Cross, Euston and Hampstead; Great Northern, Piccadilly and Brompton Railway Co. Dissolution of transferred companies, termination or alteration of guarantee of interest by the Underground Electric Railways Co. of London, Ltd.

London United Tramways.—Extension of time for completion of tramway in Richmond, and incidental powers.

Mersey Railway.—Extensions of periods for payment of interest on certain debenture stocks; various other provisions, including allowances for depreciation and renewals of electric plant, rolling stock, &c.

Metropolitan District Railway.—Capitalising arrears of dividends, and various powers.

Metropolitan Railway.—Extension of time for authorised work; construction of subways; various powers.

Milnrow.—Application by U.D.C. for power to construct and work tramways.

Morecambe Tramways Co.—Reconstruction of tramway; use of mechanical power; provisions as to capital; dissolution of company.

North and South Shields Electric Railway.—Extension of time for completion of railway and works. Additional capital, &c.

North-East London Railway.—Extension of time for subscription of capital, commencement of works and construction of railway. Agreements with Metropolitan Railway. Amendments of Acts.

Nottingham Corporation.—Extension of time for construction of tramways authorised in 1905; powers to construct further tramways.

Rawtenstall Corporation.—Construction of further tramways.

Rhondda U.D.C.—Construction and working of tramways; mechanical power.

Southampton.—Corporation is applying for further tramway powers; also for powers to provide and fix electrical fittings.

Wimbledon and Sutton Railway.—New company. Agreements with the Underground Electric Railways Co. of London, or other authorities, as to supply of electricity for working railway.

Peat as Fuel.—The central station on the moors in East Friesland, to which reference was made in this journal several months ago, was opened for public supply on November 15th. Peat is used as fuel, and it is calculated that the quantity available is sufficient to raise steam for a period of 100 years. The cost of establishment has amounted to £150,000, the plant is capable of dealing with a demand for 5,000,000 KW.-hours per annum, and the distributing network extends over 150 miles. Various contracts for supply to local authorities have been concluded, but the dockyard at Wilhelmshaven is not connected with the mains, as the erection of two plants for dock and lock works was projected before the station was built, and has already been carried partly into effect. On the other hand, the station affords a supply to the harbour works at Emden. It is expected that the contemplated tramways at Wilhelmshaven and Rustringen will be operated from the moorland station.

Carbide of Calcium Syndicate.—Reports of a contradictory character are in circulation in Germany regarding the question of the constitution of a syndicate of producers of carbide of calcium in various countries. We quoted last week the reported establishment of a syndicate for the regulation of production and prices. On the other hand, a Frankfort newspaper learns from well-informed circles, that doubts exist as to the actual constitution of a syndicate. Surprise is also expressed that important producers, such as the German, Swiss and Tyrol interests, know nothing of such negotiations, whereas an understanding without the inclusion of these works is scarcely conceivable, having regard to the large proportion which they possess in the aggregate output.

NOTES ON TRADE ABROAD.

The Future of Canada.

We commend to the serious attention of all our readers who take an interest in the future of Canada, and especially those who desire to gain from its industrial development, the important question of British and American investments in Canadian undertakings. There is a vast difference between the American and British manner of investing there. The American when he puts his money into the country goes along with it and establishes a business —perhaps a branch of a similar works in the States—and he stays there either altogether or sufficiently long to set the new concern on its legs, so that an efficient American or Canadian staff can run it for him. British investors put their money by the million into Government bonds, municipal bonds, railway stocks, and so forth, yielding, say, 4 per cent., and remain at home, leaving someone else to get a bigger benefit by their direct effort; thus we too often withhold that important British influence which our active presence and enterprise would exert upon the conduct of affairs. Of course, many of our investors are merely wanting a safe investment for their money, have little or no knowledge of, or interest in, industrial affairs, and have no personal necessity to worry themselves, so long as they can gain a sure and steady 4 per cent. We are not going to suggest that these should refrain from so investing, for Canada needs all the money it can get for the enormous development works of a public kind that are in progress and in contemplation. But if only those who know something about British industry and British manufacturing were to commence active operations over there, we have little doubt that they could influence a good deal of capital to flow into their purposes. It is good as far as it goes to have British money developing the country, but it needs also British capital accompanied by British effort in industrial and manufacturing work if a reasonable proportion of British-leavening spirit is to be maintained in the future.

We hope that the electrical manufacturers of this country, as the result of their increased attention to the market, and the opening of offices and the appointment of agents in the chief centres of the Dominion, will be able to do a far better business than they have been doing, in goods made in our own factories here. But it may be that in some cases where manufactures are known to be suited to the Canadian requirements, some of our manufacturers may find it good policy to consider the establishing of branch factories in Canada. To compete with the widespread American influence in electrical affairs in Canada—partly consequent upon the investment of American electrical capital in setting up factories which made available certain lines of manufactures whose ready presence in such a country had a good deal to do with the creation of a demand and subsequent preference for them, about which we have heard something—our firms will need to carry large stocks. When that has been done and has succeeded, it will be possible to see whether the prices obtainable leave a larger profit than would ensue if works, operating with higher priced labour, were established there. American electrical factories went over the border, because of the tariff on their exports from United States works, because they by their closeness to the country more speedily recognised the greatness of the electrical opportunity, and we believe also because of the railway charges. Exports from this country get in more favourably than do others, because of the preferential tariff, but they have a sea journey, and perhaps a long river or overland journey, as compared to the States railway journey. Manufacturing costs here are lower—labour being cheaper, and the workman's output superior—than in either the States or Canada, if we turn things out in sufficient quantities. On the other hand, we suffer in the matter of time of delivery under the disadvantage of distance, whereas the States factory may be not far off, and can thus give a quicker delivery. The presence of the American manufacturer in Canada is an accentuation of our difficulty where time is of any consequence, but in lines that we can carry in stock, or where time is only a secondary matter, we ought to be favourably placed. All these and other pros and cons have to be considered, and we shall not be surprised if some of our electrical and engineering manufacturers think it better and more profitable policy to manufacture in Canada than to export from England, after they have succeeded as the result of their present more aggressive policy in establishing extensive business connections there.

We have been led to write the foregoing by an article, entitled "A Word to British Investors," appearing in our always entertaining contemporary *Canada*. Herein figures are quoted, showing that approximately £46,000,000 of American money is invested in Canadian *industrials*—mills, timber, mines, lumber, packing plants, implement distributing houses, &c. The *Monetary Times* is quoted thus: "In certain industrial lines the United States have gathered their own industrial fruits. Britain has left the gathering to someone else, and has had to pay the middleman. It is a question as to whether 4 per cent. and no worry is better than 8 or 10 per cent. and the comparatively trifling worry as to the future of a country such as Canada."

The British investor does a good deal of this sort of thing in other parts of the world as well as Canada. New York has only got to ask the London financial world for dollars by the million, and it gets them, at a fair rate of interest, but its people run over the Canadian border with many millions more to lay out in industrial operations, and secure a far bigger yield. Our investors will find the necessary capital to enable German manufacturers to carry out the electric power supply to the Rand, but our banks will not furnish the money on reasonable terms for strengthening the hands of the British manufacturer so that he can make the profit on the making of the plant, &c., giving work to our people while still leaving the investor the opportunity of investing in the undertaking itself. The writer in *Canada* concludes: "It is all important that British sentiment should predominate. If more British capital with British control found its way into Canada, not only would trade between Great Britain and Canada be increased, but British sentiment in the Dominion would necessarily be fostered."

It may be thought desirable that our great engineering firms should wait before taking so important a step as we have suggested until a greater degree of actual development, creating an immediate and continuous need for them, has been reached. In the meantime the American financial hold and industrial control is getting a firmer grip. It is easy to wait too long, allowing others to become masters of the situation while we await the arrival of more favourable conditions. However, there is an immediate need for adopting an aggressive policy of appointing local agents and opening up branch offices, whatever else may have to follow in the course of time.

The British Position in India.

One of our Indian correspondents writes as follows regarding our recent survey of the electrical market in India:—

"Your extremely interesting article in the current number (October 29th) of the Electrical Review will be read with interest by electrical importers in India. The writer of 'Notes on Trade Abroad' has hit the mark when he says that Consul-General Michael's reference to electrical 'machinery made in the United States as being considered by Indian electrical engineers to be the best in the world' is a trifle American in its mode of expression. Your statistics quoted from Government Blue-Books prove that the value of American electrical goods imported here is small, as compared with British made, and no unbiased person will claim that Americans make the 'best in the world.' That their electrical gear is good no one can gainsay, but for some reason—it may be the loyalty of the native to the Union Jack—the Americans have up to now failed to get a grip of the Indian electrical market. That they are gradually insinuating their way is a proposition that British manufacturers cannot afford to ignore. In Mysore, Kashmir, and to a small extent in Nepal, a lot of American work is being done; and as one successful contract leads to another it behoves our home manufacturers to keep a keen look out ahead for orders to come. In regard to Afghanistan, it is a tradition of this kingdom to remain aloof and isolated and keep its affairs secret: but the recent visit of the Amir to India has put him in touch with modern ideas and with fruitful results as regards thing electric. One of the large Indian electric firms has secured a handsome order for all sorts of electrical equipment—palace lighting, motors, generators, turbines and a long-distance transmission line. To thoroughly investigate the possibilities of a local coal supply, the Amir has employed a coal mining expert to make exhaustive reports on the condition of existing coal mines in his kingdom.

Bengal coal fields.—Two years ago, during a period of abnormal activity in the coal mines of Bengal, a central power transmission scheme was keenly discussed and would probably have taken effect by now, but for the bad seasons which followed. For the past 18 months most of the mines have been curtailing their supply purposely because of the small demand, and a few of the less important mines have ceased work altogether. Now there are certain signs of a better demand and more prosperous seasons in consequence. Cheaper and more up-to-date methods of hauling and coal-cutting are sure to be sought for, and English manufacturers who make a speciality of electrical machinery for mines should leave no stone unturned to push their material. Certain German firms are already actively canvassing both by representatives on the spot and by means of cleverly-worded articles in Indian papers in which their specialities are made prominent. *Verb. sap.*"

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The First Telephone Switchboard.

Referring to "W. E. B.'s" question as to "When and Where the first Telephone Switchboard was erected in England?"—It is well known that for lack of opportunity of sifting evidence, several gentlemen claim "the honour of bringing the first pair of speaking telephones to this country," and it is probable that for similar reasons there may be several "first switchboards."

As a contribution to the discussion, I quote the following from a paper which I read at the Institution in 1895 on "The Origin and Development of the Telephone Switchboard":—"It will be remembered that telephone exchange business was started almost simultaneously in London by two different organisations—the Bell and the Edison Companies. The Edison Co. had an experimental exchange at 6, Lombard Street. It was publicly opened on September 4th, 1879, with 10 subscribers connected. The switchboard then used formed the subject of the first specification for a telephone switchboard in the English Patent Office (No. 3,794, September 20th, 1879). The elevation drawing attached to that specification is here reproduced. The switchboard used by the Bell Co. in their first exchange at 36, Coleman Street, was of a different character. The sketch shown is made from a photograph in my possession." (*Journal* of the Proceedings of the Institution of Electrical Engineers, Vol. XXIV).

In the discussion following my paper, Mr. J. G. Lorrain stated that the Manchester Exchange, started by him in July, 1879, was about a week or a fortnight earlier than that in Coleman Street.

The switchboard at Lombard Street was in operation before the public opening, but the exact date of its setting up I was unable to remember, and, like that at Colman Street, have been unable to ascertain. It was a neck and neck race between the two companies, and there cannot have been much difference in time, if any. The date of installation of the board at Manchester I do not know, but Mr. Lorrain indicates July.

There must of necessity be difficulty in determining the exact date of the erection of the various boards. But if obtained, it does not determine much. To place a switchboard in an office and illustrate its operation by instruments in the same building was not a difficult matter, even in those days. To connect up a number of distant places and interconnect them on the exchange system was a different matter. If "W. E. B." will alter his question to "When and where was the first public operating exchange?" the inquiry may be more fruitful.

Your issue of September 15th, 1879, mentions not only Coleman Street, but also Lombard Street in the same article, whilst a note intimates that "an attempt is being made to establish a telephonic exchange in Manchester on the American plan."

Your issue of September 1st, 1879, has a note stating that "The Telephone Co. are about to introduce Bell's telephone into London on the exchange system."

The evidence of the public opening of the Edison Exchange will be found in an article in the *Times* of September 6th, 1879, which mentioned the localities of the offices connected. "The Telephone in Principle and Practice: Its Origin and Development," by J. E. K. (David Bogue, 1882), gives the names of the 10 subscribers, of which the *Times* itself was one and the undersigned another.

If Mr. Poole and Mr. Lorrain will submit similar evidence for Manchester, and Mr. Fletcher can be prevailed upon to investigate the claims of Coleman Street, perhaps some conclusion may be reached.

J. E. Kingsbury.

London, W.C., *December 6th*, 1909.

Electric Ignition.

I was rather surprised to see the paper on Magnetos read before the Institution of Electrical Engineers. When perusing different parts of it one has to ask if this was intended for gas, motor, or boat engineers, motorists, or what!

A description of machinery, as printed in catalogues, neither satisfies the engineer nor delivers anything novel to the layman. Jumping from gas engine ignition to petrol firing, high and low tension, coil, magneto, &c., and without any reference to conditions, demands, machinery and so forth, confuses more, and acts only harmfully on this already very poorly understood subject. However, one good thing has been gained, viz., a little more knowledge of the foreign firm whose courtesy has put their catalogues in the hands of Mr. Wilson.

Subjects such as cycle pattern magnetos of the high and low-tension variety, single twin, V type, two-cylinder machines, stationary and revolving armatures, self-starting devices, advance and retarding mechanism, gearless multi-cylinder magnetos, distributors, lagging, insulation, &c, were really required, and not the primitive and "actually known by every engineer machines" described.

H. Armature.

Heston and Isleworth Pupilships.

On opening my ELECTRICAL REVIEW this morning, I was astonished to find an extraordinary reference to ourselves in your leader columns, and, with many instances in my mind of your fairness, general accuracy and good taste, I can only assume that you have printed the paragraph sent in probably by some local correspondent, without fully appreciating its contents.

Such phrases as "whose electric lighting venture has not hitherto been a conspicuous success," "the station will in future be run principally by unpaid labour," and "we shall watch with interest the future financial results which it is to be hoped will show to better advantage than those hitherto returned," seemed more suited to the requirements of a local and unfriendly "rag" than to the columns of our premier professional paper.

The question exercising your paragraphist's mind was evidently the Council's scheme of offering pupilships in our various departments to sons of residents, and as the general conditions of this scheme are very plainly set out in a pamphlet issued by the Council, which can be obtained gratis on application, your correspondent's distortion of the facts would appear to be deliberate.

Briefly, the Council have thrown open to competition by public examination *one* pupilship in each of the four departments of the Council, viz.: clerk's, surveyor's, medical officer's and my own. A second vacancy will arise in 1911, and a third, and final, in 1913.

The positions are limited to sons of residents—they are certainly not limited to "lads attending the secondary schools"—and it is difficult to see any logical reason why pupils appointed in this manner should be in any way inferior to those appointed by influence or for a monetary consideration.

Your correspondent "*presumes* that it will be the duty of the chief engineer to father these lads," and he also "*does not know* if it is proposed to increase the remuneration of the chief engineer for the additional duties involved." Instead of "presuming" and "not knowing," our literary friend might have made a few civil inquiries from me to satisfy his curiosity. He would, at all events, have received a courteous reply. On one point, however, he is emphatic, and commits himself to the definite statement that "the station will in future be run principally by unpaid labour." Oh, happy station! But, unhappy reporter, he has not sent you all the news. Has he not heard that we are getting our coal given us and are running a bazaar to pay for the E.R.S. and repairs?

But, seriously, Mr. Editor, how came the proof reader to pass such a ridiculous statement as that?

Your correspondent's facts are bad, but it is a great consolation to us to know that he has a good heart—he means well. Alas, that so many people should be so eager to keep the well-known road in such good repair. He will "watch with interest," and he "hopes" that our financial results will show to better advantage than those hitherto returned. Well, I hope so, too—they cannot be too good as far as I am concerned, but when, after only four years, we show a *gross* profit of £3,652 on a revenue of £6,699, and a capital of £56,771, added to which, on an output of only just over half-a-million units, our works costs are only ·89d., and our total costs 1·31d. per unit, with all due modesty, we do not consider that we are taking such a very poor place in the records of electricity supply authorities.

I must apologise for emerging from my natural obscurity, but an attack by insinuation is so foreign to your columns, that I feel sure you will desire to be placed in possession of the truth as soon as possible.

Percy E. Rycroft,
Engineer and Manager.

December 3rd, 1909.

[We have to thank Mr. Rycroft, the engineer and manager of the Heston and Isleworth U.D.C. Electricity Works, for a copy of the conditions of pupilships and apprenticeships which the Council are offering to the sons of residents. He takes us to task, and justly so, for basing our remarks of last week on the incomplete information of a local correspondent, and we regret that before commenting on the scheme, as we understood it, we did not communicate with him.

As to the financial success of the undertaking, this is no doubt largely a question of point of view, and Mr. Rycroft points out that his department showed a gross profit last year, the fourth year of operation, of £3,652 on a capital of £56,771. We find, on looking up the records, that after paying interest, and allocating to sinking fund an amount equal to 2·58 per cent. on the capital, there was a net balance on the right side of £80, and we were guilty of characterising this as "not a conspicuous success."

We apologise as to the pupilships; the pamphlet sent to us puts the matter in a very different light to that in which it appeared from the notes previously received. The scheme embraces three pupilships in each of the following departments, viz.:—The Clerical, Health, Engineering and Surveying, and Electrical Departments. Each pupilship will be tenable for five years, and an appointment will be made in each department in each alternate year. The qualification of candidates are that they shall be not less than 14½ nor more than 16½ years of age, and must have been resident with their parents or guardians within the Urban District of Heston and Isleworth for three years prior to sitting for the entrance examination. The examination will be held at the Council House, the subjects including arithmetic, geography, précis-writing, short essay, English history, and general knowledge (oral).

The pupilships will in all cases be awarded on the recommendations of the examiners, and such recommendations shall be according to merit.

The articles of pupilship may be cancelled at the expiration of six months if the head of the department should report that the pupil has not made satisfactory progress, or is not suitable for the office in which such pupilship is held.

No salary will be paid during the first three years, but in the fourth and fifth years the pupil receives a salary at the rate of £26 and £39 respectively.

The pupil will be required to pursue the course of study necessary to making him an efficient officer of the department to which he is attached. In the electrical department the subjects of study specified are "Machine Construction, Applied Mechanics, and Electricity and Magnetism."

The Council accept no responsibility in regard to any pupil, nor do they undertake to give him employment at the termination of his articles.

As the pupil is required to enter into articles of pupilship with the head of the department, we take it that Mr. Rycroft's pupils will at the end of their time be entitled to style themselves "electrical engineers." It will be observed that no technical qualifications are required before entering into articles, nor is the study of technical electricity a requirement during pupilhood. We should scarcely have thought that "Electricity and Magnetism" would provide the necessary mental equipment, and were under the impression that workshop practice was considered essential to the proper training of the electrical engineer.—Eds. E.R.]

The Steady Job.

The philosophy of the ordinary man.
With acknowledgments to "A. P. C."

Some wise man once said that the man of genius is as a rule only about 1 or 2 per cent. genius and the rest ordinary man. Similarly it may be said that the enterprising man is, as a rule, enterprising only in a few directions, most of his ideas going according to custom. Equally true is it that, of the people who at any time make up a nation, only a small proportion are highly enterprising, according to the age they live in, while the vast bulk are just ordinary, humdrum people.

Consequently, however desirable we may think it to make the world a place suitable for the few who exhibit great enterprise, we shall not succeed in doing so without taking the mass of ordinary people into account. After all, the problem of living is not for the talented alone, but also for the commonplace, and as these are by far the larger number, it is practically certain that any attempt on the part of the talented to set up a social system suitable to themselves, without consideration of the ordinary person, will result in the mass of ordinary men swamping the few talented.

Your most enterprising person likes to have an underlying basis of security even in his wildest speculations, and (unless he is a lunatic) some tolerable prospect of reward, while it is commonly to be observed that the most enterprising will be found among those who have acquired tolerable security, insecurity being unfavourable to enterprise except in the merest handful of cases. "If a man does not gain personally by any deed of his own, he will not take the trouble to do it." That is, it is just the fairly secure prospect of an adequate reward that calls out diligence in the ordinary man, and it is because hitherto the ordinary person has had fair security of reward for his enterprise in the U.S.A., and because every man has felt that earnest and enterprising endeavour would certainly bring its reward, that that nation has gained the title of enterprising, not in the least because of any suppositious insecurity. There is every whit as much insecurity here as in America.

Anyhow, everyone can't be Lord Mayor of London, no matter what effort they make; by far the most jobs are ordinary routine jobs requiring simply the faithful and punctual performance of definite duties, and with such as these most people will have to content themselves.

As for "not counting in the evolution of things," it is just the ordinary man who does count, helping or retarding according as he favours or rejects the ideas men of enterprise put before him.

Above all, one may dispute the wisdom of enthusing over the idea of the enterprising supermen "trampling down" their weaker brethren—or even killing them out. The fact is that your enterprising person is largely dependent upon ordinary persons for the very opportunity to develop and exhibit his quality. Who builds his house, weaves his clothes, grows his food? Who cleans his house and prepares food to sustain him in the intervals of his exhibitions of enterprise? The ordinary person. If the enterprising person wants to embody the fruits of his enterprise, say a patent machine, in a form useful to man, who does most of the work—the casting and working up of the metal, the necessary advertising and putting it on the market. Ordinary men do most of it. But this is not the limit of his and their mutual inter-dependence. Modern medical science is arriving at the conviction that the chief predisposing factor in disease is unhygienic surroundings or mode of life. These supply a soil favourable to the propagation of disease germs. Now the ordinary person, when thoroughly trampled on, habitually gets into such conditions as these, and then by reflection, so to speak, returns any infection he may get in no small measure to the enterprising parties now on top. In other words, the process of trampling injures the trampler only less than the trampled; so that any attempt to evolve a race of enterprising supermen at the expense of the ordinary man recoils on the head of the former, and only evolves a race of super-savages brutally fighting in the jungle of bricks and mortar that constitutes a modern city.

John Smith, *ordinary man.*

The article by "A. P. C." in your issue of November 18th, suggests that there may be other points of view than that taken by the writer of that article, and it may be worth while considering some of these.

If the competition for permanent jobs is as keen as is admitted, it must mean that some at least of the supermen of this generation are desirous of obtaining them and recognise their advantages, and if the illogical idea of a race of supermen could be realised, we should have these supermen fighting with superhuman energy for the super-permanent jobs, and the state of affairs would relatively be the same as at present.

It must be obvious that the idea of a race of supermen is illogical, because, if all men reached that stage, they would not be supermen, but merely men in a more developed stage than at present; and Max Nordau, in his book, "Degeneration," states—and, indeed, the mere statement is sufficient—that it is not the supermen of a race that are perpetuated, but the average of the race; and natural evolution is the gradual improvement of the average, and not the perpetuation of the freaks.

There is also a well-founded belief that the mental capacity of the individual has not appreciably—if at all—increased during the period since Homer wrote, and the ancient Chaldean astronomers made their observations and deductions; but the knowledge possessed by the individual has greatly increased, and the first men in the now abolished Cambridge Tripos Examination may be safely considered to have a greater knowledge of mathematics than Isaac Newton, though their mental capacity may be less, and similarly, the knowledge of medicine of the newly qualified student may be many times greater than that ever reached by Harvey. From these considerations it is safe to assume that the suggested race of supermen would only be the superiors of the present race in knowledge, and not in mental capacity or energy.

The impossibility of breeding a race of supermen is emphasised by the well-established fact that men of genius have smaller families, if any at all, than the average man, and it is rare for any of the children of supermen to be themselves supermen, and still rarer for any of the third generation to be above the average in mental capacity.

The exception taken to the existence of the mediocre men is untenable, as there is a vastly wider field for the mediocre in the world than for the supermen, apart from the fact that the supermen would require to be clothed and fed, and carried from place to place, by factories, farms, locomotives, ships, and if you will, airships, which could, and would, be run by the mediocre amongst the supermen.

Again, a vast amount of work is done—and well done—by the average or mediocre man without any great advantage of education, and, indeed, in the engineering world we are familiar with the vast array of good engineers, draughtsmen and others who, in relation to the superman, can only be classed amongst the mediocre, and yet they have added their quota of little improvements which go to make up the perfection of modern machinery, civil engineering appliances, &c.

There is, further, the fact that some of the supermen in some walks of life at least, such as commerce, finance, &c., are not always the most cultivated and pleasant companions, and, indeed, sometimes their position as supermen is entirely due to the employment of their energy and capacity to circumvent and outdo their fellow men, and in such cases it cannot but be admitted that their nature has suffered some loss, some narrowing, due to their concentration on the one object which they deem worthy of pursuit, and such men would be no advantage to the suggested "Utopia." It is a very true though unpleasant thought that all gain implies some loss, and exceptional success in any one direction is but rarely unaccompanied by a narrowing in others; and in the rush of life, as lived in the more highly organised nations—such as this country, the United States, Germany, &c.—the supermen who attain great eminence are generally those who devote the whole of their thoughts and working hours to the furthering of their aims.

It is to an extent true that the average responsibility in a permanent job—*i.e.*, a Government, municipal or similar appointment—is less than in a commercial position of similar standing; but this is, to a considerable extent, due to the fact that the permanent jobs are filled by men who have been longer in their position than the average time in commercial life, and the jobs themselves are the development of many years; and as a result, the shares of responsibility have been more completely apportioned out, so that the routine work is done by the juniors, and the seniors are left more free to attend to matters out of the routine; and it should not be forgotten that some—and in these days of examination a good many—of the positions, junior and senior, are held by men who at least when they were young were supermen in the full sense of the word. Perhaps the principal difference is that in a commercial firm each department is generally run by one responsible man with a number of cheap juniors, while in the permanent post we may get men of any age, some of whom, if in commercial life, as they got older, would have to move out as heads of other departments, or be moved out, because for the work which they were doing, cheaper and younger men would suffice. In the only comparable case, *i.e.*, where the commercial houses are sufficiently large, something of the system as adopted in public offices is followed, and the various departments have separate heads, responsible to the general manager, and through him to the proprietor or directors.

Further, the existence of the supermen who devoted their energies to the development of the modern standard of sanitation, ventilation, education, hospital treatment, &c., has had the direct result of keeping alive immense numbers of the weakest and most incapable of the human race, and is directly hostile to the development of a race of supermen, and a very striking case is that of our asylums where the mentally and morally deficient are kept alive and so far "recovered" that they are discharged to return to their families, only to be readmitted after a short period, sometimes only a matter of months.

S.

Daimler Engineering Scholarships.—The Daimler Motor Co. (1904), Ltd., have decided to continue their offer of Works Scholarships for 1910. These consist of one Major and four Minor Scholarships. Full particulars of the conditions for gaining these scholarships may be obtained on application to Prof. W. Morgan, B.Sc., Manager, Pupils Department, Daimler Works, Coventry.

Two Remarkable Records.—We learn that an engineer of one of the largest public institutions in the country has informed the makers that a Sunbeam carbon lamp of 230 volts, 5 c.p., has burnt continuously for over 18,500 hours, and only then failed through receiving a severe knock, which damaged the filament. We are informed also that two Sunbeam metal lamps have burnt for 5,700 and 4,000 hours respectively on a street lighting circuit, and are still burning satisfactorily and with but slight diminution in their candle-power.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Extra-High-Tension Cable.

Messrs. W. T. Henley's Telegraph Works Co, Ltd., of Blomfield Street, E.C., have recently manufactured for Messrs. Marconi's Wireless Telegraph Co., Ltd., a remarkable cable for use at their Clifden and Glace Bay Stations. The cable is 0·02 sq. in. cross-section circular twin, insulated with impregnated manila paper, lead-sheathed and wire armoured, as shown (full size) in fig. 1; it will be used to convey current at 40,000 volts pressure from the power house to the transmitting house, the current being generated by Thury dynamos, connected in series, for charging accumulators.

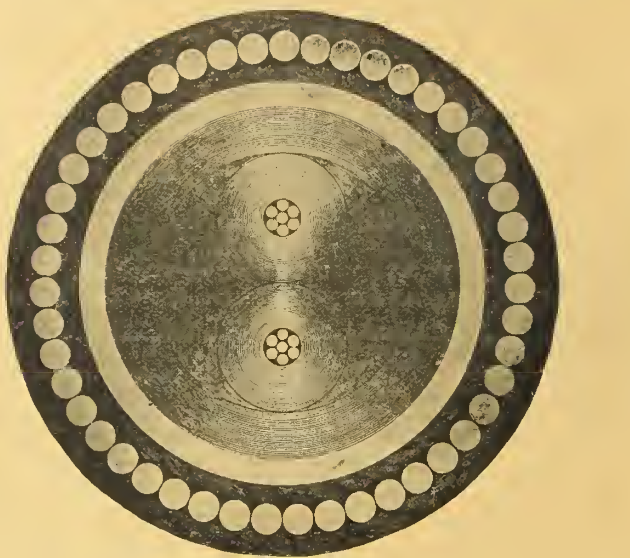


Fig. 1.—Extra-High-Tension Cable.

A large factor of safety was required, and the purchasers specified that the cable was to be tested before delivery with a pressure of 56,000 r.m.s. volts between core and core, and between cores and lead; Messrs. Henley's, not content with this, further subjected the cable to a pressure of 130,000 r.m.s. volts for 10 minutes, a drastic test which the cable successfully withstood. This very high pressure was reached by gradual stages without any interval of rest for recovery between the tests, as follows:—

75,000	volts	for 5	minutes.
90,000	„	5	„
100,000	„	20	„
115,000	„	30	„
130,000	„	10	„

During the tests the cable was bent in two places to a radius of 17 in. These results are claimed by the makers to constitute a record.

B.T.-H. Ampere-Hour Meter, Type MS.

The British Thomson Houston Co., Ltd., of Rugby, have brought out a new d.c. ampere-hour meter of the mercury type for switchboard use, generally similar in construction to their house service meter. As shown in the accompanying illustration, the instrument is furnished with a glass and metal cover and is self-contained, so that it can be mounted directly on the switchboard without a sub-base. An external current shunt is provided. The motor consists of a copper cup immersed in mercury in a strong magnetic field produced by permanent magnets. The pressure on the jewelled bearing is extremely light, and the mechanical losses have been reduced to a very low figure. The mercury chamber can be completely sealed and the spindle securely clamped for transportation. All parts are standard and interchangeable, and can therefore be replaced from stock, if damaged.

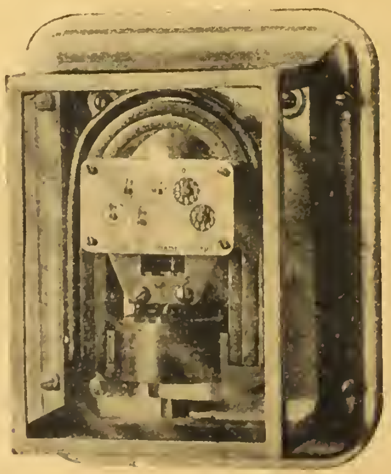


Fig. 2.—B.T.-H. Ampere-Hour Meter, Type MS.

Large Motor-driven Exhaust Valves.

The advent of the steam turbine, and the added importance which this has given to condensing plant and its accessories, has been responsible for many improvements in the latter. As an instance, exhaust valves, particularly, have increased in dimensions until their operation by power has become a necessity, and for this reason Messrs. Alley & MacLellan, Ltd., of Glasgow, have to some extent specialised in motor-driven valves.

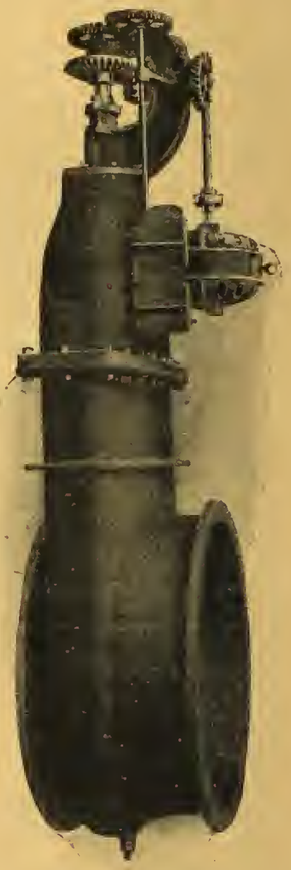


Fig. 3.—Motor-Driven Exhaust Valve.

Our illustration shows one of the firm's standard full-way wedge gate valves, arranged for operating direct through worm-gearing by a 5-b.h.p. three-phase squirrel cage 50-cycle motor running at 610 r.p.m.

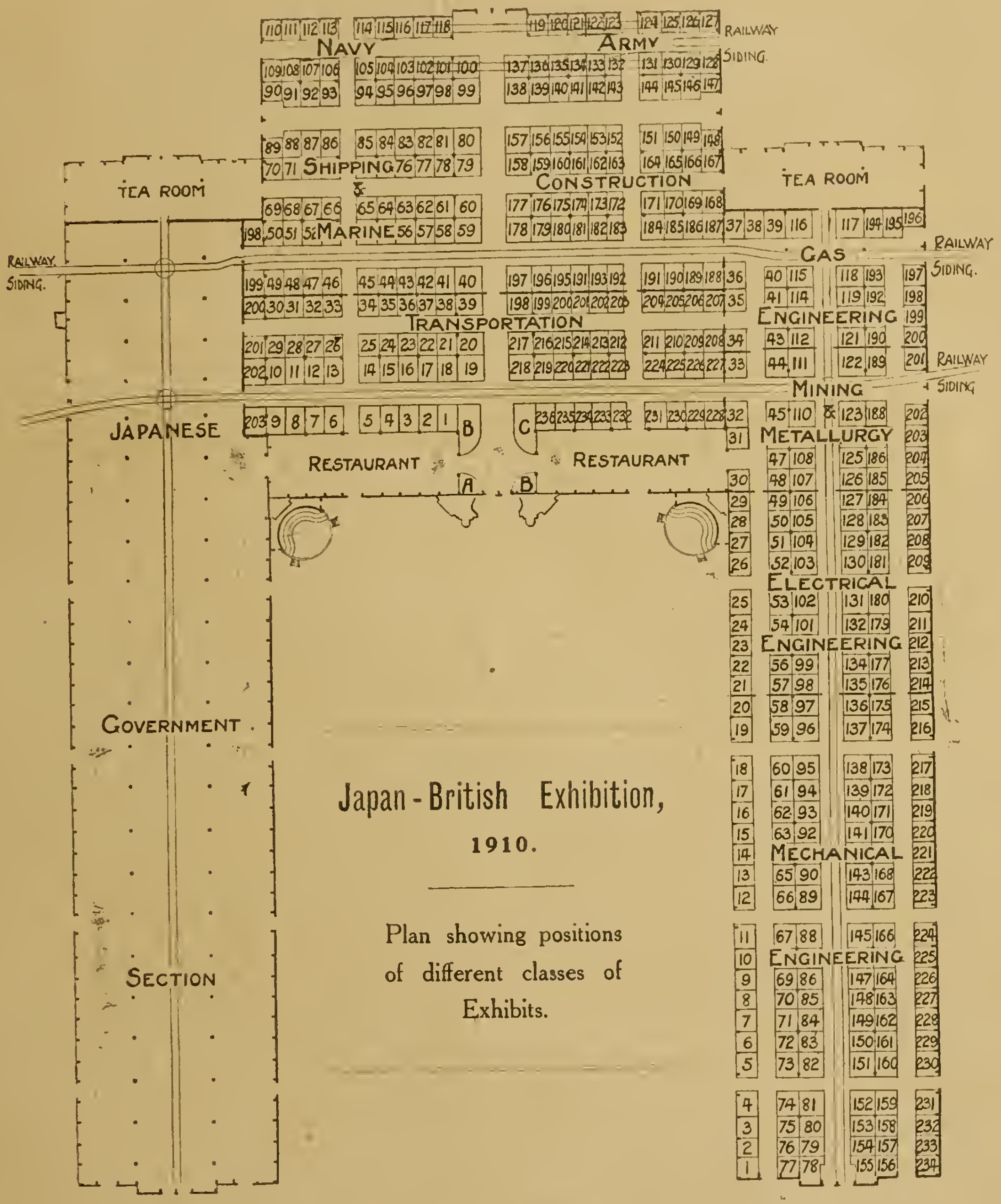
Automatic starting and cut-off switches are provided, and an automatic stop is fitted to the bottom of the valve body to prevent over-running, should the cut-off switches by any means fail.

Such valves are made in sizes up to 76 in. bore, the larger sizes being fitted with patent anti-friction rollers and machined guides.

Platinum.—Some time ago representations were made to the Russian Government with the object of creating a kind of State monopoly in platinum, particularly in regard to the mines in Nishny-Tapil, which produce about three-fourths of the output of this rare metal in that country, but the proposal was not entertained at the time. It is now reported that the negotiations with the Government have so far proceeded on the part of the platinum ore producers that a scheme has been prepared by the Russian State for making advances on the ore, and that it will shortly be submitted to the Ministerial Council for decision. This action leads to the conclusion that the Government has hitherto not taken any measures to counteract the speculation, but rather that the delay in arriving at a conclusion will make the suppliers of the metal become still more reserved, and cause a scarcity and a further forcing up of the price. It is, however, certain that the conditions of the market have become extraordinarily strained. Apart from isolated exceptions, it is stated that the consumption of platinum in the past two decades has been subject to no large fluctuations, and that as a consequence the market stands solely under the influence of speculative operations. It is believed that the stocks of crude ore held by the Compagnie Industrielle du Platine, of Paris, now amount to 6 tons, a quantity which exceeds the production of one year.

THE JAPAN-BRITISH EXHIBITION.

Following up our reference to this Exhibition in our last issue, we are now enabled to give below a plan of the Machinery Hall, indicating the respective positions which have been allocated to electrical and other engineering exhibits. We give this for the interest of firms in our industry, whom, it is hoped, will be adequately and efficiently represented on this very important foreign trade occasion.



PARLIAMENTARY.

Traffic Board.—Mr. Peel asked the President of the Board of Trade whether the Government had taken any steps to give effect to the views put forward by the deputation from the London County Council to the Prime Minister on November 24th, 1908, with regard to the establishment of a Traffic Board for London; in this connection if he would state what duties were performed by the London Traffic Branch of the Board of Trade, and whether it was the intention of the Government that that branch should be in substitution for the Traffic Board suggested in Part III of the Report of the Royal Commission on London Traffic.—Mr. Churchill replied as follows:—Since the deputation referred to waited upon the Prime Minister, steps have been taken to strengthen the London Traffic Branch of the Board of Trade. The principal duties of this branch, are to study the problem of London traffic continuously in all its branches, to keep the statistics up-to-date, to report upon all schemes affecting London traffic seeking statutory authority, and to make an annual report on the whole subject for submission to Parliament. The increase lately sanctioned in the staff of this branch will enable it to undertake certain special inquiries recommended by the Royal Commission on London Traffic, particularly with regard to the roads leading out of London. The branch performs many of the duties that would have been assigned to the Traffic Board, recommended by the Royal Commission, and to this extent it may be regarded as a substitute for it, at all events, for the present. Should an independent statutory board be constituted by a future Act of Parliament, it would find its work materially simplified and facilitated by the work now being carried out by the London Traffic Branch.

Fair Wages in Contracts.—Mr. Hudson, on December 1st, asked the First Lord of the Admiralty whether he would state the what action had been taken by the Admiralty to investigate the truth or otherwise of the allegation that Messrs. Armstrong, Whitworth & Co., of Elswick, were not observing the fair wages clause in the payment of certain electrical wiremen in their employ; whether he was aware that the matter had been in negotiation since July, 1908; and whether he would take steps to have it thoroughly investigated and promptly settled.—Dr. Macnamara replied that full inquiries were made of the firm upon the statements originally made, and the conclusion was reached that the Fair Wages Clause was not being infringed. If Mr. Hudson was in a position to submit any detailed particulars applicable to the present time which would suggest the contrary, he would carefully consider them.

ELECTRICITY IN MINES: THE MINERS' POINT OF VIEW.

The Right Hon. Thomas Burt, M.P., secretary of the Northumberland Miners' Association, in his monthly circular for November, publishes the following:—

"A short time ago I called attention to the dangers arising from the use of electrical appliances in mines, and I offered some suggestions for the mitigation of such dangers by stricter supervision and better inspection, by the appointment of properly-trained men. Arising out of my comments on that occasion, I have received letters from correspondents on the subject, including some interesting communications from a consulting and inspecting engineer and colliery expert, who is in active practice in these northern counties. Bearing upon practical points, I append a few sentences from his letters. My correspondent criticises the manner in which 'installations' have been carried out in some of the mines.

"'With reference to the general question on Electricity in Mines, as I said in conversation to-day, I should be pleased to have a further talk with you when you have more leisure, as it is a question which I have carefully studied during the past 10 or 15 years, and I have had considerable experience in the application of electricity in mines. I feel strongly on the question of having certificates given to the mechanical engineers of collieries who are in charge of the electrical plant, and who are more or less responsible to the colliery manager and to the owners. Unfortunately, however, the colliery manager is the man responsible to law, and as a rule it is he who takes up the purchase of the installation with the contractors, and many contracts have been let at ridiculous prices to electrical companies, who were anxious to get in touch with mining work, but who had no experience of the operation of colliery electrical machinery, and who, to save making a bad bargain put in the cheapest kind of machinery and plant to do the work. The colliery manager and the colliery engineer, in many cases, had little or no knowledge of electricity, and consequently were quite unable to supervise the work, and even now, although many colliery engineers have a good knowledge of electricity, there are many collieries indeed where the electrician has only a very inadequate knowledge of electricity, and is certainly not competent to design or superintend the installation of electrical plant of any consequence. In some cases, consulting engineers have been employed; but, again, the man appointed has usually been an electrical expert pure and simple, and he has had to gain his mining experience at the expense of the owners, and sometimes at the expense of the workmen.

"'With regard to Inspectors, I would like to point out that it is useless to appoint Electrical Inspectors who are purely electrical engineers. He may have every qualification as an electrical engineer, but unless he has had a very considerable experience in actual colliery work he cannot carry out the duties efficiently. . . .

"'The only other point which I should like to mention is the suggestion I made to you *re* the Miners' Association appointing their own electrical expert. The point raised is this: So far, the owners of collieries have installed through their colliery managers electrical plant, of which the latter has very little, if any, knowledge, and so far as the men themselves are concerned, their interests were not sufficiently considered; but in going through the whole of the accidents that have occurred due to "Electricity in Mines," it is the men who have been the sufferers, and they have suffered in the majority of cases simply because the installation had not been fitted as it ought to have been by the electrical contractors.

"'The Home Office have drawn up special rules, but these rules were drawn up by men who had no knowledge of the conditions of mining, and the result is that many of these rules are bad; in fact, one especially, that one relating to armoured cables is even dangerous. They have recently also appointed a new Electrical Inspector of Mines.

"'The suggestion I have to make is this: That the miners themselves appoint their engineer to attend inquests, and make a report on every fatal accident, and to make suggestions for their prevention, and such a record would not only be valuable to the miners themselves, but would be of material assistance to the owners when installing electrical plant, and would thus do very much to remove the present feeling against the use of electricity in mines, which can do much to improve the conditions of the men underground if properly installed and used.'"

Russia.—A Moscow Consul recently reported: "Electrical engineers have chances to exploit their ability in the Baku district, as electrical power is being instituted in the immense oil fields of that district. Oil-well supplies, such as casing, drilling tools, rig and engineering machinery, and irrigation outfits are in demand."

The Nijni-Novgorod city authorities have been advertising for tenders for an extension of the horse tramway concession.

In a report on the projected development of means of land and water communication in Russia, the Minister of Public Works states that during the next few years there will be built many steam and electric railways, canals, and roads for connecting up all the important places and opening up the interior.

LEGAL.

Hancock *v.* British Westinghouse Co.

At the Salford County Court on Monday morning, before his Honour Judge Wills, application for an award under the Workmen's Compensation Act, was made on behalf of Jabez Hancock, a labourer, of Warde Street, Hulme, against the British Westinghouse Electric and Manufacturing Co., for whom Mr. Cross appeared. The applicant claimed that as the result of lifting a heavy iron box, in company with some fellow workmen, he was seriously injured at the respondents' works, and thereby incapacitated from following his employment under them at Trafford Park.

Mr. Oppenheim said the respondents had raised every possible issue. They claimed that there had been no accident, and if there had been, it had not caused incapacity.

Mr. Cross said that legal notice of the accident was not given until eleven weeks after it was said to have happened, and the respondents were accordingly prejudiced, because it was impossible for them to investigate whether there was or was not such an accident on the day mentioned. Secondly, the applicant worked for eleven weeks after he said the accident had occurred, and he had admitted that this was because he wanted to go on earning full wages If he had had treatment at once he might have been cured in a week or two. In the third place, it was impossible at so late a date for the defence to get an expert medical opinion as to whether the man's condition resulted from the accident or not. In the result, his Honour awarded Hancock compensation at the rate of 9s. per week from October 2nd last, with costs on the B scale.

Raworth's Traction Patents, Ltd.

In the Chancery Division on Tuesday, December 7th, Mr. Justice Swinfen Eady heard the petition of this company for confirmation by the Court of a resolution to reduce the capital of the company. The company, whose registered address was given as 22, Cooper Street, Manchester, was formed to acquire and exploit a patent electric regenerative control for use on electric tram systems and underground railways.

Mr. Walker, for the company, said that its capital was £30,000, divied into 15,000 preference shares of £1 each and an equal number of deferred ordinary shares, also of £1 each. It was proposed to reduce that amount to £20,625, and thus wipe off £8,839 15s., which had been lost or was unrepresented by available assets. The evidence showed that the company's goodwill and assets did not exceed £18,000, and no dividends had been paid except in respect of the first year's working.

His Lordship granted the petition.

Musgrave & Sons, Ltd., *v.* Bradford Corporation.

In the Court of Appeal last Friday, before the Master of the Rolls and Lord Justices Moulton and Farwell, the hearing of plaintiffs' appeal from a judgment of Mr. Justice Darling in the King's Bench Division, was concluded.

Mr. Walter, K.C., and Mr. Disturnal appeared for the appellants, and Sir Alfred Cripps, K.C., and Mr. Hutchinson for the respondents.

Mr. Walter, in opening the case, said that the judgment of the learned judge appealed from was delivered in three separate parts, viz., on June 17th, 18th and 19th last. The plaintiffs brought the action to recover a sum of about £1,200, the balance of £7,870, the price of a 2,000-h.p. low-speed steam engine supplied by the plaintiffs to the defendants. To the action the following defences were raised: First, the defendants said that it was a condition precedent to the plaintiffs' right to recover that they had the certificate of the engineer of the Corporation, and that, the plaintiffs had not got. Secondly, the defendants said that the shaft of the engine was too weak, which rendered the engine unsafe to work, and caused certain bolts on the flange of the fly-wheel to break. The defendants counter-claimed for £1,990 upon the ground that they had taken out the shaft and replaced it with another shaft, and they claimed the price of the alteration. The plaintiffs' reply to that was that it was a lump sum contract, and that there was no clause in the contract which made the certificate of the engineer a condition precedent to the plaintiffs' right to recover. Further, the plaintiffs said that there was an arbitration clause in the contract which took away the certificate of the engineer as a condition precedent. The plaintiffs further said that the certificate was wrongfully withheld by reason of collusion between the engineer and the Corporation. As regarded the counterclaim, the plaintiffs' defence was that the shaft was not defective, and that the breaking of the bolts was not due to any act on their part, but to the fact that the flange in the armature of the Westinghouse generator was not true with the face in the flange on the fly-wheel. Mr. Justice Darling found that the engineer's certificate was a condition precedent, and that the shaft was not defective. He next found that there was no collusion between the engineer and Corporation, and he further found that the flange not being true was the cause of the bolts breaking. The learned Judge thereupon found that because the plaintiffs had not bolted the flanges in question together they had been guilty of some breach of contract, and he entered judgment for the defendants on the claim, upon the ground that the engineer's certificate was a condition precedent, and he gave judgment for the defendants on the counterclaim, but as the amount was not large, he thought the parties ought to agree on the amount, and the amount was agreed at £10. Counsel contended that the plaintiffs were entitled to judgment both on the claim and the counterclaim. He said it was clear that the flange which the plaintiffs put on the fly-wheel was absolutely true, and that it was equally clear that the flange of the armature, which was put on the shaft by the Westinghouse Co., was the one out of truth.

In reply to the Master of the Rolls, Mr. Walter said he did not now contend that there had been collusion between the Corporation and the engineer, as Mr. Justice Darling had found against the plaintiffs on the point.

Mr. Walter then contended that under the terms of the contract, the certificate of the defendants' engineer was not a condition precedent to the plaintiffs' right to recover.

Lord Justice Moulton said it was clear, in his opinion, that it was the plaintiffs' coupling which failed.

Mr. Walter said that the plaintiffs were not responsible for that under the contract. It was clear from the evidence that every part of the plaintiffs' work was "dead true." It was owing to the fault of the Westinghouse Co. that a strain was put on the bolts, and that caused the sag. It was due to the fact that there was a defect in the flange of the armature, which caused a strain upon the bolts and forced their heads off. It was the plaintiffs' case that, because the Westinghouse Co. did not do their work properly, the bolts broke.

Lord Justice Farwell expressed the opinion that the plaintiffs should have discovered the defect.

Mr. Walter said that the defect was not found out until long afterwards. The defendants said that the plaintiffs should have insisted upon the armature being taken off and repaired, but that he (counsel) contended, was unreasonable. It took days to do that. No amount of bolting or screwing would make a thing parallel which was not parallel.

Mr Disturnal followed on the same side.

Without calling upon counsel for the respondents, Lord Justice Moulton, in delivering the judgment of the Court, after stating the facts, said he was of the opinion that the decision of Mr. Justice Darling that the getting the engineer's certificate was a condition precedent to the plaintiffs' right to sue was correct, and that as the plaintiffs had not got that certificate when the writ was issued, their claim could not be maintained. Upon the counterclaim—upon this point of the case it was really an appeal as to costs—Mr. Justice Darling had found that the defendants' engineer was wrong in saying that the shaft of the engine was too weak, and that being so he thought the engineer would probably now issue his certificate. His Lordship was of opinion that the judgment of the learned judge must be affirmed, and the appeal dismissed with costs.

The Master of the Rolls and Lord Justice Farwell concurred.

Electrical Apparatus in Fife Mines.

The prosecution of officials of the Fife Coal Co. was resumed before Sheriff Shennan at Dunfermline on Monday. The respondents are Charles A. Carlow and Henry Rowan, described as managers or agents of the Fife Coal Co., and William E. Richardson, certificated manager of the Foulford Colliery. They with charged with having, between April 1st and August 7th, permitted the use at the company's Foulford Pit, Cowdenbeath, of electrical plant and apparatus which did not conform with the special electrical rules, and that despite the fact that on April 30th, Mr. Robert McLaren, H.M. Inspector of Mines, had addressed a letter to the company directing that the plant and apparatus should be made to conform with the rules. Mr. R. S. Horne, advocate, Edinburgh, instructed by Messrs. Ross & Connel, and Mr. G. R. Stevenson, Dunfermline, acted for the respondents. At the last hearing the whole of the evidence for the prosecution was taken, and one witness, an electrical expert from London, was examined for the defence.

Mr. W. E. Richardson stated on Monday, when evidence for the defence was resumed, that he had been eleven years in the employment of the Fife Coal Co., and for ten years had been acting as manager. There was a sufficient and competent staff for the management of the three pits of which he was in charge. Mr. Masterson, H.M. Inspector, visited Foulford Colliery on April 1st, but prior to that date he had had no criticism on the part of the Government Inspectors in regard to the electrical apparatus. On April 1st Mr. Masterson only made a complaint regarding the gate-end box, and made certain suggestions. Witness had never been trained in electricity, and had had no examinations to pass. What he knew he had obtained from experience, and he relied upon Mr. Runciman, who had charge of the electrical apparatus. He thought the gate-end box was quite satisfactory, but as the Inspector had recommended a change, he had ordered it to be done. He made it more or less a rule to conform to the wishes of the Government Inspectors whether he considered that they were reasonable or not. He had had no other communication between April 1st and July 15th from the Government Inspectors, until Mr. Nelson, the Home Office electrical expert, visited the colliery. Mr. Nelson went into the switch room, but said nothing to him regarding it. On the main road, Mr. Nelson found a cut in the cable. It was a very small cut, and if a man had laid the broad of his hand on the cable, he would not have touched the wire. He would have required to use the tips of his fingers before he could have reached the wire. The cut must have been caused by a sudden fall from the roof. This sort of thing occurred from time to time, and there was not a mine in the world that was not subject to falls. He gave orders to have the cut repaired. At another part of the pit Mr. Nelson considered that the cable was too near the passing tubs which he suggested had been rubbing the cable. The cables were put in during the month of April. Witness asked Mr. Nelson what he thought of the electrical installation, and he said he could improve it, but he had seen worse. Witness had never at any time been refused material or equipment for the pit. It had always been made available for him. Mr. Rowan was his agent, and he never had any dealing with Mr. C. A. Carlow.

Examined by Mr. J. S. Soutar, the prosecutor, Witness said none of the oversmen of the three pits were appointed under-managers, and it was his duty to exercise daily supervision over the pits. He had no view of his own regarding earthing. Mr. Masterson visited the colliery on April 30th, but said nothing about the gate-end boxes. In answer to respondents' counsel, witness said the visit of Mr. Masterson on April 30th was regarding an accident, and he went to the place where it had occurred. He never went near the gate-end boxes.

David Storrock, pit bottomer, said he had never heard of anyone getting an injury by working the lighting switch. He had worked it frequently himself, and had felt no sensation.

Andrew Bruce Muirhead, senior engineer of Selby, Bigge and Co., electrical engineers at Newcastle and Glasgow, next gave evidence. He stated he gave his opinion regarding the matter from an entirely outside point of view. On October 22nd he visited the Foulford Colliery. He found that the switchroom was a completely insulated chamber, and he considered it was an apartment specially arranged for the purpose. The switch used was the one that was most in use in collieries. He had never seen such a switch as that recommended by Mr. Nelson. He saw no necessity for changing the kind of switch which had been in use. The fuses he also considered complied with the rules.

Alex. Anderson, of Anderson, Boyes & Co., electrical engineers, Motherwell, stated that in a well-regulated pit the gate-end box was shifted every day. From the point of safety there was no reason why this should not be done. He had never heard of a single accident from the type of gate-end boxes in the Foulford pit, and his firm supplied hundreds of them. He knew of only one place in Scotland where a gate-end box was fixed, and he knew of only three cases where they were earthed. Because of the difficulty in understanding them, he considered the rules to be a source of annoyance. There were a great many questions opened up when they talked about earthing gate-end boxes.

Hugh Gordon Fraser, electrical engineer in charge of the electrical plant in the Fife Coal Co.'s pits, stated that copies of the rules had been issued to his assistants. He had always obtained all the material he required. There was no fear of any man getting a shock while standing upon the concrete floor of the switch room.

By Mr. Soutar: Practically the same switch was put in the pit with the exception that it was in an iron box. It was put in to please Mr Nelson, not because the change was thought necessary.

James Fraser Irvine, representative of Edison & Swan United Electric Light Co., Dundee, said he had heard of only one accident resulting from the kind of switch in use.

By Mr. Soutar: Witness admitted that the switch was an article provided for low pressure, but it would do for any pressure.

Geo. Russell, electrician, Aitken Pit, explained that Mr. Nelson had approved of porcelain switches in use at the Aitken Pit about five months ago. He admitted that he showed the switch to Mr. Nelson when above ground.

Charles Carlow, managing director of the Fife Coal Co., gave further evidence, and this closed the evidence.

Counsel having addressed his Lordship, the Sheriff intimated that he would give a written judgment.

Electrical Co., Ltd., *v.* O. H. Thomas, Son & Co.

Mr. E. J. Pollock, as Official Referee, sat at the Swansea Guildhall on Tuesday, to hear an action brought by the plaintiffs against the defendants, who are proprietors of the Glynvi Valley Colliery, near Maesteg, for the recovery of £3,100 for electrical plant for the colliery and goods sold and delivered. There was a counterclaim for the sum of £30,100.

Mr. Abel Thomas, K.C., M.P., Mr. John Sankey, K.C., and Mr. Bowen Davies (instructed by Messrs. Michael, Abrahams, Long and Co., London) were for plaintiffs, and Messrs. B. Francis Williams, K.C., and D. Villiers Meager (instructed by Messrs. Collins and Wood, Swansea) defended.

Mr. Abel Thomas, in opening the case, stated that plaintiffs contracted to supply pumps of a certain capacity for the colliery, and of the counterclaim £24,000 was damages claimed by the defendants for alleged delay, which caused them to decline certain contracts. Plaintiffs were very large makers of electrical plant, and as regarded the alleged delay in installing at defendants' colliery, counsel pointed out that Messrs. Thomas & Co. were not ready when they received machinery to set the same to work. The machinery was delivered within a reasonable time with the exception of one pump, and in that case no damage whatever was sustained. As regarded payment, 60 per cent. was to be paid on delivery, 30 per cent. on starting, and 10 per cent. in three months. It was alleged that the pumping was defective, but counsel pointed out that the work, after erection, was satisfactory, that the defendants were then not only sinking a drift, but working the coal required. He further contended that the plant was satisfactory in all respects, and that any breakdowns were due to lack of knowledge by the defendants of electrical working. Counsel characterised the counterclaim as ridiculous. The greater part of the day was taken up in the reading of voluminous correspondence between the parties, and the hearing, which is expected to last a fortnight, was adjourned to London.

REVIEWS.

Auto-Transformer Design: A practical handbook for manufacturers, contractors and wiremen. By Alfred H. Avery. London: E. and F. N. Spon. Price 3s. 6d. net.

It is difficult to see how any of the three classes for whom Mr. Avery professes to cater, could benefit by reading this book. The first two would certainly not be impressed, while the average wireman would lay it down with his mind in a muddled state, and with some very erroneous ideas as to the principle and design of transformers.

The first sentence in the preface is typical of the contents of the book—one part makes a statement, and the second implies its contradiction. The descriptive matter is very mixed, and one cannot help thinking that the author is not at home with his subject.

For the purpose of explaining why a balancing auto-transformer is carrying little current on a balanced full load, the author cites the example of two 100-volt dynamos supplying a three-wire system, and states: "Should all the lamps be switched off one side of the system, either A or B, current will flow at 100 volts pressure along that circuit only from outer to inner, as shown by the curved arrows, the others remaining idle." This is an incorrect statement, and at the best could only mislead a novice.

Chapter II goes into questions of illumination, and contains some curious statements. It concludes with the remark that a transformer renders a consumer independent of the supply pressure and enables him to "juggle with it as he pleases." Most consumers would rather not juggle with the pressure.

Chapter III leads off with a weird explanation of the generation of an E.M.F., and in explaining the fundamental equation, the author states: "The factor 4·44 times the frequency *f* represents the 'root-mean-square' value of the alternating wave form, or the quadratic mean value of the alternating flux, varying four times per cycle."

The root-mean-square value is totally different to the quadratic mean value, and neither of these has anything to do with the flux. μ B curves of Stalloy and Lohys brand sheet-iron are given, but there is no explanation of what these symbols mean.

Densities of 50,000 to 60,000 lines per sq. in. for Stalloy brand sheet are given as good practice, apparently for all periodicities, as "cores designed for this flux density will work perfectly cool for any length of time." Later on in the book Mr. Avery explains that he selected these densities principally for arithmetical reasons. What could be more simple?

We are told that the resistance of a transformer coil is practically of a constant value. Would it were so. It varies sufficiently to upset some of the author's calculations by a matter of some 19 per cent.

Chapter IV is given up to calculations of core densities, number of turns, &c. A table of dimensions for eight different "core" type carcases is given, but there is no mention of the output for which they are intended, and the proportions might easily be improved upon.

It is intended to have windings on only one of the limbs. The cores are of perfectly square section, and round coils are recommended on the score of improved ventilation. It is practically useless to provide ventilating ducts in such very small transformers, especially when they are intended to be enclosed in iron cases, more or less air-tight.

Coils should be shaped to suit the core, and they should be placed as close to the iron as possible if good regulation is to be secured. Cores with longer limbs, shorter yokes, and coils placed one on either side would be more economical and give better results.

There is no mention of the necessity of insulating the laminations from one another, and the iron weights and losses are incorrect, as they are calculated on a unity space factor. With plates ·02 in. thick, 10 to 14 per cent. of the gross area would be taken up with insulation or air space.

Chapter V deals with efficiency calculations, but as the author makes the mistake of calculating the coils at a temperature of 60° F., an error in the neighbourhood of 20 per cent. is introduced, while the error in the iron circuit has already been commented on.

Mr. Avery is not happy in his explanation of "power factor." He states that a wattless current is of no value, as it is delivered at zero pressure, and then produces a diagram which proves that his own statement is incorrect; he should know that the wattless component of the no-load current serves a decidedly useful purpose, at least *while in the transformer*.

A power factor diagram is given, in which the words "apparent current" are used. This is needlessly confusing, as all currents are real whether they are wattless or not.

Chapter VI is given up to constructional details. Two methods of building up the core are discussed, the better one being rejected for the absurd reason that the magnetic flux would have to cross the grain of the iron.

Four joints in the magnetic circuit are advocated in preference to two. Mr. Avery should know that this will result in increased magnetising current and poor regulation.

Enough has been said to indicate the nature of this work. Mr. Avery has taken a certain amount of trouble in the writing of the book, but it is a pity that some technical friend was not given an opportunity of going through the MS. before it was submitted to the printer. The reviewer is afraid there will not be much room for it until it has been thoroughly revised.—F. B. O'H.

Steam Power Plant and Piping Systems. By W. L. Morris. New York: McGraw-Hill Book Co. 1909. Price 21s. net.

The author of this volume is very strong on system, though in his eyes the system of a power generating station consists not in engines and pumps and boilers, but in pipe arrangements. He regards everything through pipes as through a telescope. Now, there are men who have laid out power stations and have put their engines and boilers where they could, and have proceeded to join them up by pipes—pipes on walls, pipes on piers, pipes in troughs and sumps and trenches. Has a pipe to go through a wall a hole must be cut, for it would be presumptuous for a mere pipe to expect a wall to be built with a hole in it on purpose for an expected pipe. Indeed, what right has a pipe to be expected? Pipes are very properly mere accessories, for do we not read about pipes and other accessories? When all the work has been done the engineer very properly takes a holiday while the pipe fitter just puts up a few pipes. Not so the author. Pipes are all to him. Engines and boilers are mere accessories put down for the purpose of maintaining a flow of steam through the pipe system which is the *raison d'être* of the station.

No doubt this is a proper spirit in which to approach a special subject, though a pipe enthusiast is, perhaps, somewhat prone to do too much by way of putting in plant so that a pipe system may be installed. An excellent idea of his book may be got from the chapter headings in the contents index, for there are 31 chapters dealing with the many pipe systems in a station, the feed piping being a system, the artesian well piping a system, the oil pipes to lubricators or bearings a system; and to each system there is its section in other chapters which treat of its details, such as in the live steam system, the branches to auxiliary engines, pumps, fans, whistles, oil cleaners, superheaters, and so on.

In short, the author makes his subject colossal, for pipes dominate, and dwarf all else.

The engineering of a power station is pipework only. No engineer nowadays dreams that his duty to his employer is to design him his engines and boilers. These he has got to buy like so much putty, from recognised makers. But, says the author, it is his duty to lay out the piping systems properly and with care aforethought. What he advises is that an engineer should develop the system and give diameters, but he should leave to the contractors' specialist to determine the location of pipes and branches, for pipe-fitting firms now employ men who have the ability and the special experience to do this. The author begins with diagrams not to scale, showing the systems to be employed and their various connections. It is from these that actual connections are to be designed together with details.

In regard to continuous operation of plant as secured by the piping systems, a distinction is made between absolutely necessary plant, and plant that may be temporarily dispensed with. Thus, a condenser, a heater, or an economiser, are none of them essential to running, though they are all valuable accessories, and should be awarded reasonable safeguards, but not the same refinement as is given to absolute essentials. Thus a condenser may be made to attempt a duty beyond its rating, giving 15 in. of vacuum, which is better than none.

And so the drawings given to the contractor are to show the results to be secured. He is to make the plans to suit his own ideas, and his own materials and patterns, and the engineer is to approve. It seems to us that this is already done in the majority of cases, not only for the pipes, but even for the whole station, for we seem to have heard of an engineer getting out the whole of a station in under a fortnight all by himself, so to speak, ready for tender. Well! these things do happen. The author would regularise them so that there would no longer be any of the present sham and pretence.

The book is full of illustrations of general diagrams and of details, which show, for example, the arrangement of the controlling feed pump, open heater and jet condenser, and the same for the surface condenser. The author approves of the method of removing air from the top of a counter-current condenser, into which the exhaust enters at the bottom, and the coldest tubes are at the top; this notwithstanding that air is heavier than water vapour. He claims that practical records show that there is no error in the method, and his arguments in its favour are well enough. Is it not often the case that practice negatives our stock theories, and points the way to vision of some overlooked factor, as it appears to do in this case?

On pages 68 and 69 an excellent boiler blow-out and wash-out system is outlined, and one of its safety results is pointed out.

But this book is not merely a book of piping; it is a long series of little briefs on the method of working the multiplicity of station accessories—such as lubricators and lubrication systems, the method of applying oil, and the wastage of oil in a circulatory system; on air pressure oil supplying, and so on; at every detail there is a wealth of information, and perhaps, also, of controversial matter, for probably many will differ from the author in numerous matters. But an engineer will profit by reading the book from cover to cover, laborious as the job might be.

The author puts in a word for the all-steel and steel-plate fitting as more reliable than cast-iron, which is unfortunately so much used for pipe-fitting pieces.

The author is an American, and his practice is, of course, largely American, and some of it would be regarded here as obsolete. For artesian or bore-hole purposes, for example, the cup-leather bucket is stated to be universal. Now, this practice is only that of very general pump-makers' gear. The best practice is to use a plain solid bucket of considerable length with numerous close pitched square grooves cut in it. And how is it that an 8-in. casing only admits a $5\frac{3}{4}$ pump barrel? It ought to be easily possible to use a $6\frac{1}{2}$ barrel in an 8-in. casing.

However, we may forgive the author this, for he throws doubt on the use of the pump barrel just locked into the casing pipe, a method only fit for emergency.

The author's explanation of the action of an air lift pump will not be at all generally accepted. Still, his conclusions are right, and everyone can find some blemishes in any book.

This one ought to become the classic on piping systems. It is written by a man who is an engineer and can see things.

BUSINESS NOTES.

Canada.—By an order of Council issued last month, the following appears among a number of additions to the Free List of the Canadian tariff: "Metallic elements and tungstic acid when imported by manufacturers for use only in their own factories in the manufacture of metal filaments for electric lamps."

Bennis Stokers.—In a list of recent contracts received by Messrs. E. Bennis & Co., Ltd., of Little Hulton, we observe the following:—

Long Eaton U.D.C. Electricity Works.—Two high-duty smokeless and gritless coking stokers and compressed air furnaces for a Lancashire boiler. Repeat order.

The Richmond (Surrey) Electric Light and Power Co., Ltd.—Four stokers and compressed air furnaces for Davey-Paxman boilers. Repeat order.

Lincoln Corporation Electricity Works.—Four stokers and compressed air furnaces for dry back type boilers. Repeat order.

Daniel Adamson & Co., Dukinfield (for shipment to India for the Bengal-Nagpur Railway).—Four high-duty coking stokers and compressed air furnaces for Lancashire boilers.

There are in the list of orders numerous other works including paper and flour mills, breweries, spinning mills, soap works, &c., for which Messrs. Bennis have supplied equipments. The firm ask us to state that they will be pleased to show their coking stokers in operation in the boiler houses of well-known firms, to any of our readers.

Dublin Electrical Contractors Busy.—We learn from a correspondent who ought to know, that electrical contractors have more than they can do in Dublin just now, and there are a good many big things still to be done within the next few months.

Consular Notes.—Dutch East Indies.—The Belgian Consul in the Dutch East Indies reports that the official statistics published by the Government do not throw any light on the extent of the imports of electrical goods, electrical machinery being included under the heading "Steam and industrial machinery," lamps and accessories under "furniture," and electrical wire under "copper." Persons competent to judge, however, state that, though the total imports may not be very considerable, they are increasing from year to year. The articles in this branch of trade which are most in demand are telegraphic and telephonic instruments and their accessories, such as galvanised steel wire, insulators, posts, &c. After these come installation work for the distribution of electrical energy in the towns, &c., and material necessary for electric tramways at Batavia. Most of the companies which exploit electrical enterprises in the country purchase their materials through the parent company abroad, but a German firm has obtained a considerable footing in the market, and not only sells its goods but also interests itself financially in the establishment of companies for the production of electrical energy. Its special line is the supply of steam engines for dynamos, and amongst the lighting installations it has recently made are those of Lawang, Soerabaja, and various tea and sugar works. At the present moment the firm in question is making an installation of 1,700 h.p. to supply electrical energy to Soerabaja, and it proposes to extend the distribution in this town by utilising the water-power which is available at a short distance. Another important German firm with an agency in the country has decided on the installation of electric power plant in the petroleum mines at Balikpapan (Borneo). The largest lighting company in the colony is the Nederlandsch Indische Gas Maatschappij, of Batavia. Its electrical installation, which includes boilers heated by means of petroleum residues, was made by a German company. The sale of energy in 1908 amounted to 480,000 kw.-hours at a price of 40 cents for light and 20 cents for power. The number of lamps used during the year was 2,920 of 5 c.p., 30,000 of 8 c.p. (many Osram lamps), 431 of 16 c.p., 820 of 25 c.p., 4,233 of 32 c.p. (most with metallic-filament), 640 of 50 c.p., and 178 arc lamps of from 10 to 18 amperes. The current is single-phase alternating, of 110 volts and 50 periods. The company arranged to lend out electric motors for motive power from January 1st, 1909, but as the industry is still relatively small and the cost of current rather high, this method of exploitation has not given very good results. The lamps, wires, meters, &c., are purchased at the headquarters of the company at Rotterdam, and have been supplied up to the present by Dutch and German houses exclusively. Two methods for securing a trade in electrical goods in the country are recommended. The first is for a syndicate of producers to establish an agency at Samarang and Soerabaja, not only to sell the machines and apparatus, but also to interest itself in new enterprises and even to encourage their establishment. The second is to make offers to the parent companies or buying houses in Europe of the firms mentioned below, and especially to MM. van der Linden et Têves (dynamos) and the Nederlandsch Indische

Gas Maatschappij (lighting apparatus). It should be added that in order to achieve success, the apparatus offered must be of irreproachable quality, and should compete as regards price with German products. The following is a list of the importers of electrical machines and apparatus in the Dutch East Indies:—

Companies which chiefly exploit Electric Lighting.

Bandoensche Electriciteit Maatschappij, of Badoneng.

Nederlandsch Indische Gaz Maatschappij, of 71, Bounpjes, Rotterdam.

Solosche Electriciteit Maatschappij, of Batavia.

Electriciteit Maatschappij Medan, of 164, Heerengracht, Amsterdam.

De Algemeene Nederlandsch Indische Electriciteit Maatschappij, which was established on April 8th, 1909, to supply electricity to the Dutch East Indies. It possesses the following concessions:—(1) Supply of electric lighting to Soerabaja, Malang, Sidoardja, Sisir and Batoe, Kasri and Prigen, Bangil, Lawang, Pasoeroean, Singosari, Grisee, Porrong, and Samarang; (2) use of power from various waterfalls; (3) establishment of aerial systems at Soerabaja, Samarang and their suburbs; (4) establishment of electric tramways at Soerabaja and Samarang.

Telephone Services.

The Dutch East Indies Government, besides exploiting the telegraph systems, also works the following telephone systems:—Batavia, Samarang, Soerabaja, Praenger-Regentschappen, Buitenzorg, Djombang, Pasoeroean, Probolinggo, Madioen Soerakarta and Djokjakarta.

Intercommunale Telefoon Maatschappij, of Batavia.

Telefoon Maatschappij Insulinde, of 61, Hugo de Grodstraat, the Hague which exploits the services of Malang, Loemadjang and Bangil.

Pekalongansche Telefoon Maatschappij, of Pekalongan (Java).

Algemeene Telefoon Maatschappij, of Samarang, which exploits the service at Padang (Sumatra).

Blitar Telefoon Maatschappij, of Soerabaja.

Tegalsche Telefoon Maatschappij, of Tegal (Java).

Cheribonsche Telefoon Maatschappij, of Cheribon.

Kediri Telefoon Maatschappij, of Kediri (Java).

Telefoon Maatschappij Japara, of Samarang.

Tramway Companies.

Batavia Electrische Tram Maatschappij, of 259, Heerengracht, Amsterdam; capital 1,600,000 florins, length of line 14 kilometres, power plant 3 units of 200 H.P. each, rolling stock 22 motor-cars and 22 tenders.

Suppliers of Machines and Apparatus.

Allgemeine Electricitäts Gesellschaft, of Berlin, represented at Batavia, Samarang and Soerabaja by M. Maintz & Co.

Siemens-Schuckertwerke, of Berlin, agency at Soerabaja.

Maatschappij tot Woortzetting der Zaken van der Linden et Tèves, Samarang and Soerabaja; buying house, 157, Stadthouderskade, Amsterdam.

De Nederlandsch Indische Industrie, Soerabaja, and 119, Bezindenhont, The Hague.

Carl Schlieper, of Remscheid, Germany, Batavia and Soerabaja.

Handelmaatschappij Het Centrum, Batavia; buying house, 204, Singel, Amsterdam.

Constructiewinkel De Bromo, Pasoeroean (Java).

Maschinehandel voorheer Becker & Co., Soerabaja.

Maatschappij tot Voortzetting der Zaken Ruhaak & Co., Soerabaja.

De Rooy & Co., Soerabaja.

Russia.—The Austrian Consul at Odessa reports that the electrical materials used in that district are chiefly supplied by Russian houses, the heavy dynamo machines, cables, wires, and accumulators from St. Petersburg, and the porcelain goods from Riga. Smaller and lighter dynamos, measuring apparatus, carbons, incandescent lamps, installation materials, &c., come from abroad and chiefly from Germany. Glassware for lighting purposes is chiefly of Bohemian origin, Hungary supplies some incandescent lamps, and England certain kinds of incandescent lamps for vessels.

Holland.—The Austrian Consul at Amsterdam reports that at the beginning of 1908 there were in Holland 4,946 factories with 7,226 steam boilers. The use of electric motors in small industrial undertakings has considerably increased in recent years. On January 1st, 1904, when the municipal central station was first set working, there were in Amsterdam 438 gas engines of 2,553 H.P.; on January 1st, 1908, there were only 246 gas engines of 1,429 H.P. On the other hand, at the end of 1907, there were 1,672 electric motors of 6,783 H.P., and by the end of 1908 this figure had increased to 2,000, or more than 8,300 H.P. There is a considerable opening for electric motors in Holland, the sizes most in demand being those of 2-5 H.P. for small industrial undertakings. There is a certain home production, but as yet this is of no great importance. There are two electrical works at Amsterdam. The Electra supplies two-phase current of 72 or 110 volts, whilst the municipal works supply three-phase current of 220 volts.

A Simplex Competition.—In the Christmas number of *Installation News* to be issued next week, Messrs. Simplex Conduits, Ltd., introduce a "picture" competition with the object of popularising their new catalogue, to which we recently referred, and making its contents better known. The competitor has to give a name to the fittings, of which only a portion will be illustrated. Of course he can only do this by making a close search through the catalogue.

For Sale.—Offers are invited for plant, &c., of the Solium Electrical Co., Ltd., metallic-filament lamp makers, Nottingham, of which some particulars are given in an advertisement to-day.

Messrs. Ferranti, Ltd., are offering a 300-KW. Ferranti-Schuckert steam dynamo, a Ball & Wood engine, and "C. & C." dynamo (120 KW.), also condensing plant, for sale. See our advertisement pages to-day.

Catalogues and Lists.—Messrs. L. Andrew & Co., 2, Carr Street, Blackfriars, Manchester.—Leaflet relating to "Palmetto" self-lubricating packing.

Messrs. Baxendale & Co., Miller Street, Manchester.—Forty-eight page catalogue containing particulars of a variety of Christmas presents ranging from a button hook to a sewing machine, with a variety of dolls' houses, boys' bicycles, and other such things which cost us dear at Christmas time—yet somehow we do not seem to mind!

Messrs. Geo. W. Green & Co., Crown Works, Feltham, Middlesex.—Illustrated list describing their trolley standard earthing device as used on a number of tramway systems; also a leaflet drawing attention to a number of their other manufactures, including anchor ears, suspensions, rail cleaners, and other traction and transmission supplies.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Descriptive price list of the "Eclipse" flame arc lamp, illustrating the lamp and a number of accessories for same.

Siemens Bros. Dynamo Works Co., Ltd., Tyssen Street, Dalston.—In their series of Tantalum lamp "Satisfied Consumer" show-cards, this firm have now included one specially designed to appeal in the French market. Eight-page list showing and stating reduced prices of a number of new patterns of Holophane glassware spheres, hemispheres, concentrating reflector bowls, distributing reflectors, &c., for tantalum lamps. Electrical dealers and contractors who so desire can have a supply of the lists with their own name and address printed thereon for bringing Holophane glassware before electric light consumers, if they send their trade card to the firm.

Messrs. Berry, Skinner & Co., 78, Upper Thames Street, E.C.—Illustrated and priced leaflet relating to their new Berry's patent mica insulated auto-locked D.P. ironclad switch. In outward appearance this switch is exactly similar to the firm's well-known combined switch-fuse, and we understand that their object in putting it on the market is to enable contractors to make a uniform job, where in some cases switches only are required and in others switch-fuses on the same installation. The features claimed for the gear are:—Mica insulation, great mechanical strength, freedom from springs likely to get out of order, rapid make and break. The switch is known as the "Micaloc," signifying that it is mica-insulated and auto-locked.

The Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Two new lists. No. 126 E (12 pages) describes and illustrates, and tabulates data and prices of, a line of small direct-current motors for industrial purposes, which have been designed by the company's principals—the Bergmann Electrical Works. The motors are made in all sizes from $\frac{1}{16}$ H.P. to 6 H.P. The standard machines are of the open type, but they can also be supplied ventilated enclosed and totally enclosed. They can also be supplied as dynamos for either direct lighting or battery-charging apparatus, and for fixing either on a horizontal or vertical surface, or for ceiling suspension. The list also gives particulars of starters and regulators, and prices of motor-generators, flexible couplings, spare parts, &c. A large stock of machines for the usual voltages and standard speeds is held at the above address. Copies of the list will be sent to those interested on application. The other list (No. T 65) deals fully with the "Adnil" electric hooter for mines, tunnels, ships and outdoor use, and with electric horns for motor-cars, fire-alarm and signalling purposes.

Messrs. Laidler, Ritchie & Co., Ltd., Longsight, Manchester.—Several small leaflets, one drawing attention to "Fludor" and the "Fludor" soldering lamp. Another particularises and prices the "Meteor" metallic-filament lamp; yet another is devoted to their electric hoist block.

Messrs. Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.—New catalogue (No. 11), containing 48 pages of excellently illustrated matter regarding their "Sentinel" air compressors. A number of pages contain a long list of users of these compressors. Belt-driven, motor driven, gas engine-driven and portable compressors are all shown and detailed. A number of half-tone views show the latest extensions made to the firm's works.

Messrs. Isenthal & Co., 85, Mortimer Street, Cavendish Square, W.—New list supplementary to No. 16, illustrating and giving tabulated particulars and prices of their Ruhstrat rheostats.

The British Electric Plant Co., Ltd., Alloa.—Two finely produced publications. No. 169 (green cover) contains in 24 pages illustrations and tabulated figures of outputs and speeds of their patent self-balancing centrifugal pumps for high and low lifts; also giving some hints on the installation of electrically-driven turbine pumps, and a table of friction loss in water pipes. No. 142 (red cover) is a second edition of the company's 36-page publication dealing with "Industrial Applications of Electric Motors"; its purpose is to indicate generally the large and varied field of service in which the B.E.P. manufactures find employment. It is capitally illustrated with half-tones, and contains a number of diagrams.

Schiersteiner Metallwerk, Schwerinstr. 3, Berlin w. 57.—Leaflets Nos. 34-37, relating respectively to their automatic switch for lighting alternately two groups of sign lamps; the "Lucifer" automatic time-switch, for stairs, corridors, &c., which extinguishes the lamps connected with it after a period of ½ to 3 minutes, according to the setting; current limiters, time switches, &c.; and a turnstile.

The American Westinghouse.—The East Pittsburg shops of the Westinghouse Electric and Manufacturing Co. have just begun work upon the heavy order for motors and equipment for the Long Island Railroad Co. This order calls for 130 car equipments, of two 200-H.P. motors each, together with controls, wiring, conduits and air brakes. The total amount of the contract amounts to almost $1,000 000. The apparatus will be delivered early in 1910, in time for the installation of electrical operation on the Long Island system, in connection with the completion of the Pennsylvania tunnels.—*Electrical World.*

Book Notices.—*Schutz der Hochspannungsanlagen.* By Hermann Zipp. Hanover: Dr. Max Jänecke. Price 3M. This is another useful addition to Jänecke's "Bibliothek der Gesamten Technik," as it deals with a subject of great importance at the present time. The problem of the protection of electrical systems against voltage rises, whether due to atmospheric effects or to internal causes, has not yet received the attention it deserves, and a book like the present one, which gives a concise and yet fairly comprehensive account of the whole matter in simple language, and from a non-mathematical point of view, will meet the needs of a large number of readers and may encourage a more systematic and general investigation of the subject. To begin with, the various causes to which voltage rises may be due are discussed, including lightning discharges, stationary or slowly moving static charges, resonance voltage rises, and voltage rises due to switching operations or to accidental short circuits. Some particulars are given of the replies received to a circular on the subject, issued by the "Elektrotechnischer Verein," but the absence of more information as to actual breakdowns which have occurred, and the recurrence of which has been stopped by the adoption of one plan or another, is to be regretted, especially as a good deal of this sort of information already lies scattered through the pages of the technical journals. The second part of the book deals with the question of safety devices to combat the ill-effects of these voltage rises. Under this heading come the question of the earthing of the system, the use of condensers for dissipating high-frequency discharges, spark gaps of the horn type and of the multiple roller type, electrolytic arresters, and one or two other devices. Finally, some particulars of the actual construction of the choking coils, condensers, resistances, &c., used with these devices are given. It will be seen that by keeping strictly to the one subject and assuming that the reader has a general knowledge of the underlying principles, the book, in spite of its small size, covers the ground fairly completely. One or two minor errors may be pointed out for correction in a future edition. On page 28, with a view to emphasising the resonance effect, an impossible and somewhat misleading value of the inductance of an alternator armature has been chosen. On page 39 the explanation given for the voltage rise in a transformer on suddenly switching off the load is unsatisfactory, the action being chiefly due to the leakage flux and not to the main flux. In the numerical example worked on page 55 ordinary logarithms have been used in place of Naperian ones, and on page 140 the suggestion for the use of two protective choking coils in series with overhead lines—one of low inductance to deal with high-frequency discharges, and one of high inductance for low-frequency discharges—is impracticable and unnecessary, as, in any case, the inductance used is limited by the permissible drop in it with the working currents, and a single coil having this inductance gives all the protection available.

Kapazität und Induktivität. By Dr. Ernst Orlich. Brunswick. Fried Vieweg & Son. Price 14 M. ("Elektrotechnik in Einzel-Darstellungen," Vol. 14).—It might at first sight appear doubtful whether a separate volume dealing solely with the question of capacity and inductance is justified, but an inspection of this book shows that its 294 pages are none too many for the detailed discussion of the subject from both the theoretical and practical points of view. Prof. Orlich has been able to draw upon the unrivalled experience of the Reichsanstalt, and the result is a book which contains not only a sound theoretical investigation, but also a mass of practical experimental data which can be fully appreciated even by those not able to profit by the theory. The theory, moreover, is never allowed to stray far from practice, and the author is always careful to explain the physical meaning of the formulæ arrived at and to illustrate the results by applications to important practical problems. The theorctical part occupies about half the book, and deals with such subjects as the effects of a static-electric field as explained by Maxwell's theory, the calculation of capacities, the electric current and the magnetic field it sets up, the Biot Savart law, the definition and calculation of induction coefficients in connection with steady and fluctuating currents, periodic quantities treated by the symbolic method, the effects of capacities and inductances in alternating circuits treated first approximately and then exactly, voltage and current resonance, formation of potential waves in long lines, the influence of skin effect on the coefficient of self-induction, &c. The practical part of the book starts with descriptions of the various available sources of low and high frequency, alternating voltages for test purposes, including stretched wire interrupters, microphone interrupters, high-frequency generators and Duddell arcs. Next, the various instruments suitable for use with fluctuating currents are discussed. These include ballistic galvanometers, electrometers, telephones, and vibration galvanometers. The relative suitability and sensitiveness of these is fully dealt with. The standard capacities, inductances and resistances used for exact tests are then described, and, finally, a large number of selected methods of carrying out absolute and relative capacity and inductance measurements are described in detail, together with their chief sources of error. It is to be regretted, however, that these numerous methods are not more thoroughly compared in a critical spirit, so as to bring out their good and bad points more clearly. As it is, the reader is left in some doubt as to the best method to employ under any given circumstances.

"Journal of the Association of Teachers in Technical Institutions." Vol. II, No. 4. London: St. Bride's Press, Ltd. Price 1s.—This number contains the report of Council and Committees, and various interesting short articles, including Electrical Notes by S. S. Richardson and S. G. Starling. There is also a list of members.

"Electricity and Magnetism." By G. C. Foster and A. W. Porter. Third edition. London: Longmans, Green & Co. 1909. Price 10s 6d. net.

The Globe Code Co., Ltd., of 18, Eldon Street, E.C., have sent us circulars relating to their "Globe Standard Code," price three guineas, and the "Globe Code Condenser," price one guinea, as well as other publications of the same nature.

"Electric Waves," by W. S. Franklin. New York: The Macmillan Co. London: Macmillan & Co., Ltd. 1909. Price $2 net.

"Journal of the American Society of Mechanical Engineers." December, 1909. Vol. 31, No. 12. Baltimore: The Society.

China.—The following items of news regarding electrical matters in China recently appeared in the *London and China Telegraph*:—

The merchants of Kiangse, China, have subscribed $30,000 gold to establish a telephone service throughout the province, and request the permission of the Governor to do so.

The Chinese Board of Posts and Communications intends to follow the foreign fashion by establishing postal and telegraph offices at all the principal railway stations for the convenience of travellers.

The merchants and gentry of Swatow, China, say that as the business of the port is increasing they do not want to be behind the times, and so have subscribed $200,000 to establish electric trams in the city.

Bankruptcy Proceedings.—Ernest Goodman (trading as E. Goodman & Co.), electrical engineer, 30, Hertford Street, Coventry.—This debtor attended at the County Hall, Coventry, on Monday last for his public examination before Mr. Registrar Kirby. Replying to the Official Receiver, debtor said he added "and Co." to his name just to give a bigger appearance. He had lost a third of the amount of his contracts, competition being so very keen he had to cut things as fine as possible. He had no one to keep but himself. He drew £4 a week out of the business, which, after meeting his expenses, left him 30s. per week for himself. He spent this on clothing expenses and in getting work. Asked if he did not think he had been rather extravagant in his expenses, debtor replied he did not think so. The causes of his failure were bad trade, keen competition and losses on contracts. He first became aware of his position six weeks before filing his petition; he had not said that he knew six months before. What he said was that he knew six months before that he could not pay his debts in full. He borrowed £144 from his home, and spent that in paying his debts, hoping that it would put things right, but it did not do so. The examination was concluded.

Harry Graham, electrician, Albion Street, Huddersfield.—The public examination of this debtor was to have been held last Monday at the County Court House, Queen Street, Huddersfield, before Mr. Registrar Freeman, but the Official Receiver stated that the trustees (Messrs. Netherwood and G. W. Smith) desired to make further investigations into debtor's affairs, and he (the Official Receiver) asked that the case be adjourned. The application was granted.

Robt. Herbert Scotter, civil engineer, late of Southend-on-Sea, but whose present address the petitioning creditor is unable to ascertain. Public examination is announced in the *Gazette* to take place at Carey Street on January 11th.

Dissolutions and Liquidations.—Bradford Electrical Engineering Co., Ltd., 56, Manningham Lane, Bradford.—The solicitor for the liquidators, Mr. W. I. Crabtree, has called a meeting of the creditors of the company for 15th inst., at the Queen's Hotel, Boar Lane, Leeds.

Rossendale Valley Tramways Co., Ltd.—A meeting is to be held at 61, Gracechurch Street, E.C., on January 4th, to hear an account of the winding up.

Mono-Rail Construction Co., Ltd.—This company is winding up voluntarily, with Mr. W. F. Scott Armstrong, 34, Old Broad Street, E.C., as liquidator. A meeting of creditors is to be held on December 20th.

Santoni Arc Lamp and Engineering Co., Ltd.—The accounts just circulated by the joint liquidators show total amounts realised £293 (£118 trading receipts, £33 book debts, and £142 goodwill and stock). The disbursements were: Trading payments £134, legal, liquidation and other charges £75, preferential creditors £27, leaving a dividend of 1s. 10½d. per £ on creditors' claims (£619) £57 = £293.

Glover's Almanac, 1910-11.—The editor of this Almanac is inviting contributions for next year's editions. See our advertisement pages to-day.

Co-operative Societies and Electricity.—A news correspondent learns that various co-operative societies in Manchester and Bolton districts are about to have extensive electrical installations put down in central and branch premises. The contracts will probably be placed early in the new year.

Trade Announcements.—The Electrical Apparatus Co., Ltd., have appointed Messrs. Tetley & Co., of Salford, to be their Manchester and district representatives for E.A.C. motor control gear. The agency does not cover electricity meters.

Messrs. Feld Bros. & Co., Ltd., of London, have appointed Mr. Geo. W. Bunting, consulting electrical engineer, 49, Park Avenue, Whitley Bay, as their sole representative for Newcastle, Middlesbrough and district.

The Ferabin Lamp and Electrical Accessories, Ltd., have recently commenced business at 118, Queen Victoria Street, E.C., for the supply of electrical plant and all kinds of accessories for lighting, bell, telephone and traction installations. In their showrooms they are exhibiting the latest designs of fittings, radiators (glow lamp and convector patterns), and cooking apparatus and large stocks of bell and lighting material are held. The firm's specialities include the Ferabin lamp and dry batteries in various patterns for use in stores, warehouses, &c., for inspection purposes, and by cyclists, motorists, &c., the "Imer" lamp (metallic-filament) for indirect lighting, motors and dynamos, hand-drilling apparatus, &c. Lists are now in the Press.

Messrs. T. H. Brooker & Co., electrical and mechanical engineers, of Gray's Inn Passage, have increased their staff and opened an office at 44, Bedford Row, W.C.

The Electric Construction Co., Ltd., have appointed Messrs. Fyfe, Wilson & Co., 145, Bath Street, Glasgow, to represent them in Scotland, with the exception of collieries. For colliery work they will be represented, as heretofore, by Messrs. Hunter & Jack, 101, St. Vincent Street, Glasgow.

Exhibit.—At the Cattle Show which closes to-day, Messrs. W. H. Wilcox & Co., Ltd., have a stand at which they show a variety of their engineers' stores.

LIGHTING and POWER NOTES.

Acton.—The Electricity Committee has instructed the engineer to prepare a schedule of prices for the wiring of consumers' premises, the proposal being that local electricians who are willing to carry out the work on this scale, be allowed to do so. The present method is to give the contract for free wiring to one firm.

Aberdare.—The District Council's application for sanction to borrow £17,000, in order to lay down an electric generating plant, has been granted by the L.G.B., and it is expected that the work of erecting the new station will be commenced early in the year.

Australia.—Boulder (W.A.).—The T.C. is reported to have resolved to raise a loan of £8,000 for additional plant at the generating station.

According to *Commercial Intelligence*, 20 suburban municipalities in the neighbourhood of Melbourne are promoting a scheme for the erection of municipal electric lighting works. An expert is to be employed in giving a detailed report on the cost of carrying out the work.

Several of the suburban municipalities are negotiating with the Sydney Council with a view to the extension of electricity supply into their areas. When the Sydney Council obtained control of the supply in its municipal area, it was anticipated that it would also supply the surrounding areas, but this has not so far been the case. As a matter of fact, the neighbouring Balmain Municipal Council has handed over to a private company its concession to supply its own citizens and the citizens in surrounding boroughs, and consequently the Balmain E.L and Power Supply Corporation is now competing with the City Council for the custom of the surrounding Councils.

The Sydney Council's engineer has reported on the necessity of holding a stock of metal-filament lamps for street lighting, and recommends that some 3,400 of these lamps be obtained, at an estimated cost of £1,100.

Bexley.—The Council has adopted a revised set of tariffs for electric light and power consumers.

Birkenhead.—The T.C. has decided to light the covered and open markets by means of 30 arc lamps at a cost of £250.

Brazil.—The various concessions granted to the Rio de Janeiro Tramway, Light and Power Co. are understood to have recently been extended as regards electric lighting and gas on satisfactory terms. The company now possesses a virtual monopoly in the Federal District of the tramways, power, electric and gas supplies; it also holds all the share capital of the Rio Telephone Co.

One of our correspondents in Brazil writes:—"It has been reported in several Brazilian papers (dated November 11th and 12th) that the Light and Power Co., of Rio de Janeiro, have intimated to the *Prefeitura* of that city that they intend to raise an action for damages against the authorities for the violation of their concession by the granting of a contract to Messrs. Guinlé & Co. for the supply of electrical energy in Rio. The sum mentioned as indemnity is 10,000 contos of reis, equal to about £600,000. The sum claimed seems enormous, but it is the figure mentioned in three different papers. Whether an extra nought has accidentally slipped in I cannot say."

Camberley.—The Council has decided, by 8 votes to 4, to apply for a prov. order for electric lighting.

Canada.—The Ontario Government's power policy is meeting with a good deal of opposition. Only last week a deputation of prominent citizens from Hamilton, Galt, London, &c., waited on Sir Wilfred Laurier and other members of the Government to urge the disallowance of the hydro-electric power legislation of the Ontario Government. They contended that the legislation was arbitrary, illegal and not in the best interests of the public as a whole. They argued that it was having an injurious effect on the investment of capital from abroad, and that particularly in the case of Galt, which has been compelled to join in the municipal power scheme against its will, it was most unjust. They declared that if the people of Ontario were really aware of the situation the vast majority would demand a repeal of the Act.—Sir Wilfred Laurier, in replying, said there was much force in the arguments presented, and the question of disallowance was now before the Government, which would consider it both from the standpoint of its constitutionality, and with due regard to the expediency of disallowing any provincial Act affecting principally the people of that province. It is extremely doubtful whether Sir Wilfred and his Government will disallow the Act.

A brochure issued by the Department of Mines shows that in the Ottawa and Gatineau valleys there is much undeveloped water-power, and that electrical energy can be produced for $7 per H.P. The water-power at Chat's Falls, 20 miles above Ottawa, can be developed at a cost of $4·50 per H.P. per year, and within a radius of 25 miles from Ottawa 522,325 H.P. can be developed. The report is exceedingly valuable, as these water-powers are destined to exercise a great influence in the development of the country.

Cheltenham.—The T.C. on Monday decided to apply for a loan of £4,000—£2,000 for mains extensions, £1,000 for house services, and £1,000 for meters.

Darwen.—The local Gas and Electricity Committee has decided to supply lighting for outside illuminations in connection with Darwen shopping week, at half the usual cost. The Committee has also decided to decorate a tramcar.

Dover.—The T.C. has received from the L.G.B. sanction to the following loans:—£300 for transformers; £630 for a booster; £600 for chain grate stokers; £3,958 for mains; £1,941 for services; and £990 for excess expenditure on wiring consumers' premises.

Eccles.—The T.C. has decided to apply to the L.G.B. for a loan of £3,234 to cover the amount expended on mains, &c., from March 31st, 1908, to date, and the capital charges in respect of an additional traction set.

Edinburgh.—In the report by Sir A. Kennedy, to the Electric Lighting Committee of the T.C., he estimates that the additional capital expenditure on the Dewar Place and M'Donald Road power stations would amount to £45,000. The new plant would comprise exhaust turbines, condensers, cooling towers, pipework, and would supply at least 3½ million units, generated at a cost of £6,575, or, say, 0·45d. per unit. At present Dewar Place is completely filled with plant, the whole of it being of the non-condensing type, and he considered it impossible to obtain further output without cooling towers. Steel towers cost much less than brick towers, and from prices he had obtained, brick towers would cost for the output suggested about £18,000, while steel towers would cost only about £12,000.

Elland.—The U.D.C. has decided to extend the mains to Hullen Edge providing all the owners of houses agree to take a supply of electricity.

Epsom.—Mr. T. F. Squarey has given his award on the question of payment of fees for services rendered by Mr. Vaux-Graham, the consulting electrical engineer. The amount claimed was £385, and the award is that Mr. Vaux-Graham is entitled to the whole of this amount, the fees being reasonable and proper. The arbitrator's fees to be paid by the Council.

Inverkeithing (Fife).—The T.C. is considering a proposal to install an electricity plant for public supply.

Kingsbury.—The chairman of the U.D.C. (Mr. Jose Diaz, J.P.) has been given full power to act on behalf of the Council in regard to the negotiations which are proceeding with the North Metropolitan Electric Power Co., in respect to the electric lighting of the district. In the Kingsbury section of the Edgware Road there are 23 street lamps now lighted by incandescent gas, and these it is proposed shall be converted to electricity.

Leyton.—In regard to the trial public arc lighting, which has been going on for some months in Leytonstone Road, the engineer places the lamps in use in the following order of suitability:—(1) Johnson & Phillips, (2) Jandus, (3) Oliver, (4) Crompton. He accordingly recommends the adoption of the first-named lamp, of which 48 will be required, at a net cost of £10 17s. each. The Council adopted the recommendation of the engineer, subject to inspection and approval of the lamps by the E.L. sub-committee.

London.—Hampstead.—A new sub-station is to be built in Redington Road to cope with the increase in consumption in the West Heath district. Series gears are to be fixed in five sub-sub-stations to increase the transformer capacity, and 95 street gas lamps are to be converted to incandescent electric lamps in the boundary roads between Hampstead and Marylebone and adjacent thoroughfares. It is estimated that 4s. 6d. per lamp per annum will be saved by the conversion.

Bermondsey.—Owing to the growth of the loads on the Spa Road, Grange Road and Tower Bridge Road feeders, it has been decided to lay additional cables to supplement those at present in use.

Shoreditch.—The Lighting Committee has decided to reduce the price for arc lighting outside shops, theatres, churches, &c., and for outside signs, to 2½d. per unit, provided the supply is taken through a separate meter, for which a charge of 1s. per quarter will be made.

Woolwich.—At the last meeting of the Council, it was reported that mains are to be extended to supply a factory in the West Woolwich area. Numerous power users there have been for some considerable time past prepared to favourably consider the adoption of electricity for power purposes. The Woolwich Guardians have accepted the borough engineer's estimate for the installation of electric light at the receiving house and dispensary in Parkdale Road. The necessary extension to the distributing mains will cost about £57.

Milnrow.—The U.D.C. is applying to the B. of T. for a prov. order to enable it to construct two lines of tramways in the town, which will join an intended route from Rochdale.

North Walsham.—The U.D.C. has decided not to apply for a prov. order for E.L

Port Glasgow.—The T.C. has applied to Greenock Corporation for a supply of electricity, and the Greenock authority is to confer with the neighbouring Council regarding the proposal. Leading shipbuilding firms and manufacturers in Port Glasgow favour the project.

Reigate.—The T.C. has decided to have the mains extended to Cromwell Road Schools at a cost of £42 10s. The Education Committee guarantees a minimum payment of £15 per annum for five years.

Salford.—The T.C. has decided not to raise any objection to the application of the Lancs. Electric Power Co. for a prov. order for E.L. in the urban district of Radcliffe.

South Africa.—The Victoria Falls Power Co., which took over from the Rand Central Electric Co., its station at Brakpan and at Germiston, has had put up alongside the old power station at Brakpan, a new building, constructed of steel and corrugated iron, measuring approximately 114 ft. × 110 ft., and plant has been installed consisting of eight Babcock & Wilcox marine type boilers, in four units, fitted with chain grate stokers, and supplying steam, at 200 lb. pressure, supeaheated to 575° F., to two 3,000-kw. A E G. turbo-alternators which generate three-phase current at 10,600 volts and 50 periods. Condensing water is taken from the Brakpan reservoir alongside the station, and is circulated by means of motor-driven centrifugal pumps, smaller pumps of the same type being also provided for the supply of cooling water through the generator stators and the turbine bearings. Another station recently completed and put into operation at Simmerpan contains similar plant to that installed at Brakpan. The generating capacity, however, is much greater, and there are 16 boilers in two houses and four 3,000-kw. three-phase turbo-alternators. Provision is now being made for the addition of 6,000 kw. of plant. In order to obtain water for condensing purposes for the Simmerpan plant, a canal of about 200 ft. long, 10 ft. wide, and 29 ft. deep from the water level, has been excavated through the rock.—*African World.*

Southgate. — An agreement has been entered into between the North Metropolitan Electric Power Supply Co., Ltd., and the U.D.C., enabling the latter, on giving 12 calendar months' notice, terminating at the expiration of a period of 14 years, or any subsequent period of seven years, to acquire all plant, &c., used by the company upon paying to the company the amount of capital expended by them, and in addition (*a*) if the purchase is at the expiration of a period of 14 years a sum equal to 30 per cent. of the capital expenditure; (*b*) a period of 21 years, 22½ per cent.; (*c*) a period of 28 years, a sum equal to 15 per cent.; (*d*) a period of 35 years, a sum equal 7½ per cent.

Stevenage.—Mr. W. R. Walton, of Manchester, who has been negotiating with Messrs. Crompton & Co. for the transfer of the E L. order, has informed the U.D.C. that Messrs. Crompton require the payment of £340 in cash or shares, for out-of-pocket expenses, the purchase through them of the necessary plant on a 15 per cent. profit basis, and the payment by Mr. Walton of all the transfer expenses. The Council considers the terms excessive, and has decided to assist Mr. Walton in trying to obtain modified terms.

Torquay.—In connection with the electricity works it is reported that, notwithstanding the large number of lamps connected for private lighting, the demand on the generating station is practically identical with that at the corresponding period of last year, due to the changes made from carbon to metal-filament lamps. The position of the works to deal with the lighting demand is a much better one than last year, as the whole of the alternating-current plant is now available for lighting purposes, whereas last year it was liable to be called upon at any time to supply power for traction. A scheme to extend the main to Chelston, at an estimated cost of £1,312, has been referred to a sub-Committee, and a similar reference was made with regard to the proposed extension of the mains to the higher part of St. Marychurch Road.

Turton.—The U.D.C. has decided to seek expert advice as to the question of putting the new E.L. order into force.

Walsall.—An inquiry was held last week at the Town Hall by Mr. H. R. Hooper, L.G.B, respecting an application by the T.C. for sanction to borrow £35,000 for the purposes of the Corporation's electricity undertaking. The borough engineer (Mr. Barnard) said he was anxious to get the three-phase system alongside the present works, so as to deal with large applications for power. The Inspector pointed out that there was an outstanding debt on the undertaking of £90,000, and they were seeking to secure a further £35,000. He regarded it as a serious thing, that for some years the capital charges had gone up steadily. With their increased output, the capital charges ought to have been reduced. They were faced with a very serious financial difficulty, and should cut their coat according to their cloth. The town clerk pointed out that the £90,000 had been spent in paying their way, and that the ratepayers had not been called upon to pay a single penny. The Inspector next pointed out that last year there was a loss on the undertaking of nearly £900, there was very little reserve fund, and altogether the position was very weak. It was unfortunate for Walsall that it had an obsolete system, but they had no funds whatever to deal with desirable improvements. With regard to the Bloxwich section of the scheme, the Inspector questioned whether the possible increase in consumers would be sufficient to warrant the additional outlay. He suggested that the application might be reduced from £35,000 to £22,000 by leaving out Bloxwich and erecting no new buildings. Mr. Morse (solicitor) opposed the application on behalf of the South Staffordshire Tramway Lessee Co., and submitted that the company for whom he appeared had offered to supply the Corporation more economically than under the proposed scheme, and contended that it would be in the interests of the ratepayers and the Corporation if the offer were accepted. The Inspector will report upon the application in due course.

Wealdstone.—The Board of Trade has revoked the 1906 E.L order as from December 1st.

York.—The T.C. has applied to the L.G.B. for a loan of £2,475 for electricity purposes, £1,100 being for mains, £800 for motors, and £575 for meters.

TRAMWAY and RAILWAY NOTES.

Accrington.—The borough treasurer has prepared a revenue account of the Corporation tramways for the last half-year. This shows a gross income of £12,708 and a gross expenditure of £11,904, leaving a surplus revenue of £804. This is after making provision for the service and redemption of debt and for the fixed contribution to the depreciation and renewal fund.

Airdrie and Coatbridge.—The local authorities in the towns affected by the operations of the Airdrie and Coatbridge Tramways Co. have received notice of the company's intention to introduce the "fair fare" system at an early date. This system of charging was referred to in our last issue.

Bacup.—Terms have been provisionally agreed upon between Bacup and Rochdale Corporations with regard to the running of cars between the two towns, and in the event of a procedure under the Light Railways Act, 1896, being adopted, an allowance of £126 per annum towards a renewals fund is to be made by the Rochdale Corporation. It has for the present been decided to leave open the question of a supply of electricity, Bacup Corporation undertaking to obtain powers in its provisional order for the Rochdale Corporation to supply electricity in the borough.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, the manager submitted the revenue accounts for the past eight months up to the 30th ult., from which it appeared that the net income was £14,530. The tender of Messrs. Dempster, Moore and W. H. Wilcox, Ltd., for certain supplies, was accepted. At the monthly meeting of the Corporation, on the 2nd inst., it was decided to abolish the centre poles of the tramway system in a certain number of streets.

British Columbia.—The latest extension of the British Columbia Electric Railway will be 64 miles in length. The power to operate the road, comes over H.T. lines at full voltage, and will be reduced to operating voltage by five sub-stations. The machines therein will be 300 to 600-kw. sets. The trains will operate on the multiple unit system. For freight transportation the company has purchased three 50-ton electric locomotives, one of which is in use at present, and has been described in our pages.

Burnley.—The Corporation is going into the question of the revision of the rents of the tramways in Nelson, Brierfield and Reedley Hallows and also the question of the supply of electrical energy in Nelson and Brierfield.

Canada.—The Toronto City Council is considering a plan for a municipal tube system to furnish rapid transit between the heart of the city and the suburbs. The proposal is to build a subway from the Union Station and the St. Lawrence Market up Yonge Street to St. Clair Avenue, with surface lines reaching out to those newly annexed portions of the city, formerly known as Toronto Junction and East Toronto. The tube and surface lines can be built and equipped for less than $5,000,000 (£1,027,397). A referendum on the project will be taken probably in January.—*Standard.*

Continental Notes.—Austria.—It is considered that the conversion to electric traction of the Vienna City Railway, to which reference was made in this journal a few months ago, cannot be indefinitely postponed, as the working of this steam line already results in an annual deficit, which amounted to £66,000 in 1908, whilst the interest on the capital reaches £291,000 per annum. It is calculated that the work of transformation would involve an expenditure of £2,500,000, and the attention of German firms is being directed to the scheme, as the principal electrical firms in Austria are subsidiaries of the former. The State is financially interested in the railway to the extent of 86 per cent. of the capital; the province of Lower Austria holds 5 per cent. and the municipality of Vienna 9 per cent. It is sought to find a solution of the problem without having to consult Parliament, as Parliamentary conditions are such that a speedy settlement in this way would be out of the question. The idea has, therefore, been conceived that the working of the railway should be entrusted to the municipality, which would have to raise the money for the conversion and equipment. Negotiations on the subject are on the point of being undertaken between the Railway Minister and the Minister of Finance, and these will be followed by deliberations of the Traffic Commission, which at present controls the working of the railway. On their conclusion it will be possible to work out a scheme, and it is possible that the execution of the enterprise will be commenced at the end of 1910.

Norway.—The electrification of the Tinnas railway has been decided on, and work in connection with the electrification will be started at once. It is intended to have it completed in the course of next summer, and tenders have been invited for the supply of the materials required. The Rjukan railway is also to be electrified as soon as the work of harnessing the Rjukan waterfalls has been completed.

Germany.—Plans are being prepared in respect of a projected electric tramway between Alzenau, Horstein and Weiskirchen, in Bavaria.

Probably as the result of experience gained in Cologne, the German postal authorities have recently placed contracts for the construction of 25 electric motor mail vans for the rapid conveyance of letters between the various post offices in Berlin. In order to save time, a sorter is to be carried on the vans in addition to the driver, so that the letters may be sorted *en route*.

France.—The new electric tramway along the recently-completed boulevard between Lille, Roubaix and Tourcoing was opened for traffic on the 4th inst.

Glasgow.—A lengthy report has been prepared by Mr. Dalrymple, the general manager, on non-paying car routes on the system. It has been decided, in consequence, to stop two of the routes, and in connection with the other lines, that the service be so arranged that, while giving a reasonable service, the present loss on working will be minimised as far as possible.

In view of the present severe weather, additional covered cars are being hurriedly prepared at the Corporation tramway workshops. It was reported this week that the work of building 100 new double-deckers and putting top covers on another 110 cars was going on. The latter work was nearing completion, but only 50 new cars have so far been built. Instead of proceeding with the construction of other 50 new cars, top covers will be placed on an equal number of single cars.

For the past fortnight Glasgow has seldom been free from fogs, and both the tramway and the electricity departments have been affected. On the former the effect has been most detrimental, the daily drawing dropping by hundreds of pounds, and on Monday of the present week the decrease recorded on fare takings was no less than £400 on the normal. The electricity department has throughout the pressure been able to meet all demands for light and power, reaching a record output of 240,000 units on one day, the normal being 124,000 units.

Halesowen.—At a meeting of the U.D.C. last week, it was stated that Mr. Balfour, the promoter of the light railway scheme, had consented to pay £650 towards the cost of obtaining the provisional order, and that a cheque had been already received for £325.

Inverness.—The T.C. is considering a scheme of tramway haulage in connection with the cleansing department. The cost of ground to be purchased and the necessary equipment is estimated at £6 549

London.—The Highways Committee of the L.C.C. has recommended an agreement with the Leyton Council, by which the L.C.C. takes over the working of the Lea Bridge Road tramway, some 3 miles in length. The L.C.C. is to construct a junction in Upper Clapton Road, and the local Council is to receive the average receipts for cars on through roads for all mileage outside the boundary, less the L.C.C.'s working expenses, 1d. per car-mile on mileage outside the boundary, and a proportion of capital charges on the Council's car-sheds, &c.

The tramway between North Finchley and Cricklewood Broadway is practically ready for traffic, and will link up the Great North Road and Edgware Road systems, making it possible to travel by car from Barnet to Acton.

New Brunswick.—It is reported that owing to adverse weather conditions, the 12-mile standard gauge electric railway, between St. John and Aroostook Junction, connecting with the C.P. Railway, has been delayed in completion, the bridge building being particularly affected.

Newcastle-on-Tyne.—At a meeting of the City Council on the 1st inst., Mr. J. H. Rodgers, the chairman of the Tramway Committee, in submitting the monthly returns of the tramways said that this year, from April 1st to November 27th—241 days—they had carried 29,408,497 passengers, and they had taken in receipts £134,972. Last year, in the same period, they had carried 20,323,577 passengers, and had taken £135,396, or £424 more than in 1909, and in the latter year they had carried 84,920 more passengers. He pointed out that in the race week of last year and in the week following, when the Royal Agricultural Show was at Newcastle-on-Tyne, they took no less than £11,509, while in the corresponding week of this year they only took £9,598, a decrease of £1,911. Yet that lessening of their income they had reduced to £424, which he thought was most satisfactory. Mr. J. Stephenson moved a resolution from the Newcastle Ratepayers' Association, recommending that a special investigation committee be appointed to go into the question of the management of the tramways. The motion was not seconded, and fell to the ground.

South Lancashire.—Local reports state that tramway traffic in this area was completely disorganised by the heavy snowstorm on December 6th.

Sunderland.—The Corporation Tramways Committee has acceded to the request of the Urban, Rural and Parish Councils in the area served by the Sunderland District Electric Tramways, Ltd., to grant powers to the latter company, so that their cars may run into Sunderland as far as the gas office in Fawcett Street.

U.S.A.—According to the *Electrical World*, a syndicate proposes to build a moving platform system of rapid transit under Broadway, and has had its plans approved by the engineer of the Public Service Commission. Exits would be made at every street crossing, and the estimated cost of construction under Broadway from Tenth Street to Forty-Second Street is 11 million dollars, which will be furnished privately, although the ownership of the line will be vested in the city. The mechanism of this platform will be similar to those at the Chicago World's Fair and the Paris Exposition.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted and Repaired.—Nagara-Kartal cable interrupted December 2nd; restored December 2nd. Nagara-Kartal cable again interrupted December 6th. Cayenne-Salinas and Paramaribo-Cayenne cables restored November 28th. Turk's Island-Jamaica cable restored November 29th. Paramaribo-Cayenne interrupted December 7th.

New Works.—The United Wireless Telegraph Co. of America have decided to put down extensive works in the neighbourhood of Liverpool. This decision has been forced upon the company by the new Patent Act, compelling them to manufacture their patented goods in this country.

St. Vincent.—The revenue of the Telephone Department of the Government of St. Vincent, West Indies, for the last year was £482. The expenditure was £355.

Subfluvial Telephone Cable.—The Postmaster-General has under consideration a proposal to lay a telephone cable under the Tay at Dundee from Stannergate Point to Tayport.

Telegraph Breakdowns.—A violent gale swept over the British Isles on Thursday and Friday last week, causing numerous interruptions to telegraphic communication in many parts of the country.

Telegraph Memorial.—The international competition for designs for a monument to commemorate the formation of the Telegraph Union will be open up to August 14th, 1910. Particulars can be obtained from the Swiss Post and Telegraph Department, Berne.

Wireless Telegraphy.—At the conclusion of Prof. H. Stroud's address to the Newcastle Local Section of the I.E.E. on November 22nd, through the co-operation of Mr. A. Sorensen a demonstration was given showing how the Poulsen waves, being made intermittent at the transmitting station at Cullercoats, actuated an ordinary spark receiver. This demonstration was of interest as showing how stations equipped with the Poulsen arc sender only can communicate not only with Poulsen stations, but also with ships and other stations equipped with the ordinary spark receiver.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—The municipal authorities of Grottau, Bohemia, are about to invite tenders for the establishment of a central electric lighting station in the town.

Australia.—Melbourne.—December 13th. 50,750 incandescent lamps for the City Council. See "Official Notices" November 26th.

Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" to-day.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Canterbury.—March 16th, 1910. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Sydney.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" to-day.

Belfast.—January 10th. One 1,500-kw. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" to-day.

Bridlington.—January 1st. 300-kw. steam dynamo for the Corporation. See "Official Notices" to-day.

Cape Town.—January 5th. The Corporation require tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Carlisle.—December 24th. 8,000 yards of wire, and poles for overhead transmission line for the Corporation. See "Official Notices" to-day.

Dundee.—The Water Commisioners invite tenders for the supply of 70 creosoted telephone poles and 2½ cwt. copper wire same as used by National Telephone Co. Geo. Baxter, engineer.

Durham.—December 13th. Stores, including electric fittings, for the Trimdon Grange Colliery Co. (Walter Scott, Ltd.), Durham.

Glasgow.—Electric hoist for northern police office; City Engineer, Municipal Buildings.

Govan.—December 13th. Turbo-alternator, rotary converters, and high-tension switchboard, for the Electricity Committee. See "Official Notices" December 3rd.

Italy.—January 26th. The Italian State Railway authorities in Rome are inviting tenders for the supply of 50,000 metallic-filament electric lamps.

London.—Southwark.—38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" December 3rd.

L.C.C.—December 14th and 15th. Overhead electrical equipment for the construction on the four-wire system of electric traction from Woolwich to Eltham. Electric light and bell wiring and fitting for the Poplar Divisonal offices for the L.C.C. See "Official Notices" December 3rd.

Manchester.—December 13th. Wiring and complete E.L. installation (about 700 lights), at Harpurhey Baths; City Architect, Town Hall, Manchester, (Returnable deposit, £2 2s.)

Spain.—December 15th. Tenders are being invited by the municipal authorities of Ginzo de Lima (Province of Orense) for the concession for the electric lighting of the town during a period of 25 years. Tenders to El Secretario del Ayuntamiento de Ginzo de Lima (Orense), whence particulars can be obtained.

The municipal authorities of San Vicente dels Horts (Province of Barcelona) are inviting tenders for the concession for the electric lighting of the town. Particulars can be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Vicente dels Horts (Barcelona).

Wishaw.—December 13th. 25,000 or 50,000 pairs of carbons for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Canterbury.—The T.C. has accepted the tender of Messrs. E. J. Philpot & Son, for electrical work for six months.

Dublin.—The Corporation has approved the Lighting Committee's acceptance of the tender of the General Electric Co., for 750 meters.

Eastbourne.—The T.C. has accepted the tender of the Aron Electricity Meter Co. for 100 meters.

Glasgow.—The T.C. Committee has recommended the acceptance of the following tenders:—

Trolley poles.—Estler Bros.
Single-core lead-covered cable.—British Insulated and Helsby Cables, Ltd.
Polished brass tubes.—P. & W. MacLellan.
Steel gongs.—Charles M'Neil.

London.—L.C.C.—The Stores Committee has recommended the acceptance of tenders from the following:—

Electric carbons.—Wm. Geipel & Co.
Electric fittings.—Elliott Bros.; Falk, Stadelmann & Co., Ltd.; Wm. McGeoch & Co., Ltd., and A. Round.
Electric insulating materials.—British Insulated and Helsby Cables, Ltd.; British Westinghouse Electric Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.; Jas. North Hardy and Son; India-Rubber Gutta-Percha and Telegraph Works Co., Ltd.; J. G. Ingram & Son; D. Jaroslaw; Micanite and Insulators Co., Ltd.; Ruberoid Co., Ltd.; G. Schultz & Co.; Whitely Bros.; F. Wiggins & Sons.
Electric cables and wires.—Hooper's Telegraph and India-Rubber Works; Yorkshire Cable Co., Ltd.

The Highways Committee received the following tenders for the covering with asbestos tape of various high and low-tension cables used in connection with the Council's tramways:—

Johnson & Phillips, Ltd.	(accepted)	£1,212
Western Electric Co.		1,521
Siemens Bros. & Co., Ltd.		1,818
Callender's Cable & Construction Co., Ltd.		1,978
Vauxhall Engineering Co.		2,097
British Insulated and Helsby Cables, Ltd.		2,465
R. W. Blackwell & Co., Ltd.		2,510
W. T. Henley's Telegraph Works Co., Ltd.		2,737

Southwark.—The B.C. has accepted the tender of the Aron Electricity Meter Co., Ltd., for two 400-ampere meters and two 25-ampere meters.

Minehead.—A contract has been placed with Messrs. E. S. Hindley & Sons by the Minehead Electric Supply Co., Ltd. for one of their vertical multi-cylinder gas engines to be directly coupled to a 134 kw. dynamo.

Reading.—The T.C. has provisionally accepted the tender of Messrs. W. Cory & Sons, Ltd., for 160 tons of steam coal, at 9s. 3d. per ton for the tramway depôt.

Russia.—The city of St. Petersburg having recently transformed its tramway network for electric working, has placed with Messrs. Brown, Boveri & Co., of Baden (Switzerland), the order for a 5,000-kw. turbo-alternator with a surface-condenser. The new machine is capable of supplying the whole system.

Sheffield.—The T.C. has accepted the tender of the British Electric Transformer Co. for eight sets of transformers and switchgear (each set consisting of one 200-kw. main transformer, one 20-kw. auxiliary transformer and one set of two-wire series control gear), £222 each; also two 200-kw. transformers, £151 each.

Sheerness.—The U.D.C. has accepted the tender of the Sheerness Electrical Power Co., for electrically-driven pumping machinery at the Sewage Works, at £397.

Woolwich.—The B.C. has accepted the following tenders in connection with a supply to a factory in the West Woolwich area:—

Siemens Bros. & Co., Ltd.—Cable, £2,984.
Albion Clay Co.—Ducts, £765.

FORTHCOMING EVENTS.

Northampton Polytechnic Institute, St. John Street, Clerkenwell.—Friday December 10th and Saturday, December 11th. From 6.30 to 11 p.m Distribution of prizes, &c., by Sir John Wolfe Barry, and students' conversazione.

Association of Engineers-in-Charge.—Saturday, December 11th. At 1.30 p.m. Visit to the Woolwich works of Messrs. Siemens Bros. & Co., Ltd.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 11th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Electric Shot-Firing," by Mr. J. Douglas, and other papers.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 13th. At 8 p.m. Paper on "Planning and Equipment of Turbo-Generating Stations," by Mr. T. Walmsley.

Institution of Electrical Engineers (Newcastle Section).—Monday, December 13th. At 8 p.m. At the Armstrong College, Newcastle. Paper on "The Use of the Flicker Photometor for Differently Coloured Lights," by Mr. H. M. Airey.

Wednesday, December 15th. Annual dinner.

Physical Society.—Tuesday, December 14th. From 3 to 6, and 7 to 10 p.m. Annual exhibition.

Institution of Civil Engineers.—Tuesday, December 14th. At 8 p.m. Paper on "Railway Signalling in India," by Mr. C. W. Hodson.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, December 14th, Meeting at 8 p.m. At 207, Bath Street, Glasgow.

Institution of Electrical Engineers (Manchester Section).—Tuesday, December 14th. At 7.30 p.m. At the University, Manchester. Paper on "Notes on Methods and Practice in the German Electrical Industry," by Messrs. L. J. Lepine and A. R. Stelling.

Institution of Electrical Engineers (Leeds Section).—Wednesday, December 15th. At 7.15 p.m. At the University, Leeds. Paper on "Metallic-Filament Lamps: Their Possible Beneficial Effects on Supply Undertakings," by Messrs. G. Wilkinson and R. McCourt.

Institution of Electrical Engineers (Students' Section).—Wednesday, December 15th. At 7.45 p.m. At 92, Victoria Street, S.W. Paper on "Electricity Supply on Tap," by Messrs. C. B. Nadaud and W. B. Thompson.

Institution of Electrical Engineers (London).—Thursday, December 16th. At 8 p.m. At the Institution of Civil Engineers. Papers on "Some Quantitative Measurements in connection with Radiotelegraphy," by Dr. J. A. Fleming; and "Efficiency of Short Spark Methods of Generating Electrical Oscillations," by Dr. W. H. Eccles and Mr. A. J. Makower.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, December 13th.—" A " Company. Technical drill, 7 to 9.30 p.m.

Tuesday, December 14th.—" B " Company. Technical drill, 7 to 9.30 p.m.

Wednesday, December 15th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, December 16th.—" C " Company. Technical drill, 7 to 9.30 p.m.

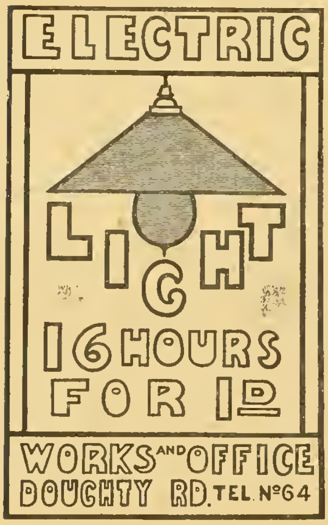
Friday, December 17th.—" D " Company. Technical drill, 7 to 9.30 p.m.

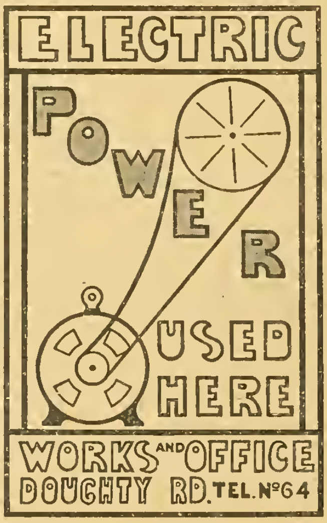
Saturday, December 18th.—Corps Dinner held at the Monico, Piccadilly Circus, at 7.30 for 8 p.m.

(Signed) P. H. Campbell Capt. R.E. and Adjutant.
For O.C. E E., L.D.

NOTES.

Advertising the Supply.—It is, or should be, a maxim of the present-day central station engineer that his wares, in the form of light and power, shall not go a-begging merely because possible consumers have not had their attention sufficiently drawn to them. Although it may be argued that the electric light or motor is an advertisement in itself, and that it cannot be beaten, yet there are undoubtedly a number of people to whom a striking sign or poster appeals far better. The poster idea has, we believe proved very successful on more than one occasion, and the sign, which is of a more permanent nature, is being taken up by several electric supply undertakings. Through the courtesy of Mr. W. A. Vignoles, borough electrical engineer of Grimsby, we are enabled to reproduce a couple of enamelled iron signs for lighting and power respectively, which he has recently designed and is introducing in Grimsby. The power sign would be fixed to works where motors were in use, and the lighting sign to lamp-posts—the latter sign being swung from a bracket and backed by a design for power similar to the one used for fixing to works, but with the wording slightly altered to suit. We congratulate Mr. Vignoles on his enterprise, and would suggest that other engineers may find it worth while to take up this matter of street signs.





Siemens Bros.' Dinner.—The dinner of the Apparatus Department of Messrs. Siemens Bros. Co. was held on Saturday, December 4th, at the Assembly Rooms, Old Charlton. This department of the works may be said to be a lineal descendant of the early telegraphic and cable work in which the firm of Siemens Bros. were pioneers. The chair was taken at 6.30 p m. by Mr. F. Hird, the manager of the department, who was supported by Mr. Grimston, Mr. Perry, Dr. Wright, Mr. Forrest, Mr Rieber, and others, and there were several guests from the Royal Arsenal and the Admiralty. The foremen and staff present numbered about 180. After the customary loyal toasts, the programme of the evening resolved itself into an entertainment of music and song, in which Messrs. Brown and Brenton distinguished themselves in their patter song and dance; and Miss Smith, Miss Turner, Miss Quilter and Miss Gladys Peters were evident favourites.

The firm has long been distinguished as one in which the relations of all from the top to the latest office-boy have been consistently peaceful, and there was a reasonable sprinkling of grey beards or white heads, to demonstrate the appreciation by the firm of the steadying effect of years, and of the fact that dividends need not be accompanied by inhumanity—that, in fact, the conditions and management of the business are such that it is not necessary to "scrap" older and experienced men in order to live up to the firm's rule of never allowing a customer to go away dissatisfied. To a strict adherence to this rule the success of the firm has very greatly to be attributed, as well as to the realisation of what responsibility means on the part of each workman; for, needless to say, in these days of mechanical exactitude every man must constitute himself a part of a human system of limit gauges, and act within the proper limits. Here, as well remarked by one speaker, comes the value of a foreman who knows the limits of his men, and, avoiding slackness on the one hand and fussiness on the other, gets out of each man his best.

Electrical Driving of Textile Factories.—After our "Correspondence" columns were closed, the following came to hand:—"Referring to the letter on the above subject which appeared in your issue of the 3rd inst., the Council of the Bradford Engineering Society, after full inquiry, desires to confirm the report as a true and accurate record of the proceedings of the Committee.

"The complete report was typed and issued to every member of the Committee several weeks before the meeting at which it was finally adopted, and no portion was, therefore, published without the knowledge of every member, and without full opportunity for discussion.

"The Committee decided from the outset not to enter into any discussion undertaken for the purpose of personal or trade advertisement, and it would obviously be useless to take notice of any further communication from gentlemen who so lightly repudiate the statements for which they themselves are responsible.

"George Carter,
Secretary, Bradford Engineering Society.

"Bradford, *December 7th* 1909."

Electricity and Publicity in London.—The Associated Municipal Electrical Engineers of London have now placed before the various borough councils owning electricity undertakings the full details of their scheme with regard to publicity matters. "Their subject," they say, "is one which is largely non-controversial, and the best results can only be obtained on systematic and co-operative lines, and in pursuance of this view, a committee of municipal and company undertakings have met together, and have fully considered the matter, and particularly its financial aspects, and they are of opinion that the establishment of such an organisation would result in material benefits to all concerned, with a maximum of efficiency and a minimum of expenditure. It is proposed that the municipal and company undertakings should appoint a joint committee for the purpose of joint action in this matter, consisting of 14 members, seven being selected from the chief officials of the municipal undertakings, and seven from the chief officials of the London companies, and it is suggested that the title of the committee be 'The Electric Supply Publicity Committee of London and District.' The committee would hold regular meetings for discussing and arranging the duties to be undertaken, which may be briefly summarised under the following heads:—(*a*) Organisation and administration of publicity matters generally; (*b*) the preparation, printing and publication of publicity productions of common interest; (*c*) control of any funds coming into the hands of the committee; (*d*) submission of annual report and audited statement of accounts to the subscribers. For the present it is intended that the work of the committee should be mainly directed to the preparation and printing of pamphlets and circulars to be supplied to members of the organisation. It would not, however, be of any advantage to set up such an organisation unless the Committee were assured of having a certain amount of support. It is, therefore, proposed that for the first year orders for publishing work to the value of about £1,000 should be guaranteed by the various undertakings, and in order that the Committee may have funds to commence operations, it is suggested that each company joining the organisation shall, in the first instance, subscribe on the following basis: Gross revenue of undertakings from private supply. Not exceeding £10,000, minimum annual contribution to the organisation, £10; exceeding £10,000, and not exceeding £20,000, £20; exceeding £20,000, and not exceeding £30,000, £30; exceeding £30,000, and not exceeding £40,000, £40; exceeding £40,000, and not exceeding £75,000, £50; exceeding £75,000, £60. Each local authority joining the organisation shall guarantee minimum orders for publicity literature on the same basis. As a general indication of the work of the Committee, and of the methods of ensuring effective publicity, which would, of course, be varied from time to time as circumstances may require, the methods of publicity will consist of: (1) Publicity of leaflets, cards, posters, &c.; (2) Regular issue of short leaflets; (3) Preparation of pamphlets on power, light, new methods of electric lighting, residential lighting, shop lighting, heating and cooking, types of heaters, cooking apparatus, economy in use, &c. It is fully expected, says the Association, that the production of pamphlets on a large scale will so reduce the cost, that undertakings will thus obtain very much more advertising matter than is possible by any other means. If any production be found to be particularly effective by any undertaking, that undertaking will be able to obtain such quantity as it may desire, even if the minimum sum be thereby exceeded."

Electric Turpentine.—In an American Consular report, it is stated that a company in British Columbia is working an electric process for the distillation of turpentine from mill refuse, tree stumps, &c. Six or eight gallons are obtained from a cord of wood, and the product is said to be chemically pure. The cost of erecting a mill is estimated at $1,500 "per cord to be treated." The by-products find a ready sale.

Institution and Lecture Notes.—Faraday Society.—At the annual general meeting on November 30th, the following officers and Council were elected to serve for the Session 1909-10:—

President —J. Swinburne, F.R.S.

Vice-Presidents.—G. T. Beilby, F.R.S.; Sir R. A. Hadfield, F.R.S.; Prof. A. K. Huntington; Dr. Ludwig Mond, F.R.S.; Lord Rayleigh, O.M., F.R.S.; Prof. A. Schuster, F.R.S.; Ernest Solvay.

Treasurer.—Dr. F. Mollwo Perkin.

Council.—E. J. Bevan, Bertram Blount, A. C. Claudet, W. R. Cooper, S. Z. de Ferranti, F. W. Harbord, W. Murray Morrison, H. K. Picard, J. L. F. Vogel, and N. T. M. Willsmore.

Junior Institution of Engineers.—In the course of his inaugural address on November 16th, the president (Engineer Vice-Admiral H. J. Oram, Engineer-in-Chief of the Fleet) referred to the various proposals to utilise electricity in the propulsion of ships. He questioned whether the economical results obtained on shore could be achieved on board ship, and argued that, in the case of certain cruisers, there would be no appreciable gain in fuel consumption at full power—though there would be a gain at low powers, and increased power for going astern. The efficiency of the high-speed propeller could probably be increased, and the use of larger slow-running propellers would in some cases be impossible owing to the design of the hull. The engine-room weights, he thought, would be increased by 15 to 20 per cent. Admiral Oram also objected to the high voltage required, and pointed out that the three electrical speeds provided for were not sufficient to enable ships to keep station. While thus adversely criticising the various schemes put forward, he said that future developments would receive careful consideration, and that the good work done by electrical engineers on board warships was too well known to need any comment.

A party of members of this Institution recently paid a visit of inspection, under the guidance of the resident engineer, Mr. E. H. Tabor, M.Inst.C.E., to the Embankment Wall Works for the New County Hall, Belvedere Road.

Royal Institution.—The following are among the lecture arrangements at this Institution, before Easter: Mr. W. Duddell, a Christmas course of six illustrated lectures on "Modern Electricity," adapted to a juvenile auditory: (1) First Principles; (2) Electrical Instruments; (3) Röntgen Rays; (4) The Generation of Electricity; (5) Electric Oscillations; (6) Electric Lighting. Prof. S. P. Thompson, three lectures on "Illumination, Natural and Artificial." Prof. Sir J. J. Thomson, Professor of Natural Philosophy, R.I., six lectures on "Electric Waves and the Electromagnetic Theory of Light." The Friday evening meetings will commence on January 21st, when Prof. Sir James Dewar will deliver a discourse on "Light Reactions at Low Temperatures." Succeeding discourses will probably be given by Mr. C. E. S. Phillips, Lord Rayleigh, Dr. Charles Chree, Prof. Sir J. J. Thomson, and other gentlemen.

Institution of Electrical Engineers (Dublin Section).—The Section was to meet yesterday to hear a paper on "The Tierney-Malone Electric Point Shifter," by Mr. J. P. Tierney, member.

The Catford Electric Home.—With reference to the Model Electric Home, of which we gave particulars last week, we learn from the South Metropolitan Electric Light and Power Co., Ltd., that the interest shown by the public has altogether exceeded expectations. The fact that this demonstration of what can be accomplished by the aid of electricity is not on the old lines of a "Model Show House," but is a "Home in full swing," seemed to have great weight with the hundreds of people who, during the short time which has elapsed since its opening, have paid visits from far and near. The example of the company is one that we hope will be copied in many parts of London and the provinces.

Westminster Electric Swimming Club.—The fourth Annual Dinner of the above Club was held at Victoria Mansions Restaurant, Victoria Street, S.W., on Monday, December 6th, about 80 members being present. Mr. Hordern (manager) was in the chair, and Mr. F. Iago (secretary) in the vice-chair, supported by the chiefs of the various departments. The dinner was voted a great success, and was followed by a concert which proved most enjoyable. The vice-chairman, in proposing the toast of "The Club," referred to the excellent progress made during the current season, which had been a record one in every way. He was very glad to see the successes which had been gained in the life-saving classes. Mr. A. Collingwood (hon. secretary) replied briefly. The prizes were presented by Mr. Hordern. Later in the evening Mr. Bennett, in proposing the health of the chairman, referred to the excellent feeling which existed between the management of the company and the employés. The toast was received with musical honours.

"At Home."—Aberdeen Corporation electricity department held its annual "At Home" on Thursday last week, under the auspices of the Sports and Works Club. Mr. Bell, as honorary president of the Club, presided.

A Disastrous Gasometer Explosion.—One of the most deplorable accidents of its kind occurred on December 7th at the Hamburg Gasworks, when a newly-built 7,000,000 cb. ft. gasometer in some way developed a huge leakage which was ignited by some neighbouring retorts. The resulting flames involved a second gasometer of 200,000 cb. ft. capacity. Both gasometers and the buildings near by were destroyed, and unfortunately 20 persons were killed and 25 injured.

Institution of Electrical Engineers' Dinner.—The annual dinner of the Institution took place on Wednesday evening at the Hotel Cecil; Dr. Kapp presided, and there were about 290 present—the smallest number for some years. After the loyal toasts, Sir W. H. White proposed "The Institution of Electrical Engineers," remarking that the Institution, while one of the youngest, was one of the most remarkable and useful of its kind, and was exceeded in numbers only by the Civil Engineers. Engineering was like a noble tree, rooted in science, and with constantly ramifying branches bearing good fruit; collaboration between all the branches was essential to progress. The I.E.E. had found a home worthy of itself, and no society more cordially rejoiced in its progress than the Institution of Civil Engineers. Dr. Kapp responded, expressing sincere appreciation of the goodwill of the Institution of Civil Engineers as personified in Sir W. H. White. Electrical engineering, he said, was a willing servant to other professions, and brought them prosperity. There were few English industries that lacked prosperity. We were passing through a temporary phase of depression—but England used to be at the top, and would be there again. In former times electrical engineers had little use for science; foreign firms had found it necessary to cultivate science in order to compete with us, and even went too far in that direction. Electricity with them was a bounteous lady—with us she was but a homely body. But some of our leaders of industry had recognised the virtues of electricity. Oxford, like Cambridge, had instituted a Chair of Engineering, and he welcomed this recognition of engineering as a noble profession. The old universities would thus teach the future leaders of industry the importance of applied science, and the newer technical universities would supply the trained lieutenants. His predecessor had pointed out that we sold more energy, at lower rates, than the Germans, but, it was said, this was generated in foreign machines. However, the amount of foreign plant installed was only 8 per cent.! There was no monopoly, and we had a fair share of the honours. Direct driving and the proper use of storage were originated in England. The first electric railway was built in Ireland, by an English firm. Multipolar dynamos and three-phase machinery came from abroad; they were now best made by us. The Continent led the way in three-phase and single-phase railway working. The turbo-generator was developed by the Hon. C. A. Parsons, and our rivals had not caught us up yet. In power transmission we were a little ahead. At Kinlochleven, for instance, 30,000 h.p. was utilised, the plant being of British make throughout. Waste gases were utilised at the Bilston works for driving the works and rolling mills, the plant, of British make, being absolutely equal to anything on the Continent. Mr. Merz had led the way in the North-east, and the consumer paid less for energy here than anywhere else in the world. Lastly, electricity could help agriculture; Sir O. Lodge's researches had enabled this to be done. About 12 farms were equipped, the result being an average increase of 30 per cent. in the crops produced.

Prof. S. P. Thompson (in lieu of Lord Justice Fletcher Moulton) proposed "Science and Industries," eulogising Sir Joseph Larmor, who had done so much to elucidate the nature of ether and matter, and Mr. J. A. F. Aspinall, who had laid down the first heavy electric railway in England. Sir Joseph Larmor, in responding, said that Faraday was one of the greatest mathematicians that ever lived, though neither he nor his contemporaries were aware of it. It was the function of science to lead the way to the Promised Land, and of engineering to take possession of it. He expressed the indebtedness of the scientific world to the Institution for the publication of *Science Abstracts*—the acknowledged standard compendium of physical science. Mr. Aspinall, also responding, praised the work of the technical colleges, declaring that our youths were as well trained to-day as those of any other country. We ought to train more commercial engineers, properly equipped for work in foreign countries and our Colonies. The countries which we had opened up were markets for British goods, but we were losing the trade for lack of trained commercial men. Liverpool University had done the right thing in starting a Faculty of Commerce. The mechanical engineer of the future would not be considered of any great value unless he had a fair knowledge of electricity.

Sir J. Gavey proposed "Our Guests," offering them a hearty welcome, and Col. Sir Charles B. Euan-Smith responded in a humorous speech.

The company then adjourned to the Victoria Hall, where conversation continued to a late hour. A programme of music was performed by the Imperial Orchestra, and the arrangements were, as usual, irreproachable.

Greater London Electrical Engineers.—A special meeting of the representatives of the Associated Municipal Electrical Engineers (Greater London), and the London Companies Officials' Association, was held at the Hammersmith electricity works on December 2nd, when papers were read by Mr. A. H. Seabrook on "The Telephone System of Charging"; and by Mr. Bell on "Electric Heating," with special application to the Therol heater. The meeting was largely attended by both the municipal and the company representatives, and an interesting discussion took place. It is hoped that future meetings of a similar nature will be arranged.

Inquiries.—We are asked for the name of a firm who contract for vulcanite sheeting moulded *in situ* on electrical machinery. A borough electrical engineer wishes to know where combined plant for lighting and traction has been installed, consisting of two dynamos coupled to one engine. (Blackpool, Portsmouth and Bexley occur to us in this connection.) The addresses of agents in England of makers of the Girod, Giffre or Keller electric furnaces are asked for.

L.C.C. Appointment.—A year ago an assistant was temporarily engaged for electrical work in the chief engineers' department of the L.C.C. in connection with the education service. It is proposed to continue the appointment until December 3rd, 1910, at 52s. 6d.

Appointments Vacant.—Assistant teacher in engineering drawing, for Faraday House (£120); assistant engineer for Dudley electricity works; senior general clerk (£130), also a correspondence clerk (£90), for Hackney Electricity Department. See our advertisement pages.

Wiring System.—Shares Offered.—We have received a prospectus of the M.P. Electrical Co., Ltd., from Mr. Sarsfield W. Martyn, of 11, Pratt Street, N.W.; 10,000 preference shares (10 per cent.) of £1 each are being offered. The objects of the company are to sell, and deal in, all kinds of electrical apparatus, but more particularly in a new system of wiring invented by Mr. Martyn, and to be known as the M.P. wiring system. The total nominal capital is £31,000. Only the preference shares are now offered for subscription. The inventor is to take £250 cash, 15,000 £1 ordinary shares, and 20,000 deferred shares of 2s. each. The remaining 5,000 ordinary shares it is intended to issue later. After the ordinary and preference have received 10 per cent. dividend, the deferred share the balance equally with the ordinary. Any of our readers who may be interested in the matter, should refer to our editorial opinion of the system as expressed on page 216 of the ELECTRICAL REVIEW, August 6th, 1909, and to the prospectus itself, a copy of which can be obtained from Mr. Martyn.

Physical Society's Annual Exhibition.—This exhibition, which is to be held on Tuesday, the 14th inst., will differ from that of previous years in that it will be open both in the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.) Short discourses will be delivered at 4 and 8 p.m. by Prof. C. V. Boys, F.R.S., on "Soap Bubbles," and at 9 p.m. by Prof. S. P. Thompson, F.R.S., on "Combinations of Mica and Selenite Crystals."

Smelting Iron Ore.—The Swedish Ironworks Society, says *Affärsvärlden*, has approved an agreement with the Elektrometal Co., Ltd., for the use of patent rights, and has authorised the expenditure of 250,000 kr. on the construction of an electric furnace at Trollhättan. A company is also being formed at Hardanger, in Norway, by the Norsk Elektrometal Co., Ltd., with a capital of one million kr., to construct furnaces employing 4,400 H.P.

Lectures.—At King's College (University of London) a special course of lectures, with demonstrations, by Prof. E. Wilson and Mr. F. Lydall, on "Single-Phase Electrical Traction," will be delivered on Mondays, commencing January 17th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The West Bromwich T.C. has adopted the recommendation, mentioned in the ELECTRICAL REVIEW last week, to increase the salary of MR. W. A. JACKSON, electrical engineer, from £300 to £350 a year.

At the Derby T.C. meeting on Wednesday, last week, after a long discussion, it was resolved to increase the salary of MR. E. G. BOISSIER, mains superintendent, from £156 to £170 per annum, with further increases of £15 per annum to £200 per annum.

The staff of the Urban Electric Supply Co. at Carne Brea has presented a dressing case to MR. WOOLCOCK, who is leaving for South America.

Sheffield T.C. has been recommended to increase the salary of MR. H. E. YERBURY, the chief electrical engineer of the tramways, from £450 to £500 per annum.

General.—MR. D. R. MAYHEW has resigned his position as branch manager to Messrs. Willans & Robinson, Ltd., in order to take up the position of general manager to Messrs. Michael Pal and Co., engineers, Westminster.

Obituary.—The numerous friends in this country of MR. T. COMMERFORD MARTIN, of New York, will learn with very deep regret that Mrs. Martin died on November 28th. Mrs. Martin, *née* Elizabeth Gould, was a native of Gravesend, Kent. Mr. Martin, it will be remembered, retired from the editorship of the *Electrical World* a short time ago in order to throw his entire energies into the work of the National Electric Light Association, of New York, as its secretary. The editors of the ELECTRICAL REVIEW desire to tender their sincere sympathies to their friend in his hour of bereavement, and they are sure that many others in the electrical world on this side will wish to do likewise.

NEW COMPANIES REGISTERED.

New Motive Power, Ltd. (106,124).—This company was registered on November 25th, with a capital of £20,000 in £1 shares, to construct, manage or control in England, railways, tramways, trolley ways, mills, factories, pumping or other works, to be manufacturers of and dealers in cycles, flying machines and other vehicles, electricians, electrical and general engineers, &c. The subscribers (with one share each) are:—W. L. Smith, 11, Tothill Street, Westminster, S.W., engineer; H. Gilbert, 43, Finsbury Square, E.C., architect and surveyor. Private company. The number of directors is not to be less than five: the first are S. Constanduros, W. G. Coxen, F. G. Rice, J. V. Sherrin and W. L. Smith. Holders of shares Nos. 1 to 10,000 may nominate another director, and such holders shall be entitled to one vote for each share held by them; remuneration according to profits. Company's borrowing powers unrestricted. Registered by H. W. Clarkson, 85, Gresham Street, E.C.

F. Burks & Co., Ltd. (106,099).—This company was registered on November 24th, with a capital of £10,000 in £1 shares, to acquire the business carried on at 37, Port Street, Manchester, and elsewhere, by F. Burks & Co., and to carry on the business of electricians, electrical engineers, manufacturers of electrical instruments, machines, telephones and other apparatus and devices, &c. The subscribers (with one share each) are:—F. Burks, Capstone, Mellor, Stockport, electrical engineer; F. C. Poulton, 7, Highfield Drive, Monton, Manchester, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are F. Burks and F. C. Poulton, managing directors, and V. Bramall, C. Stephenson and T. L. Miller; qualification, 250 shares; remuneration of managing directors, £5 each per week and 1 per cent. per annum of the net profits; of ordinary directors, £150 per annum, divisible. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Thomas Foreign Patents, Ltd. (106,196).—This company was registered on November 30th, with a capital of £500 in £1 shares, to acquire from J. G. P. Thomas the benefit of certain patents relating to an invention in connection with an electro-mechanical power transmission system, to develop and turn to account the same, and to carry on the business of manufacturers of and dealers in motor cars, cabs and other vehicles, carriages, electrical machines, accumulators, internal combustion engines, electrical, mechanical and general engineers, &c. The subscribers (with one share each) are:—K. J. Thomas, 21, Ennismore Avenue, Chiswick, W., engineer; J. G. P. Thomas, Holywell Vicarage, North Wales, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. J. Thomson, J. G. P. Thomas and K. J. Thomson. Registered by Jordan and Sons, Ltd., 116-117, Chancery Lane, W.C.

Peninsula Engineering Co. Ltd., (106,206).—This company was registered on December 1st, with a capital of £5,000 in £10 shares (380 preference), to take over the business of electrical and general engineers, contractors and agents, carried on in Spain and Portugal by Hastings, Roberts and Co. The subscribers (with five shares each) are:—P. W. McDougall, 39, Norbury Crescent, Melfort Road, Norbury, electrical engineer; A. M. Billington, Suffolk House, Laurence Pountney Hill, E.C., civil and electrical engineer. Private company. The first directors are A. M. Billington, P. W. McDougall and H. Hastings; the two last named are managing directors; qualification, £100. Registered office, Suffolk House, Laurence Pountney Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Tungsten Lamp Co., Ltd. (100,468).—A memorandum of satisfaction to the extent of £200 on September 15th, 1909, of debentures dated May 18th, 1909, securing £4,000, has been filed.

Romapac Tramway Construction Co., Ltd. (75 242).—Particulars of £1,600 debentures created October 18th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Nairobi Electric Power and Lighting Co., Ltd. (87,728). Particulars of £5,000 third debentures created November 25th, 1908, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000 (ranking *pari passu* with two former series securing £6,000 and £4,000 respectively). Property charged: The company's undertaking and property, present and future, including uncalled capital; but excluding £1,500 deposited or to be deposited in the joint names of the Crown Agents for the Colonies and National Bank of India, Ltd., uncalled capital on 10,000 preference and 6,000 ordinary shares and contract dated July 26th, 1906. No trustees.

Consolidated Signal Co., Ltd. (71,141). (Formerly Pneumatic, Electric & General Engineering Co., Ltd.)—This company's annual return was filed on November 17th, when 214,195 preference and 150,548 ordinary shares had been taken up out of a nominal capital of £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. £1 per share has been called up on 27,840 ordinary and 24,999 preference, and £52,839 has been paid. £311,934 is considered as paid on 189,196 preference and 122,708 ordinary. Mortgages and charges: Nil.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

MR. J. B. BRAITHWAITE, chairman, presided on Monday at the offices, Finsbury Pavement House, E.C., over the fifth annual general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, December 3rd, page 907), said the board had again to congratulate the shareholders on the extremely satisfactory year's progress. Last year he pointed out the satisfactory progress which had been made, but this year he was happy to say the progress was fully as satisfactory, and perhaps a little more so. The charges in the balance-sheet simply showed the issue of the additional capital which had been found necessary for the carrying on of the business. The whole of the £150,000 preference stock had now been issued, and the whole of it had been taken up in the

Colony itself, which was a very satisfactory feature. Since the close of the financial year on August 31st, he might also say they had placed the whole of the balance of the ordinary stock in Adelaide at par. Including this last issue, there was now about £130,000 capital of the company held locally, which was very satisfactory for two reasons. Firstly, it showed the confidence of local investors in the company; and secondly, it was always an advantage to have shareholders on the spot. On the credit side of the balance-sheet, the expenditure on the undertaking showed an increase of approximately £40,000, and that represented their capital expenditure during the year. The cash at the bankers and in hand was £4,645. The debtors showed an increase, which was due to the larger business they were doing, and were £6,407, as against £3,804. Last year they reduced the suspense account to £2,500. and they proposed to write it off entirely in this year's accounts out of profits. Their main interest would, of course, be in regard to the revenue account, and there they would be distinctly gratified. In the figures he proposed to deal with he would take no account of the supply of current to the Municipal Tramways Trust, because that was only a temporary thing, and was not an element of a permanent character. If he were to include these figures it would give an entirely misleading idea of the actual position. Their receipts from private consumers had increased from £19,150 to £24,091, an increase of £4,941, which was fully as great an increase as took place in the previous year. The receipts for power were £8,618 compared with £6,814, an increase of £1,804. Therefore, from these two sources they had nearly £7,000 increase in earnings. What had it cost to earn this additional money? The generation of electricity cost £10,126, against £8,571; distribution cost £2,346, against £1,903; and repairs and renewals cost £2,878, against £2,132. The result was that the £7,000 additional revenue had been earned at an increased expenditure of something under £3,000, but they had also to bear in mind that in this increased expenditure they had also supplied all the units for the Municipal Tramways Trust, so that their technical staff had to be heartily congratulated on the increased efficiency they had brought about at the generating station. In the general charges there had been an increase of £281, and the total result was that they had to carry £25,226 to the profit and loss account, which was an increase of £11,563 on the previous year. They had carefully considered what they should do with the balance, and it was a little difficult to decide, in view of the temporary character of the supply to the Tramways Trust. That supply was due to cease in September, 1910, and then there must necessarily be a certain interval whilst they were loading up the plant, which would then be set free, with their own customers. They had carefully considered what rate of dividend they could rightly declare which they could see their way to maintain, and had decided after the payment of the preference dividend to recommend the declaration of a dividend of 6 per cent. on the ordinary shares for the year, which would compare with 3½ per cent. last year; to extinguish the suspense account; to place £1,000 to reserve, bringing that account up to £4,000; and to set £5,000 to an equalisation of dividend account. This £5,000 could be used for the equalisation of dividend if necessary, although he did not think it would be necessary. Having made these allocations, they would carry £1,009 forward. He thought they would agree that this was a prudent and business-like course to adopt. With regard to the growth of the business, and again excluding the units sold to the Municipal Tramways Trust, the figures showed that they had 91,338 8-c.p. lamps for lighting against 71,138, or an increase of 20,200. The motors totalled 2,369 h.p., against 1,837 h.p., an increase of 532 h.p. The total connections, lighting and power combined, expressed in 8-c.p. lamps were 167,146, against 129,922, an increase of 37,244; and the units sold were 2,073,550, against 1,666,974, an increase of 406,576; which was almost exactly 20 per cent. They had added in the year 13 miles of mains, and had 2,314 consumers, which was an increase of 37 per cent. on the year. During the year they had authorised an extension of their mains to Glenelg, which was the Brighton of Adelaide, and no doubt they would pick up a certain amount of lighting on the way. The supply was now available along 93 miles of streets.

Mr. R. P. Sellon seconded the motion, and the report was adopted without discussion.

Mr. Braithwaite having been re-elected to the board, and the auditors having been re-appointed,

The Chairman proposed that the best thanks of the shareholders be accorded to the local board and also the technical officers, Messrs. F. W. Clements, Weeden and Inglis, and their subordinates, for their successful efforts in carrying out the company's undertaking.

This was seconded by Mr. A. F. Farish, and carried unanimously.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The directors' report for the year ending September 30th, 1909, to be presented at the meeting to be held on Tuesday next, states that after provision for doubtful debts there is a net profit of £57,927. Adding £51,980 brought forward, and deducting £12,500, the dividend on the ordinary shares paid in June, and £3,333, the dividend on the preference shares paid in July, there remains a disposable balance of £94,074, which, after providing for the balance of the dividends for the year, will leave £55,012 to be carried forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders on January 1st, and they further recommend the distribution of a dividend to the holders of ordinary shares of 15s. per share, free of income-tax, amounting to £37,500, making, with the interim dividend paid in June, a total payment of 10 per cent. for the year. The general business of the company shows an increase compared with the turnover of last year, which is, however, partly due to the higher scale of prices at which some of the company's goods have been sold. Taken as a whole, the company's foreign agencies have not done so well as the board had reason to expect, but the sales of their home agencies have been fairly satisfactory. The prices of some raw materials have attained a very high level, but the advances the company has been able to make in the selling prices of its goods have sufficiently met the case; some provision, furthermore, has been made to cover a possible fall in selling price of stocks in hand. The board is making a considerable capital expenditure at the French works to meet the expanding motor and bicycle tire trade on the Continent, and further capital expenditure will, doubtless, be necessary at home. These latter extensions are having the serious consideration of the directors, as a growing business must have facilities provided. The electrical industry continues dull. A certain amount of cable work has fallen to the company's share, and its steamers *Dacia* and *Buccaneer* have had occasional employment. The works at Silvertown and Persan have been maintained in the usual state of efficiency. The board appointed Mr. Matthew Hamilton Gray, Mr. Christian Hamilton Gray and Mr. William Ernest Gray extraordinary directors, as they have been closely identified with the management of the business for several years, and have largely contributed to its success. Mr. Matthew Gray expressed his regret that he was unable to give the close attention he would like, but hoped the board would accept his service in a consulting capacity, and to this the board agreed.

Bullers, Ltd.—The report for the year ended July 31st, 1909, as quoted in the financial Press, states that the depression in trade, mentioned in the last annual report, has continued with even greater severity, and sales have been largely reduced, both in volume and profit. The accounts, after paying directors' fees and managing directors' salaries, show a profit of £3,932, which, with £906 brought forward, makes a total of £4,839. The sum of £5,000 has been transferred from reserve account, making a total of £9,839. Interest on the preference shares, £7,500, and a dividend of 1¼ per cent. on the ordinary shares, £1,875, have been paid, leaving a balance of £464, which the directors propose to carry forward.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter to September 30th of 2s. 6d. per share, free of income-tax.

Globe Telegraph and Trust Co., Ltd.—The directors have declared an interim quarterly dividend of 3s. per share on the preference stock and 2s. per share on the ordinary shares.

Prospectuses.—*Molesworth Bros.' Rubber Estates, Ltd.*—There have been offered for subscription this week 580,000 shares of 2s. each at par. The company acquires the Molesworth Bros.' Estates, situated in Trincomali, Ceylon, 2,800 acres.

London Sumatra Rubber and Produce Estates, Ltd.—An issue at par of 50,000 shares of £1 each has been offered. The company acquires the Serapoh, Tanah-Abang and Permatang-Djiring Estates, Sumatra (7,533 acres, of which 1,538 acres are under cultivation).

Sedenak Rubber Estates, Ltd.—30,000 shares of £1 each have been offered for subscription at par. The company acquires the Sedenak Estate from the Malaya General Co., Ltd., and will develop and extend same.

T. Sugden, Ltd.—We are informed that the directors have declared a dividend of 15 per cent. per annum on the ordinary shares, payable on December 7th, 1909.

Electromobile Co., Ltd.—The directors' report states that the accounts for the year to August 31st show that the debit to profit and loss of £2,744 brought forward, has been increased to £6,511.

New York Edison Co.—According to the report for the year 1908 filed with the Public Service Commission, which has just been made public, the New York Edison Co. had a corporate surplus on December 31st of $14,835,546. Assets on the balance-sheet showed a grand total of $131,764,516. The total funded debt is $44,062,395. Figures bearing on operation show that during the year the company delivered 252,416,153 kw.-hours of energy, for which it received $15,228,716. The company at the end of the year had 73,522 consumers, an increase during the year of 8,284, of which increase 7,163 were in Manhattan and 1,121 were in the Bronx. The company had 90,283 meters in service, and a connected load at a 16 c.p. equivalent of 6,729,926. There were 41,822 arc lamps and 3,429,266 incandescent lamps in service. The report of the Long Acre Electric Light and Power Co. for the same period showed assets of $584,955, of which $566,313 was the estimated value of the franchise. The gross operating revenue was $3,804, and the total operating deficit was $20,586. The company had 10 consumers and 11 meters in Manhattan.—*Electrical World and Engineer.*

Bank Rate.—The Bank Rate was yesterday reduced to 4½ per cent.

MARKET QUOTATIONS.

Wednesday, December 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochlorio	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	£1 dec.
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£27 10	£1 inc.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c „ Tube (brazed)	„	9d.	..
c „ „ (solid drawn)	„	7⅞d.	⅜d. dec.
c „ Wire, basis	„	6¾d.	..
c Copper Tubes (brazed)	„	9d.	..
c „ „ (solid drawn	„	9d.	..
g „ Bars (best selected)	per ton	£72	£2 dec.
g „ Sheet	„	£72	£2 dec.
g „ Rod	„	£72	£2 dec.
e „ (Electrolytic) Bars	„	£61	£1 15 dec.
e „ „ Sheets	„	£77	£2 5 dec.
e „ „ Rod	„	£65 10	£2 5 dec.
e „ „ H.C. Wire	per lb.	7⅞d.	¼d. dec.
f Ebonite Rod	„	3/8	..
f „ Sheet	„	8/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	7/5	9½d. dec.
l Iron Pig (Cleveland warrants)	per ton	50/6½	5½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 5	dec.
m Manganin Wire No. 28	per lb.	6/6	..
Mercury	per bot.	£9 16	1/6 dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£142 10 to £143 10	£5 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	½d. inc.
p White Anti-friction Metals:— "White Ant" brand	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List—

Charing Cross, West End and City Electricity Supply Co.—Further issue of £182,570 4½ per cent. debenture stock.

Western Telegraph Co., Ltd. — The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1910, being at the rate of 6 per cent. per annum. The transfer books will be closed from December 13th to 18th.

North Metropolitan Electric Power Supply Co.—At an extraordinary general meeting held at Kingsway on December 3rd, Mr. Garcke presiding, the directors were authorised to issue debentures not exceeding £25,000.

Electrical Securities, Ltd.—A financial daily says that, after providing for debenture interest, the accounts for the year ended November 14th show a loss of £5,442, increasing the debit balance brought down to £10,486.

STOCKS AND SHARES.

Tuesday Afternoon.

More hopes of a reduction in the Bank Rate led up to substantial improvement in Consols and kindred securities. Although this hope, and the price of Consols, became damped, the Home Railway market for once in a way responded to the earlier lead, and a truly remarkable set of rises in this department is the feature of the week.

Precisely why the revival in Home Rails should have come at this particular time it would be very difficult to explain. Certainly the traffics of the chief companies are showing improvement, and equally certainly the Home Railway market has gone for a long time without so much as a spasm of strength. A retail demand for stock has found the market ill-supplied, and it needed but a small amount of buying to energise prices into a miniature boom.

Of the Undergrounds, Metropolitan Consolidated has the most gain to its credit, but Metropolitan District stock is 1¼ up, and City and Sonth London Ordinary rose a point. So far the Central London issues have not moved. One of the steam stocks to appreciate most has been Brighton Deferred, although the first week of the working of the newly-electrified portion was by some pessimists considered unsatisfactory.

In the advance a fair number of prior-charge issues have also shared, so that altogether it may be said that the Home Railway market presents an appearance of general strength as welcome as it is unwonted.

While the railway companies' stocks have been going ahead like this, the tramway and omnibus division has been anything but happy. London United Tramways Preference shares are ⅛ lower, and the Debenture stock a point. The London General Omnibus Company, with which, of course, the Road Car and the Vanguard are now amalgamated, has published accounts, for the first period under the triple working arrangement, which can only be described as deplorable. British Electric Traction Preference are ⅛ better, on the proposal to establish farthing fares.

Amongst the colonial and foreign traction descriptions, British Columbia Deferred and Preferred are lower, the former by 2½ points, but the 5 per cent. Preference stock has improved. Rio Trams drooped to 93½. San Paulos are steady at 153½, and Mexico Trams are 1 lower. Mexican Light and Power Common and Preference stocks have declined rather sharply.

Smithfield Markets Ordinary again make the best showing in the supply list, the price having shot up about 11s. 3d. to $2\frac{1}{16}$, which is nearly four times the price at which they stood less than a month ago. The rise is still associated with the extension of the company's lease; the matter was mentioned here last week. Brompton Ordinary and Preference have improved. Charing Cross Ordinary and City of London Ordinary are better, from which it might almost be fair to assume that the advent of radiators is already benefiting the companies.

The Drapers' Company is adding a new storey to one of the houses which it owns in Throgmorton Street, and, in consequence of necessary chimney-work, all the offices in the building will have to cease firing for a time. In its place, temporary electric radiators are being installed, and some, no doubt, will remain as permanent institutions.

Telegraph stocks and shares are unassumingly quiet. The Anglo-American Deferred speculative counter is jumping about to some extent, although on balance the net change is small. Amazon shares are ⅛ lower; West India and Panama have lost half that fraction. Commercial Cable Debenture stock continues to shrink. Eastern Telegraph Ordinary, on the other hand, displays another advance, and Globe Telegraph and Trust Ordinary are ⅛ better. Great Northerns have moved up again.

National Telephone Preferred declined slightly, and American Telephone Capital stock went back 1½ points. United River Plate Telephone shares have firmed up, and Mackay Companies' Common shares regained their decline of last week.

Castner-Kellner shares have rallied again, but otherwise the changes in miscellaneous shares are hardly worth notice. Rubber shares suffered a sharp check last week on a fall in the price of the raw material at the auction sales. There was, however, a subsequent recovery which wiped out a good deal of the previous fall.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. is payable on January 1st.

France.—The balance-sheet of the Compagnie Générale d'Electricité, of Paris, shows a net profit of £95,365, out of which a dividend of 6 per cent. is being declared.

SHARE LIST OF ELECTRICAL COMPANIES

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Nov. 30th.	Closing Quotations Dec. 7th.	Business done week ended Dec. 7th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest.	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3½— 4	3⅜— 3⅞	..	..	— ⅛	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	99 —102	100 103	..	..	- 1	4 17 1
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	143 —146	145	..	—1½	5 9 7
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 —101	100 —101	101	100	..	5 18 10
3,220,770	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	21⅞— 22⅛	21⅞ - 22⅛	22	21½	..	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾— 8⅛	7¾ - 8⅛	..	..	..	4 18 6
3,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	86½ - 88½	88	87	— ½	4 10 5
16,000	Cuba Telegraph	10	6 %	5 %	6 %	6 %	8⅜— 9⅛	8⅜ - 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	2 8 11
60,710l	Direct United States Cable	20	4½%	4½%	4½%	4½%	13 — 13½	13 — 13½	13 5/16	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —132	131 - 134	132¾	130½	+ 2	5 4 6
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½ — 86½	84½ — 86½	86	84¾	..	4 0 11
1,396,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103	102½	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12⅛	11⅞	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102	..	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅝%	5¾%	10⅛— 10⅝	10¼ — 10¾	10 9/16	10 5/16	+ ⅛	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13 23/32	13 17/32	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	29½— 30½	30 — 31	..	..	+ ½	5 16 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	51 — 53	51 — 53	51	..	..	7 1 2
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 — 95	96 — 98	..	..	..	4 1 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— ⅞	¾— ⅞	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 108½	106½ —108	107¼	105⅝	— ½	5 11 1
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120½—122½	120½ —122½	121⅞	121	..	5 2 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	..	..	..	5 10 [illegible]
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅛	100¾	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜ - 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87½ - 88½	87½ - 89½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝ - 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	102½	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 — 32	131½	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 15/16 - 7 3/16	7 — 7½	7 1/16	7⅛	+ 1/16	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 11/16	5½ — 5¾	..	..	+ 1/16	4 6 11
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜ - 1⅝	1½ - 1⅝	32/6	31/3	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13⅜ - 13⅞	13⅜ - 13⅞	13¾	13⅝	..	5 0 11
800,000	Do. do. 4 % Deb. Stock Red ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	11/16— 13/16	⅝— ¾	..	..	— 1/16	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾— 9⅛	8¾— 9¼	9	8¾	+ 1/16	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	16 13 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	91/10½	90/-	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼— 4½	4¼— 4½	87/6	..	..	5 11 1
973,230	Do 4 % Deb. Stock	..	..	..	..	4 %	90½—92	90½ - 92	91¾	91¼	..	4 7 5
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
80,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅝— 4¾	4⅝— 4¾	93/9	92/6	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	8 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾— 1¼	¾— 1¼	..	..	..	87 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1¾— 2¼	1¾— 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —148	14 —145	..	..	—2½	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 125	120 —124	123	..	—1	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —109	107 —110	108½	..	..	4 11 9
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102½ -104½	102 —105	104¼	..	..	4 6 2
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝— 1	⅝— 1	16/3	13/9	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2½— 2⅞	2⅝ - 3	58/9	52/6	+ ⅛	5 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 87	84 - 87	85½	..	..	6 14 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 65	60 - 65	64½	62½	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	7⅛	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ - 6½	6⅛— 6½	6¼	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 106	103 —106	104	..	..	4 4 11
804,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 13 10
50,000	†Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16— 3/16	1/16— 3/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½— 5	4½— 5	97/6	92/6	..	4 10 0
46,804	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
36,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¼	10 — 10¼	10	..	..	6 19 1
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼— 5¾	5¼— 5¾	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 -107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	4/6	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2⅛— 2¼	2 3/16— 2 5/16	45/6	44/-	+ 1/16	5 12 8
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 - 109	107¾	..	..	3 13 5
1,890 690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3¼%	61 — 63	61 — 63	61½	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86	..	..	4 18 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 - 46	..	..	..	5 8 8
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1½%	29½— 30½	30½ - 31½	31	30	+ 1	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½ - 1	½ 1	..	..	..	15 1 8
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 98	90 — 98	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

† A period of nine months.

From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Nov. 30th.	Closing Quotations Dec. 7th.	Business done week ended Dec. 7th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	1½%	5/32 — 9/32	3/32 — 7/32	..	..	— 1/16	34 18 0
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	2½%	1 — 1½	1 — 1½	18/9	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅜ - ⅝	5/16 — 9/16	7/-	6/9	— 1/16	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390..	2	7 %	7 %	7 %	7 %	1⅛ - 1⅜	1⅛— 1⅜	26/3	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¼	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12¾	12 — 12¾	12⅝	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛— 5½	5⅛ - 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¾— 16½	15¾ - 16½	16 7/16	..	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	3 %	8 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2⅜— 2⅞	2¼— 2¾	..	..	— ⅛	18 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	63 — 66	62 — 65	63½	62¾	—1	6 8 1
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	36½— 37	38¾— 39¼	39¼	38⅜	+2¼	1 5 5
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	64 — 66	65 — 67	..	..	+1	4 2 1
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	17¼ - 17¾	17¾	16	+1¼	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 11/16	19/32 — 11/16	..	..	..	6 10 11
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —127	124 —126	126	125½	—1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	92	91½	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ - 36	34½ - 36	35	34½	..	5 0 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100 —101	100	..	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87⅝	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	31 — 33	30 — 32	..	..	—1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	¼ — ½	¼ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	1¾ — 2¼	1¾— 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77 xd	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	1905.	1906	1907.	1908.	Closing Quotations Nov. 30th.	Closing Quotations Dec. 7th.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4¼ - 4¾	..	..	+ ⅛	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 15 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7½	7 — 7½	..	..	+ ½	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6½— 7½	7 — 7½	..	..	+ ¼	4 13 4
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	96 — 99	97 —100	..	..	..	4 0 10
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅝— 4⅛	3¾— 4¼	..	..	+ ⅛	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼— 4¾	4¼ - 4¾	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅜— 3⅞	3⅜ - 3⅞	..	..	..	5 16 2
175,000l	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9⅞— 10⅜	10⅛ - 10⅝	10⅜	10 3/16	+ ¼	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ - 12¾	11¾— 12¾	..	..	..	4 12 4
400,000l	Do. 5% Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102⅜	100¾	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7½— 8	7½— 8	7¾	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10¾	..	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	⅝— ⅞	½— ¾	..	..	— ⅛	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞ - 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾ - 7¼	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	101 —103	101 —103	..	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	7 1/32	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅞— 5¼	4¾ - 5⅛	..	..	..	5 17 1
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	9.½	..	..	4 4 8
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3¾— 4¼	3¾— 4¼	77/6	..	..	5 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	95/-	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	107	106	..	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ - 86½	83½ - 86½	85½	84½	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½ - 82½	81 — 83	82⅜	..	+ ½	6 0 6
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	71½— 73½	69 — 71	7 ½	70	—2½	4 18 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	101 —105	..	..	—1	6 13 4
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	84 — 86	85 — 87	86¼	85	+1	5 14 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	98 — 100	98 —100	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13¼	12½— 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1½— 1⅝	1½— 1⅝	..	..	..	4 18 6
100,000	Do. do. 6% Non Cum. Prof. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	23/3	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1⅜— 1⅝	1 15/16 — 2 3/16	39/4½	31/3	+ 9/16	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼ — 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ - 78½	74½ - 78½	..	..	..	5 14 8
308,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	⅞ — 15/16	⅞— 15/16	17/6	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	8⅜	8½	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1906)	5	5 %	4½%	4½%	4½%	5 — 5½	5 — 5½	5⅜	5 11/32	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909

ELECTRIC TRAMWAY COSTING AND STATISTICS.

[COMMUNICATED.]

Tramway Costing may be said to belong to that category or group of accounts whose technical appellation is Operating Costs. Costing is a generic term, and is usually preceded by a qualification according to the description of undertaking to which it is applied. Systems of Operating Costs are simple in construction, whilst the collation of the necessary material, its classification, and the mode of its presentation, are in practice free from difficulty.

All Operating Costs possess a standard or unit of measure into which they are converted. The recognised unit of cost in an electric tramway undertaking is the car-mile, in terms of which all revenue income and expenditure for uniform periods are calculated and expressed.

Schedule 1.

STORES RECEIVED BOOK.

Date received.	Stores Ledger folio.	Supplier.	Description.	No. or weight.	Price.	Amount.	Total.

Schedule 2.

STORES ISSUED BOOK.

Date supplied.	Requisition.	Stores Ledger folio.	Description.	No. or weight.	Price.	Amount.	Total.	Allocations.

Schedule 3

STORES LEDGER.

.... (Description of stores.)

Received.								Issued.							
Date.	Stores Received Book folio.	Supplier.	Description.	No. or weight.	Price.	Amount	Total.	Date.	Requisition.	Stores Issued Book folio.	Description.	No. or weight.	Price.	Amount.	Total.

Schedule 4.

STORES REQUISITION.

No. ....

.. .. Department. .... Date.

To the Storekeeper.

Please supply the following materials.

.... (Signature.)

Description.	No. or weight.	Allo-cation.	Columns for use of Storekeeper.			
			No. or weight supplied.	Price.	Amount.	Folio of Stores Issued Book.

Schedule 5.

STATEMENT OF GOODS TAKEN INTO STORES.

For the ending ....19 .

Date.	Supplier.	Particulars.	Amount.	Total.	Remarks.

Schedule 6.

STORES STATEMENT.

For the ended.........................19 .

Stores received.		Stores issued.		Allocation of issues.				
				Operation.				
Date.	Amount.	Date.	Amount.	Oil, grease, tallow, &c.	Water.	Light.	Sundries.	Total.
Stock on hand brought forward from immediately preceding period.								
Stores taken into stock during the period, as per statement attached.		Stock on hand.						
Total								

ALLOCATION OF STORES (*continued*).

Generation.							
		Repairs and maintenance of					
Fuel.	Water, oil, waste and engine-room stores.	Power house buildings.	Engines and boilers.	Dynamos, exciters, &c.	Other machinery & instruments.	Accumulators, &c.	Total.

ALLOCATION OF STORES (*continued*).

Distribution.						Buildings.	Permanent way.			
	Repairs and maintenance of—							Repairs and maintenance.		
Inspection.	Cables.	Overhead equipment.	Section boxes.	Sub-stations and plant.	Total.	Repairs and maintenance of offices, car sheds, stores and other buildings, excluding power house buildings.	Inspection.	Ordinary maintenance	Renewals.	Total.

ALLOCATION OF STORES (*continued*).

Cars and car equipments.									
	Repairs and maintenance.								
Inspection.	Car bodies.	Motors and controllers.	Trucks and gear.	Axles and wheels.	Trolley poles and wheels	Lighting equipments	Total.	Capital. (As per details attached.)	Aggregate.

Schedule 7.

Wages Pay Bill and allocation for the week ended............. .. 19

						Allocation.				
						Operation.				
No.	Name.	Grade.	Time.	Rate.	Amount.	Clerks and storekeepers.	Traffic and other inspectors.	Drivers and conductors.	Pointsmen, car and track cleaners, and sundry labour.	Total.

ALLOCATION (*continued*).

Generation.							Distribution.					
	Repairs and maintenance of							Repairs and maintenance of				
Generation.	Power house buildings.	Engines and boilers.	Dynamos, exciters, transformers, &c.	Other machinery and instruments.	Accumulators.	Total.	Inspection.	Cables.	Overhead equipment.	Section boxes.	Sub-stations and plant.	Total.

Allocation (*continued*).

Buildings.	Perm. way.			Cars and car equipments.										
	Repairs and maintenance.				Repairs and maintenance.									
Repairs and maintenance of offices, car sheds, stores and other buildings, excluding power-house buildings.	Ordinary maintenance.	Renewals.	Total.	Inspection.	Car bodies.	Motors and controllers.	Trucks and gear.	Axles and wheels.	Trolley poles and wheels.	Lighting equipments.	Total.	Capital (as per details attached).	Aggregate.

Schedule 8.

Salaries Pay Bill for the ended .... 19 .

No.	Name.	Grade.	Rate.	Amount.	Allocation.						
					Capital, as per allocation at foot.	Generation.	Distribution.	Operation.	Cars and car equipments	Buildings.	Permanent way.

Schedule 9.

Comparative Summary of Income and Expenditure for ended..................19 .

Income.

Route.	For corresponding period of ended......					For ended					Increase.					Decrease.				
	Receipts.	No of cars.	Car-miles.	No. of passengers.	Receipts per car-mile.	Receipts.	No. of cars.	Car-miles.	No. of passengers	Receipts per car-mile.	Receipts.	No of cars.	Car-miles	No. of passengers.	Receipts per car-mile.	Receipts.	No. of cars.	Car-miles.	No. of passengers	Receipts per car-mile.
Traffic Receipts																				
Sundry Receipts																				
Total for 28 days																				
Brought forward from immediately preceding period.																				
Total to date																				
Balance at date																				

Expenditure.

Description.	For corresponding period of ended......		For ended......		Increase.		Decrease.	
	Amount.	Per car-mile.	Amount.	Per car-mile.	Amount.	Per car-mile.	Amount.	Per car-mile.
Operation ..								
Generation..								
Distribution								
Buildings ..								
Perm. way ..								
Cars and car equipment								
Administration and general								
Total for 28 days								
Brought forward from immediately preceding period.								
Total to date								
Balance at date								

Schedule 9.

Cost Statement and Statistics for ended..............19 .

Description.	Amount.	Total.	Per car-mile.	
			This year.	Last year.
(*a*) Operation—				
Inspectors' wages				
Clerks and storekeepers' wages				
Drivers and conductors' wages .. .				
Point boys, car and track cleaners, and other wages				
Salaries				
Stores				
Water				
Light				
Sundries..				
Total				
(*b*) Generation—				
Wages				
Salaries				
Fuel				
Oil, waste, water and engine room stores				
Repairs and maintenance—				
Power station buildings wages......				
stores				
Engines and boilers wages......				
stores......				
Dynamos, transformers, motors, &c. wages......				
stores......				
Other machinery, instruments, &c. wages......				
stores......				
Accumulators wages......				
stores......				
Sundries				
Total				
or				
(*c*) Purchase of Energy— (Particulars.)				
Total				
Forward				

Schedule 9.

Description.	Amount.	Total.	Per car-mile.	
			This year.	Last year.
Forward				
Distribution—				
Wages				
Salaries				
Stores				
Repairs and maintenance—				
Sub-stations and plant wages......				
stores				
Overhead equipment wages......				
stores......				
Cables and section boxes wages......				
stores......				
Sundries..				
Total				
Buildings (excluding Power Station)—				
Wages				
Salaries				
Stores				
Total				
Permanent Way—				
Salaries				
Ordinary maintenance wages......				
stores......				
Renewals wages				
stores......				
Total				
Forward				

Revenue income, it may be stated here, is income, the equivalent of which is not payable by the undertaking, and revenue expenditure as distinguished from that of capital is expenditure from which the equivalent is not receivable by the undertaking.

Stores, Wages and Indirect Charges may be said to embrace comprehensively all the data required for the preparation of an electric tramway cost return. The usual accounting method of dealing with stores is to debit a stores account with the stores received and to credit the supplier with the purchase. The stores received are entered in the Stores Received Book (Schedule 1), and the stores issued in the Stores Issued Book (Schedule 2). The former book is posted to the debit and the latter to the credit of appropriate accounts raised in the Stores Ledger (Schedule 3), the total of the balances of the various stores accounts indicating the value of the stores on hand. Stores, naturally, are only issued upon the production of, and in exchange for, properly authenticated requisitions, as per Schedule 4.

Periodically—say every four weeks or 28 days, or for any other adopted period—a statement, showing on the one hand the stores received and taken into stock, and on the other the stores issued, is prepared, the form of which may be as per Schedules 5 and 6. The information for the supply of the columns on the left-hand side—that is, goods received—and the information for the columns on the right-hand side—that is, goods issued—may be obtained readily from the Stores Received and Stores Issued books. The balance of the statement, when the receipts exceed the issues, represents the book value of the stores in hand.

The wages sheet is prepared weekly, of course, from the time sheets and other sources, and may be in the form of Schedule 7.

Schedule 9.

Description.		Amount.	Total.	Per car-mile.	
				This year.	Last year.
Forward					
Cars and Car Equipments—					
Wages					
Salaries					
Repairs and maintenance—					
Car bodies	wages				
	stores				
Motors and controllers	wages				
	stores				
Trucks and gear	wages				
	stores				
Axles and wheels	wages				
	stores				
Trolley poles and wheels	wages				
	stores				
Lighting equipments	wages				
	stores				
Sundries					
Total					
Administration Charges—(Chief Office.)					
(Particulars)					
Total					
Aggregate for period					

Schedule 9.

STATISTICAL SUMMARY.

Description.	This year.	Last year.
1 Route mileage of lines operated		
2. Number of car-miles run		
3. " car-hours		
4. " service hours		
5. Receipts per car-mile		
6. " per car per day		
7. " per route-mile		
8. " per passenger		
9. Expenditure per route-mile		
10. " per car-mile		
11. " per passenger		
12. Units generated and/or purchased		
13. " sent out from station		
14. " used in offices and works		
15. " used in street lighting		
16. " sent out to cars		
17. " per car-mile		
18. Maximum demand (KW.) of traction load		
19. Units per mile		
20. No. of car-miles per car-hour—*i.e.*, car-miles / car-hours		
21. Lost mileage		

State of weather.	This year.	Last year.
First week		
Second week		
Third week		
Fourth week		

No. of passengers carried at each fare.	This year.	Last year.
½		
1		
1½		
2		
3		

Schedule 8 is representative of the salaries, and is compiled monthly, whilst the petty cash expenditure is subject to analysis on similar lines. For the reception of the expenditure as shown by the periodical wages, salaries, stores, and petty cash allocations, appropriate accounts are raised in the ledger, to which the expenditure is posted by journal entries debiting the various accounts to which the different classes of expenditure refer, and crediting wages, salaries, or stores account, as the case may be. The element of estimating is ever prominent in varying degrees in costing, and, if we are to impose reasonable limitations upon it, some attention must be devoted to undue, and in some cases absolutely useless, disintegration or segregation of itemised cost.

The cost statement, which may be designed as per form 9, is compiled from the wages, salaries, stores and petty cash revenue allocations, and is therefore merely the product of the tabulation and incorporation of the revenue information contained in these sheets for a uniform period, with the addition of the head office, general and administrative charges, which, in the case of an undertaking which is entirely running, can be readily and accurately estimated.

(*To be continued.*)

THE LOADING OF TELEPHONE CABLE CIRCUITS.

By A. W. MARTIN.

A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

INTRODUCTION.

In any telephone circuit there are at least four factors which exert a marked influence upon the transmission of the electric impulses, waves or rapidly alternating currents, which are convertible into speech by means of a telephone receiver. These factors are :—

(*a*) Resistance.
(*b*) Inductance.
(*c*) Electrostatic capacity.
(*d*) Leakance (reciprocal of insulation resistance).

There is no definite relationship between these quantities in the sense that if three be known the fourth can be determined ; consequently, the investigation of their joint influence upon the transmission of speech is a matter of some complexity. It is not, however, so complex but that anyone acquainted with the ordinary laws connecting the well-known electrical quantities may follow the consideration if a little mathematical knowledge be possessed.

Four quantities have been named above ; but there are others not so obviously included. When any current of varying strength—particularly one of high frequency such as a telephonic current—flows through a circuit, eddy currents are produced in any mass of conducting material near the main conductor, and such currents react upon those producing them so as to retard the rise and fall in strength. Again, if there be iron near the main conductor, the iron will be reversely magnetised with each alternation of the current, and for every cycle through which the magnetisation is carried there will be a definite hysteresis loss in the iron.

So far as the main, or telephone, circuit is concerned, there is a certain loss of energy due to eddy currents and the hysteresis in the iron. It should be noted that these losses are *absolute* and not comparable with inductance and capacity effects in which energy is stored, not lost. The energy lost in any circuit is proportional to C^2R, where C is the current strength and R the resistance. If eddy currents and hysteresis losses produce the same effect as a resistance in limiting the current strength, they may be represented by a resistance, and, clearly, such a so-called resistance is an addition to the ordinary resistance of the circuit as measured under steady current conditions. The term *effective resistance* is used to denote ohmic resistance (or that offered to steady currents) plus that due to the effect of eddy currents and hysteresis.

In any ordinary telephone circuit consisting of overhead, underground or submarine wires revolved, without special treatment, the effective resistance is not very much greater than the ohmic resistance; indeed, the difference is so small as to be practically negligible. *Do not, however, imagine that this is the case where inductance or loading coils are placed in a circuit, or where inductance is increased by coating the conductor with magnetic material, such as a layer (or layers) of iron wire.* As will be mentioned later, the effective resistance in these cases is vastly different from the ohmic; either owing to the presence of the mass of iron used in the loading coils and the copper of which the coils are formed, or to the mass of iron distributed uniformly over the conductor as the case may be.

The subject of effective resistance has been emphasised early, because it is a matter of the utmost importance, and is unfortunately overlooked by many observers. Methods of increasing the inductance of a circuit are not difficult to find; the real difficulty is to devise a method of introducing inductance without largely increasing the effective resistance.

In circuits free from iron, the inductance may be regarded as constant for all currents and frequencies; but if iron be present, as in the case of circuits loaded with iron core coils, this is not absolutely true. By properly selecting the quality and arranging the quantity of iron or other magnetic material used, a very close approximation to uniformity of inductance values for all important telephonic frequencies may, however, be obtained. In what follows, it will be understood that the inductance considered is that measured at the frequency assumed in the particular cases; but it may at once be stated that for all frequencies between 500 and 2,000 per second, the loading coils (with or without iron) used in practice are constant in inductance for telephonic currents.

PART I.

Any treatise on algebra dealing with exponential and logarithmic series will show that, if—

$$e = 1 + 1 + \frac{1}{\underline{|2}} + \frac{1}{\underline{|3}} + \ldots \&c.,$$

then $$\mathrm{M}\,\epsilon^{ax} = \mathrm{M}\left(1 + ax + \frac{a^2 x^2}{\underline{|2}} + \frac{a^3 x^3}{\underline{|3}} + \ldots \&c.\right),$$

where M is a constant.

If this expression be differentiated with respect to x, then

$$\frac{d(\mathrm{M}\,\epsilon^{ax})}{dx} = \mathrm{M}\left(0 + a + a^2 x + \frac{a^3 x^2}{\underline{|2}} + \frac{a^4 x^3}{\underline{|3}} + \ldots \&c.\right),$$

$$= \mathrm{M}\,a\left(1 + ax + \frac{a^2 x^2}{\underline{|2}} + \frac{a^3 x^3}{\underline{|3}} + \ldots \&c.\right),$$

$$= \mathrm{M}\,a\epsilon^{ax}.$$

Put $y = \mathrm{M}e^{ax}$, and the following relation is obtained—

$$\frac{dy}{dx} = ay.$$

From this it is argued that when the rate of increase of any quantity, y, with respect to another, x, is proportional to itself, it obeys the relation—

$$y = \mathrm{M}\,\epsilon^{ax}.$$

If a further step be taken and the expression for $\mathrm{M}\,\epsilon^{ax}$ be differentiated twice, then—

$$\frac{d^2 y}{dx^2} = \frac{d(\mathrm{M}\,a\,\epsilon^{ax})}{dx} = \mathrm{M}\,a^2\,\epsilon^{ax},$$

or, since $$y = \mathrm{M}\,\epsilon^{ax},$$

$$\frac{d^2 y}{dx^2} = a^2 y.$$

This is all very straightforward when one meets with $y = \mathrm{M}\,\epsilon^{ax}$, but when one begins with an equation such as—

$$\frac{d^2 y}{dx^2} = a^2 y,$$

it does not follow that—

$$y = \mathrm{M}\,\epsilon^{ax} \textit{ simply.}$$

Let $$y = \mathrm{M}\,\epsilon^{ax} + \mathrm{N}\,\epsilon^{-ax},$$

then $$\frac{dy}{dx} = \mathrm{M}\,a\,\epsilon^{ax} - \mathrm{N}\,a\epsilon^{-ax},$$

and $$\frac{d^2 y}{dx^2} = \mathrm{M}\,a^2\,\epsilon^{ax} + \mathrm{N}\,a^2\,\epsilon^{-ax},$$

$$= a^2\,(\mathrm{M}\,\epsilon^{ax} + \mathrm{N}\,\epsilon^{-ax}),$$

$$= a^2\,y.$$

By trial, therefore, it is seen that—

$$y = \mathrm{M}\,\epsilon^{ax} + \mathrm{N}\,\epsilon^{-ax}$$

is a solution of the equation—

$$\frac{d^2 y}{dx^2} = a^2\,y.$$

(See Boole's "Differential Equations," Second Edition, Chapter IX, page 194.)

As a matter of fact, one may put y equal to as many terms in e as one pleases, so long as the powers to which e is raised are kept equal to ax and $-ax$ respectively. In the above expression M stands for the algebraic sum of all the coefficients of terms in ϵ^{ax} and N represents that of all the coefficients of terms in ϵ^{-ax}.

Proceeding now to the consideration of a telephone circuit, let it first be understood that every sound used in normal speech is composed of a nnmber of superposed sound waves. Suppose three of these waves to be as shown by a, b and c in fig. 1, the resulting wave would be of the form shown by d.

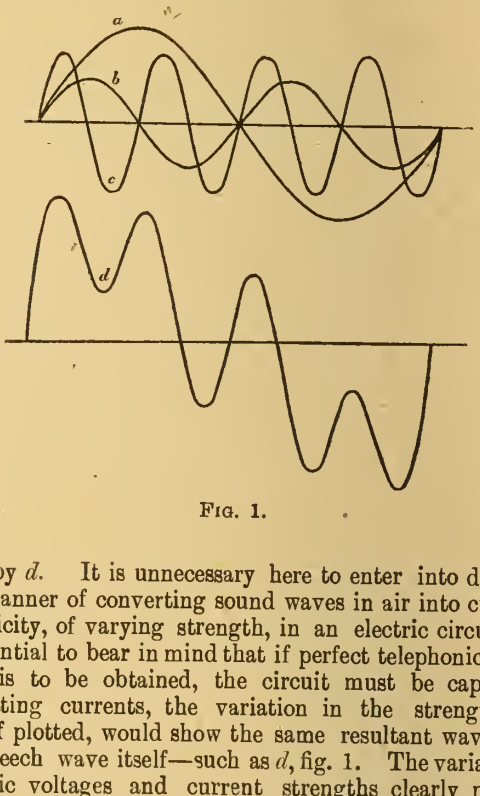


FIG. 1.

It is unnecessary here to enter into detail as to the manner of converting sound waves in air into currents of electricity, of varying strength, in an electric circuit, but it is essential to bear in mind that if perfect telephonic transmission is to be obtained, the circuit must be capable of transmitting currents, the variation in the strengths of which, if plotted, would show the same resultant wave form as the speech wave itself—such as d, fig. 1. The variation of telephonic voltages and current strengths clearly may be assumed to obey the general laws for periodic E.M.F.'s and currents of high frequency.

The following symbols will be used hereafter, others being employed and defined as required :—

R = effective resistance in ohms per mile of loop.
L = effective inductance in henrys per mile of loop.
K = electrostatic capacity in farads per mile wire to wire.
S = leakance in mhos per mile wire to wire. (Or reciprocal of the insulation resistance in ohms per mile wire to wire.)
p = $2\,\pi$ times the periodicity per second.

In fig. 2, let A B be a looped circuit; at A let there be a means of impressing an alternating E.M.F. Take any extremely small length of the loop—say, at P—and call it $\Delta\,x$. Suppose that, at the instant considered, the upper wire as viewed in the figure, is at a positive, and the lower at a negative potential; and, that the dotted lines represent the way in which the potentials change along the wires of the loop in the neighbourhood of P. Next, for the sake of convenience, imagine the short length Δx to be re-drawn on a very enlarged scale as in figs. 3 and 4. Consider, first, fig. 3. If C be the instantaneous current strength in the length of loop Δx, then the fall of potential difference between the wires in the direction A to B (see fig. 2), or the rise from B to A, due to the joint effects of the resistance $R\,\Delta x$ and the inductance $L\,\Delta x$, will be $CR\,\Delta x + L\,\Delta x\,\frac{dC}{dt}$, so that, if V be the difference of potential at the right end, that at the left will be $V + \left(CR + L\frac{dC}{dt}\right)\Delta x$. As Δx is extremely small, no grave error will arise if it be assumed that the instantaneous difference of potential between the upper and lower wires of the short length is V, and that ΔV represents the small change of potential difference between the ends of Δx. In which case, and considering B to A—

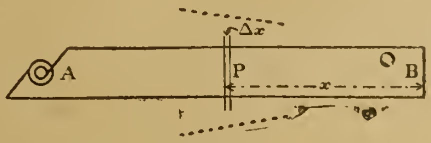


Fig. 2.

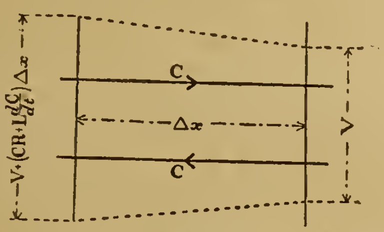


Fig. 3.

$$\Delta V = \left(CR + L\frac{dC}{dt}\right)\Delta x,$$

$$\frac{\Delta V}{\Delta x} = CR + L\frac{dC}{dt} \text{ nearly,}$$

and if Δx be made less than any assignable magnitude then, absolutely—

$$\frac{dV}{dx} = CR + L\frac{dC}{dt}. \quad \ldots\ldots \quad (1)$$

Now, consider fig. 4; where the length Δx is the same as in the preceding case. The leakance between the two wires will be $S\Delta x$, and the electrostatic capacity $K\Delta x$. If the instantaneous difference of potential between the wires of the short length of loop be V, then the current leaking across the dielectric from wire to wire will be $V\,S\,\Delta x$. In addition there will be required a quantity of electricity to satisfy the electrostatic capacity of the length Δx, and this quantity, expressed as a current strength, is equal to $K\,\Delta x\,\frac{dV}{dt}$. If C be the current at the right end of the short length of loop, then that at the left end will be $C + \left(SV + K\frac{dV}{dt}\right)\Delta x$. The decrease of current strength from A towards B (see fig. 2), or the increase from B to A due to the combined effects of leakage and capacity, will therefore be $\left(SV + K\frac{dV}{dt}\right)\Delta x$. Again, as Δx is extremely small, no grave error will arise if it be assumed that the instantaneous current strength in the wires of the short length of loop is C, and that ΔC represents the small change in current strength between the ends of Δx. In which case and considering B to A—

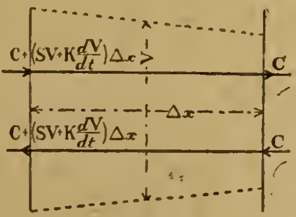


Fig. 4.

$$\Delta C = \left(SV + K\frac{dV}{dt}\right)\Delta x,$$

$$\frac{\Delta C}{\Delta x} = SV + K\frac{dV}{dt} \text{ nearly,}$$

and if, as before, Δx be made less than any assignable magnitude, then, absolutely—

$$\frac{dC}{dx} = SV + K\frac{dV}{dt}. \quad \ldots\ldots \quad (2)$$

It is from the equations (1) and (2) that the whole theory of telephonic transmission, so far as lines, at least, are concerned, is built up.

(*To be continued.*)

PROCEEDINGS OF INSTITUTIONS.

Experiments on Single and Stranded Low-Tension Fuses.

By W. T. Maccall, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Leeds, November* 17*th*, 1909.)

For a single-wire fuse the usual formula is that due to Sir William Preece, viz.:—

$$C = k \,.\, D^{\frac{3}{2}},$$

where—

C = fusing current in amperes;
D = diameter of wire in inches;
k = constant for any particular metal or alloy,

its value being about 10,244 for copper, 1,642 for tin, and 1,379 for lead.

These constants are proportional to $\sqrt{T\,E/P}$, where—

T = rise of temperature to fuse the wire;
P = resistivity at temperature of fusion;
E = emissivity " "

The emissivity of wires varies with the diameter, a fact apparently not recognised by the suppliers of fuse wire, who generally give Preece's table, which neglects this variation. When fuses are stranded, the constant is further modified by the mutual influence of the wires. Experiments were undertaken to determine the variations in Preece's constant with change of diameter, the effect on fusing current of house-service fuse-holders, and the ratio of the fusing currents of single and stranded fuses in the open, and in holders.

The current was slowly increased by small increments, with a pause of one minute at each step. Some experiments were made with the fuses horizontal, but it was found preferable to have them vertical, as in practice. For the experiments in air, large terminals, ⅞ in. in diameter, with centres 3 in. apart, were used; the porcelain fuse-holder employed had copper end-pieces with nuts and washers, as in fig. 1. The experiments were confined to tin fuses, the wire containing 99 6 per cent. of tin.

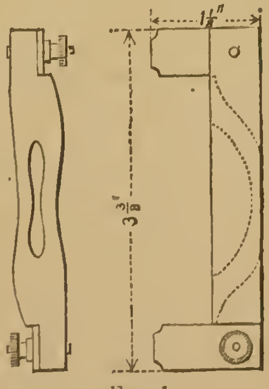


Fig. 1.

The results for single wires were as follows (air temperature 16° C.):—

SINGLE WIRES.

Diameter. Mils.	S.W.G.	In air or fuse-holder.	N.F.C. Amperes.	$10^3 \times$ E.	$k \div 10^3$.
15·3	28	Air	3·58	2·60	1·89
21·9	24	,,	5·26	2·42	1·66
28·6	22	,,	7·53	1·77	1·56
15·3	28	Holder	4·58	4·27	2·42
21·9	24	,,	6·28	3·44	1·94
28·6	22	,,	8·17	2·08	1·69

The value for 28 S.W.G. in air is with fuse horizontal, all others with fuse vertical.

It will be seen that the values of E and of k decrease with increasing diameter, especially for fuses in holders; in the latter case the N.F.C. (normal fusing current) instead of varying as $d^{\frac{3}{2}}$, does not vary even as rapidly as the diameter, but about as its 0·92 power.

In all cases a wire carries more current before fusing in a holder than the same wire in the air, but the increase is most marked for the smaller wires.

Passing on to two-stranded fuses, the question arises as to the effect of more or less twist of the wires. To avoid complication from this source, the amount of twist was kept moderate and approximately proportional to the diameters of the wires.

TWO-STRAND FUSES.

Diameter. Mils.	S.W.G.	Twists per inch.	In air or fuse-holder.	N.F.C. amperes.	$10^3 \times$ E.	$\frac{k}{10^3}$
15·3	28	3¾	Air	5·37	1·47	1·42
21·9	24	3	,,	8·85	1·37	1·37
28·6	22	2	,,	13·0	1·32	1·34
15·3	28	3½	Holder	6·37	2·06	1·68
21·9	24	2¾	,,	9·38	1·53	1·44
28·6	22	2¼	,,	13·4	1·52	1·39

The same general results are seen here as for the single fuses, except that k varies less, especially in air.

Comparing the two sets of results we obtained the following:—

RATIO OF N.F.C.'s FOR SINGLE AND DOUBLE FUSES.

S.W.G.	In air or fuse-holder.	$\frac{\text{N.F.C. for two-strand.}}{\text{N.F.C. for single.}}$
28	Air	1·50
24	,,	1·68
22	,,	1·73
28	Holder	1·39
24	,,	1·49
22	,,	1·64

The first figure is affected by the position of fuse being horizontal, so that probably the ratio is fairly constant in air. The increasing values with increasing diameter for wires in the holder are due to the diminishing effect of the holder, so that these values gradually approximate to those for fuses in air.

DISCUSSION.

MR. A. J. CRIDGE said that further experiments were necessary, especially with regard to different numbers of strands and the amonnt of twisting. He had known men who, not having the gauge of fuse wire required, had taken a piece of wire of larger gauge, and reduced its cross-section by stretching. This was a most inaccurate way of trying to arrive at the required result.

MR. H. E. YERBURY said these experiments were valuable, though if one must allow such a large margin or factor of safety in all fuses used for domestic and industrial purposes, the difference in fusing point with different types of holders and in air would be ignored by practical men.

MR. E. J. MARSH asked what result would be obtained with two similar fuses in series, one in air and the other enclosed in a holder. Would the fuse in air blow first on a short-circuit? Experiments with cartridge fuses would be of considerable interest.

MR. T. W. SAMPSON said the effect of the holder on the fuse seemed contrary to what one would expect to find. Regarding the twisting effect, there was not twice the amount of radiating surface when the wires were twisted as when they were straight. Therefore they had a longer length and less radiating surface, which would have the effect of reducing the fusing current.

MR. W. H. L JAMES (Bradford), in a communication, said that Mr. Maccall's experiments on single wires confirmed the results given by Prof. Schwartz and himself, as to the considerable and variable departures from Preece's law which occurred in practice. Mr. Maccall had been rather unfortunate in his choice of fuse-holder. In the type used, even if the wire was quite tight when put in, it would expand slightly before fusion, and the degree of contact between the cooling porcelain surface and the fuse-holder would be of a variable and uncertain nature. The statement that in all cases a wire carried more current before fusing in a holder than the same wire in air, though true for the type of holder made use of, was not true for every type of fuse-holder. If a tubular fuse-holder were used with the wire going down the centre (out of contact with the porcelain), the N.F.C. might be lower in the holder than in the open air.

MR. W. M. ROGERSON said he found that aluminium as a fuse, gave far better results in the case of heavy currents, than tin or copper. Copper fused practically the whole length, whereas with aluminium a small portion only was affected. In Halifax they had adopted aluminium altogther for fuses, with excellent results.

MR. W. T. MACCALL, in reply, said he thought that for wires of small diameter, *e.g.*, 28 S.W.G., which was often used, having a fusing current of 3 or 4 amperes, and even for 24 S.W.G., the difference produced by placing the wire in the holder was sufficiently important to matter, especially as it was an increase in the fusing current. He had not done any experiments on short circuits, but he thought that the difference in fusing current would be sufficient to make the one in air fuse first. He had noticed that it made quite a considerable change in the fusing current if the wire were put in the holder loosely instead of tightly. He thought that in the actual experiments the effect was not very great. Three strands carried a little more than twice as much as one, and a double strand carried 1·5 times as much as a single.

Recent Developments in the Transmission of Electrical Energy.

By PROF. E. W. MARCHANT, D.Sc., Member, and E. A. WATSON, M.Sc., Student.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, November 30th*, 1909.)

INTRODUCTION.

THE transmission of electrical energy over long distances has received far greater attention in America than on the Continent of Europe. At Niagara there are five power stations for the supply of electrical energy, giving a maximnm output of 320,000 H.P. These supply power over a distance of 150 miles; very shortly this distance will be extended to 250 miles. The effect of this vast source of power on the industrial development of the district in which it is placed has been enormous. At the present time it is estimated that a population of 40 million people resides within the area which represents the field of distribution for Niagara Falls, and in future years, as the electrification of the railways progresses, it is certain that the Niagara district will become an unrivalled centre for manufacturing industries. In no other single place in the world (except possibly at the Victoria Falls of the Zambesi) is there located so vast a supply of power.

On the Pacific Coast the problem has been of an entirely different character. Large towns have sprung into existence chiefly as the result of mining and agricultural enterprise, and as fuel is expensive, the supply of electrical energy for lighting and tramways from water-power has led to the development of many comparatively small powers, the energy from which is distributed sometimes for as great a distance as 250 miles.

For the supply of electric power to the City of San Francisco, which is under the management of the Pacific Gas and Electric Co., no less than 11 water-powers are connected to the system, the power for which is obtained from water used for irrigation purposes; these are coupled in parallel on a single network, covering in all an area of 30,000 square miles, extending nearly 250 miles along the Pacific Coast. The total length of 60,000-volt overhead line on this network is over 1,000 miles.

A great factor in making these systems a commercial success is undoubtedly the low price of land and the cheap rate at which way-leaves can be obtained.

The longest distance over which water is carried is at the Electra station, where the distance from the source of supply to the reservoir is 30 miles. There are, however, many other cases in which water is carried several miles before it can be used for power purposes.

A study of these stations makes it evident that many water-powers in this country which have hardly been considered as of practical utility, may ultimately be developed to the great benefit of the surrounding district, provided that the necessary wayleaves for the transmission lines can be obtained at a reasonable rate. In this connection too great emphasis can hardly be laid on the advantage which a new country possesses in having land which can be used for purposes of this kind without payment of heavy dues, though it may be hoped that even in this country, when the great economic and industrial advantages of a cheap supply of electrical energy are thoroughly understood, it may be possible to use transmission lines over distances much greater than have hitherto been attempted.

The standard pressure at present in use is 60,000 volts, three-phase. This pressure is used in nearly all transmissions of 50 miles and over, and appears to give rise to no practical difficulties in operation. In several cases stations have been designed for pressures up to 110,000 volts; in many of these, lower pressures are being used until the load on the station is sufficiently large to necessitate the higher pressure being employed. The station at Island Bar commenced operation at 110,000 volts on October 1st, 1909, along its transmission line of 153 miles, while that of the Central Colorado Power Co. at Shoshone has been in operation at a pressure of 90,000 volts since May, 1909. The efficiency of transmission over these distances is usually figured at 90 per cent., and it can be maintained nearly constant as the load on the station increases, by raising the working pressure.

Higher voltages are undoubtedly possible at the higher altitudes of Colorado and the Nevada's than could be used on similar installations in our great manufacturing districts; but, allowing for all effects of climate and atmosphere, there is no doubt that there is no great technical difficulty involved in the use of much higher voltages than have hitherto been attempted in this country.

At the present time, the possible voltage is only limited by the production of a corona or brush discharge from the line itself.

This corona is due to the electric stress produced in the neighbourhood of the wire, by the electrostatic charge which it carries being greater than the air can stand. Disruption of the zone of air next the wire takes place, accompanied by light, sound and chemical effects, and a serious loss of energy. A corona on a high-tension line must never be allowed, as the power loss which accompanies it will amount to a very considerable figure.

The stress which will be produced in the air at the surface of a transmission line depends on the potential difference between lines, the diameter of the wire and the distance apart of the wires.

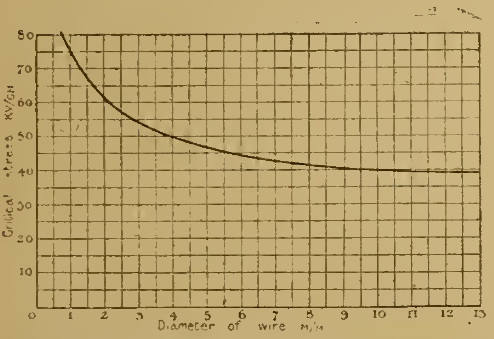


Fig. 1.—Relation between "R" (Electric Stress) and the Diameter of the Wire.

The value of the electric stress which can be allowed in the neighbourhood of a transmission line depends on a good many factors. It has been demonstrated beyond any doubt that it depends to some extent upon the size of the conductor, rising as the conductor size decreases, according to the curve shown in fig. 1. Secondly, the electric strength of the air is known to become less as the atmospheric pressure is decreased, so that at high altitudes a corona is more easily formed than at low ones, the relation between electric strength and air pressure being given approximately by the expression—

$$R = R_0 (0{\cdot}2 + 0{\cdot}8\, p/760),$$

where p is the pressure in millimetres of mercury.

A similar lessening of the electric strength is also produced by an increase of temperature, the law being linear in this case also.

The voltage of discharge from a perfectly clean wire seems to be little affected by the presence of water vapour in the atmosphere; but if the wire be dirty, not only does the discharge in any case occur at a lower voltage, but the voltage is lowered still further if water vapour is present. For this reason there has been considerable discrepancy between the results obtained by various workers on the subject.

For the present it is suggested that the figures given in fig. 1 should be used, combined with a factor of safety which should have, approximately, the following values:—

Large towns or industrial districts especially near sea-level, *e.g.*, Lancashire, &c.	1·8-2·0
Ordinary open English country	1·5
Mountainous or other districts far from any source of contamination of the air	1·2

The systems which use a working voltage approaching the possible maximum are as yet but few in number. The ordinary 60,000-volt plant, of which there are numerous examples throughout America, does not approach the limit, except it be on an occasional short feeder of small diameter. The main transmission line of a 60,000-volt scheme, even if of copper, is rarely less than 000 B. and S., or ·47 in. diameter, and very often an aluminium conductor of considerably larger size is employed.

The lines which are at present being worked at voltages approaching the limit, the stresses existing on these lines, and the factor of safety which has been allowed, are given below:—

Plant.	Voltage.	Conductor. B. and S.	Spacing	Altitude.	Stress.	Factor of safety.
			Cm.	Ft.	kv./cm.	Allowing for altitude.
Great Western Power Co., Island Bar	110,000	000	300	800	24·2	1·52
	150,000	—	—	—	33·0	1·11
Central Colorado Power Co.	110,000	00, 7-strand with hemp core	300	6,000	23 2	1·34
Grand Rapids ...	100,000	0000	300	1,000	19·6	1·87

With the exception of the few comparatively small plants installed in France and Switzerland, all the modern transmission schemes employ three-phase alternating current. Undoubtedly, for a very long transmission from a remote source of power, such as a waterfall to a large city or industrial area, the Thury system of direct-current transmission has many advantages.

In the first place, the working voltage with a direct-current line may be much higher than that which is possible with an alternating current one, as the effects which limit the alternating voltage available, such as the corona, depend not upon the R.M.S., but upon the maximum value of the voltage used.

The charging current of the line in an alternating current transmission is a factor needing serious consideration, especially when a frequency of 60 (frequently used in the States) is adopted.

The possibility of resonance (not really very serious) and the danger of interference with telephone and telephone circuits, also militate against the use of alternating currents.

On the other hand, the elasticity of the alternating-current system, with its parallel method of working, renders it very suitable for the large networks of power lines which are springing up all over the American Continent.

The question of frequency is settled more by the question of standardisation than by any other consideration.

The standard frequencies on the American Continent are 25 and 60 cycles, the latter being used almost universally for lighting purposes. It is, however, distinctly too high for a really sound long-distance transmission. There seems to be a great aversion to using 25-cycle current for lighting, although in one or two towns this is done. The large plants on the Pacific Coast all use 60 cycles and have very large charging currents. One plant in particular, which will ultimately operate a line 153 miles long at 110,000 volts, will have a charging current corresponding to an output of nearly 15,000 K.V.A. In at least one case, the question of the charging current due to the high frequency has limited the value of the transmission voltage employed.

It seems unfortunate that the excessive standardisation prevailing among the manufacturers of electrical machinery should cause the adoption of such an admittedly unsatisfactory frequency as 60 cycles per second.

The operation of a number of widely distributed central stations on a common distributing network has presented few difficulties in actual practice. The methods adopted for synchronising the machines are similar to those employed in this country, rotary synchronisers being most commonly used. In many cases water-power plants are running in parallel with steam turbines through 100 miles of line, and no difficulty from hunting has been met with.

The latest practice to facilitate good synchronising is the use of pneumatically controlled switches. These are much quicker in operation than any other form of switch yet put into service, and the new switch has the advantage of being independent of the judgment of the operator.

As a matter of fact, synchronising through a long transmission line is a much easier matter than synchronising in a central station.

The practice of switching-in machines without synchronising is not common in hydro-electric stations, though in the General Electric Co.'s works at Schenectady, synchronous motors and converters are put into circuit in this way, the motors being fitted with copper damping rings to give the necessary starting torque and bring them up to speed.

The protection of the overhead line against lightning stroke and atmospheric discharges is a matter of great importance. American engineers state that this problem is one of the most serious that they have to face, and the opinion is very generally held that no so-called lightning arrester is effective in protecting a transmission line against the effect of lightning stroke. In nearly every station that was visited the old arresters are being displaced by those of the electrolytic type. These arresters are kept charged by being connected every other day direct to the overhead line, but normally they are arranged with a spark-gap between them and the line. Even on a long line arresters are fitted only at the central station and at the sub-stations, the extra safety gained by fitting them at intermediate points being discounted by the increased risk of breakdown due to their use.

The most effective protection against lightning is undoubtedly the earthed wire. During a recent very severe lightning storm near San Francisco, the only transmission line that was not put out of service was one having an earthed wire arranged above the line. Not only does the earthed wire act as a screen against the electrostatic effect by charged clouds moving in the upper regions of the atmosphere, but it also provides a path to earth more direct than that of the line wire over the whole length of the transmission line, and thus prevents a lightning stroke from striking the transmission line. In most cases where the earthed wire is fitted, however, the best practice is to connect a lightning arrester of the ordinary type to the line as an additional safeguard.

Troubles from lightning are much less likely to occur on a high-voltage transmission line than on those working at 20 or 30 kilovolts, on account of the more effective insulation of the line.

In no stations are there water-jet dischargers installed in which an electrostatic charge is conveyed to earth through a water jet playing against the line. With the high voltage used, it is obvious that the resistance of the water, if there is to be no considerable leakage current, would have to be so high that it would not be sufficiently conducting to get rid of an electrostatic charge with any great rapidity.

It has been suggested at various times that asynchronous generators consisting of ordinary induction motors run above synchronous speed could, with advantage, be employed in many transmission systems. This is especially the case in large networks fed from a number of stations. On some of these networks where there are many small water-powers the use of such a small generator has many advantages. It is extremely robust and mechanical in construction, and quite simple in operation; it needs no exciter and has no rubbing contacts. It can be thrown straight on to the line without synchronising, and it can be short-circuited with impunity. It requires, of course, that the current at the station shall lead on the voltage in order to supply the necessary magnetising component. This is not generally a disadvantage, as on all high-tension long-distance transmission lines the heavy charging current will look after this. An asynchronous generator connected to a line of sufficient capacity will excite itself and furnish power without the use of any synchronous machine to set the step, and on this account care should be taken that the magnetic circuit of such a machine is not worked at too low a density. If an asynchronous machine be taken whose voltage magnetising-current characteristic is given by a straight line—*i.e.*, if the iron is unsaturated, there will always be found a critical value of connected capacity at which the machine just excites. Any increase of the capacity will cause the voltage to rise until the magnetic circuit becomes saturated, and if this occurs much above the normal working voltage, serious damage may result.

Asynchronous stations feeding into networks generally have their governors arranged so that they work steadily at full load all the time. The variable portion of the load is taken care of by ordinary synchronous generators.

An interesting example of the use of asynchronous machines is given by the exciter sets in many of the generating stations of the Pacific Gas and Electric Co. In these sets a water-turbine or Pelton wheel, a direct-current generator, and an induction motor are all coupled together. In case of a heavy load on the generator, the induction motor helps the water-wheel, while, if the load is light, power is returned to the line by the induction motor running as a generator. No governors are provided, the speed being controlled entirely by the induction motor. Synchronous machines had been tried, but had given trouble by breaking step.

An efficient system of telephones is a matter of fundamental importance in the operation of a large network, and the question of telephone interference is, therefore, one which requires most careful consideration. In the case of a transmission line at 100,000 volts and over, no attempt appears to have been made to run the telephone lines on the poles used for the transmission line. With 60,000-volt schemes the usual practice is to arrange the telephone line about 10 ft. below the transmission line, and to support it on insulators on the same poles. In order to avoid mutual induction effects, the telephone lines are transposed at frequent intervals. Transposition of the telephone line is, however, not sufficient to prevent induction, as the inductive effects from the three main lines are sufficiently different in magnitude on the two telephone lines to give large currents along the whole length of line. Electromagnetic induction may be almost completety avoided by transposing both the transmission line and the telephone line. The transposition of the transmission line is effected by using special pairs of towers at intervals of about 3 miles; in most cases the lines are transposed by the third of a revolution at each transposition point. With these precautions the telephone is sufficiently satisfactory, even over a line of 150 miles in length.

If the neutral point of the three-phase system is earthed, this arrangement serves as an efficient safeguard against electrostatic effects, but where Δ-connected transformers are used, and there is no definite earthpoint provided, these effects may be very large. In order to obviate them as far as possible at the telephone, the wires are connected by a split choking-coil at the ends of the line, and the centre point of this coil is connected to earth.

In most of the large installations the telephones are brought to a controlling station, from which all instructions as to the operation of the various plants are issued by a "load dispatcher." The "load dispatcher" gives instructions to each plant as to the number of units which are required to be in operation at the station; all breakdowns of the line are reported to him, so that he knows exactly what sources of power are available for the supply that is required.

The arrangement of the transformer on the high-tension network is one in which considerable discrepancy of practice appears to exist. At the present time there seems to be a decided preference in favour of Δ connection. Briefly stated, the relative advantages of the two methods of connection are as follows:—

Advantages of Δ: (1) If one of the phases breaks down, the other two will supply power to the extent of two-thirds of the capacity of the transformer; (2) if an earth occurs on one leg of the transmission line it does not affect the running of the system provided the insulators on the other two wires are sufficiently large to stand the concatenated pressure of the system.

Advantages of star: (1) The size of insulator used need only be large enough to withstand the star pressure of the system; (2) the neutral point can be earthed and the pressure between each line and earth definitely equalised. This point is of great importance in connection with telephones (as mentioned above).

As a matter of fact, the advantages of the Δ system in enabling the transformer to run with two phases only, if one of the lines break down, is not practically important, as it is found with 60,000-volt working that the insulators installed are rarely large enough to withstand the full-line pressure, and if one of the phases breaks down, the line is put out of service until repairs are effected. The same thing holds good with regard to the transformers. In spite of this, however, Δ connection is much more common than star, and at the Great Western Power Co.'s station, where the change from 60,000 to 110,000 was made on October 1st, 1909, the connection was altered at the same time from star to Δ.

It is remarkable that star working is not more frequently used, as it would appear to be a much more satisfactory arrangement from almost every point of view on extra high-tension systems.

(*To be concluded.*)

Röntgen Society.

At the meeting of the Röntgen Society which took place on December 2nd, Prof. A W. Porter, B.Sc., gave a demonstration on the subject of electrical discharges on photographic plates. His technique is the usual one followed by previous investigators, such as Mr. J. Brown, of Belfast, and the late Lord Armstrong—namely, a spark from an induction coil producing an electrical discharge over a photographic plate, at the back of which is one terminal in the shape of a copper plate, while the other terminal is a wire brought into contact with the sensitive emulsion. The point at which his experiments part company with those of other observers is in the creation of a partial vacuum around the plate. The negative discharge at atmospheric pressure produces a characteristic and well-known figure, but if the pressure be lowered some remarkable features make their appearance. With a pressure of about 55 centimetres of mercury Prof. Porter found a general tendency for the familar fan-shaped figures to spread out rather more widely and to become more fully developed. At 45 centimetres' pressure a new phenomenon was noted in the shape of a detached triangular figure, sharply pointed, which looked as if it represented the re-aggregation of the discharge after it had been spread out. This bright pointer became much more pronounced at half atmospheric pressure.

He then carried out some experiments by changing the gas surrounding the plate, and found that nitrogen, oxygen, carbon dioxide and ammonia each gave distinct figures, and that it was almost possible to determine the gas through which the discharge had passed by the character of the figure obtained. He suggested the side-splash theory to explain why it was that the discharge in air, starting from the terminal and shooting across the plate, would suddenly send out a branch at right angles to its main line of direction. Each of the finer lines in the figure obtained with the negative spark on a plate probably represented the actual path of one or a group of the small ions into which the composite ion was broken up.

Prof. Porter proceeded to demonstrate the effects obtained by sending a blast of air across the plate and by placing the plate between the poles of an electromagnet while the discharge was being passed. Such a procedure modified that part of the discharge which went right across the plate to the other side. He thought that this part of the discharge consisted of heated air which was made into a conductor, and the effect of the blast of air or of the magnetic field was to blow this heated air on one side. The appearance was as though the plate had been the region of a cyclone. He made a further series of experiments in which the electrode on the sensitive side of the plate consisted of a wire brought down into contact with a small triangle of copper or other metal. In the case of a positive discharge, *i.e.*, one in which the triangle was made the positive terminal, there was a tendency for the streamers to come off from the corners of the plate, while in the case of a negative discharge they came off almost at right angles to the sides of the plate. The fact that the negative discharge came off at right angles seemed to indicate that it was governed much more by the statical conditions than the discharge of the positive. He had been unable to trace any effect due to the plate. Whatever the speed or sensitiveness of the photographic plate, the luminous picture was exactly the same.

THE FÉRY ELECTRICAL PENDULUM.

By DR. ALFRED GRADENWITZ.

In order to eliminate the slight deviations from perfect accuracy that still impair the working of mechanically operated pendulums, due to the influence of mechanical friction, even when they are fully compensated for temperature and pressure variations, electric propulsion has been adopted, with a considerable measure of success.

Certain drawbacks are, however, experienced also in connection with electrical pendulums. The oscillating part usually operates the contact used to drive it, and such contacts are apt to interfere with the working of the pendulum. The isochronism of the latter is further disturbed by the effect exerted by the winding-up of the weight or spring, so as to make the pendulum sensitive to the slightest alterations in the amplitude of oscillation.

As a pendulum mainly serves to regulate the working of a clock, it should be touched as little as possible, and should have to perform the minimum of work, in order to be kept at as regular a working rate as possible. In order to comply with these requirement, Prof. Ch. Féry, of Paris, has constructed an electrical pendulum based on a novel principle, which has been under observation for two years in his laboratory.

The most remarkable feature of this pendulum is its complete freedom from contact with solid bodies throughout its oscillations. The regulating device of the pendulum presents some analogy with the synchronising attachment suggested by Cornu, which has been used by Féry in its original shape in connection with some other pendulum mechanisms. This consists of a fixed coil traversed by the synchronising current, which acts on a bar magnet rigidly connected to the pendulum.

The improvement suggested by Féry is the substitution of a horse-shoe magnet for the bar. Magnets of this kind are far more astatic with regard to magnetic disturbances, and of a considerably more constant magnetic intensity.

The most interesting feature of the novel device, however, is that the other pole of the magnet freely oscillates inside a brass ring C (fig. 1), which constitutes the bob of a small auxiliary pendulum of exactly the same oscillation period as the main pendulum. Between the oscillations of the two pendulums there is produced a lag of one-quarter period, the auxiliary pendulum being operated by the reaction due to the currents induced in the ring C.

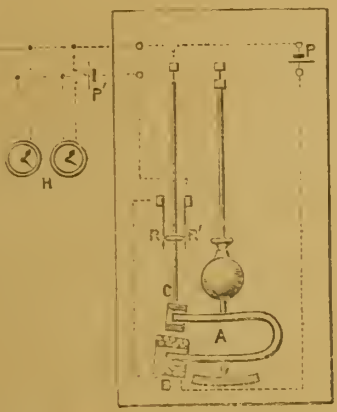


Fig. 1.—Féry Electrical Pendulum.

The function of this auxiliary pendulum is to operate the two contacts RR′, the former of which closes the current of a constant battery P connected to the operating coil B, while the other maintains or synchronises the working of the secondary clocks HH by means of the battery P′.

If this pendulum be properly regulated, it will have the important property of starting of its own accord as soon as its terminals are connected to a battery. It can therefore be installed even in an inaccessible place (*e.g.*, in a constant temperature cellar) inside a casing in which the air pressure is maintained constant.

As the consumption of electricity is said to be only about 1 watt-hour per annum, any kind of standard cell can be used for the operation of the pendulum.

The instrument was shown for the first time at the recent annual exhibition of the French Physical Society.

NICKEL WIRE RESISTANCE FURNACES.*

By Dr. M. LEBLANC.

In connection with some experiments which the author has been carrying out on the nitrification of calcium carbide, he has found it necessary to employ temperatures up to 1,300° C. for long periods, and the satisfactory results which he and his collaborator obtained by using a nickel wire resistance furnace led him to determine whether nickel wire could be used also in the construction of small crucible furnaces capable of being connected direct to a 110-volt network.

The first point was to ascertain the correct thickness of wire to employ. After some preliminary experiments it was found that the most suitable thickness was 1 mm. This wire was wound in triple layers round a Pullak cylinder 14 cm. long, 4·5 cm. internal diameter and 1·5 mm. thickness of wall. The distance apart of the individual turns was in the first layer 0·5 mm., in the second 0·8, and in the third 1 mm.; the windings extended along the cylinder for a distance of 12 to 12½ cm., 1 cm. being left free above and 0·5 to 1 cm. below. After winding, the first layer was smeared with a magnesia paste, and a piece of asbestos paper 2 mm. thick was laid upon this to insulate it, the second layer being afterwards wound, and so on. The total length of wire employed was 38·5 m. After being wound the clay cylinder was inserted in an iron (or, better still, aluminium) housing 11 cm. diameter and 22 cm. long, closed at the top by a lid having a suitable opening left, and at the bottom by a clay slab. The outer edge of the cylinder was flush with the lid. The housing was filled in with magnesia for retaining the heat. The ends of the windings conveying the current were covered with nickel wire 1·5 mm. thick, and passed through two terminals fixed in the lower clay slab. The latter was 6½ cm. from the ground, the lower part of the housing being so cut away as to form three legs on which to support it.

After completion, the furnace was connected to a 10-volt 2-ampere circuit to dry it out, being subsequently put on the 110-volt 3-ampere circuit to finish this operation. After being allowed to cool, it was then connected direct to the 110-volt municipal supply (which occasionally showed fluctuations of 10 per cent.), and the following results were obtained:—

Time (minutes).	Current. Amperes.	Temperature. Degrees C.	Time (minutes).	Current. Amperes.	Temperature Degrees C.
0	22	20	30	4·5	1,090
5	6·0	520	50	4·4	1,110
10	5·25	790	60	4·4	1,135
15	5·0	930	153	4·0	1,125
20	4·75	1,000	355	3·6	1,065

With a view to ascertaining the behaviour of the furnace with a longer duration of heating, and also to determine its life, two series of experiments were carried out on two furnaces which differed from that described only in that the clay cylinder had a thickness of wall of 3 mm. In the first series the furnaces were in circuit continuously, and in the second the furnace was disconnected from the supply 23 times, and reconnected after cooling. The first series gave the following results:—

Period of burning hours.	Current. Amperes.	Temperature. Degrees C.	Period of burning hours.	Current. Amperes.	Temperature. Degrees C.
2	4·2	1,130	223	2·7	910
43	3·25	990	256	2·65	880
72	3·0	970	390	2·55	850
127	3·0	940	418	2·5	820
151	2·9	920	437	2·5	800

The furnace was then switched off, and it fell to pieces while cooling.

The second series of tests showed a similar drop in temperature and current. After burning for 351 hours (excluding time taken to cool), the furnace gave, just before burning out, a temperature of 790° with 2·2 amperes.

For many experimental purposes, temperatures up to 300° C. are sufficient, and in these cases the thickness of wire employed can be reduced. Care should be taken when winding to see that there is not a kink in the wire.

From the data given, it seems possible without much trouble to construct other types of furnaces employing nickel wire as the heating unit.

Certain objections have been raised by Carpenter to the use of nickel wire for this purpose, owing to the structural changes which he states take place in it when submitted to high temperatures, but the author holds that nevertheless there are considerable advantages to be derived from the substitution of nickel for platinum, one of the chief being that a laboratory can construct and repair the furnaces in its own workshop. The cost of constructing the nickel-wire furnace is about 10s., as against the price of £4 10s. for a 110-volt Heraeus platinum furnace of smaller dimensions; the cost of renewing the nickel wire is about 3s.

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*Abbreviated translation from "Zeitschrift fur Elektrochemie," Vol. 15, September 18th, 1909.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—In order to secure entry under the lower scale of duties which has been fixed for goods, the produce of countries receiving most-favoured-nation treatment in Italy, of which the United Kingdom is one, British goods should be accompanied by a certificate of origin issued by Italian Consular officers, Italian Chambers of Commerce in foreign countries, municipal authorities, Chambers of Commerce, foreign Customs authorities or other authorities specially designated by the Ministry of Finance, showing that the country of origin of the goods is a country entitled to most-favoured-nation treatment. By country of origin is understood the country wherein the goods were produced or received their ultimate industrial transformation, whatever, in the case of manufactured goods, be the origin of the raw materials used in their production. When goods proceeding from countries enjoying most-favoured-nation treatment have been supplied to trade, or have entered public or Customs warehouses in a country which does not enjoy such treatment, they cannot claim the benefit of the lower tariff. Certificates of origin must bear the autograph signature of the authority issuing them and the following details:—Name and residence of the consignor of the goods, name and residence of the consignee, quantity marks and numbers of the packages, the quality of the goods according to their commercial denomination, the gross weight of the packages, or such other information sufficient to determine the quantity of the goods, the means of conveyance used for the shipment, and the date on which the certificate was issued.

Lire = $9\frac{6}{10}$d., or 25 lire = £1. Kilog. = 2·204 lb.

The following duties are payable, the rates given being those of the lower scale referred to above:—

	Lire per 100 kg.
Iron and steel wire:—Having a diameter of 5 mm., or less, but exceeding 1½ mm.	11
Having a diameter of 1½ mm. or less	15
Iron and steel rails for railways	6
Copper, brass or bronze: In bars, sheets and plates	14
In wire of a diameter of more than ½ mm.	20
„ „ „ „ „ ½ mm. or less	40
Hammered, in coarse articles	18
In ornamental articles not gilt or silvered	75
Gilt or silvered: In bars, sheets or wire	100
Wound in threads of textile materials	100
Other	120
Articles not specially mentioned	30
Multitubular boilers	14
Other „	12
Steam engines: Fixed (without boiler) or semi-fixed (with boilers), gas and petroleum motors, including rotary motors	12
Hydraulic machinery and water or wind motors including turbines, hydraulic wheels, pulsometers, pumps and elevators, presses, accumulators, lifts, hydraulic jacks, &c.	10
Locomotives without tenders	14
Locomobiles and marine engines	12
Dynamo-electric machines: Weighing more than 1,000 kg.	16
Weighing 1,000 kg. or less	25
Electric accumulators and metallic parts thereof	16
Electric transformers, with or without oil	25

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,101. "Improvements in telegraph transmitters." G. M. Goddard, A. C. Grover and G. C. Thrall. November 22nd. (Complete.)

27,103. "Improvements relating to carbon holders in magneto-ignition apparatus, current distributors or the like." Firm of R. Bosch. (Date applied for under Sec. 91 of the Act, July 27th, 1909, being date of application in Germany.) November 22nd. (Complete.)

27,125. "Improvements in electric switches." L. Lomas. November 22nd.

27,154. "Clockwork mechanism provided with an electric winding device." J. Steiger and J. Besabcon. November 22nd. (Complete.)

27,172. "Improvements in or connected with electrically-operated frame apparatus." A. H. Gibbings. November 23rd.

27,175. "Improvements in electric actions for organs and the like." C. Bamberger. November 23rd.

27,183. "Model electric aeroplane." H. W. Horne. November 23rd.

27,221. "Improvements in and relating to electric storage battery plates." Accumulatoren-Fabrik Akt. Ges. (Date applied for under Sec. 91 of the Act, February 11th, 1909, being date of application in Germany.) November 23rd. (Complete.)

27,245. "Improvements in or relating to regulating devices for direct-current dynamos." F. Krupp Akt. Ges. (Date applied for under Sec. 91 of the Act, March 18th, 1909, being date of application in Germany.) November 23rd. (Complete.)

27,252. "Improvements in or relating to rotating magnet wheels for turbo-generators." O. T. Blathy. November 23rd. (Complete.)

27,270. "Improvements relating to electrical machines." W. A. Price. November 23rd.

27,295. "Improved method of and apparatus for heating air or gas by electricity." T. McClelland, Jun. November 24th.

27,335. "Improvements in electrical standard resistances." W. R. Bousfield. November 24th.

27,355. "Improvements in electric clock-winding devices." M. Falk. November 24th. (Complete.)

27,395. "Improvements in and relating to the transmission of messages by wireless telegraphy or telephony." British Radio-Telegraph and Telephone Co., Ltd., and J. G. Balsillie. November 24th.

27,410. "Improved method of locking incandescent electric lamps in their holders." G. W. Somerville and J. Butler. November 25th.

27,458. "Improvements in automatic telephone exchanges." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges.) November 25th. (Complete).

27,472. "Improvements in means for holding globes or shades on the galleries of electric light, gas and other fittings." Falk, Stadelmann & Co., Ltd., and W. J. Charles. November 25th. (Complete.)

27,478. "Improvements relating to power plants embodying alternating-current generators and motors." H. A. Mavor and Mavor & Coulson, Ltd. November 25th.

27,481. "Improvements relating to the wireless transmission and reception of electrical energy." B. Dick. November 25th.

27,492. "Motor-car or carriage lamp (electric) to turn in any position without taking lamp from its bracket." H. A. Goff. November 26th.

27,560. "Electromagnetic igniting device for arc lamps." D. Timar. November 26th. (Complete.)

27,601. "System for the production and supply of electricity at given tensions by means of a variable speeded (axle-driven) dynamo in conjunction with a storage battery for railway carriages and other suitable applications." A. A. Crawford. November 26th. (Complete.)

27,621. "Improvements in and relating to the collecting devices of overhead electric tramways and railways." W. H. Turner. November 27th.

27,641. "Improvements in the method of and connections of rotor and stator bars of electrical machinery." Brush Electrical Engineering Co., Ltd. November 27th. (Complete.)

27,646. "Improvements relating to electric lamps." L. Foster. November 27th.

27,648. "Improvements in commutators of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) November 27th.

27,663. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. November 27th.

27,674. Improvement in method of charging electric resistance furnaces." A. Peterson. (Date applied for under Sec. 91 of the Act, January 7th, 1909, being date of application in Sweden.) November 27th. (Complete.)

27,689. "Improved detector of thermal and electrical energy." Amalgamated Radio Telegraph Co. (O. Von Bronk, Germany.) November 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Boosters for Train-Lighting Systems and the like. W. Stansfield and J. J. Hall. 16,473. August 5th.

Driving Shafts Electrically at High Speeds. R. Fessenden. 21,481. October 10th. (Date applied for under International Convention, October 31st, 1907.)

Means of Electrically Heating Liquids. J. A. Abbott. 24,038. November 10th.

Incandescent Electric Lamps. Soc. Française d'Incandescence par le Gaz (Systeme Auer). 24,212. November 13th. (Date applied for under International Convention, November 12th, 1907.) (Application for Patent of Addition to No. 11,149 of 1909.)

Attachment for the Sparking Plugs of Internal-Combustion Engines. A. Feaviour. 24,525. November 14th.

Process for Producing Transparent, Flexible, Infusible, Insulating Media. K. Winkler. 24,597. November 16th. (Date applied for under International Convention, November 18th, 1907.)

Alternating-Current Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co.) 25,465. November 25th.

Electric Switch. Cardwell, Boorman, Ford-Lloyd, Ltd., and C. Stirling. 25,819. November 30th.

Manufacture of the Junction and other Fittings of Metallic Conduits for Electric Conductors. Charles H. Pugh, Ltd., and G. F. Bull. 26,232. December 4th.

Chemical Electrolytic Process for Cleaning Metal Objects to be Galvanised or Nickelled. H. Vollert. 27,034. December 12th.

Mouthpieces of Speaking Tubes and Telephones. H. James. 27,382. December 16th.

Controllers for Electric Motors. British Thomson-Houston Co. (General Electric Co.) 28,188. December 24th.

1909.

Electrically-Operated Visual Signals for Railways. W. C. S. Coan. 256. January 5th. (Post-dated May 19th, 1909.)

Contact Breakers for use with Magneto-Electric Machines. F. R. Simms and Simms Manufacturing Co. 1,641. January 22nd.

Ignition Devices for Internal-Combustion Engines. T. B. Smith. 3,469. February 12th.

Means for Actuating the Contact Arms or Levers of Electric Switches. A. H. Curtis, A. H. Mackley and Adams Manufg. Co. 4,111. February 11th.

Receivers for Wireless Telegraphy. Marconi and Marconi's Wireless Telegraph Co. 4,125. February 19th.

Electric Lighting Systems in which Lamps are Arranged in Series. C. H. Stearn and C. E. Topham. 4,694. February 25th.

Electric Generators giving Constant Pressure under Varying Speeds. R. Derain. 4,837. February 27th. (Request under Sec. 19 not granted.)

Constant-Tension Winding and Paying-out Apparatus especially adapted for Marine Cableways for Life-Saving and other purposes. T. Miller. 5,903. March 11th.

Time-Limit Devices for use in connection with Electro-Magnetic Circuit Breakers. Electric & Ordnance Accessories Co. and N. Collins. 7,276. March 26th.

Electric Fuse Boxes. R. Sheehy. 10,796. May 6th.

Electrical Switches. A. P. Lundberg, G. R. Lundberg and P. A. Lundberg. 11,605. May 17th.

Manufacture of Electrical Condensers. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 13,135. June 4th.

Metal Boxes for Switches and Wall Plugs. C. A. Backman. 14,062. June 15th.

Non-Interchangeable Safety Fuses for Electrical Circuits. Siemens Schuckerwerke Ges. 14,622. June 22nd. (Date applied for under International Convention, June 23rd, 1908.)

Telephonic Receivers. W. R. Webb. 15,657. July 5th.

Electric Heaters for Fluids or Liquids. Ponzini. 15,786. July 7th.

Electric Signalling Systems for Railways and the like. J. D. Taylor. 15,978. July 8th. (Date applied for under International Convention, January 30th, 1908.)

Control of Polyphase Motors and the like. Allgemeine Elektricitäts Ges. 17,758. July 30th. (Date applied for under International Convention, July 31st, 1908.)

Electric Insoles for Shoes, Boots and the like. O. Rampelbergh. 18,409. August 10th.

Cooling Dynamo-Electric Machines. Siemens Bros. Dynamo Works. (Siemens Schuckerwerke Ges.) 22,789. October 6th.

Devices for the Locking of Electric Lamps in their Holders. T. McClelland. 299. January 6th.

Metal-Filament Electric Lamps. J. Meszaros. 667. January 11th.

Electrical Block Signalling Apparatus for Railways and the like. F. W. Smith. 2,150. January 29th.

Electrodes for Electric Furnaces. M. Ruthenburg. 4,175. February 20th.

Electromagnetic Counters. M. S. Conner. 4,271. February 22nd.

Apparatus for Plotting Magnetic Lines of Force and for like purposes. T. Parkes. 6,258. March 16th.

Protective Coverings for Ships' Propeller Shafts and other Machine Parts, said Covering being also adapted to serve for analogous purposes, such as the Linings of Cells for Electric Accumulators and of Rooms for Containing Electric Accumulators. H. D. Traun. 11,116. May 11th.

Dynamos or Electrical Motors. J. H. Garty. 14,391. June 19th.

Rotors of Dynamo-Electric Machines for Reducing Noise. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 19,012. August 18th.

Dynamo-Electric Machines. B. G. Lamme. 19,392. August 23rd. (Date applied for under International Convention, October 7th, 1908.)

Means for Cooling the Rotor Windings in Dynamo-Electrical Machinery. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 19,599. August 26th.

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ELECTRICAL REVIEW.

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE TYRANNY OF THE POSTMASTER-GENERAL.

NO ONE who has constructed or maintained an overhead electric tramway can have escaped the rod of the Postmaster-General, laid on by the hands of his satellites. The Board of Trade made regulations requiring tramway owners to erect, at their own cost, an expensive and dangerous system of guard wires for the purpose of saving the public from contact with telegraph wires which might break and fall over the live trolley wires. In other words, the tramway owners have to protect the public (as well as they can under the added risks thrust upon them), not only from the breakage of their own wires, but from any wires which happen to be near enough to the trolley wires to fall on them if they should break. No matter if the tramway is the first comer: if telegraph wires are erected afterwards, guard wires must be put up at the cost of the tramway undertaking. And the Post Office officials worry the heart out of the responsible man on the tramway, making him comply not only with the plain Regulations of the Board of Trade, which are bad enough in all conscience, but with all manner of supplementary Regulations newly hatched by, or for, the Postmaster-General himself. So long as precautions are necessary to prevent the tramway during normal or abnormal working from injuriously affecting telegraph wires, however distant they be, it is reasonable enough to require the tramway—the obvious offender in such case—to adopt or pay for the adoption of suitable means for preventing future disturbances of the same nature. Under this head would fall disturbances or faults due to induction or leakage. But, when the unoffending tramway owner is saddled under compulsion with the cost of taking care of wires which are entirely foreign to his system, and are supposed to be constructed of suitable materials, and maintained in proper order by a Government Department, over whose actions the tramway owner has no tittle of control, then it is high time to cry aloud for justice.

The cry went up, years ago, and was heard by the Tyrant, who hardened his heart against the suppliants, and, when they became importunate, bade his menials scourge them with scorpions in place of the whips used aforetime. In less symbolic terms, the Post Office declared that guard wires, hooks, diversions, cablings and all other then known instruments of torture were insufficient to protect his Majesty's telegraphs, and that thenceforth the cost of inserting fuses and heat coils in every telegraph circuit which approached a trolley wire should be borne by the tramway undertaking.

No matter that the Postmaster-General deems it expedient for the safety of his lines to provide fuses and heat coils at his own expense wherever there is no overhead tramway system, he will declare, and will maintain even before an arbitrator, that the existence of the tramway in any

D

particular place has put him in dread of his wires being too weak to stand the strain, therefore he must adopt the extraordinary precaution of using fuses and heat coils at his instruments in case his wires should fall on to the trolley wire, in spite of the entanglements below, which his ingenuity has provided free of cost to himself.

This fresh piece of tyranny has been resented most strongly by all tramway owners, and strenuous efforts have been made to repudiate the persistent claims of the Post Office for payment of its charges for doing routine work in its own buildings. The matter was brought to a head by the recent arbitration proceedings between the Postmaster-General and the Tramways and Light Railways Association. For this purpose a test case was made out of a claim upon the Wemyss Tramway Co., but it was agreed that the decision of the arbitrator should apply generally to some 60 or 70 tramways in the kingdom. In reality, therefore, this was a momentous and final arbitration upon a question of principle.

As reported already in our columns, the award was entirely favourable to the Postmaster-General, but we must confess that Sir Robert Hunter's case seemed slight beside that presented by Mr. Sidney Morse for the Association, although it goes without saying that the handling of the case for the Post Office could not have been more brilliant.

If anyone is interested enough to read, and digest if he can, the legal arguments which are alleged to have led to this decision, he will find a *verbatim* report in the September issue of the Tramways and Light Railways Association Official Circular.

It is not considered sportsmanlike for a batsman to revile the umpire for giving him "out" l.b.w., and, on the same grounds, we will refrain from criticising the arbitrator's award. But it is necessary to point out that all owners of overhead trolley systems are liable now without question to be mulcted in any sum for any work which the Postmaster-General likes to say is a reasonable protection against the trolley wires. That is how the effect of the award presents itself to us, and it is, therefore, an award which makes the tyranny of the Postmaster-General a more relentless instrument of oppression than ever.

The German Electrical Industry.

THE favourable results obtained by the leading German manufacturing firms during the year 1908—9 have not, as can easily be imagined, been achieved solely from the trade in the domestic market. Indeed, the inland sales would not have sufficed to guarantee the works that amount of employment which was necessary to yield a satisfactory return on the large capital invested in the undertakings, and the deciding point is declared to have been the circumstance that the companies succeeded in conquering the markets of the world in an increasing measure. Most of the countries in Europe no longer form a specially favourable market for the German firms, as the high Protectionist movement has closed a number of countries to them, whilst others which are still good customers, such as Scandinavia, Belgium, &c., will shortly, it is thought, be gradually lost in consequence of the erection of new Customs barriers. On the other hand, the new United States Customs tariff has not had any material effect on the German electrical industry, as the former does not come into consideration for the latter, owing to the high development of the American electrical industry. But the recent improvement in business in the United States has reacted favourably upon the course of trade of the German works, in so far that the Americans are finding enough work at home, and are no longer so dependent upon competing in the markets of the world. The low prices of raw materials, such as copper, zinc, &c., in recent years, have also been of advantage, and the cheaper supplies of fuel are likewise benefiting the industry. As to the question of railway working by electricity, the work in connection with main lines does not seem to make the desired progress, and the hopes entertained in this respect from the Federal States have again been dissipated. The branches which are expected to offer the largest scope for the employment of electricity in the near future are considered to be electrochemistry and electrometallurgy. In particular it is thought that where suitable ores and water-powers are available, the electrical production of iron will gradually supersede the use of blast furnaces, whilst the progress made in the lamp industry is calculated to lead to the expulsion of gas as an illuminant within a moderate period, and to its employment as a producer of heat to a far greater extent than at present. Apart from these considerations the German electrical firms, especially the A.E.G., are preparing to render themselves more than ever independent of making any purchases in the market other than those of raw materials, and the A.E.G. is negotiating for a larger site in the suburbs of Berlin for the establishment of large works for the production of various articles, including glass and porcelain ware.

Indian Railway Workshops and Electricity.

THE various railway workshops are being gradually converted to electric motor drive, and the undoubted economy and flexibility of this method of machine driving so commends itself to the authorities that all-round extensions are in contemplation. The most important railway—the E.I. Railway—has its central shops at Jamalpur, and under the able guidance of Mr. Tyson Wolff, the electrical engineer, a very complete system has been developed. The shops, yards and neighbouring cantonment are brilliantly lighted, and the workshops themselves are quite up-to-date in their modern electric-motor equipment. Between Howrah, the Calcutta E.I. Railway terminus, and Lilloah, the location of the carriage works, there is a three-phase high-tension transmission transformed down at either end for lighting and power.

The O R. Railway has its central workshops at Lucknow, and here, too, are some very modern examples of motor work. Various sized motors are geared down to direct drive on to slow-speed shaft lines, doing away with the old cumbersome, noisy, and inefficient belt drive from engines fixed at the end of each line of shafting. For the carriage works there is a high-tension three-phase transmission, the voltage at the far end being stepped down for use on small motors for various purposes. The O.R. Railway is wholly a Government Railway, and no electric extensions have been carried out during the current year. It is said that the recently appointed loco. superintendent is hatching a large scheme for electric expansion, which will probably be put into effect in the next financial year if the Budget and the higher authorities are both favourable.

The North-Western Railway has its headquarters at Lahore, where a new workshop is being built. Under the skilful direction of the electrical engineer, Mr. G. Wright, the electrical equipment of the old workshops leaves nothing to be desired. The special feature here is the single motor drive, each machine—lathes, planers, rolls, and drills—being entirely self-contained, with its motor and switchgear under the immediate and easy control of the workman.

The central power station is modern in every respect, the latest addition being several sets of chain-grate mechanical stokers for the water-tube boilers. It is anticipated that the electric installation of the new workshops will be a masterpiece in its way. Being a Government railway, all machinery is indented through the India Office, Whitehall, and Indian contractors get the go-by, except in cases of emergency, and for casual accessories. This is an old grievance in India, and will probably remain a grievance—but that is by the way.

Bengal-Nagpur railway workshops at Khargpur, about 70 miles from Calcutta, leave little to be desired in the way of up-to-dateness. The electrical engineer, Mr. Franklin, who is at present home on leave, is a keen enthusiast at his work, as is shown by a cursory glance over and around the shops. As the workings of this line are not so completely overshadowed by Government officialdom as those of the other lines, possibly the results are due to greater freedom of design and more scope for originality.

The foregoing by no means exhaust the number of important railway lines with large and modern electric equipments. The Great Indian Peninsular Railway, the Bengal North-Western, the Madras Railway, the South Indian, all can boast of having important electric power plants, but the few superficial notes given will help to indicate that railways in India are not far behind their elder brethren at home in their utilisation of modern electric ideas and practice.

What Can be Registered as a Trade Mark?

DEALERS in electrical fittings are often anxious to appropriate for their own use and benefit some special word or phrase, and register it as a trade mark. It is almost a natural tendency for anyone who is selecting a trade mark to endeavour to acquire some title which shall be laudatory of their goods, or attach them to a particular locality. But this the law does not allow.

In giving judgment in three trade mark cases heard in the Court of Appeal, the Master of the Rolls laid down certain principles of general importance in relation to what is, and what is not, a valid trade mark. The real importance of his observations lies in the fact that this is the first time that the Court of Appeal has had to consider the meaning of Sec. 9 of the Trade Marks Act, 1905, which amended the law affecting trade marks. By that section, a trade mark must contain, or consist of, at least one of the certain essential particulars, including the name of a company or form represented in a special or particular manner, a signature, or an invented word or invented words. It may also (by Sub-sec. (4)) consist of "a word or words having no direct reference to the character or quality of the goods and not being according to its ordinary signification a geographical name or surname." No other name, signature, or word can be deemed a distinctive mark, except by order of the Board of Trade or the Court. The object of Sub-sec. (4) is clear. It is meant in the first place to prevent traders seizing hold of laudatory adjectives and monopolising them. For instance, "Elegant electric fittings" could not be registered. In the second place it is intended to prevent the name of a town or district being attached to one article to the exclusion of others. Thus, "Birmingham boosters" could not be registered. As the Master of the Rolls said: "Wealthy traders are habitually eager to enclose part of the great common of the English language, and to exclude the general public of the present day and of the future from access to the enclosure." He also said: "It is apparent that no word can be registered under this Sub-sec. unless it is 'destructive,' that is to say, 'is adapted' to distinguish the goods of the proprietor from the goods of other persons. Some words such as good, best, &c., cannot be adapted. There are other words which are capable of being adapted, and as to such words the tribunal may be guided by evidence as to the extent to which use has rendered the word distinctive. . . . . . It is not unimportant to observe that a laudatory epithet if allowed to be registered cannot be removed after seven years. . . . . Again, there is this distinction between word marks and other marks. A word appeals to the eye as well as to the ear. It seems to follow that a word not being an invented word ought not to be put on the register if the spelling is phonetic and resembles in sound a word which, in its proper spelling, could not be put on the register." In the light of these observations the Court declined to allow the registration of the "Crosfield's Perfection Soap" with the word "Perfection" upon it. They also granted an application to remove from the register the word "Orlwoola" as applied to woollen goods. They refused, however, to prevent an application being made for the registration of "Californian Syrup of Figs," because it has here for many years been a widely-known proprietary medicine, and the name has been recognised in litigation as a trade mark. It is material, however, to observe that when the application for the registration of these words is made it will be competent for other persons to come in and object.

We sometimes wonder whether people really understand the distinction between a trade name and a trade mark. A trade name can be acquired by long usage, and if the goods of the particular trader have come to be known by it, it can be protected. Thus, suppose certain goods had come to be known in the electrical world as "Morell's Matchless Motors," no one else could describe his motors as "Morel's Matchless Motors," making a colourable alteration in the spelling of the name for the purpose of deceiving the public. Again, if the firm of Brown & Robinson sold "Brown and Robinson's Lamps," Robinson, who carried on a rival business, could not take a man named Brown into partnership for the express purpose of enabling him to call his lamps "Brown & Robinson's." He could not, of course, be actually prevented from taking Brown into partnership, but the Court would restrain him from selling his lamps under such titles as would be calculated to lead the public to think that they were the goods of another and an older firm.

Tramways and Stray Dogs.

LAW is said to be the incarnation of common sense! That is the theory; but a casual perusal of many of the decisions of the Courts is not always calculated to convince the non-legal mind. As a general rule where there is a dispute between a tramway company and a passenger, the company comes off second best. This is nearly always the case where the issues of fact are left to a jury. When the trial is before a judge alone, the element of prejudice is eliminated, and the dictates of common sense appear to mould the decision. In this connection reference may be made to the case of Todd *v.* Paisley District Tramways Co., decided in Scotland on December 7th.

The claim was for £20 damages in respect of the loss of a dog, said to have been killed through the fault of a servant of the defenders. It was alleged that on August 10th, 1909, while acting as driver of a car, notwithstanding the fact that a valuable schipperke dog which belonged to the pursuer was then underneath it, and that his (the driver's) attention was duly called to the fact, he started the car, with the result that the dog was killed. The defender's witnesses stated that the car was in motion when the driver's attention was called to the fact of the dog being under the car, and that immediately he was informed of the fact he stopped his car as quickly as it was possible for him to do so.

Sheriff Lyell, in deciding the case in favour of the defenders, stated that it was unnecessary for him to deal with the evidence of either the witnesses for the pursuer or the witnesses for the defenders, as to whether the car driver stopped his car after his attention had been directed to the dog being under same, as the pursuer himself had so materially contributed towards the accident by permitting what he contended was a very valuable schipperke dog, to be at large and unattended in a public thoroughfare, where there was an obvious danger of its coming to grief, and he accordingly found for the defenders, with costs.

We should be glad to see the principle of contributory negligence more often applied to accident cases on this side of the border. For instance, if those who are in charge of children allow them to run at large in streets and other places where they are in constant danger, why should the owner of the vehicle which runs over the child be always held responsible?

ELECTRICITY IN THE WEAVING SHED.

In view of the extremely unconvincing report on electrical driving of textile factories which was recently issued by the Bradford Engineering Society, it is somewhat of a relief to turn to a careful investigation carried out in connection with a small German jute weaving shed, which possibly did not offer the best of opportunities for electrical driving to prove its worth.

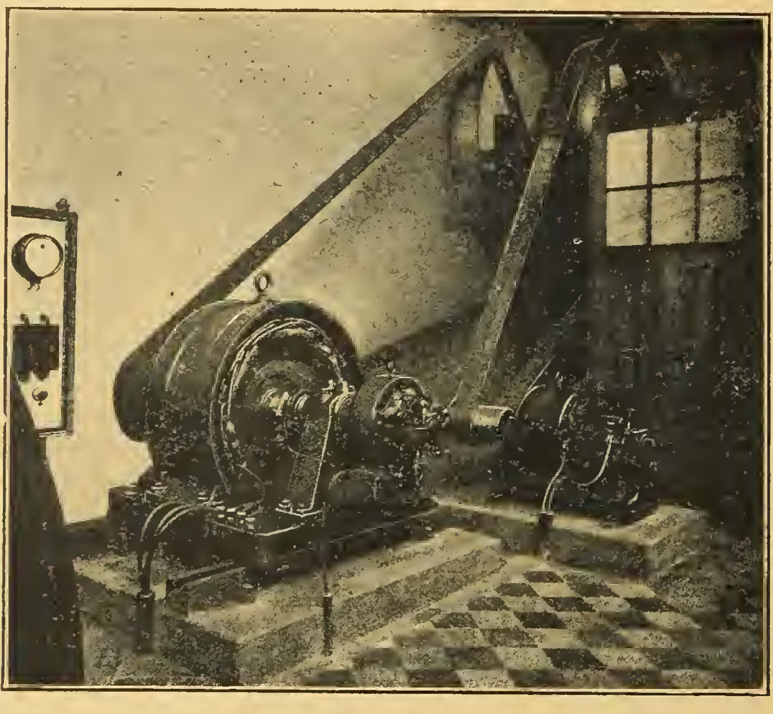


Fig. 1.—Siemens-Schuckert Generators Supplying Power to Weaving Shed.

The weaving shed in question is situated in the town of Vetschau, and the owners were confronted with the question whether they should choose mechanical driving direct from the engine or individual electrical drive, using the same engine for generating electricity.

With a view to arriving at a decision, tests were made of steam and coal consumption with the existing installation, which showed that the 30 looms in use averaged ·52 H.P. per loom, with reed widths of 36 in. to 72 in. and speeds of 130 to 112 picks per min. This power consumption was averaged from several indicator diagrams, giving 15·7 I.H.P. for the 30 looms, but as it was recognised that loom stoppages affected the figure, and that a single loom under normal running conditions required more than ·52 H.P., further tests with three motor-driven looms of different sizes were arranged by the Siemens-Schuckertwerke, which confirmed the experience in other jute mills that the power consumption could be reduced and the output increased, and incidentally led the firm to adopt the individual electrical drive without reference to a possible increase in power consumption.

It was found that the annual coal bill with the existing drive amounted to £28 7s., and the firm agreed that it would pay to install the individual electric drive even if the coal bill increased to £33 17s.

The actual plant installed consisted of an 85 KVA. three-phase alternator giving 230 volts pressure at 750 R.P.M., and a dynamo for lighting purposes giving 210 amperes at 110 volts and 1,280 R.P.M., both being belt-driven from one countershaft, as shown in fig. 1.

The loom drives, which are shown in figs. 2 and 3, necessitated the re-erection of those machines, and include reduction gears and slipping clutches.

The working of the clutch is as follows:—A brake disk B is keyed on the loomshaft A, fig. 2. The large spur wheel C, having the brake lever D fixed upon it, surrounds the disk B. By means of the lever D the brake-band E, which is laid round the brake-disk B, can be drawn as tightly as desired. The tension is obtained from the spring F, which can be regulated by the nut G.

The spring F is thus tightened until the power necessary to drive the loom smoothly is transmitted from the large spur wheel C to the brake disk B, and thus to the loomshaft A. If now an impulse is given in excess of the torque suitable for the normal running of the loom, the brake band E is enabled to slip slightly on the brake disk B.

Undue strain is thus avoided on the teeth of the large spur wheel C and of the pinion H on the motor spindle.

In addition to the occasional overloads mentioned, the slipping clutch comes into action every time the sudden stoppage of the loom takes place in ordinary working. The loom motors are totally enclosed as a protection against dust and mechanical injury.

The interest of the case, however, lies in the results obtained with the new drive, which was tested by several independent investigators on behalf of the firm.

In the first place it was found that the speed of the looms averaged 9·15 per cent. higher than with mechanical driving, and that due to the regular drive yarn breakages were no more frequent and the cloth had a more uniform appearance.

Under the new conditions the average power consumption works out as follows, the results being summarised:—

By the terms of the agreement the original power consumption (15·7 H.P.) could be increased in the ratio $\frac{\pounds 33\cdot17}{\pounds 28\cdot7}$, giving 18·8 H.P.

Allowing for increased speed (9·15 per cent.) this becomes 20·5 H.P.

Allowing for the "standstill" time, which was with steam drive 40 per cent., and under the new conditions 26·4 per cent., the consumption may be further increased to—

$$20\cdot5 \times \frac{(100 - 26\cdot4)}{100 - 40} = 25\cdot2 \text{ H.P.}$$

It had thus to be proved that the 30 looms with individual electric drive did not require more than 25·2 H.P. on the average, assuming a fully-loaded generator with an efficiency of 87 per cent. and an engine with an efficiency on full load of 85 per cent.

Tests were taken with the 30 looms running only, and nine steam diagrams showed an average of 42·7 I.H.P.

Deducting the friction load of the engine (16·6 H.P.),

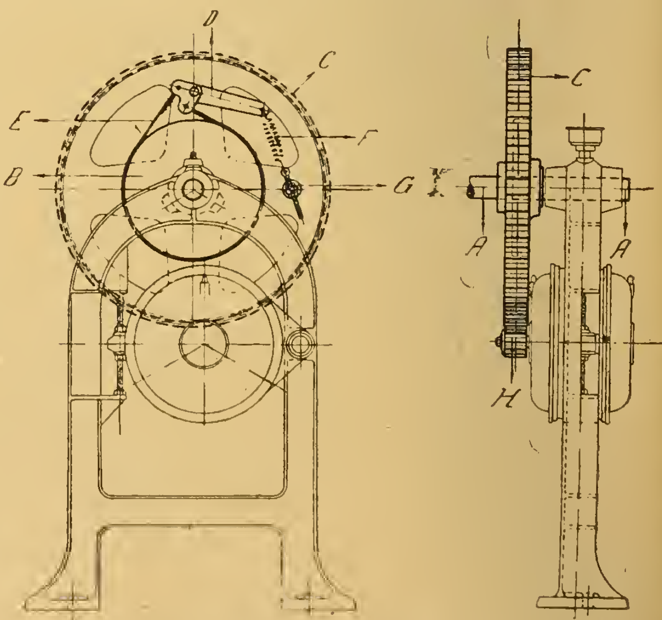


Fig. 2.—Electrical Loom Drive by the Siemens-Schuckertwerke.

and allowing an engine efficiency of 85 per cent., the power consumed amounted to—

$$(42\cdot7 - 16\cdot6) \times \frac{100}{85} = 30\cdot7 \text{ I.H.P.}$$

Making an allowance for the generator working at only 68 per cent. efficiency owing to the small load, the figure is again reduced to 24 H.P., or 4·6 per cent. less than the guaranteed figure.

The most important result, however, is that the same looms as were mechanically driven are now able to give an increased output of 15 to 20 per cent., and that with (as the result of further tests) a decreased coal consumption of 2 lb. of coal per loom per day.

As we have previously mentioned, this particular case—for the details of which we are indebted to Messrs. Siemens Bros. Dynamo Works, Ltd.—is not one which favours the individual electrical drive, but the results show that it is well worth recording.

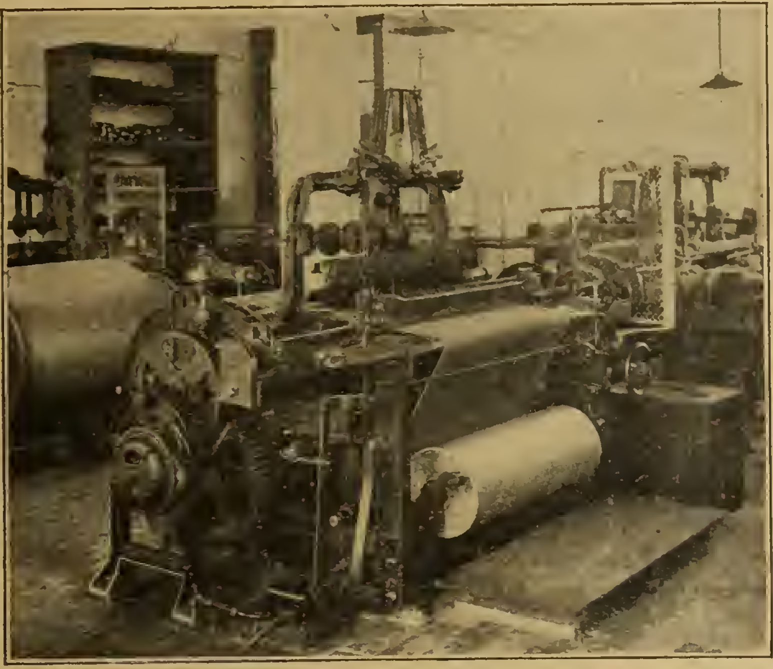


Fig. 3.—Electrically Driven Loom, Siemens-Schuckert System.

We only regret that the German investigators did not carry their tests a little further and provide us with some actual figures as to the net value of the increased output of the looms, and the terms under which the Siemens-Schuckertwerke carried out the installation, as it is an unfortunate fact that the British manufacturer is, generally speaking, unable to grasp the advantage of a change unless it be stated in value of yarn or cloth, and is, moreover, not so favourably placed, financially, as his German contemporary in regard to the carrying out of such a scheme as that referred to above.

IN REPLY TO "A. P. C."—A BROADER PHILOSOPHY.

> The strong shall wait for the weary, the hale shall halt for the weak. . . . . . . With hammer and chisel and pen, We will work . . . . . for ever and ever. Amen.—*Kipling.*

The arguments recently advanced in these columns under the heading, "The Fetish of the Steady Job" (November 19th, 1909, pages 838, 839), can hardly be allowed to pass unchallenged. Already, at least one correspondent has pointed out some of the inaccuracies of reasoning, but there are many still uncorrected. The article referred to cannot be called unbiased, or even reasonable. Its tone is bitter, so bitter, indeed, as to suggest a disappointed desire on the part of its author to secure one of the "steady jobs" which he so much decries. He accuses Government officials of ignorance concerning the conditions of commerce and trade: the accusation is, in the vast majority of cases, unfounded, such men having, and generally utilising, exceptional facilities for studying this subject. The author ventures to express an opinion that "A. P. C.'s" knowledge of Government officials, their work and merits is highly superficial. The philosophy he advances is shallow and none too wholesome. It is, however, one which is too frequently urged in extenuation by those who participate in a "wild and undignified rush" after their own advantage.

The sentiment of "Sufficient unto the day, &c.," is greatly and widely distorted and abused, while, on the other hand, that of Kipling's "Imperial Rescript" is equally contravened. It is difficult to discuss such a topic as the present one without encroaching on the borders of religion and sentiment, but the author thinks that the following remarks will be endorsed by most broad-minded persons, and such as are not too hopelessly prostrated by the gold fever.

"A. P. C." assumes that all men are, by nature, inherently "slackers" (a cynical and rather significant assumption). Without going so far as to inspect "the whole world's history," or to study "the rise and fall of nations," it may be safely asserted that the above conclusion is erroneous. A capable man of the type which "A. P. C." assumes would succeed so brilliantly if only subjected to insecurity of tenure, would rather rise to yet greater heights in consequence of the very knowledge that he worked towards a steady end. His employment would not change with the days and there would be real inducement to concentration.

Rich men, who have, from the present point of view, a maximum "security of tenure," frequently abuse the same and lead idle wasted lives, but it must be admitted that an increasing number follow a brilliant and useful career—and this is especially so in the scientific world. Security of prospects has again and again enabled progress which would have been impossible had £ s. d. alone been the end in view. Life is given to us that we may live, and on "A. P. C.'s" own showing, the steady-job man leads a steady, clean and useful life—one from which revolutionary methods and aims are no doubt excluded, but one which the author ventures to affirm is of more real merit and leads to greater national stability than the strenuous life which "A. P. C." advocates. There is a strenuous life which is meritorious, but it is not that which the condemnation of the "fetish" upholds.

The existence which "A. P. C." apparently regards as ideal is one of *purely selfish* motives, and therein lies the real core of the whole discussion. The perfect submersion of self is vaguely advocated, but is totally at variance with the general sentiment of the article. Moreover, the author fails to see how, self being eliminated, anyone could derive the least pleasure or use from life. The whole community is supposed then to be feverishly working each man for his advancement, yet self is presumed submerged, and the net result anticipated is a race of supermen—the argument is not convincing.

"That specialisation is valueless" is, surely, the grossest and most absolutely unjustifiable statement in the whole of the article or philosophy criticised. Again, America is stated to be the first country to appreciate the futility of specialisation, yet America is to-day the most striking example of ultra-specialisation which the world has yet seen.

Confining our attention to engineering ("A. P. C.'s" sweeping denunciation of "every trade and profession" having no subsequent support in his indictment), American engineering is brilliant, but can scarcely be termed reliable. Refer but to the appalling death roll of colliery and railway accidents, to the continual failure of engineering structures of every kind in the New World, and it will be seen that the fruits of strenuous insecurity may be bitter.

Insecurity in one part of a social scheme must result in insecurity in every other section thereof, particularly where the fundamental insecurity lies in the tenure of position on which depends the livelihood of the community. In America, insecurity of life, property and finance, and even of integrity and honour is only too well known.

The author has heard it repeatedly asserted by travellers and residents in America that the average American, with all his hustle, fuss and commotion, does not "get any forrarder" than his more phlegmatic fellows across the seas. Time devoted to the direction of energy expenditure, to a true course for the end in view, is not wasted.

Possibly quite a number of persons will hear with surprise that France is a decadent country—among them is the author. Personally, from a considerable study of the motor and aeronautic industries and from a tolerable acquaintance with recent developments in science, he was under the impression that France was far from losing her high position among nations. The only decadence which France has really to lament is that of her birth rate. This is truly alarming, and would hardly be remedied by the adoption of the principle that "marriage and settling-down are but minor considerations."

The choice of Germany as an example of the benefits of uncertainty of prospects is not at all convincing, seeing that German stolidity, constancy of purpose, and tremendous specialisation and attention to detail, are leading national characteristics.

"Greatness" in the financial world can, of course, hardly come to one in a Government or municipal position, but abstinence from the reckless and ruthless gambling, which unfortunately characterises so many millionaires, is hardly regrettable. It has been wisely said that no man can honestly acquire many millions of pounds in a life-time, and seldom even one million. The success of that one man is purchased with the happiness, honour and, too often, the lives of his rivals or victims.

Turning, however, from commerce to science, it cannot be denied that the sense of security, engendered by the knowledge that one can always obtain a livelihood for himself and those dependent upon him, is far more conducive to earnest endeavour and uninterrupted progress with scientific matters than would be the so-called "strenuous" life. A "great" man is not likely to be repressed by holding a Government position or other "steady job." Surely the knowledge that he has a steady competence on which to rely will embolden him to pursue original lines of study, research and working which he would hardly dare to follow under other circumstances.

"The whole world's history goes to prove that the man with the steady job has never done anything to aid progress, &c.," is again a grave misstatement, though it is difficult to repress a smile at the confident naivete of the wording. Many of our greatest men living at all periods of our history and following many different "trades and professions" have held State or other "steady jobs." The world's great men have ever been characterised by the zeal with which they pursued their avocation for its own sake and their disregard of their own fame and prosperity.

In the Government position, so far as concerns the work directly connected therewith, the individuality of a man is no doubt largely obliterated, but conscientious fulfilment of duty and thoroughness in detail are encouraged. To say, however, that a Government official has no personal responsibility is ridiculous. Every such official—excepting those in the lowest positions, held by men who would otherwise be door porters or hold other posts of similar insecurity of tenure but doubtful national importance—is under a heavy personal bond. He is fully responsible for any error on his part whether in the collection of duties, the sale of stamps or licences, in accountancy or in more abstract inspection duties. Moreover, these bonds are rigorously enforced.

As to whether a rapidly varying occupation is really more interesting than the thorough study of one or a few branches of knowledge there can, of course, be two opinions, but an expert in any subject—and it *is* the experts who nowadays count—will affirm that the more advanced his studies the more interesting have they become to him. The author is still of the opinion that a subject which is made an able man's life work is likely to yield better results than would a medley of matters under the same conductor. On the other hand, an incapable is more likely to approach useful efficiency and reliability by adhering to one avocation than by repeatedly changing his employment. Such men must come into the world, and we are scarcely justified in urging their extermination. As to whether a man has a "right of existence," it is not for a fellow mortal to determine. The licence of life is granted equally to us all: to discuss whether such equality is justified approaches dangerously to arrogance.

Our lives are surely given to us for some better end than mere money-grubbing and killing off our less efficient neighbours. There is a certain genus of beings who prate of the benefits accruing to mankind from the strenuous life as advocated by them. In reality these beings, wittingly or unwittingly, care for nothing but their own advancement: their morals are hopelessly warped by the spell of greed, and to engender a nation of such creatures would be hardly less disastrous than reversion to Anarchy and Socialism.

Safety, reliability and thoroughness are essential in engineering, in individuals and in nations. Transient effects, however brilliant, can have no permanent value, and the long thin trail on the record of time, however faint, will be longer seen, respected and remembered than the misplaced cavities caused by the explosive, ill-directed energy of the modern strenuous man.

Pampered luxury will lead to the downfall of any nation, as surely as it precipitated the Empire of Rome, but the philosophy which sets every man against his neighbour in a mortal fight for that from which, when attained, all pleasure in possession has flown, is no less disastrous in its results.

Such philosophy is shallow and false: it is selfish in its aims and narrow in its conceptions of humanity. Even in the twentieth century we must leave a small space for sentiment, and must allow that the universe was created for another motive than that every man should waste and shorten his life in a feverish attempt to "best" his fellows.

Lest any should condemn these notes as idealistic—they are surely far more materialistic and representative of the bulk of human nature than a doctrine which has as its goal the "abolition of mediocrity," the creation of "a race of supermen," and the "trampling" and "starving out of existence" of inefficients and all those below the average superman standard—hardly a pretty side of human nature and ambitions.

Hard work, and plenty of it, is an excellent, an essential thing, but it is not enough alone: it is neither necessary nor desirable to live simply and solely to work.

The author is not a Socialist—Socialism spells invidious ruin—he does not believe that the abler man should not rise above his fellows; but, on the other hand, he does not believe in the venomous, extremist principles advanced by "A. P. C." In this he trusts and believes the majority of his readers to be with him.—R.E.N.

THE ELECTRIC LIGHTING ACT, 1909.—A LEGAL VIEW OF ITS EFFECT.

This measure, which is now upon the statute book, comes into force on April 1st, 1910. It makes very important changes in the law relating to the supply of electricity.

It is not possible, in the space of a short article, to deal fully with all the various changes which are made by this Act. It is necessary, however, for the benefit of supply companies and consumers who will be affected, to make brief reference to its more salient features. Sec. 1 makes an important change in the law as to the acquirement of land for the purposes of a generating station. Hitherto it has not been competent for an electric lighting company to acquire land otherwise than by an agreement. Now, however, the Board of Trade may, by a provisional order, authorise any undertakers who are already working under statutory powers, to acquire land for a generating station *either within or without their area of supply.* The price payable is to be fixed in accordance with the Lands Clauses Acts, pursuant to which, of course, 10 per cent. must be paid by way of compensation for compulsory purchase.

The only thing to be said about this clause is that it comes rather late in the day. It would be interesting to know how many supply authorities there now are in the country who are likely to avail themselves of the power here conferred.

The beneficial effect of Sec. 1 is largely taken away by Sec. 2, which provides that no undertakers may erect a generating station on land acquired after March 31st, 1909, unless with the consent of the Board of Trade given by provisional order. Such consent can only be given after notice to owners and lessees of land in the neighbourhood. The section does not apply to transforming stations.

Difficulties have arisen in the past owing to the fact that undertakers have not always been able to break up roads, railways and tramways outside the supply area for the purpose of laying mains. In future, however (by order of Sec. 3), the Board of Trade may authorise undertakers to do this, subject, in the case of roads, to the consent of the highway authority affected. If such consent is unreasonably withheld, the Board may dispense with it.

Supply in bulk has never until now formed the subject of legislation in a public Act. Again, even in the private Acts authorising bulk supply, no authority has been conferred to supply outside the area. Sec. 4 of the measure before us provides that the Board of Trade may authorise supply in bulk by provisional order, unless they think the scheme so large as to merit a private Act. The Board may permit undertakers to supply electricity in bulk to any other undertakers upon such terms and subject to such conditions as may be specified *if the supply can be given without breaking up any streets except such as the undertakers giving or the undertakers receiving the supply are authorised to break up.* "Persons affected" by the order may appear and object thereto.

To "supply electricity in bulk" means to supply it (*a*) to any local authority, company or person authorised to distribute electricity to be used for the purposes of distribution; or (*b*) to any local authority authorised by any general or special Act to undertake or contract for the lighting of streets, bridges or public places, to be used for the purposes of lighting streets, &c.

With regard to supply outside the area, the fact that no supply can at present be furnished outside the area has long been a source of trouble and annoyance. Even where premises are on a boundary line, the owners cannot legally get all their supply from one source. By Sec. 5 of the new Act, provision is made for supply to railways, canals and tramways partly outside the area of supply. Such a supply may be furnished (with the consent of the Board of Trade) for the purpose of haulage or traction. Such consent must not be given until persons affected have been given an opportunity of appearing and stating their objections. A provisional order must, however, be obtained for the supply of electricity to any such railway for purposes incidental to the working or lighting of the railway, &c.

Sec. 6 makes provision for supply to other classes of consumers outside the area. If the Board are satisfied that a consumer outside a supply area wants a supply, and the local authority *and* the undertakers consent, the Board may order a supply to be given upon such terms as they think fit. If consent is unreasonably withheld, the Board may proceed as if it had been given.

With regard to compulsory purchase, useful provision is made, by Sec. 7, to meet the difficulties which must arise in the case of the undertaking of a company which is within the district of more than one local authority. Thus a local authority may, with the consent of the company, and subject to conditions approved by the Board of Trade, transfer their right of purchase to any other local authority. In the case of an undertaking authorised after the commencement of the Act, the consent of the company will not be necessary.

As to joint exercise of powers by two local authorities, Sec. 8 provides that the Board of Trade may, with the consent of the Local Government Board, authorise two or more local authorities to exercise the powers conferred on them by the Electric Lighting Acts or any provisional order.

With regard to revision of prices (Sec. 9 provides that) the period in future is to be five years instead of seven years.

The transfer of powers by undertakers is also put under control. Thus (by Sec. 14) undertakers may not divest themselves of the powers, rights or obligations conferred upon them by the Electric Lighting Acts or a provisional order otherwise than under, and in accordance with, a provision contained in a licence, order or special Act.

One of the most important provisions is that relating to supply to premises having a separate supply. A person having such a supply must (by virtue of Sec. 15) agree with the undertakers to pay them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises. The sum to be paid is to be determined, in default of agreement, by arbitration.

Another provision affecting consumers is contained in Sec. 17, which provides that 24 hours' notice must be given to undertakers before quitting any premises supplied with electrical energy by the undertakers. In default of such notice, the consumer renders himself liable to pay the amount registered by the meter at the next reading. Again, if payment is in arrear in respect of one set of premises, the undertakers may refuse a supply to other premises of the same consumer (Sec. 18).

To overcome a difficulty which was brought out in a recent case in the courts, agreements for the supply of electricity are in future to be exempt from stamp duty (Sec. 19).

Amongst the remaining provisions contained in the body of the Act, by far the most important is that which relates to private supply companies. It introduces the monopoly principle. We have often pointed out in these columns that, under existing law, statutory undertakers have no monopoly in their district. Anyone may supply electricity to his neighbour if he is so minded. Sec. 23 of the Act, however, provides that "it shall not be lawful for any other local authority, company, or person *to commence* to supply or distribute electricity within the same area (*i.e.*, the area of the undertakers) unless such supply or distribution is authorised by Act of Parliament or provisional order." The section, however, does not "prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers." It is further provided that the section shall not prevent any company who at the passing of the Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic.

This section must inevitably be fraught with important consequences to many persons who are supplying electricity all over the country. Times and again we have in these columns pointed out that such a business is legal; and when this Act comes into force there will be many companies and firms in existence who are deriving a decent revenue from this source. The words "to commence," however, which are underlined, seem to show that the section will not apply to companies and persons whose business is *in existence* at that date. Anyone who is about to give or receive a supply should take care to complete his arrangements before April 1st, 1910.

A nice question will arise as to what will be the result of a breach of this enactment. No penalty is specified. Other offences against the Electric Lighting Acts are the subject of penalties or may be the cause of revocation of a provisional order. Presumably the local authority or other undertaker affected could apply for and obtain an injunction.

The provisions of the schedule to the Electric Lighting Clauses Act which relate to meters and their certification are modified in certain material respects. Meters must not only be certified but must be fixed and connected with the service lines in some manner approved by the Board of Trade. A meter will not be considered duly certified unless it is accurate within such limits of error as may be allowed by the Board of Trade. An electrical inspector is at present only bound to examine the meter itself. In future he may be required to examine the connections. At present a meter must not be disconnected by a consumer without notice to the supply authority. In future the supply authority must give notice to the consumer before disconnecting the meter.

We hope to deal much more fully with this Act before it comes into operation.

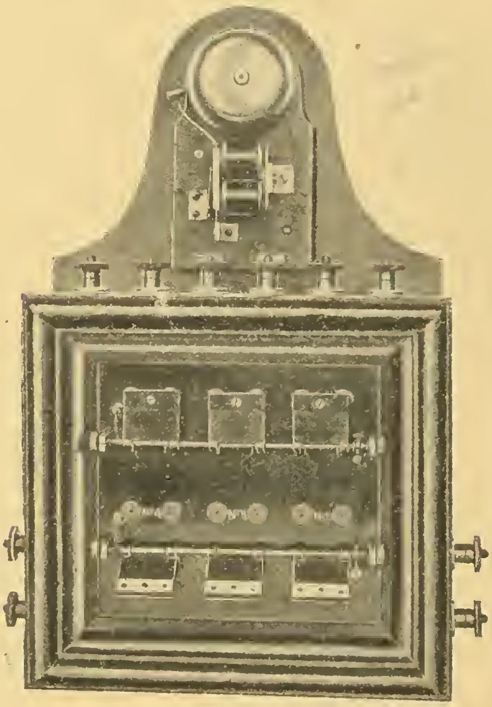
CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The First Telephone Switchboard.

With reference to the correspondence upon the subject of the first telephone switchboard, I beg to bring to your notice one which I believe to be the first, it being prior to either of those mentioned in the correspondence.

A telephone exchange on a small scale was established at 6, Lombard Street, E.C., in September, 1878. The firms connected were :—The Equitable Insurance Co., of New York, in Princes Street ; Arthur Anderson, stockbroker, 30, Throgmorton Street ; Azienda ; an American firm in Lombard Street ; Renshaw & Renshaw, of 2, Suffolk Lane ; the London Banking Association. Enclosed is a photo of the shutter indicator and bell used upon this system ; upon the fall of a shutter the horizontal rods completed the bell circuit. A common battery was used, and the interruption of the line circuit caused the bell to ring.



F. Higgins.

London, E.C., *December 13th*, 1909.

Protection of Tramway Trolley Standards.

Referring to the letters that have appeared in your columns with respect to the earthing of trolley standards, it appears to be commonly held—amongst rolling stock superintendents, at any rate—that the insertion of a lamp or other resistance to check the current in the event of the standard becoming "alive," is a preventive against electric shock.

The writer is prompted to call attention to this dangerous delusion by a recent experience. Happening to remark casually to a car superintendent that the idea above referred to was a delusion, he was considerably surprised to hear it strongly maintained. The supporting argument is worth recounting, if only to show how dangerous it may be.

On the writer mentioning that the presence of a lamp between trolley standard and earth gave no protection to the passengers, he was met with the statement that "when the lamp lighted up it discharged the trolley standard, so that a shock could not be obtained from it."

Of course, it did not take long to dispel that fallacy, but it is the subsequent query on the part of the superintendent that indicates the real danger ; he said, "Then why do the Board of Trade sanction lamps with audible signals ?"

Of course, I was reduced to silence, because I do not know why the Board of Trade do so, considering that their function is to safeguard the public in every way.

Perhaps you, Sir, can explain why they allow the travelling public to run such unnecessary risks.

Nemo.

[There is only one efficient safeguard that we know of ; and that is to earth the trolley standard with a substantial cable. Why this is not made compulsory we cannot say—it would be easy enough to put an indicator in circuit with the earthing cable, to show which car had earthed the system.—EDS. E R.]

In connection with the discussion going on in your columns at present on the above subject, I would like to draw your attention to a simple method of protection for trolley standards.

A few years ago when trolley retrievers were much discussed, I sketched ont an arrangement of trolley catcher which would act as a live trolley indicator.

The method was to provide a spring winch on which the slack trolley rope could be wound. The spring would be normally locked by means of a magnet connected between the overhead line and earth. On the trolley leaving the wire, the magnet would release the spring, permitting the winch to haul down the trolley clear of the overhead work.

If the earth connection of this magnet be made to the trolley standard, then on the standard becoming live, the magnet is shunted by the fault and the spring winch is released, hauling down the trolley. The arrangement would thus constitute a very efficient protection and a very definite indicator.

If it were necessary to get the car home without clearing the earth, means might be provided whereby the spring drum could be mechanically locked ; the same movement putting in action any warning devices that might be thought desirable.

Robert Chalmers Black.

Glasgow, *December 6th*, 1909.

Cost of Living in the Federated Malay States.

I do not agree that the statement mentioned in the Editors' reply in the ELECTRICAL REVIEW for October 15th "cuts both ways," because invariably when a man is engaged at home he is taken on at a sterling salary, hence if he has the idea that the dollar is worth only about 2s. he gets a nasty shock, shortly after his arrival, when he learns that instead of receiving, say, $200 per month, he receives actually only $171.40. I can assure anyone intending to come out to the Straits that the difference of $28.60 per month would prove a very considerable amount.

Having met so many young fellows who, soon after their arrival here, have for the first time discovered exactly what their sterling salaries will represent in dollars, I do not think that the point is laboured at all.

It is true that I took exception to the one point only, but I thought that this would make it clear that the writer of the article must have left the Straits some few years ago, and it is generally well known that in a comparatively young and rising colony such as this, great alterations (usually including smaller profits in business and increased cost of living) take place, and it seems to me to be always necessary to get this kind of information direct from one on the spot. Taking one or two items mentioned in the article, the cost at the present time in Singapore would be as follows, according to my own experience :—

Dhobi.—This costs usually $5 per month, although they can be obtained at $4, as against $1.50 mentioned in the article.

Cotton Suits.—It is necessary, on arrival, to purchase at least 15 suits, as the dhobi comes only once a week. He never comes regularly ; this is the usual number to start with : one per day and a spare one = eight, and seven more in the dhobi's hands.

The usual price for these is $45.00 per dozen.

'*Rikisha Hire.*—In Singapore a European generally uses a first-class (rubber-tired) 'rikisha, the hire for which is 10 cents per mile ; 6 cents, mentioned in the article, is the hire for a second-class 'rik (iron tired). I believe, however, that in many places in the Native States there are no first-class 'riks.

In the table given of cost of living, no mention is made of 'rik hire, which should be included, as the usual way of getting about is by 'rik, or by the more expensive gharry, of which there are first, second and third class, although, at the present moment, there are, I think, no first-class gharries in Singapore, these having all been labelled second class, and the original second class are now third class.

The very lowest amount spent monthly on 'rik hire is, say, $10.00, and it is generally much more, $20.00 being a safer amount to allow.

There are also other necessary expenses, such as clubs and the drinks thereat; in Singapore, a European must join one club, and he would probably be a member of at least two; most people are. These are the S.C.C. (the Singapore Cricket Club) and the Swimming Club. There are also others.

Precision.

Domestic Electrification.

As the manager of an electric supply company, the writer is deeply interested in cheaper house wiring consistent with good work that will not give trouble, so does not favour flexible wires on walls, but has used flexibles on ceilings—where they are out of reach—with advantage. This is usually done in bedrooms by placing the ceiling rose on the wall, close to the ceiling, and suspending the lamp from it in any position desired by an insulated hook fixed in the ceiling. A ceiling-switch alongside operated by two cords is also an advantage. A single fitting consisting of a combination of a ceiling-switch and ceiling rose would make a better, cheaper and neater job. Is there such a fitting on the market?

In the discussion on the recent papers at the I.E.E., Mr. Price (Cambridge) stated: " . . . The revenue with a house wired throughout was only about 3s. per lamp." Can you give the revenue for a three-pint electric kettle and a 4-lb. flat-iron used in an ordinary household?

We all know what the consumption of current is, but have only a remote idea of the number of units such apparatus will enable us to sell, year in and year out. I admit that the units are liable to vary between wide limits, but what is required is statistics of a large number of such apparatus. Such are now available where separate meters are used for heating and cooking.

When we receive inquiries for electric light we can easily estimate within 10 per cent. the revenue such light will yield. With small undertakings in poor towns it is absolutely necessary to know this.

On the other hand, as to the number of units that one can safely calculate on selling for each electric kettle, flat-iron, &c., only very vague ideas prevail or are obtainable.

A. B. C.

Auto-Transformer Design.

May I revise the title of the above work slightly, and commend it to your notice as "A Practical Handbook for Manufacturers, Contractors, Wiremen *and Reviewers*?" Your reviewer may be pardoned if the subject is a new one to him, but what he does not know about the practical and manufacturing side of auto-transformers would fill a considerably larger volume than the above-mentioned, and surely it is a pity to waste nearly a whole page of the Electrical Review in making this so obvious!

The criticisms are nearly all too puerile to call for any serious reply, and I must decline to be "drawn" to the extent of a verbal sparring match, such as the recent example in these same columns.

Two years' experience in the design and manufacture of auto-transformers under the severest competitive conditions, and a fairly intimate acquaintance with other designs and designers' work, are likely to carry more weight than the hair-splitting and incomplete phrase-extracting your reviewer indulges in.

The proof of the pudding is in the eating; may a better digestion await him in the coming festive season than was evidently present when he penned his critique.

To save misunderstanding, let me say also that I have no intention of continuing this correspondence, and your reviewer is very welcome to the last word on the matter.

A. H. Avery.

Tunbridge Wells,
December 11th, 1909.

The Fetish of the Steady Job: A Rejoinder.

The article under the above heading, which appeared in the Electrical Review of November 19th, has aroused considerable criticism, which though not particularly favourable, is very gratifying, since it is proof that some thought has been given to a subject which had not previously exercised the minds of the contributors to the discussion. The practically unanimous condemnation of some of the principles expressed in the original article will give food for thought to those who have found the remarkable truths underlying all of Ibsen's writings, and will recall to mind his most famous dictum that the minority is always right.

The letter of "A.C. Circuit" is so childish in its construction and so petty in its argument, that readers might safely be left to form their own conclusions; but for its own benefit and for that of any who may be equally misguided, it will be as well to point out some of the more striking and elementary of the fallacies expressed.

The remark that there must be equality of opportunity before the best of us can rise, implies that "A.C. Circuit" has never heard of men making their own opportunity, whereas it is absolutely undeniable that nearly all who are successful have done so, and that men who are so handicapped that it is nearly impossible for them to make their mark in the world, scarcely exist. In any case, making the opportunity is part of, and the first step towards, success, and is in fact the beginning of the rise and cannot be dissociated from it.

"A. C. Circuit" attempts to disprove the statement that men work for their own benefit, by reference to the great inventors, and writers, apparently oblivious of the fact that he is descending from the rule to the exception, and is simply proving the argument that he wishes to defeat. Does he not see that those who work solely for the benefit of mankind (and they are very few, and certainly do not comprise all the great inventors, many of them work for fame) have already reached the state of supermanhood, which is just what it is desired that all men should attain?

The two paragraphs concerning the Americans are self-contradictory and scarcely need comment. We read that United States is "a country gifted with natural resources," and the majority of its inhabitants seem to be "semi-engineer-travellers who . . . end by getting themselves and their firms into a mess." Such a combination does not often produce greatness, and it will scarcely be admitted that natural resources are of much use without the aid of capable men to develop them.

"A. C. Circuit's" knowledge of the world and people seem to be peculiar and unfortunate, and one can only be amused at his interpolation of "men with hair-brained schemes dashing about . . ." which has obviously no reference to the matter. It would be thought that only hare-brained men do anything so foolish, but "A. C. Circuit" apparently has the idea that this is the method of the successful man.

In the course of an inspiring peroration we are told that "men with a preponderance of brain power . . . shriek and scramble . . . in their efforts to pile up profit for someone else." This is somewhat original; in the experience of most people, clever men do not shriek and scramble, nor do they usually work for the gain of others.

The keynote of the whole letter is given by the trite remark that the world is "for the use and enjoyment of all its inhabitants," which, though very generally accepted, is about as degenerate a philosophy as it is possible to imagine, and those with no higher conception of the objects of life are much to be pitied; but fortunately there is always time to learn even when one "is middle-aged . . . and has the privilege of forming and moulding the minds of his children."

It is rather unfortunate, that Mr. Prentice has introduced the personal element, which should be entirely lacking if one wishes to arrive at any useful conclusions, and it need scarcely be said that the writer had not the least intention of advocating a system to suit his particular case. Mr. Prentice is clearly under a misapprehension in implying that the writer desired to bring "all men up to the same standard," and it certainly was not stated that there should be "one hard and fast rule for all alike." The argument was that, as Mr. Prentice himself admits, there is good in most people, but that good is not put to its utmost use by the possessors of the steady job, simply because it would not benefit them to do so. The fact of causing all men to exert themselves to their fullest capacity, by making it impossible to live otherwise, would not bring them all up to one standard, but would bring each man up to *his* highest standard, which admittedly does not occur without incentive. On no grounds whatsoever could this be deemed anything but an improvement on the present lax state of existence. The example mentioned of the "wonderful mathematician . . . of a nervous temperament" can hardly be considered as destructive criticism of the main point at issue, and it is highly probable that the only effect of a more strenuous life upon such a man, would be to render his ideals more practical, and thus enhance his actual value to the world at large—in other words, he would benefit the many at the expense of the few. Mr. Prentice has also quite failed to realise that nervousness like slackness would soon die a natural death.

The point raised regarding selfishness makes it apparent that no differentiation has been made between worthy and worthless selfishness. The latter, which is one of the predominant features of modern life, and particularly that portion of it represented by the holders of the permanent positions, consists in living entirely for self, and adding nothing to the advancement of the world—usually, in fact, detracting from it. In the former, as was clearly pointed out in the original article, the aim may be personal, but the result is universal advancement, and surely the selfish man who moves the world, is on an infinitely higher plane than the unselfish one who is a cause of retrogression, by retarding the efforts of others.

The short letter of "J. P. F." is full of mistakes. His "object in life" is, to say the least of it, feeble and one-sided; his idea of the steady job is contrary to that of most people. No inventors are specialists, and versatile men are not "jacks-of-all-trades."

There is an underlying fallacy in the whole of the "philosophy of the ordinary man" of "John Smith" which is somewhat similar to that of the previous contributors. Of course, it is the ordinary man who counts, if the holding back of those who are naturally supermen can be called "counting," which was obviously not the interpretation intended. To say that the writer desired to set up a social system, suited only to the talented and not to the commonplace, is very misleading, since it is just the ordinary men who would be raised in the struggle for existence, and all their latent talents now fettered by the security of the steady job would be forced out automatically.

The concluding paragraph indicates that "John Smith" has not grasped the real meaning of the article. The difference in the calibre of men will always exist, and the classes will remain much as hitherto, but in each class, whether it comprise those who build houses or those with the highest mental endowments, there will be more rapid advancement when the necessity of advance is forced upon it. This will have the further effect, which must not be lost sight of, that the advance will not only be material but to a probably even larger extent spiritual, since the putting forth of all one's energies will lead to a contempt for the minor phases of life and an altogether higher aim, which is the ultimate result to be attained.

The very involved logic from which it is deduced that those who are trampled on, cause injury to the higher men, is inapplicable to the matter, since it is no more the fault of the men who have risen, that the degenerates are forced out of existence, than it is the fault of a horse who knocks down a man standing deliberately in front. Just as the one has the muscular power to move, so has the other the vital power to exist.

The thoughtful criticism of "S" offers no reflection on the cardinal points. The main contention is that a race of supermen is impossible, and this need not be denied since it does not affect the question. It must be remembered that "race" does not mean "generation," and that when all are supermen in the highest sense of the word, the race ceases, which, of course, fully explains Nordau's rather elementary statement. This being so, it is evident that the very extraordinary state of affairs of supermen fighting with superhuman energy for the super-permanent jobs need not be seriously considered—except perhaps in a future novel of H. G. Wells, who no doubt could do full justice to such a stirring episode. The point missed by "S" is that men will not become supermen at the same time.

There is certainly a very wide field for the mediocre men, and that is precisely why they should be roused to a sense of their possibilities; but in order that they may have any success they must cease to be mediocre in the present-day meaning of the term, and one can hardly talk about "wide fields" in connection with a man who spends the greater part of his life in the same daily vocation and whose ultimate worth to humanity is insignificant. The cases cited, of engineers without education who have added to the perfection of machinery, are but instances of embryo supermen, and it will be found that these little improvements have been carried out by the fighting men and not by those who have no incentive to move onwards.

The statement that in permanent jobs there are better systems of routine, in most instances implies that the number of men employed is greater than necessary, and it is undeniable that quite a large proportion of those in such positions are unproductive; that is, the actual value of the work they do is less than the amount they are paid.

The principle of the detrimental influence of the steady jobs is entirely corroborated by the remark that they are frequently held by "men who were supermen when they were young;" in other words, the effect of the steady job is to convert a possible superman into a degenerate.

The argument that supermen are devoting their energies to retaining the lives of lunatics and the physically unfit, has no bearing on the case, since it is not the object of the work of these supermen, but the result of a deficient social system over which they have no control.

A. P. C.

The "Contract Demand" System.

With reference to your comment on my letter *re* the "Contract Demand" system in the current number of the Review, let me hasten to assure you that the conditions here are not quite so Utopian as you might otherwise imagine. The price I quoted is our maximum tariff figure, and it does not follow that we always get this! Then, again, we give considerable reductions on a sliding scale, so that for large consumers the price works out at 9d. per 30-watt lamp per month for all-night burning.

These prices include the Government tax of ½d. per B.T.U. Steam coal costs us nearly 40s. per ton, while the income-tax is actually 2s. 4d. in the £ (nominally it is 4s. 2d. !).

On the other hand, thanks to an overhead system and the total absence of any Board of Trade Regulations, our services cost us on an average about 8s.

With regard to the vexed question of metallic-filament lamps (which, owing to the courtesy of the makers, we had in use here before they were on the market), I consider their advent an unmitigated blessing, it having raised the standard of illumination to such an extent that the diminution in consumption has been negligible, although, in addition to the "*à forfait*" system, we are supplying 800 consumers on the flat-rate system, for which our price varies per B.T.U. according to conditions. We have not, however, introduced the 25-volt system, as we consider that it tends to reduce the standard of illumination.

We undertake free wiring on the "*à forfait*" system, or by meter if with an annual minimum guarantee.

I have read with much interest your abstract of Messrs. Handcock & Dykes's paper; but on one point I must disagree with the authors, viz., the feasibility of a dusk-to-dawn supply. We started here by supplying from dusk to 2 a.m., but this we soon had to extend to dawn, and after about three years, found ourselves obliged to give a continuous supply. There are dark corridors and basements to be considered, even in the sunny south! A common practice out here is to run a separate line, which can be switched off during the day, and this, with an overhead system, is quite simple.

In our agreements for the contract system, we fix a minimum fine in case of fraud, as it is otherwise difficult to prove more than nominal damages, and it is not, as a rule, wise to sue for theft under the penal code.

It may, perhaps, interest Mr. Wilkinson to know that our smallest limiter has a minimum capacity of 0·07 ampere, and will cut out with an increase of 0·03 ampere. I hope soon to forward a description of the instrument.

W. A. Brodie.

San Remo, *December 6th*, 1909.

The Socialistic Bogey.

By the tone of your leader in the current issue, one is led to believe that the "Socialistic Bogey" has at last filtered through to the Editorial sanctuary. You ask, Whither will it lead us?" Why, where the people will. What effect will it have upon trade and industry? Stimulation, by increasing the purchasing power of the people through a more scientific distribution of wealth, which is created by the combined efforts of Capital and Labour.

Is it "catching on"? You should have seen Snowden addressing crowded meetings of workmen at Tunstall on Sunday, and you would have received an eye-opener. What can we do to prevent its advance? Nothing! May as well take a broom and try to stem the rising tide; and this state of things has been produced by the brutal unorganised competitive system, which is wearing us out by a slow process of attrition; as I write, there, laying before me, is the inevitable:—Dear Sir, Owing to improved methods we are now offering 10-H.P. motors at £25. The improved methods, no doubt, means a few more hands displaced, and the ranks of the unemployed with a few more recruits.

There are no "Wicked Rich"; what is proposed is to tax the ultra rich up to to 20s. in the £ on all incomes above £5,000, if necessary, for there cannot be ultra rich unless there are abject poor. The "flitting" of "capital" from our shores is really too good to answer; but that the masters have been taught to combine is the best example of Socialism I know. They economise, co-operate, and once or twice a year reckon up and "divide the profits."

Stoke-on-Trent.

Electric Driving of Textile Factories.

Your issue of the 10th inst. contains a letter from the Council of the Bradford Engineering Society, the extraordinary contents of which require immediate correction. The words "full inquiry" and "very carefully considering" which appear respectively in this letter and in the document described as "the Report of Special Committee" on "Electric Driving of Textile Factories," seem to the gentlemen responsible for these publications to have a different meaning from that ordinarily connected therewith. We can only reiterate that this document has been published without our knowledge or approval, and does not represent the views of the Committee. The actual facts regarding its origin are as follows:—

The substance of the clauses on pages 5, 6 and 7 was, with certain reservations, adopted by the Committee merely as a basis for a discussion at a future meeting of the society. The matter on pages 3 and 4 (to parts of which we take strong exception) was issued after the last meeting of the Committee, and there is no justification or authority for including this as part of the Committee's report.

The Council now state that a meeting took place subsequently, in which this report was finally adopted. This statement is exceedingly surprising, as the undersigned members of the Committee cannot trace having received any notice of such a meeting. In fact, we have since learned from the secretary that the last meeting of the Committee took place on July 30th, whereas the typewritten copy as reproduced on pages 3 to 7 of the printed report was not issued until the 31st, and was not previously seen by the Committee. This disposes of the Council's statements and of their claim to have since made a full inquiry.

Whilst waiting for the meeting of the Society, we found ourselves suddenly confronted with the broadcast Press publication of the "Report" which had not, and would not, have received our signatures. In addition, it is headed by an "Introduction" of an entirely biased character, which has never even been submitted to the Committee. We, therefore, reluctantly adopted the only course open to us—*i.e.*, to dissociate ourselves publicly from this document.

The letter from the Council of the Bradford Engineering Society concludes with personal remarks and the insinuation of trade advertisement, the taste of which is quite in keeping with the methods adopted in the publication of the "Report." In this connection it is significant that the meeting of the Council which decided on the issue of this letter consisted of eight mechanical engineers, and that the only electrical engineer on the Council did not receive any notice of the meeting.

H. Ellis,
H. A. Jones,
R. Pohl,
T. Roles,
C. W. Salt,
W. B. Woodhouse.

Bradford, *December 10th*, 1909.

LEGAL.

Welsbach Case Settled.—Summonses Withdrawn.

At the Clerkenwell Police Court on Saturday, after a protracted hearing and several adjournments, the summonses against the Welsbach Incandescent Gas Light Co., of Gray's Inn Road, W.C., charging them, under the Merchandise Marks Act, with applying a false trade description to their electric lamps, were withdrawn by arrangement. The proceedings were initiated by the Wolfram (Tungsten) Filaments, Ltd., and the General Electric Co., and the prosecution arose out of an advertisement issued by the defendants. It was alleged that this advertisement and the use of the words "Welsbach" and "Aur" on the electric lamps sold by the defendants, were calculated to lead people to believe that they were invented or manufactured by Baron Welsbach or the Auer Co., of Berlin.

Mr. Rufus Isaacs, K.C., Mr. Colefax and Mr. Lunge appeared to prosecute. The defendants were represented by Mr. A. Walter, K.C., and Mr. Bodkin.

Mr. Rufus Isaacs said he had had an opportunity of discussing the matter with Mr. Walter, and he proposed to take a course which he hoped would meet with his worship's approval, and which he hoped he would think was proper in the circumstances, having regard to the investigation that had already taken place. They had realised that it must necessarily be, and had already been a long, protracted and expensive inquiry, and that between firms such as he represented, and the firm represented by Mr. Walter, there ought to be some means of arriving at a settlement of a dispute of that character, so that they might avoid the necessity of continuing the proceedings. He was glad to say they had been able to arrive at a point at which it became useless to continue the investigation there, or to ask for any judgment from his worship. His friend, Mr. Walter, would state that Dr. Auer von Welsbach was not the inventor of the electric lamps sold by the Welsbach Co., and that the electric lamps advertised by the company were not the lamps manufactured by the German Co.—the Auer Co. He accepted without reserve the statement that Mr. Walter had made to him to the effect that the defendant company had no intention of misleading any persons by the advertisement which they issued, and that they did not intend to lead the readers of that advertisement to believe either that Dr. Auer von Welsbach was the inventor of the lamp, or that it was manufactured by the Auer Co. His friend had also stated that the defendant company would not issue the advertisement in that form again, nor would they issue any advertisement containing words calculated to lead persons to believe that Dr. Auer von Welsbach was the inventor, or the Auer Co. the manufacturer, of the electric lamps that the Welsbach Co. was selling. Accepting those statements, it appeared to him that the proceedings might end by the withdrawal of the summonses.

Mr. Walter said he agreed with the remarks Mr. Rufus Isaacs had made, and he desired, on behalf of the Welsbach Co., to state that they had not the smallest intention, in issuing that advertisement, to lead persons to believe that the lamp was the invention of Dr. Welsbach, or that it was manufactured by the Auer Co. They certainly did not intend to repeat that advertisement, or anything that would lead the public to believe that. Of course, they would continue to mark their goods with the name "Welsbach," and their trade-mark "Aur" would be continued on their lamps.

Mr. Bros, the magistrate, said he thought the parties were very wise. These inquiries must naturally be very expensive. Scientific witnesses and professional men had to be brought there at great expense, and then it was merely a preliminary inquiry to another which would have been as expensive, and perhaps more so. The time had not been wasted, if it had had the result of the parties coming to an agreement in open court. He had great satisfaction in knowing the case was now going to be withdrawn.

Mr. Rufus Isaacs: All the summonses will be withdrawn, and also the summonses that were pending against Mr. Fletcher. I accept his statement as to his having no intention to mislead.

The summonses were accordingly withdrawn.

Electrical Apparatus in Fife Mines.

Sheriff Shennan issued his decision at Dunfermline on Friday last, in the prosecution at the instance of the Home Office against officials of the Fife Coal Co., in connection with the electrical apparatus in certain pits owned by the company. The case was followed with keen interest by colliery proprietors and officials throughout the country. Two days were occupied in hearing evidence. His Lordship dismissed the complaint against C. A. Carlow, and found H. Rowan and W. E. Richardson not guilty.

The charge, it may be recalled, was to the effect that Charles Augustus Carlow and Henry Rowan, "agents" or "managers," for the Fife Coal Co., and William Edwards Richardson, colliery manager, Foulford, had permitted to be used at the Foulford colliery electrical apparatus and plant which were defective, despite a letter addressed to the company on January 30th by Mr. Robert McLaren, H.M. Inspector of Mines, directing that the electrical plant or apparatus installed prior to the special electrical rules coming into force on April 4th, 1905, should be made to conform to all the sections and rules applicable to the installation.

In the course of a lengthy judgment, Sheriff Shennan said that it appeared, and he thought the prosecution were not aware of this fact when they charged Mr. C. A. Carlow, that on July 13th, 1900, the Fife Coal Co. duly informed H M. Inspector of Mines that Mr. Henry Rowan had been appointed mines agent for the whole of their collieries in the Cowdenbeath and Kelty districts, including Foulford Pit. The appointment was explicitly given to Mr. Rowan, and therefore there was no room for the suggestion that Mr. C. A. Carlow occupied by implication the position of agent with respect to the Foulford Pit. It was fair to say that the system of division of responsibility, as described, seemed fair enough. For so large a company it was in the interests of efficiency that the supervision of the practical mining work should be committed to skilled agents such as Mr. Rowan was universally known to be. While the commercial side was attended to by the manager, he found nothing to show that Mr. Carlow's appointment as manager implicitly revoked Mr. Rowan's appointment as agent. Accordingly the case against Mr. C. A. Carlow must be dismissed.

Through a misconception as to the scope of Rule 55 of the Special Electricity Rules, His Majesty's Inspector issued no directions before the present year regarding the installation in Foulford Pit. But, following on a decision in that Court as to the effect of this rule, His Majesty's Inspector issued notices in general terms to 37 owners on January 30th, 1909. He assumed for the moment that this notice was effective as against the owners, the Fife Coal Co., but neither the notice nor a copy of it was sent to Mr. Rowan as agent, or Mr. Richardson as manager, and neither of these gentlemen was, in fact, aware of it. How, then, could Mr. Rowan or Mr. Richardson know that it was part of their duty to see that these special electricity rules must be obeyed? It appeared to him that the case for the prosecution must break down at the outset. It might have been the owner's duty to apprise the "agent" or "manager" regarding the application of the rules to the Foulford Pit, but they could not punish these officials for the owner's neglect. If, as he had already suggested, His Majesty's inspector had communicated direct with the agent, this difficulty would never have arisen. Accordingly, he must find Mr. Rowan and Mr. Richardson not guilty, on the ground that the prosecution had failed to prove the existence of a duty which they were said to have neglected.

Reviewing the case further, the Sheriff said he had serious doubts whether H.M. Inspector's letter of January 30th, 1909, was a proper direction under Rule 55, Sec. 11 (1). The terms were too general. What meaning were the Fife Coal Co.'s officials to take from the words "installed at your colliery" when they had 41 shafts, some with electrical installations before 1905, some with new installations, and some without any electrical appliances? As to H.M. Inspector's letter of May 3rd, the Sheriff holds there was no presumption that the letter reached Mr. Richardson. The importance of the letter lay in this, that it naturally led to the prosecution owing to the belief that its terms were being ignored.

A circular to 37 owners, telling them to bring their installations into conformity with the rules "from this date" seemed an extraordinary direction in terms of Rule 55, and one of doubtful validity. He made the observations in fairness to the company, and this was not a case where there was any evidence of attempts to thwart H.M. Inspector. Several of the matters complained of were just such things as would have been attended to out of deference to the opinion of H.M. Inspector.

Dealing with the alleged various defects, the Sheriff held that the charge, in view of the evidence as to the switches and fuses, was not relevant. It was matter for observation that no opportunity was given the company to remedy any defects, since the switches were never complained of till the case was brought. If the authorities regarded the question of switches and fuses as urgent, they must frame special rules, fixing the type that was to be permitted, or at least the type that was forbidden. In regard to the fixed terminal boxes, he thought it would be hard to convict a manager of negligence who innocently misinterpreted a rule on the point. He agreed with the interpretation of the respondents that a fixed terminal box was a box containing fixed terminals, and not a fixed box containing terminals. As regarded the cables, he could not hold the charge of negligence established. At the same time, he had no doubt that Mr. Nelson, the Home Office electrical expert, was right in impressing on agents and owners the urgent necessity of paying strict attention to the condition of cables. In the course of the proof there was an illustration of the ignorance of men unskilled in electricity, as to the possible risk from defects in the cables. There should be no reason for slipshod work in the electrical installation, and care should be taken to have everything kept in the best possible condition in order to protect the unskilled. Electrical experts knew how to protect themselves, but others would never realise the dangers that were involved.

Hall *v.* Marconi's Wireless Telegraph Co., Ltd.

On Tuesday the Master of the Rolls and Lords Justices Fletcher Moulton and Farwell heard an appeal by the plaintiff in this action from a judgment of Mr. Justice Ridley, dismissing his action brought to recover damages for alleged breach of agreement on the part of the company to use their best endeavours to procure a quotation on the London Stock Exchange of 10,000 £1 shares in the company that had been allotted to him.

The appellant appeared in person, and the defendants were represented by Mr. Montague Lush, K.C., and Mr. Wallace.

The plaintiff, Henry Cuthbert Hall, formerly a managing director of the company, claimed that he could have realised the shares at 12s. 3d. per share but for delay on the part of the company, whereas he only succeeded in obtaining an average price of 7s. 1d., and he claimed in respect of the difference.

Without calling upon counsel for the respondents, their Lordships dismissed the appeal with costs.

Phosphor Bronze Co., Ltd.

The petition by E. Austin & Son and Others, for the compulsory winding-up of the Phosphor Bronze Co., was again before Mr. Justice Swinfen Eady on Tuesday last.

Mr. Gore-Browne, K.C., in support of the petition, stated that it was presented by a number of creditors whose aggregate claims amounted to between £3,000 and £4,000.

Mr. Grover, for the company, asked for a further adjournment. Negotiations, he said, had been going on between his clients and the petitioners, with a view to a reconstruction.

His Lordship pointed out that there had already been a month's adjournment, and asked whether there was any evidence as to what had been done in the meantime.

Mr. Grover said there was not, but Mr. Gore-Browne's clients were aware of the steps that were being taken.

Mr. Gore-Browne said he had no objection to a further adjournment so long as the petition was disposed of this sittings.

His Lordship said that that was the last company day that sittings.

Mr. Gore-Browne said then he must press for an order. He had no objection whatever to a reconstruction, but thought that perhaps a compulsory order would be the best means of bringing that about.

His Lordship accordingly made the usual order.

The Electrical Co, Ltd, *v.* Messrs. Oliver H. Thomas, Son & Co., Ltd.

This action was continued before the learned Official Referee, Mr. Pollock, in the High Court of Justice on Monday, December 13th.

The Electrical Co., Ltd., of Charing Cross Road, London, are suing Messrs. Oliver H. Thomas, Son & Co., Ltd., of Neath, Wales, colliery proprietors, for the sum of £2,976 in respect of an electrical pumping plant which plaintiffs supplied to the Llyner Valley Colliery, belonging to the defendants at Llangonoid.

Plaintiffs allege that the contract was made between the parties by letters dated November 17th and 20th, 1905, and the contract price was to be paid as to 60 per cent. on delivery, 30 per cent. on starting the pumping work and 10 per cent. three months later. No payment had been made.

Defendants, on the other hand, denied that the contract was contained in the letters referred to. They admitted plaintiffs' claim to the amount of £1,035, and also £51 1s. 4d. for goods sold and delivered. Further, however, they declared that the plant plaintiffs supplied became defective and wholly inefficient for the work required of it at the colliery. They ordered the machinery from plaintiffs with a view of its replacing the existing steam pumping system, for unwatering the mine and enabling them to develop and work the colliery. Defendants ordered the electrical plant from plaintiffs, relying on the latter's skill and judgment to supply suitable machinery, but this they had failed to do. Furthermore, defendants contended that the machinery was not delivered within a reasonable period, and respecting these things they had suffered great loss and damage by reason of the flooding of the mine. They counterclaimed the sum of £31,200 10s. 1d.

Plaintiffs repudiated the claim, declaring that any loss defendants had suffered was due to the bad conditions under which the plant had to work, and the unskilled labour used by them to work it.

Mr. Abel Thomas, K.C., with Mr. Sankey, K.C., and Mr. Bowen Evans were counsel for the plaintiffs (instructed by Messrs. Michael Abrahams, Son & Co., of Tokenhouse Yard), and Mr. Williams, K.C., with Mr. Meager, appeared for the defence (instructed by Messrs. Collins & Wood, of Swansea).

Mr. Sankey, K.C., in opening the case for the plaintiffs, dealt with a mass of correspondence with a view to showing that much of the delay complained of was due to defendants failing to have the site ready when plaintiffs desired to come and fix the machinery. When the plant was handed over to the defendants breakdowns occurred. On such occasions defendants would simply wait until plaintiffs sent a man to inquire into the matter. It was then invariably found that the stoppage was caused by defendants' neglect to oil and clean the machinery. Plaintiffs wrote to the defendant company complaining of the negligence of the men employed to look after the plant and repudiating the suggestion that the machinery was unsuitable. On June 17th, of 1907, the pumping machinery failed, and the mine became flooded, due, the plaintiffs alleged, to defendants' improper handling of the plant, and the bad conditions under which it was working. A fresh agreement was then made whereby plaintiffs' were to unwater the mine, and defendants to supply unskilled labour and certain materials. When plaintiffs proceeded to overhaul the machinery they found it in a very neglected condition, and the trouble, which continued after the new agreement had been entered into, was due to the unsatisfactory nature of the material defendants supplied and the labour they employed. In November a third agreement was made, defendants declaring that matters were in a serious state. Nothing satisfactory resulted, and the present action was commenced.

Hearing adjourned.

F. Suter & Co., *v.* Drake & Gorham, Ltd.

In the Divisional Court, King's Bench Division, on Thursday, December 9th, this action was before Mr. Justice Darling and Mr. Justice Phillimore. The matter came before their Lordships on plaintiffs' appeal from a decision of his Honour, Judge Woodfall, in the Westminster County Court, when the question at issue was the liability of a company for goods received after the intervention of debenture-holders, to have that liability set off against a previous debt.

Mr. Jolly, who appeared for the appellants, said his clients were a company under the Joint Stock Companies' Act, and some time ago issued debentures in the usual form. Before these debentures, became due and enforcible, the company, which was carrying on business in the ordinary way, incurred a debt for something like £100 to the defendants. In March the debentures became due, and a receiver was appointed to carry on the business. Counsel contended that the Conveyancing Act of 1831, for certain purposes made the Receiver the agent of the company in such a manner as to exclude him from all liability attaching to the persons who appointed him. The Receiver was entitled to use the name of the company for the purpose of enforcing claims, but after his appointment, although the business was carried on in the name of the company, it was being carried on by the Receiver solely for the benefit of the debenture-holders. The action was brought for the price of the goods supplied after the intervention of the debenture-holders, and the question was whether as against that debt the defendants could set off a debt which became due from the company long before the debenture-holders' action.

Without calling on counsel for the respondent (Mr. Hogg), the Court held that the Receiver for the debenture-holders was not entitled to credit all the receipts to them, but only enough to extinguish their debt, and that the defendants were entitled to set off a debt due to them against the Receiver.

The appeal was accordingly dismissed with costs.

Hufton *v.* Leeds Corporation.

On Monday Mr. Justice Bucknill had before him at the Leeds Assizes an action in which Harold Hufton, formerly head boots at the Albion Hotel, sought to recover damages from the Leeds Corporation for personal injuries received. Mr. J. A. Compston was for the plaintiff, and Mr. E. Tindal Atkinson, K.C., and Mr. J. A. Greene for the defendant Corporation.

Mr. Compston said the plaintiff's position was a rather remunerative one, for whereas his wages were only 10s. per week and board, his earnings with tips amounted to between £3 and £3 10s. per week. Late on the night of Saturday, March 6th, he got on a tramcar in Boar Lane to travel home to Wortley. As he got on the conductor was inside collecting fares, and he called out to him that he could not go upstairs because it was full. Plaintiff replied that there was nobody sitting in front, and the conductor rang the bell. A drunken man was standing on the top of the steps, and when the car started in consequence of the conductor ringing the bell, the man fell down the steps on to Hufton, who was ascending, but had only reached the third step. Had the conductor not stopped Hufton by saying there was not room on the top, he would, said counsel, have got safely past the drunken man before the car started. Hufton was thrown back on to the platform, his head and neck being jammed against a rail, and he was very seriously hurt. He had to remain in bed for about two months, and during his illness he was so violent at times that he had to be held down by four or five persons. In June, when able to resume work, he found that his employer had filled his position, and it was not till July 5th that he found he would get employment at Huddersfield. As a result, said Mr. Compston, the plaintiff had lost 14 weeks' wages, which, reckoned at £3 10s. a week, amounted to £49, and in addition serious expense had been incurred for medical advice, nursing, &c.

For the defence, it was suggested that the plaintiff should have got off the car when told it was full, and that the accident was not due to negligence on the part of the Corporation's servants. A point in the case was as to whether the man who fell down the steps was drunk.

Mr. Justice Bucknill had a word of sympathy for the lot of the tram conductor. On wet nights, when there was a rush for the shelter of the cars, he was a man to be pitied.

The jury found for the plaintiff for £100, and judgment was given accordingly.

Gould *v.* Lehwess.

Last week the case of Gould *v.* Lehwess was opened before the Court of Appeal, composed of Lords Justices Vaughan Williams, Buckley and Kennedy, upon the defendant's appeal from a decision of Mr. Justice Phillimore in the King's Bench Division.

Mr. Gore-Browne, K.C., and Mr. R. J. Willis appeared for the appellant, and Mr. J. R. Atkin, K.C., and Mr. D. C. Bartley for the respondent upon the appeal (the plaintiff).

Mr. Gore-Browne, in opening the case for the appellant, said it was an appeal by the defendant from a judgment for the plaintiff for £2,528. The judgment was in respect of an agreement dated April 28th, 1908, whereby the defendant promised to secure that the Electrobus Co., Ltd., or some other company, would purchase some electrical storage batteries, the property of the plaintiff, and if the Electrobus Co. or some other company did not pay for them the defendant would, subject to the batteries passing a satisfactory test. The story was a very complicated one. The plaintiff, Commodore Charles Gould, was an American, and was President of an American company called the Gould Storage Battery Co. Defendant was Dr. Lehwess, a doctor of science, a German, who had been naturalised in this country for a good many years. Defendant was the principal proprietor of another company which supplied the vehicles to the Electrobus Co. In November, 1906, defendant went to America on the authority of the company to negotiate a contract for getting any battery that might be better than those they were then using, and in that way defendant got into communication with the plaintiff. It appeared from the statement of the learned counsel that on November 1st, 1906, the defendant and the plaintiff agreed to form a company in England to be called the Gould Storage Battery Co., and plaintiff's case was that the company should have a cash capital of £25,000, the plaintiff to have 55 per cent. of the shares fully paid up. That company was registered on November 20th, 1906, with a nominal capital of £26,000. On November 30th, 1906, the plaintiff sent the defendant a cable as follows:—"Do I understand £25,000 in cash has been paid in?" to which the defendant replied on the same day, "All shares issued cash, about 4,000 reserved." Plaintiff alleged that defendant meant to convey that the company was possessed of £21,000 as cash capital. Plaintiff alleged that in consequence of this representation he delivered to the company 15 sets of batteries and accessories, whereas the fact was that the company had not any cash capital, as none of its shares were issued for cash. Plaintiff accordingly claimed that as the company had not paid for the batteries, &c., the defendant by virtue of an agreement made on April 28th, 1908, was liable to pay for them.

In reply to Lord Justice Vaughan Williams, Mr. Atkins said the plaintiff's case was that in consequence of the misrepresentations of the defendant, he had parted with the batteries to the Gould Storage Battery Co., and had, therefore, lost the value of them. Plaintiff's other cause of action was against the defendant on the contract of April 28th, 1908, and upon that the plaintiff was entitled to damages. Plaintiff further said that the defendant had himself prevented the tests of the batteries being carried out within the specified time.

At the conclusion of the arguments on Wednesday last week their Lordships gave judgment.

Lord Justice Vaughan Williams said the Court was of opinion that there ought to be a new trial. It was not usual when a new trial was ordered for the Court to go into matters that had been discussed before them on appeal, because if they went into them it was almost impossible to avoid making observations which might be calculated to prejudice the new trial. He would state broadly why he believed a new trial should be ordered. He was clearly of opinion himself that the damages should have been assessed otherwise than they had been. Apart from any measure of damages applicable in the case, he thought that there was not sufficient ground for leaving out of consideration certain portions of the evidence that had been given. Further than that he hesitated to make any observations as to the conclusions he had come to upon a great many matters which ought to have been dealt with on the best evidence. The best evidence was not given. He would direct a new trial upon the usual terms that the costs would abide the result.

Lord Justice Buckley agreed. He said he was extremely sorry that there should be a new trial, and he came to that conclusion with great reluctance, but he was not satisfied that the damages had been properly ascertained.

Lord Justice Kennedy concurred.

The judgment in the Court below was accordingly set aside, and a new trial was ordered, the costs to abide the result.

An application for a stay with regard to costs in the event of an appeal to the House of Lords was refused.

SOME POINTS IN RELATION TO ARC LAMPS.

[COMMUNICATED.]

The arc lamp, although it was one of the earliest forms of electric lighting, has throughout the years of the electrical industry been subjected to an almost endless succession of changes, and it may be partly due to the fact that this change has been going on, and also to the variation in the systems of supply, that even at the present day there are points about the use of arc lamps on central station supply systems which have yet to be overcome. If this were not so, the task of the superintendent of the arc lamp department would be rendered a very nominal one, so from the point of view of the maintenance engineer it is, perhaps, as well that there are one or two difficulties still left.

One of the systems upon which public arc lamps are supplied is the series circuit, with provision for compensating the voltage should one or more of the arc lamps in series fail to operate properly. One of these systems which was very much to the front a few years ago, and is still in use, is the rectified current system, by means of which a series of arc lamps are supplied direct from an alternating-current station, with a constant current, fluctuating but unidirectional, and, therefore, as the periodicity is usually pretty high, suitable for use with a continuous-current lamp. When everything is working properly this system is a very simple one, but it has troubles which now and again render the life of the engineer not altogether devoid of excitement. For example, one case occurred where direct-current street arc lamps were run in groups of lamps in series on a high voltage, and the alternating current was rectified at the generating station in the usual way. Unfortunately, however, a trimmer in cleaning one of the arc lamps managed to leave out a wire from one of the lamp resistances. In this way the circuit was broken in spite of the fact that automatic short-circuit devices were attached to each lamp. The result of this slight omission was that when the rectifiers were switched in at night the open circuit on one group of lamps managed to find a weak place in the insulation of one of the coils, and proceeded to burn it out, with consequent disaster to that group of lamps.

Another defect which a series system of street lighting has is that although the voltage available on the terminals of any lamp will not exceed 50 volts, it is quite possible to get a pressure to earth on certain parts of the circuit exceeding this value many times over, and it is therefore evident that the insulation of the whole circuit must be of a first-class nature. Moreover, it is highly necessary from the point of view of public safety to see that any iron work in connection with the lamps is thoroughly well earthed, as otherwise a passer-by might get a violent shock. This is not an altogether visionary idea, as in one such instance, where an earth occurred on a lamp-post which was fairly near the high-tension end of a series supply, quite perceptible shocks were obtained from the arc lamp column by a person standing upon the pavement. It would appear almost impossible for the potential difference between the lamp-post fixed in the ground and the pavement itself to be great enough to administer a shock, but this actually was the case, and the advisability of connecting arc-lamp columns on such systems to efficient earth plates in damp ground was amply demonstrated.

A very usual system of supply both for street and private arc-lamp lighting at the present day is either by means of direct current on a series of lamps at 200 or 400 volts, or by means of small transformers fed from the high-tension mains, the low-tension side of which is connected to each individual lamp or to a small group of lamps. In a good many cases small individual transformers are used, and where these are adopted they are often turned out rather cheaply, so perhaps one ought not to grumble at their little imperfections. It is, however, possible in a good many cases to obtain slight shocks from the corners of these transformers, and upon investigation it is sometimes found that the wires leading from the coils to the terminals are insulated, or supposed to be insulated, by stringing black glass beads upon the bare flexible conductor. In many cases these beads touch the cover or some other portion of the transformer. A little reflection will show that if any damp happens to be about, the formation of the surface of the beads and the fact that a short path to the potential-charged conductor is offered through the crevices left between adjacent beads, tends to collect the moisture and to put the conductor into almost direct connection with the earthed portions of the transformer. In spite of the fact that short circuits and shocks can easily be obtained from this cause, the method of insulation has so much to recommend it on the score of cheapness that it is very far from being abolished, although, in the interests of a supply system, it is hardly to be recommended.

A feature which is bringing considerable anxiety to the engineer in charge of an arc-lamp system, is the heavy strain which is being put upon the earning capacity of arc lamps as current-consuming devices. This factor is a very important one in connection with the revenue production of an electricity supply system, and it may be urged that some of the offers which are being made to private consumers for the purpose of inducing them to adopt arc lamps, say, for shop-window lighting, are verging upon the farthest limit of safety with regard to profit and loss. Let us try to investigate a typical instance, which is not by any means an exaggeration of terms which are being offered publicly to consumers in supply areas. Suppose that an electricity supply authority in running an arc lamp rental system offers a flame arc lamp with, in the case of an alternating-current distribution, the necessary transformer, together with carbons, maintenance, repairs and energy for a maximum of, say, 800 hours' burning per annum, at a price varying between £8 and £9 per year. It will occur to many readers that this is a low figure, but it is believed that similar, if not exactly the same, rates could be found upon inquiry among the supply authorities operating at present. It must be remembered that the arc lamps are put upon the mains at precisely the same time that the ordinary peak load is present—that is to say, between the hours of 5 and 11 in the winter, and about 8 and 11 in the summer. It is, therefore, proper to rate the value of the energy at the ordinary lighting tariff, and a figure which may be fixed for the purpose is of the order of 3½d. per unit. As such flame arc lamps suitable for burning outside shop windows take about 3 amperes, the energy alone for 800 hours at this rate totals a charge of about £7, and it is to be supposed that most of the consumers who adopt this system will run their lamps at about the maximum number of hours. On the top of this is the fact that the lamp itself, if it is of any good make, will cost something like £6; while a transformer, if this has to be supplied, will work out at about £2 to £2 10s. It can hardly be assumed that the life of such rental lamps and transformers can be more than three years, so that there is a pretty heavy interest on capital and depreciation to pay out of the balance. Moreover, in the winter, the time of a man sufficient to call every morning to re-carbon the lamps and to effect any necessary running repairs has to be taken into account, while in the summer it is probable that the man will have to call about three times a week. It does not appear that on such terms arc-lamp rentals are a paying proposition, and it is, therefore, a matter of surprise that so many supply authorities appear to be considering similar propositions. The way in which this affects the arc lamp maintenance engineer is that he is inevitably called upon, in view of the fine limits on which the supply is being run, to cut down the costs of his work to the very finest limit; it will readily be seen that this is unjust, and a very onerous task is placed upon the practical man who is called upon to eliminate by close attention to duty any trouble the financial effect of which has not been allowed for in an original estimate of cost.

Italy.—La Société Electro-Métallurgique Piémontaise is the title of a new company which has just been formed in Brussels, with a capital of £100,000, to acquire the rights in the Froment process for the electro-metallurgical recovery of gold from auriferous ores, and to take over the demonstrating plant at Domodossola, Italy.

THE RIGHT TO CUT OFF THE SUPPLY.

[BY A LEGAL CONTRIBUTOR.]

One of the most important privileges conferred upon the "undertakers" who supply electricity to the public is that which enables them to discontinue the supply, in a case where the consumer refuses to pay rent or otherwise misconducts himself. This right may be exercised in a variety of circumstances. Thus it is provided by Sec. 21 of the Electric Lighting Act, 1882, that if any local authority, company, or person neglect to pay any charge for electricity, or any other sum due from them to the undertakers in respect of the supply of electricity to such local authority, &c., the undertakers may cut off such supply, and for that purpose may cut or disconnect any electric line or other work through which electricity may be supplied, and may, until such charge or other sum, together with any expenses incurred by the undertakers in cutting off such supply of electricity as aforesaid, is fully paid, but no longer, discontinue the supply of electricity to such local authority, &c.

The period when the meter rent is to become due and payable is usually settled by the contract between the parties. Thus the undertakers may require payment of their accounts quarterly, monthly or weekly.

The Electric Lighting (Clauses) Act, 1899, also makes provision for the cutting-off of supply in certain events. By Clause 27 (3) of the schedule to that Act, which is incorporated with nearly every provisional order, the undertakers may, after they have been giving a supply of energy in respect of any premises, by notice in writing, require the owner or occupier of those premises, within seven days after the serving of the notice, to give to them security for the payment of all moneys which may become due to them in respect of the supply, in case the owner or occupier has not already given that security, or in case any security given has become invalid or insufficient; and in case any such owner or occupier fails to comply with the terms of the notice, the undertakers may, if they think fit, discontinue to supply energy for the premises, so long as the failure continues.

There is one other event in which the undertakers may cut off the supply, and to state the circumstances is to state the justice of the case.

Clause 27 (4) of the schedule to the Electric Lighting (Clauses) Act provides that if the owner or occupier of any premises uses any form of lamp or burner, or uses any energy supplied to him by undertakers for any purposes, or deals with it in any manner, so as to interfere unduly or improperly with the efficient supply of energy to any other body or person by the undertakers, the undertakers may, if they think fit, discontinue to supply energy to those premises so long as the lamp or burner is so used, or the energy is so used or dealt with; the Act also provides that the undertakers are not to be compelled to give a supply of energy to any premises unless they are reasonably satisfied that the lines, fittings and apparatus therein are in good order and condition, and not calculated to affect injuriously the use of energy by the undertakers or by other persons.

Any expenses incurred in cutting off the supply of electricity may be recovered summarily as a civil debt; and, of course, it is competent for the undertakers, instead of bringing pressure to bear upon a defaulting consumer by cutting off, or by threatening to cut off, his supply, to recover the amount due by summary process in a police court.

The right to cut off, and the threat to exercise this right, are, however, most effective remedies in the hands of the company, and so long as the consumer is not arbitrarily treated, there is no hardship upon him. The proper way to test the matter is to consider what would happen if the company were bound to go on giving a supply whether their lawful charges were paid or no. In that case it might be incumbent upon the undertakers to continue a supply until every little claim which they might have against the consumer were tested and enforced in a court of law. Unless, however, they exercise the power judiciously, they lay themselves open to unfavourable comments from the Bench; for they must go to Court if they wish to enforce payment. In a case in 1903, which was heard by his Honour Judge Emden, it appeared that in the latter part of 1901 an installation of 14 16 C.P. lamps was put in a consumer's house. Of these six belonged to the supply company. The agreement stated that 2s. per quarter should be the rent of the meter if 20 8-C.P. lamps, or their equivalent, were used, to be increased to 3s. per quarter if over 20 8-C.P. lamps, or their equivalent, were used. It appeared that the consumer, after some time, and without the consent of, or notice to, the company, changed his installation to three 16-C.P. lamps and 12 8-C.P. lamps. Upon doing this he refused for six quarters to pay more than 2s. per quarter meter rent, and eventually, on May 19th, his supply was cut off. In giving judgment for the consumer when he was sued by the company, his Honour Judge Emden thought proper to make the following observations: "I cannot allow this case to pass without saying that it is impossible for a public Corporation to carry on business if they abuse their powers in this way. Here we have a responsible gentleman, an officer who has been in her late Majesty's army, who has always paid his way; not a word can be said against him, and on a trivial claim for 6s. he is put to the disgrace of having his light cut off. The Corporation has a monopoly; it is entrusted with great powers, but if it exercises them in such a way, it is unfitted to be entrusted with such powers." We confess that we do not altogether share the view expressed by his Honour; but, at the same time, the case may act as a warning to supply companies not to exercise their powers in an arbitrary manner.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Patent Flexible Cast-Iron Pole.

We recently mentioned that a new type of pole had been invented by **Mr. J. H. Skinner**, of Imperial Buildings, Gardiner Street, Durban; we are now enabled to illustrate the pole, which can be made of cast or wrought-iron, or steel. The figures sufficiently show the construction of the device; the number of sections employed depends upon the length required, each section being about 5 or 6 ft. long. Tests have been carried out before the Postmaster-General of Natal, the Corporation of Durban, and the Acting Chief Engineer of Johannesburg, and a trial order has been

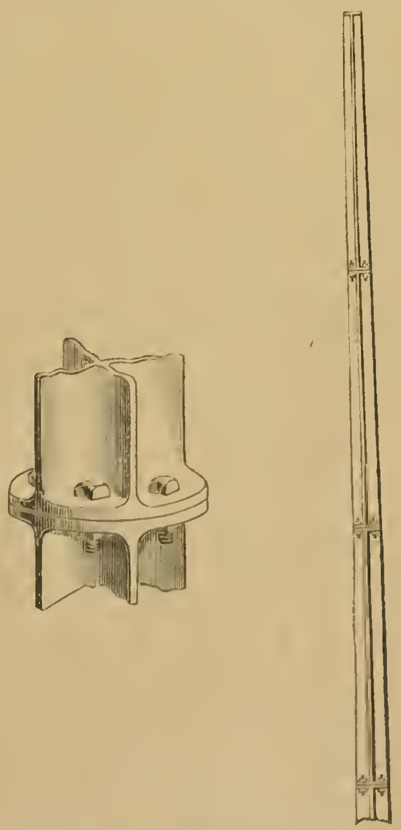


Fig. 1.—Detail and Elevation of Cast-Iron Pole.

placed with the inventor by the Government of Natal. It is claimed that the poles are cheaper than the tubular type, very flexible, portable, adaptable, and, when of cast-iron, exceedingly durable.

In the Durban tests, two poles were erected with four telephone wires between them, and the poles were guyed back until there was a stress of 320 lb. on each of them; in order to give the poles a violent jar, the guy wire was then cut, and the overhead wires pulled the poles about one foot out of the perpendicular. A single guy was then attached to a pole, and it was pulled over two feet out of the perpendicular, to which it returned when released. The pole was finally broken, in three places simultaneously, with a pull of 500 lb.—four times the normal. The length of the pole was 20 ft. (16½ ft. above ground), and the weight about 179 lb.

The Rotasphere.

The Kinetic Co., Ltd., of Kinetic Works, Lincoln, have devised a novel method of applying electric power to organ blowing. As illustrated, the electric motor is fitted with a hemisphere of polished aluminium, which drives by friction a bicycle wheel with an ordinary pneumatic tire. The latter affords an ideal member for a frictional drive, and we believe this is the first example of its use for this purpose. The motor is mounted on a swivelling carriage, revolving about an axis tangent to the tire, so that in every position the hemisphere is in contact with the latter, the gear ratio varying from zero in the position shown to a maximum when the motor is turned through a right angle, with perfectly smooth gradations; the carriage is rotated by a cord connected with the bellows, so that the speed is highest when the bellows is nearly empty. The motor is shunt-wound, and therefore runs at practically constant speed, while the speed of the wheel is reduced by means of sprocket wheels and chains, the last wheel actuating the bellows handle through a crank and connecting rod. The device, it will be seen, is extremely simple, and in running it is almost inaudible. There is but little wear on the tire, which therefore lasts a long time. The efficiency is very high, a ½-B.H.P. motor being capable of providing an ample supply of wind for an organ of ordinary size. Ball bearings are used throughout, and the parts are all standard cycle fittings. The floor space required is 45 × 16 in., and the height 33 in.

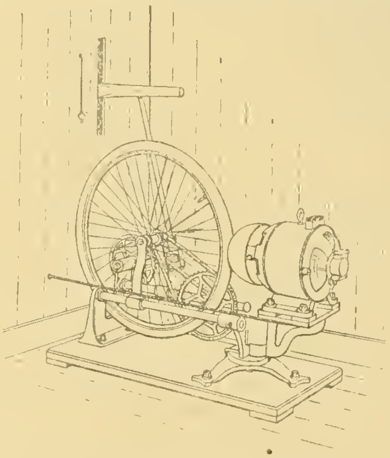


Fig. 2.—The Rotasphere for Organ-blowing.

New Tantalums.—Messrs. Siemens Bros. Dynamo Works, Ltd., are now putting on the market, and they hold stocks at their works at Tyssen Street, Dalston, an entirely new grade of tantalum lamps as follows, at a reduced price:—

50 volts to 120 volts	..	..	10 c.p.
140 volts to 160 volts	..	..	16 c.p.
20 volts to 60 volts	..	..	5 and 10 c.p. (a candle lamp).

They are also introducing a range of tantalum battery lamps.

BUSINESS NOTES.

Book Notices.—*Hazell's Annual*, 1910. Twenty-fifth year of issue.—Edited by Hammond Hall. London: Hazell, Watson & Viney, Ltd.—We need write little at this date regarding the serviceableness of this book. We have perused a number of the sections in which we take a more particular interest, and find them profitable reading as reminders of events that have happened, and tendencies that have been observed, during the past year, and if, as we believe they are, other sections are equally correct, then we shall frequently be helped in hunting up references to matters with which we may not be so directly familiar and upon which we may require light occasionally during 1910. The section on "Electricity Supply" is brief, but it will suffice to give the uninitiated reader a correct impression of what is proceeding in that department, and there are similar brief sections regarding telephones, wireless telegraphy and the cables of the world. In a section entitled "The March of Science," Sir Oliver Lodge discusses "Physics in the New Century." "The Evolution of the Flying Machine" is handled by none other than Sir Hiram Maxim, and a great deal of other and very interesting material regarding aerial navigation in 1909 appears, together with instructive illustrations. But these are only a fleabite of the matters covered in this "cyclopædic record of men and affairs" revised to November 30th. There is a very full index, and its whereabouts is plainly indicated by a blue edging. We congratulate the editor and publishers on another useful edition of this widely-used book.

The Annual Report of the Glasgow and West of Scotland Technical College for the past year contains views of the magnificent buildings of the college, the third section of which has been finished and occupied. The fourth section will be ready for occupation in September next year. An expenditure of £362,083 has been incurred, of which some £40,000 remains to be raised. During 1908-9 there were in attendance 487 day students and 4,623 evening students, as well as 714 pupils of Allan Glen's School. In electrical engineering there were 940 students—122 day and 818 evening. Prof. M. Maclean is the head of the department, with Mr. F. H. Downie, B.Sc., as chief assistant. A sandwich system is in force in the engineering department, whereunder the day students enter works from April to September. In a report to the Education Department Prof. Perry speaks in the most eulogistic terms of the equipment and *personnel* of the departments of mathematics, mechanics and engineering.

"Proceedings of the Physical Society of London." Vol. XXI, Part V; October, 1909. London: Taylor & Francis.

"Science Abstracts." Sections A and B, Vol. 12, Part 11; November 25th, 1909. London: E. & F. N. Spon. Price 1s. 6d. each part.

"Who's Who, 1910." London: A. & C. Black. Price 10s. net.

"Who's Who Year-book, 1910." London: A. & C. Black. Price 1s. net.

"Writers' and Artists' Year-book, 1910." London: A. & C. Black. Price 1s. net.

"Englishwoman's Year-book, 1910." London: A. & C. Black. Price 2s. 6d. net.

"The Shot-firer's Guide," by W. Maurice, President of the Institution of Mining Electrical Engineers, is being issued by the *Electrician* Printing and Publishing Co., Ltd., London, price 3s. 6d. net. As its title implies, it is a book of instruction for colliery officials regarding the use of explosives, and contains much information on the electrical methods and apparatus employed.

Russian Exhibition.—The Russian Exhibition in London is being vigorously pushed. Mr. Crisp, one of the founders of the Anglo-Russian Trust, according to a St. Petersburg paper, and Mr. Hartley, manager of the Earl's Court grounds, have arrived in St. Petersburg on business connected with the Exhibition in question. It is stated to be the intention of the organisers of the Russian Floating Exhibition, that is about to leave Odessa and visit the Near East ports with specimens of Russian goods, to take advantage of the Russian Exhibition in London next year, and at its close to make a round of the English ports as a continuance of the Exhibition.—*The Financier.*

Christmas Holidays.—Messrs. Bruce Peebles & Co., Ltd., announce that their works at East Pilton will be closed from December 24th to January 4th for the holidays. No goods will be received or despatched, and only urgent correspondence will be dealt with.

Catalogues and Calendars.—Dewhurst's Engineering Co., Ltd., Sheffield.—Three most acceptable wall calendars have been received from this firm. Those electrical men who receive any of these will find the subject extremely interesting—to say the least—and those who receive them all will for a while be in a dilemma as to which is the best to grace their office walls. Some, according to predisposition and temperament perhaps, may affect to favour "Lily of Killarney"; to others "The Old Breakwater" will more particularly appeal; but that fascinating picture of "A Village Scene in France," from a painting by Albert Wallet, makes one, as one contemplates it, feel that it is indeed good to be alive. We congratulate the company on their excellent selections.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster.—Catalogue No. 519, "Telephone Switchboards," describing types suitable for private telephone installations of all sizes, from four lines to 250, including private branch exchanges allowing a proportion of the stations to communicate with the local or trunk exchange. The larger sizes are suitable for small towns, and both magneto and battery calling systems are provided for, the latter including the common-battery system, which is generally used in installations for 100 users and upwards. Accessories and spare parts are also listed, and illustrations and prices are given. The catalogue is in the form of single sheets, held by fasteners, so that other sheets can be added as they are issued. Catalogue No. 517, Section II—"Kalkos" conduits. This is a companion to Section I, which dealt with "Metacase" conductors. A very wide range of fittings and accessories is illustrated, the system being very flexible and adaptable to a variety of requirements; special attention is drawn to the advantages gained by combining the Kalkos and Stannos systems, where the wiring has to be watertight throughout, and adapters are provided to facilitate the combination. Where concentric wiring is permissible, either system or both combined can be employed, the Kalkos tube having ample carrying capacity.

The Wardle Engineering Co., 196, Deansgate, Manchester.—New lists of "Streetlite" specialities for metal-filament lamps, including fittings for station platform lighting, shop window reflector lighting, watertight fittings, brackets and globes; also of the "Carlite" electric side and tail lamps.

Chicago Pneumatic Tool Co., Chicago.—Leaflet describing the Franklin high-speed air compressor.

Messrs. Southam & Wood, Ltd., 162, Oxford Street, W.—Pamphlet illustrating the "Zephyr" self-contained electric fountains and cascades for decorative and advertising purposes. They are supplied in marble, bronze, silver, terra cotta or stone.

The Electrical and Engineering Supplies Co., Ltd., 36 and 37, Upper Thames Street, E.C.—Two recently issued price leaflets showing their electric flashing signs for shop windows, counters, &c., also their decorative outfits for interior decorations (Christmas tree and shop-window) with miniature electric lamps.

The Davis Electrical Co., Ltd., 17, Moor Street, Charing Cross Road, W.C.—Thirty-two page illustrated catalogue and price list of electrical steel conduits and accessories; also lists of "Attracta" electric signs, Chamberlain's anti-vibrator, and the "Ellco" invisible lamp lock.

The Premier Accumulator Co., Ltd., Cattle Market Road, Northampton.—New catalogue (for 1910) wherein in the course of 24 pages are contained particulars rendered descriptively and in tabular form of the Premier accumulators of the central station type, also those for country house lighting, shipand yacht lighting, traction cells, train lighting, ignition and portable lighting batteries. Dimensional drawings appear of cells and wood stands, also prices of renewals and accessories, testing instruments, acid, &c.

Mr. J. Conway Price, of 151, Fleet Street, E.C., who is known in the electrical trades as a technical advertising specialist, has sent us a folding leaflet relating to his work as a designer of advertisements and giving a list of electrical firms who are using his designs. Copies can be obtained on application by any advertiser.

The Key Engineering Co, Ltd., Trafford Park, Manchester.—Twelve-page red covered pamphlet describing and giving illustrations of their system of "solid" protection for underground cables.

Messrs. Donovan & Co., Barwick Street, Birmingham.—Illustrated price leaflets relating to cast-iron and watertight fittings, Barwick motor-starters and motor-starting panels, and iron-clad fuseboards.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet showing the "Eclipse" flame arc lamp with an ornamental case in green relieved by bronze, and hexagonal type globe. Mr. Braulik is now representing in the United Kingdom and in English possessions abroad, Messrs. B. Paege & Co., of Berlin, manufacturers of electrical insulating varnishes, cabling compounds, &c., and he will keep a stock of these in London, both in bulk and in small tins. A catalogue and number of leaflets relating to these products has been received, and copies can be obtained on application.

Messrs. Hawksley, Wild & Co., Ltd, Brightside Boiler and Engine Works, Sheffield.—Two new publications; one a leaflet containing a brief general description of the "Suckling" water-tube boiler; the other a 20-page catalogue giving a fuller and much more detailed description of the same boiler, with some fine examples of half-tone printing. Types of tube cleaners, and a report of a test on the boiler by Messrs. Burstall & Monkhouse, also appear.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Booklet No. 706 (28 pages) in the company's standard form in two sections. The first half is occupied with a description, with many half-tone illustrations, of the works at Edinburgh; the other half contains illustrations, with brief letterpress, of dynamos and motors, turbo-alternators, motor converters, and other manufactures made therein.

General Electric Co, Ltd, 71, Queen Victoria Street, E.C.—Pocket booklet of 12 pages, giving illustrations and prices of a number of patterns of electric radiators and elevators made under the "Archer" system.

Cowper-Coles Engineering Co., Ltd., 82, Victoria Street, London, S.W.—A number of illustrated lists in binding cover, giving descriptions of the following manufactures:—Centrifugal pumps for acids, acid valves (corrosion proof), filter economisers, atomising plants, aluminium welding process, acid injectors, and a patent motor headlight.

Accumulators for Central Stations.—The D.P. Battery Co., Ltd., inform us that during the past 12 months they have installed, or have now on order, batteries for 20 central stations, including a large battery of over 2,500 ampere-hours capacity at 550 volts for the Corporation of Dudley, as well as others for the East Indian Railway at Howrah, of 862 kw.-hour capacity, for the Colonial Government at the Bahamas, the Liverpool and District Co., Manchester Corporation, and nine installations for Australia.

Admiralty Work.—Maxwells, Ltd., Dundee, have been placed on the Admiralty list for work, and since the arrival of the submarines several repair jobs have been sent to their establishment.

Conversazione.—The directors of Messrs. Rawlings Bros., Ltd., of Gloucester Road, South Kensington and Belgravia, gave a conversazione on Saturday evening last to their employés and their wives and friends. These, to the number of some 400, met at the Cabins Restaurant, Caxton House, Westminster, where a musical entertainment, largely contributed to by the employés themselves, had been arranged. An excellent programme of music and song was thoroughly enjoyed. During an interval, light refreshments were handed round, and conversation and laughter were indulged in without restraint, the occasion being one for real social intercourse.

The New Exhibition Building for Manchester.—We have received from Mr. W. Davenport, of Ridler Place, Holland Street, Blackfriars, S.E., particulars of the scheme to erect a large Exhibition Building for Manchester. It is stated that the work of erection will be commenced next month. A well-placed site has been secured in Old Hall Lane, and a handsome building, with a floor surface of 100,000 sq. ft., for which the plans have already been passed by the Corporation, will be erected. The proprietors of this building have already secured contracts for four important undertakings, and the scheme has so far commended itself to those business men who have been approached in the matter that it has been unnecessary to ask the public for a single penny of the capital involved. The scheme of erecting such a building had its genesis in the successful Electrical Exhibition that was held in October last year, and the architects of the present building have based their plans largely upon the requirements there shown to be necessary. Manchester, the second city of the Empire and the centre of the great manufactures of the North, will soon, therefore, have an Exhibition building suitable to its importance as a centre of commerce. The contract for the building has been placed with Messrs. Davenport, Sons & Co., of Birmingham. The contracts already entered into are for the Manchester Industrial Exhibition, May 12th to June 25th, 1910, which is being organised by the International Trade Exhibitions, Ltd.; the Great Textile Exhibition, October 8th to 29th, 1910, promoted by Mr. H. Greville Montgomery, M.P.; from November 16th, 1910, to April 30th, 1911, a skating rink; and in May and June, 1911, a General Engineering and Allied Trades Exhibition organised by International Trade Exhibitions, Ltd. The building will be 600 ft. long × 180 ft. wide, lighted by electricity and fitted in an up-to-date style in all departments.

Trade Announcements.—Messrs. H. Jaggar & Co., electrical engineers, of Halifax Road, Dewsbury, have opened new business premises in Henrietta Street, Commercial Street, Batley.

The Adnil Electric Co., Ltd., have appointed Mr. James Turnbull, of 3, New Street, Birmingham, their agent for the whole of the Birmingham district, including the counties of Warwickshire, Worcestershire, Shropshire and Staffordshire.

Dissolutions and Liquidations.—Mackey's Electric Lamp Co., Ltd.—This company is winding up voluntarily, with Mr. W. Bean, of 174-175, Aldersgate Street, E.C., as liquidator. A meeting of creditors will be held at Manchester Hotel, Aldersgate Street, on December 24th,

The Electrical Ore Finding Co., Ltd—A meeting is to be held at Suffolk House, Laurence Pountney Hill, E.C., on January 17th, to hear an account of the winding up from Mr. J. D. A. Norris, the liquidator.

Messrs. W. Tully & Howard Straker have dissolved partnership. Debts, &c., will be attended to by Mr. Howard Straker at the office of Mr. W. Tully, 16, Water Lane, Great Tower Street, London, E.C. Mr. William Tully continues in business as a mica importer and dealer on his own account as Wm. Tully & Co., at the above address.

Uxbridge and District Electric Supply Co., Ltd.—By an order of the Court, Messrs. J. O. Callender (Callender's Cable Co.), and W. A. Bird and J. C. Saunders (Metropolitan Electric Supply Co., Ltd). were appointed a committee of inspection to act with the liquidator.

Morris-Hawkins Electrical Co., Ltd.—A meeting will be held at 58, Coleman Street, E.C., on January 12th, to hear an account of the winding up from Mr. E. I. Husey, the liquidator.

F. Burks & Co., manufacturers of electrical machines, apparatus and devices, 37, Port Street, Manchester.—Messrs. F. Burks, F. C. Poulton and V. Bramwall have dissolved partnership. Debts will be attended to by F. Burks & Co., Ltd., of the same address.

LIGHTING and POWER NOTES.

Amble.—At a meeting of the U.D.C. on the 9th inst., Mr. Wanless moved that the Council was prepared to proceed with the erection and equipment of an electrical installation for lighting and power purposes within the urban area. The motion was carried.

Australia.—The Perth (W.A.) City Council has given notice of its intention to obtain Parliamentary powers to take over the gas company's undertaking (which includes both gas and electricity supply). The gas company's estimate of value for its property ranges from £137,000 to £236,000.

As a result of street lighting experiments in Sydney, the electrical engineer advises that arc lamps should be retained in the main thoroughfares, but that flame arcs be substituted for open type. The cost of metal lamps for such situations would be excessive, but these lamps should be adopted in side streets which may be lighted in future. The cost of altering the arc lamps is placed at £3,000.—*Australasian Hardware and Machinery.*

Ayr.—The proposal of the T.C. to extend the use of electric lighting in the streets of the burgh was opposed at the last meeting by Mr. Wm Smith, who pointed out that in 1895, before the electricity works were started, the cost of lighting the burgh was £1,500, whereas it was now £4,837. He admitted that the town was better lighted, but held that it could be lighted with incandescent gas burners at half the cost. Mr. Smith did not get a supporter, and the proposal was carried.

Brighton.—The Lighting Committee has recommended the T.C. to enlarge the plant at the Southwick Works by the addition of a 3,000-kw. set, &c., at an estimated cost of £14,500, and to provide additional plant for the North Road sub-station at a cost of £3,500.

Burnley.—On Saturday last the extensions carried out by the Corporation Electricity Committee during the last two years were opened by the Mayor, who has been chairman of the Electricity Committee for seven years, and Mrs. Hargreaves, wife of Councillor T. W. Hargreaves, vice-chairman of the committee, started the new 750-KW. generating set. The supply of electricity was commenced in August, 1893. Extensions became necessary in 1895, and in 1899 it was found that the capacity of the plant would very soon be overtaxed. A change was, therefore, made, and the distribution converted from a three-wire system with 220 volts, to one with 440 volts. Burnley was one of the towns which paid a royalty for using the three-wire system. In 1901 electric tramcars were running, and by 1903 all the old steam-driven tramways had been converted, and some new branch lines opened. In 1904 the station load had increased to warrant another extension, and a 500-KW. Belliss-Dick, Kerr generator and an additional boiler were installed. The last new set consists of a Belliss engine coupled to a Dick, Kerr multipolar generator. The condenser, of the Westinghouse-Leblanc type, is one of the largest of its kind installed in the country. The boiler-house extension includes provision for six Lancashire boilers, pump room for two feed pumps, economiser, coal and ash handling plant, &c.

Caerphilly.—The B. of T. has informed the U.D.C. that it has received objections to the proposed transfer of the E.L. order to the South Wales Electric Power Distribution Co. The Council has replied that the Council is in favour of the scheme, but the three members of the Town Ward were not. The latter have asked the B. of T. to hold an inquiry into the matter.

Canada.—After a long fight in the City Council, lasting all night, the City of Hamilton has decided unanimously to enter into a contract with the Ontario Hydro-Electric Power Commission for 1,000 H.P., on terms outlined by the Commission. This was one of the cities which recently sent a delegation to the Federal Government to have the Hydro-Electric Power Bill vetoed.

The Ottawa Electric Co. has obtained a 10-year contract to light the town of Eastview at the same rates as charged in Ottawa.

Carmarthen.—The Carmarthen Electric Light Co. has been formed with a capital of £10,000 to supply the borough with electric light and power, and the company has acquired an existing prov. order. At present the town is lighted by gas, but the company has entered into an agreement with the T.C. for the lighting of the street lamps by electricity, and the Council has consented to the use of overhead mains throughout the borough. The contract price for the electric installation is £7,205. Mr. S. G. Leech, M.I.E E., of Westminster, is the engineer.

Carnarvon.—At a meeting of the T.C. last week, a letter was read from the National Electric Construction Co., with whom the Corporation has an agreement giving it the option of acquiring the electric light works at the expiration of the stated alternative periods, reporting favourably upon the progress of the works, in spite of the trade depression. If this progress was to be ensured, representations must be made for the necessary borrowing powers for extending the works. It was also suggested that the electricity be utilised for street lighting, the estimated cost of installing eight arc lamps being £400, and the annual cost of lighting £150. The matter is to be further considered.

Chadderton.—With regard to the application of Oldham T.C. to supply consumers in Chadderton, the B. of T. has informed the Council that it has no power to grant a prov. order, as Chadderton Council has refused its consent. The Board added that it was prepared to consider the question of making an order in respect of any application from would-be consumers.

Chippenham.—The B. of T. has informed the T.C. that as there did not appear to be any early prospect of the Council exercising the powers of the E.L. order, it is proposed to revoke it.

Cookstown, Co. Tyrone.—At the meeting of the Urban Council on the 6th, a motion to take the necessary steps to supply electricity for public use was defeated by 6 votes to 5. It is understood that the coming elections will be fought on the electric lighting question, a large number of the ratepayers being in favour of the latter.

Edinburgh.—After considering Sir Alexander Kennedy's report as to the future working of the Dewar Place and M'Donald Road stations, with special reference to the cooling towers, the Electric Lighting Committee has decided that in view of the new principles involved, the Council before committing itself to any decision should send a deputation to London and Birmingham, where the new type of plant mentioned by Sir Alexander in his report is in operation.

Glasgow.—Owing to the impossibility of securing proper hall accommodation, the T.C. has postponed the proposed exhibition of electric and gas lighting, heating, and cooking appliances till autumn of next year.

Grimsby.—The Public Lighting Committee has decided in favour of borrowing £2,000, so that the street lighting may be carried out by metallic-filament lamps in all streets where electric mains are laid, and that the existing arc lighting be brought up to date by the introduction of flame arcs. Various reductions to private consumers, the maximum reduction being ¼d. per unit, are proposed.

Govan.—It is reported that the T.C. has agreed to extend its electricity plant at a cost of over £9,000.

Huddersfield.—The T.C. has decided to apply for a prov. order for electric lighting in the South Crosland district.

Kendal.—The L.G.B. has forwarded to the T.C. sanction to a loan of £1,976 for electricity purposes.

Leyton.—Without appeal, the U.D.C. has secured a reduction in the assessment of the electricity works from £3,302 to £3,150.

London.—HAMMERSMITH.—The Council has agreed to increase the accepted contract price (£660) for the coal-handling and storing plant by £90 for various alterations and additions, and also for the contractors (Messrs. Fraser & Chalmers) to undertake the erection of the plant. The charge for the 400-C.P. metallic-filament lamps now fixed in the Grove is to be reduced from £20 per lamp per annum to £17. The Electricity Department has saved, by converting the system from the ordinary arc lamps to metallic-filament lamps, £40 per annum, which is equivalent to £2 16s. per lamp per annum. The charge for public lighting in side streets has been fixed at £2 14s. per lamp per annum for current, maintenance, &c. The question of granting special terms to consumers taking a large amount of energy per annum for lighting purposes has been considered, and it has been decided to give the following discounts off 3d. per unit, the general rate charged:—When the amount exceeds 20,000 units and does not exceed 30,000 units per annum, 2½ per cent ; 30,000 and not exceeding 40,000, 5 per cent. ; exceeding 40,000, 10 per cent.

ST. PANCRAS.—The L.C.C. has drawn the attention of the B.C. to the fact that the whole of the surplus on the electricity undertaking in 1908-9 was transferred to the relief of the rates. The B.C. is asked, when considering the disposition of any further surplus from the electricity account, to bear in mind the large amount of loans which have been borrowed, mostly for 42 years—a period much in excess of the life of mains, machinery and house services—and that 72 per cent. of the loans are on the annuity system of repayment, whereby the burden of repayment is heavier in the later years of the loan period than in the case of the instalment system.

STEPNEY.—The Electricity Committee has presented a report by the borough electrical engineer relative to necessary extensions of the generating plant, owing to the rapidly growing electricity supply in the area. The engineer points out that the units generated during the year 1908-9 exceeded the estimates for 1909-10 (viz., 7,500,000 units). The Council has also pledged itself to give a stand-by supply to the Poplar B.C. at Christmas, 1910, of 600 KW., and including this the estimated maximum load will then be 4,900 KW. Under the circumstances, the engineer estimates that the following expenditure will be necessary:—

BLYTH'S WHARF—		
Boilers and accessories	£9,630	
Chimneys, fan draught, economisers and flues	3,984	
Steam and other pipework	2,700	
Generating plant	10,280	
		£26,594
OSBORN STREET—		
Converting plant	3,600	
Switchgear, cables, &c.	1,075	
		4,675
WAPPING SUB-STATION—		
Converting plant	3,500	
Switchgear, cables, &c.	1,850	
Travelling crane	200	
		5,500
Total, exclusive of land and buildings for Wapping sub-station		36,819
Contingencies and engineering charges		3,681
Grand total		£40,500

This estimate does not include the cost of the land, buildings or cables for the Wapping sub-station, the site of which has not been fixed. The new plant should be available by September 30th, 1910; it includes three extra marine type boilers, chimneys, fans, economisers, &c., switchgear, and a 2,000-KW. turbo-alternator and condensing plant, which will utilise all the space provided in the existing Blyth's Wharf building; also a third converter and switchgear at Osborn Street and a sub-station at Wapping for the riverside load. As a result of the additional financial charges, a small deficit is expected in 1910-11.

Loughborough.—The accounts of the Gas and Electricity Committee of the T.C. for the last half-year show an increased profit of £339, as compared with the corresponding half-year.

Merthyr.—The Merthyr County Council has accepted the tender of the Merthyr Electric Traction Co., as against that of the Dowlais Gas Co., for the public lighting of Dowlais.

Oldham.—The Lancashire Electric Power Co. has informed the T.C. that it is prepared to give permission for the Council to supply electricity in the urban districts of Crompton, Royton, Chadderton, and Lees, and in the rural district of Limehurst in all cases where it does not exceed 50 H.P. In cases where applications for power exceed that amount, special permission should be applied for. The T.C. regards the offer as a very generous one.

Portsmouth.—Application is to be made to the L.G.B. for sanction to borrow £24,000, the estimated cost of new mains and public lighting works during the next three years.

Oldbury.—The Shropshire, Worcestershire and Staffs. Electric Power Co. has applied to the B. of T. for consent to the use of overhead 5,500 and 400-volt three-phase transmission lines for the supply of energy to the Brades Steel Works, Oldbury, Griffin Foundry, and the Pump Houses at the U.D.C.'s Sewage Works.

Ravensthorpe.—The Lighting Committee has recommended the U.D.C. to give the Yorkshire Electric Power Co. notice to discontinue supplying electricity to customers for lighting purposes in the Council's area.

Royton.—The U.D.C. has consented to energy being supplied to consumers in the township by Oldham T.C., provided that the same price is charged as to consumers at Oldham.

Saltburn.—The U.D.C. has asked the Cleveland Power Co. to quote terms for the supply of electricity in bulk for public and private lighting.

Singapore.—The Straits Settlement Government, in connection with its harbour improvement scheme at Singapore, has equipped an electric power station and installed 1,700 B.H.P. of plant for driving workshops, pumps, cranes, coal-handling, lighting, &c. The work has been carried out under the supervision of Mr. F. R. Marsh, the Harbour Board's chief electrical engineer.

Stretford.—Mr. T. L. Miller has been re-appointed consulting engineer to the electricity undertaking for one year at a fee of 25 guineas.

Walkden.—Following upon the adoption of electrical driving by Messrs. E. Lane & Sons and Messrs. J. Booth & Co., of the Hope and Bridgewater Mills, Walkden, a correspondent states that two other prominent manufacturing firms here are also arranging to have extensive electrical installations put down.

Walsall.—The electrical engineer reports that by the regulations issued by the Home Office considerable alterations will be required at the high-tension switchboard in the generating station, as well as several minor precautions for guarding the exposed portions of the H.T. system. The matter is to stand over until the decision of the L.G.B. is received to the application for the loan of £35,000, as it is possible that the alteration, if now made, will afterwards be found to be useless.

West Ham.—In October last the Council wrote to the Woolwich Borough Council asking for facilities to supply energy in bulk to the Port of London authority. Woolwich Council has now replied to the effect that it hopes to be in a position to give a supply to the North Woolwich area in the near future, and for this reason it is not prepared at present to favourably consider West Ham's request for consent to the supply of current for use in an area controlled by the Woolwich Council. The town clerk of West Ham is to apply to the Board of Trade under these circumstances for consent to give the supply in question to the Port of London authority under the provisions of the Electric Lighting Acts (Amendment) Act, 1909.

Weymouth.—The T.C. has applied to the L.G.B. for a loan of £500 for mechanical stokers, and £1,500 for mains extensions for three years.

Worksop.—At Monday's meeting of the U.D.C. the Lighting Committee presented a report from the electrical engineer respecting an application from the Worksop Co-operative Society for the electric supply to be extended to the site of the Co-operative Gardening Society, and recommended the Council to accede to such application. The recommendation was adopted, and it was resolved to make application for sanction to acquire an additional loan of £1,500 for purchasing cables, meters, &c.

TRAMWAY and RAILWAY NOTES.

Accrington.—Last week the chairman of the Electricity Committee stated that the revenue from the electric cars last half year had been sufficient, for the first time, to meet the charges; the Committee had decided to set apart for the depreciation and renewals fund, in addition to making the provision required for the current needs of the service and the redemption of the debt. The gross income was £12,708, and the gross expenditure £11,904. There was a net profit of £804 for the six months, or something more than a penny rate. For the financial year ended last March the deficiency was £1,216.

Aston.—A special meeting of the T.C. was held last week for the purpose of affixing the seal of the Council to an agreement between the U.D.C. of Handsworth, the City of Birmingham Tramways Co., Ltd., the Aston Council and others, in relation to through running powers over the Birchfield Road and Villa Road lines. The town clerk pointed out that another body concerned in the matter was the South Staffordshire Tramways Co. He referred to the award made by Mr. Graham Harris in relation to the purchase of the cable tramways on Soho Hill, and on in the direction of Birmingham by Handsworth; an award which has been already dealt with in the Review. Continuing, Mr. Ansell said Handsworth had promoted a Bill in this session of Parliament under which it would continue a line of tramways, commencing at Trinity Church, and forming a physical connection with the existing line there. The line would join the cable route at Soho Hill. It had agreed to link up the Villa Road line with the cable route, so that the Black Country traffic might be brought along this portion of the line, and so to the east and north-east ends of the city, and to Gravelly Hill, Erdington, &c. Handsworth was bound to carry out this part of the agreement by December, 1911, under the penalty of having to pay £2,000 liquidated damages to the Aston Corporation. Alderman M. Evans moved the resolution adopting the agreement, and Alderman Smith seconded. The motion was agreed to.

Australia.—A commencement has been made with the Prahran-Malvern (Vic.) electric tramway which will connect two suburbs of Melbourne.

Belfast.—The proposed line from Belfast to the top of the Cavehill—the very prominent mountain which overshadows the city—would measure 3 miles 1 furlong, and the estimated cost is as follows:—Construction, £56,400; equipment, £20,000; machinery, £5,150; road-making, £29,700; total, £111,550. It may be of interest to add that the first railway ever made in Ireland—now derelict—runs along part of the proposed route. It was used for conveying the stone, used at the building of the harbour, from the quarries at the base of the mountain, and was worked by an endless chain and barrel engine.

Black Country.—The question of "fair fares" is causing considerable commotion in the district, and the matter was referred to at the meeting of the Dudley T.C. last week. Councillor H. W. Hughes stated that the farthing stages had been discussed by the Tramway Committee, and it was not at all clear to the members whether the system would be applied to Dudley, or if it would be a benefit supposing it were applied. Councillor Tanfield said the system would increase the cost of travelling 50 per cent. The town, he went on, were to receive £1,000 in rental from the B.E.T. Co., and under the new proposal the people would pay three times that amount. Mr. Tanfield also complained of the completion of a lease of the lines to the company, which had not been explained to the general body of the Council. Dudley, it may be added, is a most important tramway centre, as lines running to Cradley, Stourbridge, Wolverhampton, Tipton, West Bromwich, and Birmingham, *via* Oldbury, converge there.

Bradford.—A deputation of the members of the Tramways Committee has returned home after a 3,000 miles trip on the Continent, the object of the journey being to study tramway systems abroad. The tour embraced Berlin, Vienna, Munich, Milan, Verona, Lake Como, Basle, Strasburg, Cologne and Brussels.

Continental Notes.—FRANCE.—The Compagnie des Chemins de Fer de l'Ouest having presented a scheme for the electrification of the lines running to Saint Germain and Argenteuil at a cost of 61 million francs, including the generating station, the State Railways Administration has adopted it with two modifications set out in M. Chaigne's report on the State railways. The first modification refers to the underground station at Saint Lazare, estimated alone to cost 18 million francs, which is held to be unnecessary, the existing station being considered of a capacity sufficient for a much greater amount of traffic than is at present offering, and than would be offering were all the lines on the right bank of the Seine electrified. With regard to the second modification, while the Western Railways scheme only contemplated the electrification of the line to Argenteuil and Saint Germain, the new one involves the electrification of all the lines on the right bank. The total cost is put at 67 million fr. for the electrification proper, including the generating stations, and seven millions for road works. The expenditure will be spread over the years 1910 to 1914. A beginning of the works will be made next year, for which a credit of two million francs will have to be provided.

AUSTRIA.—Sanction has been accorded by the Austrian Ministry of Railways for the preliminary surveys for the following electric lines:—To the Council of Teschen, for a narrow gauge electric railway in the township of the same name; to Herr Anton Modler for a narrow gauge electric railway from Ober Leutensdorp to Rauschengrund; to the Oderberg T.C., for a narrow gauge steam or electric railway, for the carriage of passenger and parcels only, from Oderberg station to Dentschleuten; to the Salzburg Rail and Tramway Co., for a normal gauge electric railway from Salzburg by Maxglan, to the frontier opposite Gross-Gmain; and, lastly, to the Commune of Stenico, for a projected "Judikarien" railway connecting Bagni di Comano, Campo Maggiore, Stenico, Ragoli, Preore and Tioni.

BOSNIA.—The firm of Langen & Co. has made application for water rights on the Zeljeznica River with a view to generating current for a projected electric tramway to run from Sarajevo to Ilidze.

NORWAY.—A concession has been granted by the Bergen municipal authorities for an electric cable railway for passenger traffic from the town to a spot on the mountain side overlooking the harbour. The work is to be completed by September 1st, 1910. The name of the concessionaire may be obtained at the Commercial Intelligence Branch of the Board of Trade.

SWITZERLAND.—An electrical funicular railway of metre gauge is projected from Coire to Mittenberg.

ITALY.—The director of Sicilian tramways has submitted a proposal for the temporary reopening of the Messina tramways; a new company is to be formed to electrify the Giamprelcri-Messina-Faro line and to construct additional lines.

Argentina.—It is reported by telegraph from Buenos Ayres that Congress has just approved the concessions for the construction of two underground electric railways in that city. As far as one scheme is concerned, it is stated that a group has been formed to finance it, consisting of the Crédit Mobilier Francais, of Paris, the Banque de Reports de Fonds Publics et de Depôts, of Antwerp, the Comptoir de la Bourse, of Brussels, and the firm of Th. Bracht & Co., of Antwerp and Buenos Ayres. The group recently commissioned the latter firm to take the necessary steps to further the project, which has been proposed by the municipal Council, and the concession for which is sought by the firm in question, on the one hand, and by the Anglo-Argentine Tramways Co. on behalf of the Compagnie Générale des Tramways de Buenos Ayres, on the other. The second project concerns the Eastern Railway Co., whose terminus is situated at the Plaza de Setiembre 11th, and which has resolved to continue its railway underground to the harbour as an electric line. This particular scheme was approved by the Chamber on the condition that it should solely be an extension of the existing railway, and should not prejudice the projected municipal undertaking, and both of these proposals have now apparently been sanctioned by the Upper House.

Dudley.—Prior to the prorogation Parliament passed an Act enabling the Corporation to purchase the whole of the tramway lines within the borough, and to lease them to the B.E.T. Co. for a term of 30 years. Originally the agreement with the company, known as the "Dudley Agreement," should have come into operation in 1904, but, unfortunately, it has been the subject from time to time of serious litigation, a question with respect to the Netherton line having to be carried to the House of Lords for settlement. The Corporation, it is now stated, requires a loan of £93,000 to carry out the purchase and to pay the incidental costs. The rent which the company is to pay will, it is anticipated, meet sinking fund and interest and leave a profit to the ratepayers of £1,000 per annum.

Dunfermline.—It was reported at the District Committee meeting that the road surveyor had had a conference with Mr. Balfour, of the Dunfermline and District Tramway Co., and that the latter had agreed to pay the Committee £400 in respect of extraordinary traffic and damage to the roads. The Committee resolved to opposed the prov. order for the running of tramways to Rosyth along the Grange Road.

Edinburgh.—The burgh engineer reports regarding the extension of the tramways from the terminus at Gorgie to Slateford Road, that Messrs. Dick, Kerr & Co. are of opinion that, subject to the bridge-work proceeding as rapidly as was expected, there was nothing they could foresee likely to cause delay in the opening of the new length of tramways for traffic by May 1st next. The Tramways Committee gave instructions to push on the work as speedily as possible.

Glasgow.—The general manager (Mr. Dalrymple) has submitted to the T.C. a list of 11 non-paying routes on the Corporation's tramway system. The average revenue per car-mile on each route for the year ending May 31st, 1909, ranged from 7·840d. to 9 849d. The T.C. decided that the service on those routes be so arranged that, while giving a reasonable service, the present loss in working would be minimised as far as possible.

Isle of Wight.—According to the *Times*, a conference of public authorities has approved proposals for the improvement of the local railway system by electrical working, but the railways have not yet mentioned their terms.

Japan.—According to German Consular information the Kobe-Akashi Electric Railway Co., with a nominal capital of about £210,000, intends to build an electric railway from Kobe *viâ* Suma to Akashi, a distance of 11½ miles. The first section of 5½ miles is to have a double track, the rest of the line a single track.

The Minomo-Arima Electric Railway Co. proposes to build an electric railway, 15½ miles in length, from Osaka *viâ* Ikeda to Takaradzuka, with a branch 2½ miles long to Minomo. The cost of the work is estimated at about £300,000.—*Board of Trade Journal.*

New Zealand.—The Invercargill and suburban ratepayers have decided to install an electric tramway system for the town and suburbs, energy being obtained from a water-power 20 miles distant. The estimated cost is £75,000.

Leyton.—The assessment of the tramways undertaking has been reduced from £4,150 to £3,500 without resorting to appeal.

Portsmouth.—The Hayling (Hants.) Light Railway Co. is applying for a further order to revive and extend the period limited by the Portsmouth and Hayling Light Railway Order, 1905, for the exercise of its powers under that order, including an extension of the periods limited by the order of 1905, for the completion of the works thereby authorised.

Sunderland (Correction).—In connection with our last week's note on the meeting of the T.C. on the 8th inst., when the Tramways Committee submitted a memorial received from the Urban District, Rural District, and the Parish Councils within the area served by the Sunderland District Electric Tramways, Ltd., in favour of running powers being granted to that company over the portion of the Corporation's system from Grangetown to Fawcett Street, Sunderland, the Committee reported that it did not see its way to recommend the Council to accede to the request.

West Africa.—It is proposed to construct tramways from Yonni to Kholifa and Rowalla to act as feeders to the Sierra Leone Railway. The lengths of these tramways will be about 30 and 50 miles respectively.—*African Engineering.*

West Ham.—The tramways manager reports that the net cost of the construction and erection of the 12 top deck covers recently completed amounted to £64 18s. 9d. each. As on previous occasions, 10 per cent. has to be added to this amount to cover establishment charges, which will make the cost of the covers £78 8s. 1d. each. The contractor's price was £97 1s., so that there was a saving of £223 14s. 7d. on the 12 covers.

U.S.A.—The New York Public Service Commission has issued regulations by which all closed street cars must be equipped with suitable electric heating apparatus to give a temperature inside between 40° and 65° F., whenever the outside temperature is lower than 40° F.

The *Detroit Journal* has recently commented on a report by the Detroit Committee of Fifty dealing with the Municipal Ownership of Tramways in Great Britain. Ten cities, including Birmingham, Edinburgh, Manchester, Liverpool, Sheffield and London, were "studied," and, according to the above-mentioned paper, "Congestion of population, high fares to sanitary districts, half-rate wages and colossal debts are the analysed results of municipal socialism in Great Britain. In return they have a low fare for a little ride, and lots of short rides bringing down the average." It is interesting sometimes to see ourselves as others see us, even if the others come from Detroit.

Eleven American interurban railways have now adopted the 1,200-volt D.C. system, the latest being the Shore Line Electric Railway of New Haven, Conn., some 52 miles long. Power is generated by Curtis turbo-generators as three-phase current at 11,000 volts and 25 cycles, and transformed by 600/1,200-volt rotaries for use on the line. The cars are equipped with 600/1,200-volt motors, and the equipment is arranged to operate at both pressures.—*Electric Traction Weekly.*

TELEGRAPH and TELEPHONE NOTES.

A.C. Traction and Telegraphs.—Experiments made on the Valtellina three-phase railway, described in *l'Industrie Electrique*, showed the general result that the effect of stray currents from the railway on the adjoining telegraph lines was quite negligible; electrostatic induction was also of small moment, but the electromagnetic perturbations were very serious. It was found necessary, when the line commenced electrical working, to provide metallic circuits for the telegraphs in the neighbourhood of the railway, with translators at the terminal points, but this was both inconvenient and expensive, and required skilled attendance to keep the translators in good working order. Nevertheless, there seemed to be no better way out of the difficulty, short of compelling the railways to use continuous current.

American Combine.—The Western Union Telegraph Co. gives the following reason for the disposal of stock to the Mackay Companies Associate, which has formed the subject of much speculation in London:—"A development since the close of the fiscal year is the sale of the company's holding with the New York Telephone Co.'s stock. The plan of that company for acquiring other telephone properties involved the raising of a large amount of additional capital by the sale to stockholders of an issue of $35,000,000 of new stock. It was thought inadvisable for the telegraph company to undertake to raise the large sum required for its proportion of the new issue, and advantage was taken of a favourable opportunity to dispose of the minority interest in the Telephone Co. to the American Telephone and Telegraph Co. In connection with this sale, arrangements have been made for retiring on May 1st, 1912, the $10,000,000 4 per cent. convertible bonds of the company, which are redeemable at the pleasure of the company on and after that date."

Brazil.—The provisional concession lately obtained by a Mr. Reidy for a cable joining Para with Fernando Noronha, thence to Alagoas, Rio de Janeiro and Sao Paulo, and ending at Chuy, has resulted in the lodging of a protest with the Brazilian Government by the Western Telegraph Co., declaring it to be an infringement of their rights.

Cables Interrupted and Repaired.—Paramaribo-Cayenne interrupted December 7th; Nagara-Kartal repaired December 8th; Bathurst-Bissao interrupted December 9th; Puerto Plata-Martinique repaired December 11th, 1909.

Cipher Codes.—An American Consular report states that the Turkish Government has decided to authorise the use of cipher codes for telegraphic correspondence exchanged between different parts of the Empire as well as with foreign countries.

Jamaica.—The annual Colonial Report for Jamaica for the year 1908-9 gives the receipts from post office and telegraphs as £40,695, as against £41,099 for the previous year, while the expenditure was £37,135, compared with £36,985 for 1907-8. The revenue from telegraphs was £6,221, an increase of 2 per cent.

The length of telegraph lines in operation was 715 miles, including railway telegraphs used for general purposes. Maintenance absorbed £935.

Turkish Telephone Concession.—The *Financial News* reports that the Austrian Telegraph Co , which sent in tenders for the telephone concession in Constantinople, has lodged a protest with the Ottoman Government against the grant of the concession to an Anglo-Franco-American syndicate.

Wireless Telegraphy.—The advantages of wireless telegraphy are to be rendered available to South American ships, which in crossing the ocean are cut off from communication with the world for over a fortnight. The work is proposed to be accomplished by a French company, which, on the one hand, contemplates the erection of a wireless station of great range at Dakar on the Cape Verde, and on the other, of a second station on the Island of Fernando Noronha, which is situated about 372 miles distant from the harbour of Pernambuco. The distance between the two stations is about 1,550 miles. A small station is to be erected at Pernambuco for connection with Fernando Noronha. As Pernambuco is the starting point for telegraph cables to all important places in South America, and as Dakar is in connection with the St. Louis cable station, a favourable means of communication in all directions is assured.

According to the *Exchange Telegraph*, direct wireless communication between Germany and Great Britain was established on Tuesday last, the Lepel system being used, with stations at Brunswick and London.

The *Times* says that the Marconi telegraph stations erected in the Italian Colonies are giving good results. Two different systems have now been completed in Somaliland, one connecting the posts at Mogadish, Itala, Merka, and Lugh, and the other connecting Brava Giumbo and Bardera. The Merka and Mogadish line is in active use for commercial as well as official messages, both Arab and Somali traders having discovered the benefit of being able to communicate quickly by its means.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—Tenders are about to be invited by the municipal authorities of Neupaka, Bohemia, for the establishment of a large electric generating station in the town for lighting and power purposes.

Australia.—MELBOURNE. —January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

MELBOURNE.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

MELBOURNE.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

CANTERBURY.—March 16th, 1910. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

SYDNEY.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" December 10th.

Belfast.—January 10th. One 1,500-KW. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" December 10th.

Bridlington.—January 1st. 300-KW. steam dynamo for the Corporation. See "Official Notices" December 10th.

Chatham.—December 23rd. Osram electric lamps for a year, for the T.C.; Borough Surveyor, Town Hall.

Cape Town.—January 5th. The Corporation requires tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Carlisle.—December 24th. 8,000 yards of wire, and poles for overhead transmission line for the Corporation. See "Official Notices" December 10th.

France.—December 22nd. The municipal authorities of Fontainebleau are inviting tenders for the contract for an installation of electric lighting in the Town Hall

Italy.—January 26th. The Italian State Railway authorities in Rome are inviting tenders for the supply of 50,000 metallic-filament electric lamps.

London.—SOUTHWARK.— 38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" December 3rd.

I.E.E.—January 10th. The Council of the Institution of Electrical Engineers is inviting tenders for the interior wiring and fittings for lighting and power at its new premises. See "Official Notices" to-day.

Oldham.—Main service cable at the Workhouse for the B.G.; Taylor and Simister, architects, 29, Queen Street, Oldham.

Spain.—Tenders have just been invited by the municipal authorities of Cumbres Mayores (Province of Huelva) for the concession for the electric lighting of the town during a period of 10 years.

Switzerland.—The Swiss Budget for 1910 includes, for the Department of Telegraphs and Telephones, an expenditure on new apparatus and supplies (£50,000).—*Board of Trade Journal.*

CLOSED.

Bristol.—The City Council has accepted the tender of the Bristol Electrical Co., at £130, for the electric lighting of Alexandra School.

Canada.—Cable contracts have been awarded by the Ontario Hydro-Electric Commission to Siemens Bros. Dynamo Works, of Great Britain, to supply a 12,000-volt cable for $21,149, also a submarine cable for $1,943·12, and an underground cable for $1,556.

Chertsey.—The U.D.C. has accepted the tender of the Woking Urban E.L. Co. for the installation of the E.L. at the compressor station.

Epsom.—The U.D.C. has ordered from the Foster Arc Lamp and Engineering Co., Ltd., a number of their new "Q" type flame arc lamps, in which a number of carbons moulded together side by side are employed, so that the lamp is never extinguished when changing over from one pair to another.

London.—The L.C.C. Stores Committee has accepted the tender of Messrs. H. G. Mayer & Co., for electric carbons. Also tenders of the following for electric lamps:—Cryselco, Ltd., Edison and Swan United Electric Light Co., Ltd., Maxim Lamp Works, Pope's Electric Lamp Co., Ltd., Siemens Bros. Dynamo Works Co., Ltd.

In connection with the electrification of the Lea Bridge Road the Highways Committee has recommended that for certain other work beyond that already provided for, the existing contracts with the following firms be extended:—

Dick, Kerr & Co., Ltd.—Overhead equipment.
Reid Bros.—Duct laying.
Johnson & Phillips, Ltd.—Switchgear.
British Insulated and Helsby Cables, Ltd.—Low-tension cables.

L.C.C. — A 2-cwt. electrically-driven power hammer is to be provided at a cost of £250 in order to carry out certain repair work at the Greenwich generating station.

Arc lamp raising and lowering gear is to be fitted to the lamps in the tramway car-sheds at a cost of £200.

Luton.—The T.C. has accepted the tender of Messrs. Macintosh & Co., Ltd., of London, for a year's supply of insulated cables.

Portsmouth.—The T.C. has accepted the following tenders:—

Section rails and fish-plates.—Dick, Kerr & Co., Ltd.
Tie-bars.—C. Richards & Sons.
Twin cable.—Henley's Telegraph Works Co.
Arc lamp carbons.—Oliver Arc Lamp, Ltd.

Plymouth.—The T.C. is to enter into a fresh contract with the Tudor Accumulator Co., Ltd., at £280 per annum for 10 years for the maintenance of the batteries at the Prince Rock station and at the Armada Street sub-station. The agreement may be terminated in five years in the event of the Council desiring to dispense with the batteries at Prince Rock. The combined sums now paid for maintenance amount to £319 per annum.

South Australia.—ADELAIDE.—According to *Australasian Hardware and Machinery*, Messrs. Wm. Adams & Co., Ltd., have secured the contract for the supply of the electric generating plant and high-tension switchboard to the Municipal Tramway Trust, Adelaide. The electric plant will be manufactured by Messrs. C. A. Parsons & Co., and the switchboard by Messrs. Reyrolle. The plant will consist of three units of 1,500 KW., each capable of giving 2,250 KW. as a maximum, and at 11,000 volts. Condensers will also be supplied by Messrs. Parsons. "This is one of the largest electric contracts so far let in Australia."

Stretford.—The U.D.C. has accepted the tender of Ashley & Damville for the annual supply of slack for the generating station, at 7s. 7d. per ton. It has further accepted offers of the British Westinghouse Co. and the Oliver Co. each to supply on approval a set of 10 arc lamps for six months.

Walsall. — For the T.C. Tramways Department the following tenders have been accepted for annual supplies of stores:—

British Thomson-Houston Co., Ltd.—Armature coils, mica cones and collars, and commutator segments.
Siemens Bros. & Co., Ltd.—Linen frame tape and linen tape.
Henley s Telegraph Works Co., Ltd.—B. & P. tape and Blackley tape.
British Insulated and Helsby Cables, Ltd.—Mechanical ears.
Edison & Swan United Electric Co., Ltd.—Lamps.
National Rail and Tramway Appliances Co., Ltd.—Brake blocks.

Wolverhampton.—The Corporation has accepted the tender of Messrs. Hadfield's Steel Foundry Co. for the renewal of points in Queen Square, at £279 10s.; and of the Electric Apparatus Co. for electric meters (less allowance for old meters) amounting to £114.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 17th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Resumption of discussion on Mr. D. Myles's paper on "Some Notes on Marine Boiler Design."

Electro-Harmonic Society.—Friday, December 17th. At 8 p.m. At the Holborn Restaurant. Smoking Concert.

Northampton Institute Engineering Society.—Friday, December 17th. At 5.45 p.m. Debate on "Electric Traction *v.* Steam Traction."

Institution of Electrical Engineers (Manchester Students' Section). — Tuesday, December 21st. At the Municipal School of Technology, Manchester. Debate on "D.C. *v.* A.C. for Railway Traction." Mr. J. S. Peck in the chair.

Institution of Civil Engineers.—Tuesday, December 21st. At 8 p.m. Further discussion on Mr. C. W. Hodson's paper on "Railway Signalling in India," and a paper on "The Design of Rolling Stock for Smooth-rail Working on Heavy Gradients," by Mr. F. W. Bach.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, December 20th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, December 21st.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, December 22nd.—Gymnasium, 6.30 to 9.30 p.m.

Headquarters will be closed from December 23rd, 1909 to January 2nd, 1910, inclusive.

(Signed) P. H. Campbell Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

The Constantinople Telephone Concession.—A Constantinople correspondent of a German newspaper draws attention to what he terms the peculiar methods of the Turkish Government in regard to the allocation of the telephone concession for the Turkish capital, for which 16 offers were submitted. A commission composed of high technical and various Government officials was appointed by the Ministerial Council to examine the tenders, and they selected five out of the 16 as representing competitors who alone could come into consideration as being worthy of confidence in the carrying out of such an undertaking. On a close examination of the tenders the commission adopted the system of giving a mark to each group of competitors for every compliance with the conditions contained in the specification. One of the conditions provided that the competitors must submit proof of having already constructed large telephone installations of the extent contemplated in Constantinople. It was fonnd that the most marks for the fulfilment of this condition were possessed by the Anglo-French-American group as represented by the Western Electric Co., of Chicago, the National Telephone Co., of London, the British Insulated & Helsby, Ltd., of London, and the Société Française Thomson-Houston, of Paris, and the Commission, therefore, expressed themselves in favour of the concession being granted to this group. As the group contains one of the oldest contractors for telephone installations, it was not surprising that the firm was able to maintain the record for the number of undertakings carried out. But in the opinion of the correspondent, this circumstance does not exclude the possibility that a more youthful company could execute the work better and under more favourable conditions than an old firm; and he remarks that such a case exists in this instance. Among the competitors the Commission placed in the second position the Ost Europaische Telegraphen Gesellschaft, which is a German undertaking. The technical members of the Commission even put the German company first on the ground that the offer was technically the best, and the correspondent learns that in another respect the company made a more favourable offer to the Government than the Anglo-French-American group. For instance, the company had recognised without further ceremony all the conditions in the specification, and had proposed in connection with the ultimate right of repurchase by the Government that a joint commission of members of the Government and the company should estimate the value of the installations, and thus fix the purchase price. On the other hand, the Anglo-French-American group changed the regulation in the sense that the purchase price should be represented by the value at which the installations stood in the company's books at the time of the repurchase. If, notwithstanding the more favourable offer of the German company, the Commission have awarded the concession to the triple group, the correspondent observes that other influences, political or otherwise, have been at work in the matter; and the German company has lodged a protest with the Turkish Government. But the question seems to be taking a much more unpleasant turn, as the Minister of Finance proposes to have a fresh specification prepared on the basis of the five close tenders, and to offer this solely to the Anglo-French-American group for acceptance or refusal. In the latter event, it is stated in conclusion, the new specification will then be offered to the other competitors in succession—a process which the correspondent severely condemns.

The Aluminium Situation.—According to a communication published from trade circles in the *Frankfurter Zeitung*, the hopes of an understanding among the French producers of aluminium, after months of preparatory work, had to be abandoned at the beginning of October. The inland understanding between the French firms, who produce as much as all other works combined, would naturally have formed the basis for a far-reaching combination. But from the beginning the allotment question or the regulation of the output of the individual works seems to have been incapable of solution. It is quite obvious that the powerful undertakings which during the period of high prosperity carried out what were doubtless exaggerated extensions, now object to renounce their comprehensive schemes in relation to production. Nevertheless, they will find themselves, if they also wish to improve the price of the metal, in the situation which they themselves created through the excessive straining of the (late) syndicate prices. The price of aluminium improved from the time of the appearance of the first syndicate rumour in June, 1908, but since the definite abandonment of this community of interests in October, consumers have manifested a natural reserve. This circumstance is aggravated by the accumulating offers of intermediaries who seem, owing to the continued circulation of syndicate rumours, to have supplied themselves with large quantities at the lower prices prevailing until recently. But as their speculative purchases were not so quickly realised as they had hoped for, they are inundating the market with cheap prices which again appear at about 1s. 3d. per kilogramme and lower for crude aluminium. Apart from this, consumers are deriving advantage from the situation. There is no doubt that the consumption of the metal is increasing, and must in all probability continue to progress if the price is kept within normal limits. These may be regarded as from 1s. 5d. to 1s. 7½d. per kilogramme for crude ingots or plates, with an extra of from 5d. to 5½d. for the rolling-out of sheets. On the basis of this charge for sheets, the manufacture of aluminium vessels and various articles is remunerative, but the overstepping of this maximum would reduce the consumption. In conclusion, it is stated that the present average price of 1s. 3d. per kilogramme for crude aluminium only represents a small profit, but it no longer directly results in a loss.

What is "Annual Horse-power?"—The Niagara Falls Park Commission recently sued the Canadian Niagara Power Co. for some £3,000 rental for excess power generated at the company's power house during the years 1905-8; the judge held that the "actual power"—by which is clearly meant the *energy* used, for it was defined as rate multiplied by time—was to govern the rental, and not merely the rate alone. The Commission, according to the *Electrical World*, has now applied for a rehearing of the case, contending that in the case of electricity a rate can be sold—the rate of doing work. The question is, in fact, whether the maximum demand shall control the rental, or the total energy supplied. In the case of a water-power plant, of course, the former may be a vastly more important matter than the latter. The dispute has probably arisen from the too common tendency to speak of power or current when one really means electrical energy; an agreement properly drawn up by a man who had a clear understanding of the fundamental distinction between the two could not lead to this confusion. The case is probably being heard this week, and may ultimately reach the Privy Council.

Note this Statement.—A Canadian correspondent, writing under this heading, says: "Within a radius of 8 miles of Ottawa are 200,000 electric H.P., and within a radius of 55 miles the amount is estimated at 917,403 H.P. Of this amount only 58,400 H.P. is in use, leaving 859,003 H.P. available. What an industrial centre Ottawa should be!"

Football.—L.C.C. Sub-stations Football Club.—On Wednesday last a football match took place at Herne Hill, between the Southern and Northern Sub-stations of the L.C.C. Tramways. The president of the Southern Section Club, Mr. E. L. Pope, kicked off at 3 p.m. before a large and enthusiastic audience, and after an exciting and well-fought game the result was a win for the Southern Section by 4 goals to 1.

Electric Time Service.—Portsmouth T.C. will take £300 from the reserve fund for the purpose of installing an electric time service

Electric Shock Fatalities.—A miner, engaged as a "brusher" in the Dechmont Colliery, No. 1, Cambuslang, accidentally came in contact with an electric lamp, and expired almost immediately. A joiner was killed in the Rolled Steel Forge Co.'s works, Wishaw. Along with others he was engaged in lifting a steel plate on to an iron table. A chain sling was fixed round a wooden beam, along which ran the electric wire which is used for lighting the workshop, and which carried current at about 230 volts. The sling came in contact with the live wire, which charged the sling that was being held by the unfortunate man, who was thus killed.

Appointments Vacant.—The L.C.C. is going to appoint a switchboard attendant to be employed in the chief engineer's department at Hungerford House, at 35s. per week for six months. Associate Head of the Department of Electrical Engineering and Applied Physics at Northampton Polytechnic Institute (£400). The Ilford U.D.C. is wanting a tramway manager at £300 per annum. See our "Official Notices" to-day.

Architects and Specialised Branches.—In the course of a discussion at the Royal Institute of British Architects on Monday night, on "Architectural Education in America," Mr. T. J. Jackson, R.A., said that when he had problems of heating and ventilating and electric lighting to carry out in connection with a building he called in an expert, and he thought the architect was a wise man who did this, for it was impossible for one man to know everything. Mr. H. H. Stathem agreed with Mr. Jackson that it was well to get the assistance of specialists in such matters, but thought architects ought to know the general principles underlying all matters connected with the erection and equipment of a house.

Metropolitan Association of Electric Tramway Managers.—The members of this Association held a meeting on Friday, the 10th inst., at the Municipal and County Club, Whitehall, S.W., those in attendance being Sir Clifton Robinson (London United Tramways), Messrs Blain (West Ham), Howard (Barking), Coveney (Erith), Mittelhausen (Bexley), Ulmann (East Ham), Schofield (Leyton), Hammond (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), hon. secretary. Apologies for absence were received from Messrs. Bruce (L.C.C.), Balfour (Dartford), and Murray (Walthamstow). Sir Clifton Robinson was unanimously elected chairman of the Association and Mr. Goodyer was re-elected hon. secretary. Various matters relating to Metropolitan tramway interests were discussed.

Canadian Electric Steel.—Referring to the Electric Steel Co.'s experimental plant, previously mentioned, the *Electrical World* says that it is expected that by 1912 about $15,000,000 will have been invested in the company's plant and works. It is reported that there are a dozen very wealthy persons interested in the enterprise.

Electro-Harmonic Society.—A smoking concert is to be held in the King's Hall, Holborn Restaurant, to-night at 8 o'clock. The artistes include the following:—Messrs. Harold Wilde and William Forington; Mr. Joe Morley (Banjo Solos); Mr. Nelson Hardy (ventriloquial sketches); Mr. Will Edwards (humorous songs); Mr. Harold Montague (humorous sketches); and Mr. Robert Ganthony (humorous sketches).

Copper.—The present hardening of the Copper Market is evidence of cheerfulness on the part of the "bulls" and incredulity as to the imperfections in the completeness of the copper combine, which have occasionally been surmised. The *Financial News*, in an article of December 7th, calls attention to another important factor in the situation—viz, the decision of the U.S. Courts as to the legality of the Standard Oil Trust. "'The significance," says the writer, "of the decision, should it be finally confirmed by the Supreme Court, to which it will be promptly referred, is that it will bring in question the large number of other industrial corporations that are already operating on much the same lines . . . . not to mention the new companies that are in preparation." It is pointed out, however, that in a previous case the Supreme Court refused to confirm a decision of a District Court against the Standard Oil Co., and that this may possibly happen again. Naturally, if the decision should be adverse to the Trusts, the effect on the market, at any rate for the time being, will be considerable. Curiously enough, the *Financial News* article notes, the Budget is also extending its influence over the situation. It is surmised in American financial circles that a failure to compromise must result in extensive borrowing, which will sweep up the investable money available.

Northampton Polytechnic Institute.—The annual distribution of prizes took place at this Institute in Clerkenwell on Friday evening last, the conversazione of the members and students being held on the following evening as usual. On Friday the distribution was performed by Sir John Wolfe Barry, who delivered an interesting address, in which he alluded, among other things, to the educational and social influence of such institutions as the Northampton. In the course of his report to the assembly, the popular principal, Dr. R. Mullineux Walmsley, referred to the important decision of the L.C.C. to make a special grant of £5,600 for the establishment of an electric light and power generating station. This would afford excellent opportunities for the senior students. Aeronautical engineering is also now among the subjects taught at this Institute.

International Conference on Electrical Units and Standards, 1908.—A Blue Book has been issued containing an Appendix to the Report of the Conference, consisting of notes on the methods adopted in various standardising laboratories, to realise the international ohm and ampere, and to prepare the Weston Normal cell. While the methods described fall within the general international specifications, the details of the procedure differ; the various methods, however, give very nearly identical results. The bulk of the matter relates to the procedure followed at the official laboratories of the United States, France, Germany and Great Britain, in the preparation of the Weston Normal cell.

National Industrial Education League.—A proposal is on foot to establish a League with the foregoing title, for the purpose of giving boys, before they leave school, a sound elementary industrial training. Mr. R. Applegarth, of 23, Parchmore Road, Thornton Heath, is the organiser, and has already obtained a very large and influental body of supporters, including 57 Trades Councils. The central offices are at Craig's Court House, Charing Cross, S.W.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting held in London last week there was a discussion on the state of the electrical industry, in which Messrs. Garcke, W. Rutherford, S. P. Thompson, J. S. Raworth, A. A. Campbell Swinton, W. M. Mordey and Theodore Rich took part. Our report will appear next week, together with the concluding part of the paper.

INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW).—Members of the Glasgow Local Section, I.E.E., held their eighth annual dinner in the Grosvenor Restaurant, Glasgow, on the evening of December 1st. Mr. E. George Tidd, chairman of the Section, presided over an attendance of 248, and Messrs. W. W. Lackie, W. M'Whirter, and H. A. Mavor were croupiers. The Lord Justice Clerk proposed "The Corporation of Glasgow." Bailie Archibald Campbell, who responded, said the electricity department was one of the most prosperous they had. They owed the success of the electricity department to the fact that they had been fortunate in the men at the head of it—Mr. Chamen, who was their chief engineer for a number of years, and his successor, Mr. Lackie. They had now some 65,000 H.P. at their electricity works, and the results of their operations from the financial point of view had been most satisfactory. Prof. Archibald Barr proposed "The Institution of Electrical Engineers." Dr. Kapp replied, and said that while electrical engineers had conferred many benefits on mankind, they must be on their guard against trying to do too much with electricity. If anybody, for instance, tried to smelt iron ore by electricity, he would find his pig-iron very dear, and like many who benefited others, the electrical engineer did not get much good himself from the benefits he conferred. Electricity was the servant and helpmate of all other industries, more especially of the younger industries. They heard a great deal about the foreign advances in electricity, but in other countries there were a greater number of young industries. The progress of electrical science was controlled by what might be called intellectual tides. To-day it was a race for progress between us and America, and meantime we were leading. This cry about our being backward mostly emanated from the Cassandras who controlled the electrical Press. It was a case of continual advancement, now in this country, now in that. He had recently visited the steel works of Hickman, Ltd.; the rolling mills there were driven by a set of continuous-current motors with the usual polyphase dynamos, and that installation was as perfect as anything that could be made. All that stuff was made in England by the Electric Construction Co., and no doubt many other firms could do equally good work. The Lord Bishop of Glasgow proposed "The Glasgow Local Section of the I.E.E.," which during the last 10 years had doubled its numbers. The chairman, in reply, said that during the fog which had recently been over the city, the electrical pressure had been maintained up to the standard. A vocal and musical programme was given throughout the evening.

NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.—In the programme of this Society the following papers and visits are announced:—

December 17th.—Discussion on "Electric Traction *v.* Steam."
January 21st.—"Choice of Prime Movers for Power Stations," by E. T. Driver.
February 4th.—"History and Manufacture of Electric Glow Lamps," by L. Wallis.
February 18th.—"Hydraulic Presses," by H. Webb.
March 4th.—"D.C. Liquid Starters."
March 18th.—"Oxidation of Atmospheric Nitrogen in the Electric Arc," by Mr. S. Field.

VISITS.

January 21st.—Board of Trade Laboratory, Whitehall.
February 12th.—Lot's Road Power Station.
February 25th.—Western Electric Co.
March 5th.—Robertson's Lamp Works.
March 19th.—National Physics Laboratory.

INSTITUTION OF CIVIL ENGINEERS (STUDENTS).—At the meeting on December 3rd, Mr. George Ingram, Stud.Inst.C E., read a paper on "The Design of Generating Stations," describing a suggested arrangement of plant for a shipyard, and for a large high-tension alternating current station suitable for a bulk supply scheme.

IRON AND STEEL INSTITUTE.—A scholarship entitled the "Andrew Carnegie Research Scholarship," will be awarded annually to a selected candidate, or candidates, for the purpose of conducting researches in the metallurgy of iron and steel and allied subjects. Application should be made to the secretary before the end of February.

King's College (University of London).—Special courses of lectures will be delivered on "Irrigation Works" (commencing January 13th), "Reinforced Concrete" (January 19th), and "Single-phase Electrical Traction" (January 17th), the last-named by Prof. Ernest Wilson and Mr. Francis Lydall.

Physical Society of London.—The fifth annual exhibition of electrical, optical and physical apparatus—mainly electrical—was held at the Imperial College of Science on Tuesday last. There was a very interesting collection on view, though there were, perhaps, not quite so many novel features as last year. It is a pity that the duration of the exhibition is so short—it is impossible to do justice to the apparatus shown in the time available; but doubtless the objections to extending the time are very great. We shall illustrate and describe a number of the exhibits in later issues.

Ordnance Athletic Club.—A smoking concert was held on December 14th at the King Edward VII, New Corporation Street, Birmingham, in connection with the Football Section (Second Division) Works League of this club, between 300 and 400 of the staff and workpeople being present. The chairman, Mr. J. R. Garner (works manager), read a letter of apology from the superintendent of works and president of the "Ordnance" A.C., Mr. F. E. Hinton, who regretted his inability to preside, but wished the club every success, he being strongly in favour of sports. He considered they were most essential to workers shut up in a factory all day long, and he trusted during the forthcoming season that the cup put up for competition by Messrs. Vickers, Sons and Maxim, Ltd., Sheffield, the parent company, would again come back to Birmingham. This cup was won the first year of competition, 1908, by the Ordnance Athletic Club, against teams from the works of Vickers, Sons & Maxim, at Barrow, Sheffield and Erith, and the Wolseley Motor-Car Works, Birmingham. The chairman heartily confirmed the president's sentiments, and stated that a firm who had a first-class athletic club, were invariably a successful business concern, a good player was usually a good worker. Mr. Morrison, the secretary and commercial manager of the company, was in the vice-chair. Mr. Williams, assistant works manager, proposed a vote of thanks to the chairman, which was seconded by Mr. Partridge, secretary of the Entertainments Committee. A toast was proposed by Mr. Alexander, who coupled the Works Football Association, together with the artistes. Mr. E. M. Mitton, the chairman of the Football Association, Birmingham works, responded. A very enjoyable programme was given.

Marvels of Electricity.—The *Daily Mail* has lately been greatly excited over a report that Herr Ruhmer has succeeded in transmitting the likeness of inanimate objects by telegraph—"Seeing by Wire." That this feat is conceivable has long been well-known; the enormous cost of the feat is also well-known. If any millionaire cares to devote a quarter of a million sterling to its achievement, we have no doubt that success will be attained—though we doubt whether any useful purpose will be served thereby. Our contemporary, however, finds quite a lot to say about what may happen—in the future.

Wireless telephony from Paris to New York has formed another subject for the *Daily Mail's* imagination to work upon. We are assured that in a few weeks it may be possible to speak across the Atlantic—over 3,500 miles. Nay, in a leading article we are informed that it is "on the eve of fulfilment!" We have no wish to be a wet blanket, but we think it would be well to talk efficiently over, say, 500 miles before asserting so confidently that seven times that distance will shortly be covered. The transmission of power through space, as the solution of the aerial navigation problem, forms a fitting wind-up to the leader referred to.

Damages for Personal Injury.—In the King's Bench Division on Wednesday, at a trial before Mr. Justice Ridley and a special jury, Mr. T. A. Kerr was awarded £150 damages against Messrs. T. Tilling, Ltd., for personal injuries. The plaintiff was alighting from an electric tramcar in Camberwell when he was knocked down by one of the defendants' omnibuses passing on the near side. The judge having left the building when the verdict was announced, judgment was not entered.

German Patent Cancelled.—We are informed by the Regina Arc Lamp Works, Cologne, that in consequence of proceedings taken by the German Beck Arc Lamp Co. for infringement in respect of the former company's "Conta" lamp (described in our issue of November 5th, p. 751), the Regina Arc Lamp Co. has sought and obtained the cancellation of the Beck Co.'s German patent relating to the support of the negative carbon in flame arc lamps.

Plant for Sale.—The Brighouse Corporation is offering for sale a couple of Crossley gas engines and dynamos, a booster, switchboard, &c. Particulars will be found among our advertisements to-day.

Efficiency of Turbines.—Too late for our "Correspondence" columns, the A.E.G. Electric Co., Ltd., write us with reference to their letter of the 1st ult., published in our issue of November 5th (page 732) pointing out that an error appears to have crept into diagram fig. 1, in which the Witkowitz A.E.G. turbine is given as one of 3,000 kw., while the letterpress gives the output as 2,000 kw. In point of fact, this machine was of 2,000 kw. output, and the features that they wished to bring out in the diagram were (1) that the 2,000-kw. A.E.G. turbine had the same efficiency as the 3,000-kw. A.E.G. machine; and (2) that both the 2,000-kw. and 3,000-kw. A.E.G. turbines showed a better efficiency with a 91·7 per cent. vacuum than the 2,000-kw. Willans-Parsons turbine.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Luton T.C. has increased the salary of Mr. H. A. Kell, chief assistant at the Electricity Works, from £117 to £140 per annum.

The Fareham U.D.C. has appointed Mr. Rowland Stanley Jull as assistant engineer at the new electricity works.

A staff presentation was made to Mr. W. D. Morgan, late managing engineer of the Coatbridge and Airdrie Electric Supply Co., Ltd.—at a smoking concert held in the Eagle Hotel, Coatbridge, on Friday last. Bailie Neilson, the local chairman of the company, presided, and the presentation was made by Captain Arthur, one of the directors.

Mr. F. J. Launchbury has been appointed "Resident Engineer" to the Coatbridge and Airdrie Electric Supply Co., Ltd.

General.—Nobel Prizes.—The Nobel Prize for Physics this year has been divided between Mr. G. Marconi, for his work in wireless telegraphy, and Prof. Karl Braun, whose scientific discoveries also include research in wireless telegraphy. The Chemistry prize has been awarded to Prof. W. Ostwald, one of the leading investigators in the field of electro-physics. Each of the Nobel prizes this year is worth £7,734.

Mr. A. J. E. Catto, formerly in the service of the British Westinghouse Electrical and Manufacturing Co., Ltd., and lately trading in partnership as John Price & Co., Handsworth, Birmingham, has arranged to go to Montreal, per *Corsican*, on 17th inst., to enter the employ of Messrs. Allis-Chalmers, Bullock, Ltd., of that city.

Mr. Edward G. C. Barton has resigned his position as managing director of the City Electric Light Co., Ltd., Brisbane, Queensland. and has been appointed consulting engineer, thus maintaining his connection with the company while securing liberty to engage in private consulting practice. According to an Australian exchange he has taken an office in the New Zealand Insurance Co.'s building in Queen Street, Brisbane.

Obituary.—Dr. Ludwig Mond.—This world-renowned chemist passed away at his London residence on Saturday morning last. Born in Germany in 1839 he came to England in 1862, and straightway turned his training as a chemist to good account. He settled definitely in this country in 1867, and in 1873, in conjunction with Mr. (now Sir) John Brunner, he established the great firm of Brunner, Mond & Co., of Northwich, whose alkali manufactory is now the largest in the world, and whose commercial success is the envy of all. His brain was most fertile in producing inventions in various branches of applied chemistry. In the course of an appreciative review of his life in the *Morning Post*, a writer says:—"From an early period in his career he directed his attention to the great problems of the economical consumption of coal, and of the recovery of ammonia from nitrogenous products of coal distillation. Subsequent to 1883 he took out a number of datents for appliances, which combine those two problems by utilising the coal in the form of gas, and recovering at the same time the nitrogen contained in it in the form of ammonia. The outcome of his work in that direction formed the subject in 1889 of his presidential address to the Society of Chemical Industry. Dr. Mond afterwards gave particular attention to the use of the gas produced by his methods for the direct production of power by means of gas engines, and to the utilisation of the large amount of heat that had hitherto been lost in hot exhaust gases from such engines. With the view of utilising the gas obtained by him from coal for the direct production of electricity, Dr. Mond worked out in conjunction with his assistant, Dr. Carl Langer, a new form of gas battery, which he described to the Royal Society in 1889. What is known as 'Mond gas' is now extensively employed in industry." Some 13 years ago Dr. Mond founded and endowed the Davy-Faraday Research Laboratory at the Royal Institution. He was most generous in his support of scientific research and scientific institutions, and to the latter he, of course, made very many important contributions in the form of papers.

Mr. Edward Tangye.—The death is recorded, in his 78th year, of Mr. Edward Tangye, one of five brothers who built up the well-known Birmingham engineering business of Tangye's Ltd. Mr. Tangye was no figure-head director; he took, in his early years, a very active interest in the mechanical engineering department, and in his later years, when ill-health kept him away from the works, his practical efforts in the business did not flag, for he continued to devote a real interest to the design and construction of automatic machinery. To our mind, English engineering owes much of its past and present greatness and success to the fact that such men—men who know their business well—have with their own hands and heads built up big undertakings from small things. Infinitely better thus than to have boards of directors and figure-head chairmen who, well as they may know finance or the manner of the board-room, not being practically experienced, have not heart and soul in the concern over whose destinies they preside in the interests of shareholders.

Mr. H. V. Cowell, traffic superintendent of the New St. Helens and District Tramways Co., died at his residence, St. Helens, on Saturday, after a few days' illness, aged 32 years.

TRADE STATISTICS OF HOLLAND.

The following figures, showing the imports of various goods into Holland in 1908, are taken from the recently issued annual trade statistics; the figures for 1907 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1907. Gulden.	1908. Gulden.	Increase or decrease. Gulden.
Machinery, steam, industrial and agricultural.—			
From Belgium	2,364,000	2,208,000	— 156,000
„ Great Britain ...	6,233,000	6,626,000	+ 393,000
„ Hamburg	160,000	141,000	— 19,000
„ Germany	13,139.000	14,178,000	+ 1,039,000
„ United States ...	3,276,000	3,934,000	+ 658,000
„ Other countries ...	241,000	273,000	+ 32,000
Total ...	25,413,000	27,360,000	+ 1,947,000
Gutta-percha, raw.—			
From France	1,422,000	758,000	— 664,000
„ Great Britain ...	38,000	21,000	— 17,000
„ Dutch Guiana ...	451,000	573,000	+ 122,000
„ Java	3,085,000	1,328,000	— 1,757,000
„ Other countries ...	184,000	132,000	— 52,000
Total ...	5,180,000	2,812,000	— 2,368,000
Gutta-percha manufactures.—			
From Belgium	549,000	499,000	— 50,000
„ Great Britain ...	297,000	366,000	+ 69,000
„ Germany	250,000	282,000	+ 32,000
„ Other countries ...	36,000	6,000	— 30,000
Total ...	1,132,000	1,153,000	+ 21,000
Iron wire.—			
From Belgium	709,000	1,584,000	+ 875,000
„ Great Britain ...	37,000	20,000	— 17,000
„ Germany	17,406 000	20,912,000	+ 3,506,000
„ United States ...	1,000	44,000	+ 43,000
„ Sweden	277,000	216,000	— 61,000
Total ...	18,430,000	22,776,000	+ 4,346,000
Instruments, physical, chemical, &c.—			
From Belgium	562,000	534,000	— 28,000
„ Great Britain ...	380,000	306,000	— 74,000
„ Hamburg	190,000	76,000	— 114,000
„ Germany	3,724,000	3,825,000	+ 101,000
„ Other countries ...	141,000	96,000	— 45,000
Total ...	4,997,000	4,837,000	— 160,000
Copper wire.—			
From Belgium	146,000	271,000	+ 125,000
„ Great Britain ...	77,000	83,000	+ 6,000
„ Hamburg	272,000	26,000	— 246,000
„ Germany	2,709,000	3,067,000	+ 358,000
„ Other countries ...	5.000	8,000	+ 3,000
Total ...	3,209,000	3,455,000	+ 246,000
Steel wire.—			
From Belgium	4,040,000	1,718,000	— 2,322,000
„ Great Britain ...	591,000	495,000	— 96,000
„ Germany	8,300,000	4,865,000	— 3,435,000
„ Other countries ...	31,000	8,000	— 23,000
Total ...	12,962,000	7,086,000	— 5,876,000
India-rubber manufactures.—			
From Belgium	277,000	309,000	+ 32,000
„ Great Britain ...	1,212,000	1,455,000	+ 243 000
„ Germany	1,029,000	964,000	— 65,000
„ United States ...	6,000	11,000	+ 5,000
„ Other countries ...	30,000	17,000	— 13,000
Total ...	2,554,000	2,756,000	+ 202,000
Glass manufactures.—			
From Belgium	266,000	254,000	— 12,000
„ Great Britain ...	120,000	89,000	— 31,000
„ Germany	1,539,000	1,467,000	— 72,000
„ Other countries ...	13,000	7,000	— 6,000
Total ...	1,938,000	1,817,000	— 121,000
Porcelain.—			
From Belgium	175,000	145,000	— 30,000
„ Great Britain ...	57,000	51,000	— 6,000
„ Germany	1,059,000	947,000	— 112,000
„ Other countries ...	68,000	51,000	— 17,000
Total ...	1,359,000	1,194,000	— 165,000

N.B.—Gulden = 1s. 8d.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. Sisson & Co., Ltd. (82,295).—This company's annual return was filed on November 12th, when 3,225 preference, 11,601 ordinary and 7,000 deferred shares had been taken up out of a nominal capital of £25,000 in 5,000 preference, 13,000 ordinary and 7,000 deferred shares of £1 each. £9,376 paid. £12,450 considered as paid. Mortgages and charges: Bank overdraft—limit £5,000, actual amount £4,630 2s. 3d.

Electro-Mechanical Brake Co., Ltd. (98,276).—A memorandum of satisfaction in full on November 20th of charges dated May 4th and June 9th, 1909, securing £490, has been filed.

Monte Video Telephone Co., Ltd. (27,208).—This company's annual return was filed on November 17th, when 86,492 preference and 72,680 ordinary shares had been taken up out of a nominal capital of £160,000 in £1 shares (87,000 preferred and 73,000 ordinary). £159.172 is considered as paid. Mortgages and charges: Nil.

Pacific and European Telegraph Co., Ltd. (36,683).—This company's annual return, made up to November 9th, has been filed. The entire capital of £100,000 in £10 shares has been taken up. £4 per share has been called up. £40,000 has been paid. Mortgages and charges: £99,400.

CITY NOTES.

West Kootenay Power and Light Co., Ltd.

The annual report for the year ending August 31st, 1909, states that, having regard to the conditions that have existed in the copper and other mining industries during the year, the result to the company is considered highly satisfactory. The gross revenue from all sources amounted to $300,954, from which must be deducted the operating expenses, maintenance and keep-up of every nature $96,773, leaving a net revenue of $204,181. The interest on the outstanding bonds and the bonds redeemed by the sinking fund as provided in the mortgage absorbed $104,405, leaving a surplus for the year available for dividends of $99,776. Dividends have been paid during the year amounting to $59,500, leaving a balance to be added to profit and loss account of $40,276. The amount to the credit of profit and loss account at the beginning of the year was $409,732, to which has been added the balance as above—$40,276—making a total of $450,008.

In view of having available this large balance at the credit of profit and loss account, the directors have thought it advisable to write off at once, instead of over a period of years, the whole of the cost, expenses and discount in connection with the issue of $1,500,000 of bonds, the entire interest charge during construction of the new installation, instead of adding it to the cost of construction, a substantial and fully adequate amount for depreciation in addition to the sinking fund, and to make provision for all doubtful debts, absorbing in this way the sum of $325,000.

This still allows the sum of $125,007.86 to be carried forward to the credit of profit and loss account.

During the year, the president, in company with the general manager, has visited the plant, both at Bonnington and Cascade, as well as the sub-stations at Rossland, Grand Forks, Greenwood and Phœnix, and reports the plant in most excellent condition and in a high state of efficiency, reflecting great credit on the general manager and his staff.

The completion of transactions between this company and the Cascade Co., by which this company has taken over the property and rights of the Cascade Co., has been delayed by many difficulties, but all questions have now practically been settled.

In regard to the future, it may be stated that the present low price of metals makes it advisable not to expect any very large increase during the immediate ensuing year, but the directors have great confidence in the future development of the country and the prosperity of the company.

Prospectuses.—*The Rosario Electric Co., Ltd.*—The subscription list opened on Tuesday and was to close yesterday in an issue of 20,000 ordinary shares of £5 each at par. The purposes for which the money is required were described by the chairman at the recent meeting of the company (see Electrical Review, November 5th, 1909).

Sempah Rubber Estates, Ltd.—An issue of 60,000 shares of £1 in this company has been offered for subscription at par. The company is to acquire and develop the Sempah and Sungei Jawce Estates, in the district of Neboug Tebal, Straits Settlements. There are 100,000 trees planted, some of them having been put down in 1905, but nearly one-half in 1909.

Bujong Rubber Estate, Ltd.—This company has been issuing 26,000 shares of £1 each at par. It is to acquire the Bujong Rubber Estate, Mukin of Sungei Buloh, Selangor, F.M.S. (1,000 acres, of which 356 have been planted and 129 are now being opened).

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors' report for the year ended September 30th last shows a balance of £15,053, compared with £13,391 for the previous year. The undivided revenue for disposal is £7,851. After placing £3,000 to reserve, it is proposed to pay a dividend of 1¼ per cent. on the preference shares, absorbing £1,875, and leaving £2,976. £1,500 is to be appropriated towards future maintenance of permanent way, and £1,476 is to be carried forward. Capital expenditure incurred during the year amounted to £4,962, for additional power plant and machinery, and to £1,809 for extensions of lighting mains. The sale of electricity increased by £398, compared with the previous year, or nearly 10 per cent., and, with the additional plant now at their disposal, it is hoped to further increase the income of the company from this source.

R. Waygood & Co., Ltd.—A dividend of 6d. per share on the ordinary shares is announced.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Leonard Darwin presided on Tuesday at the annual general meeting held at 106, Cannon Street, E.C. In moving the adoption of the report (see Electrical Review, December 10th, page 947), he said that the shareholders might be congratulated on the showing they were able to make on this occasion. The year had been an anxious one for them all, as the ever-increasing cost of raw material had been a constant menace. The advances had been, however, so marked and of so steady a character, that purchasers of their goods had been able to appreciate the absolute justice of the increases in selling prices which they had made during the year. Although their turnover had been higher than last year, and by turnover they meant the cash obtained for their goods, yet this turnover did not necessarily mean that the bulk of their business had been greater. An increase in the selling price of goods always tended to a decrease in the bulk of any business, but when the selling prices fell, it did not follow that the bulk would immediately increase sufficiently to prevent a diminution in cash receipts, which might, therefore, become less. He did not wish to labour this point, but he thought it well to refer to it for the benefit of some of the shareholders who had not an intimate knowledge of manufactured goods. Some of their foreign agencies had not done so well as they had reason to expect. To a certain extent this was due to their markets, which were situated at a distance, not responding so quickly to the changing conditions as their home agencies were able to do. They had been obliged to give up their warehouse and premises in Paris, where they had been for many years. This was due to their landlord requiring them for his own occupation. In selecting their new headquarters in France they had encountered considerable difficulty in getting exactly what they required at a reasonable rent in accommodation and in situation which they thought best suited their trade. Although the accommodation they had arranged for was quite sufficient for their purposes, yet they were not completely satisfied with the position. Their desire was to be efficient without extravagance. In the extension of their business they were making a new venture by opening a branch at Christchurch, New Zealand, and the agent who would have charge of it had just arrived at his destination and had secured the necessary premises. Their French works, which they had been slowly extending to meet the growth of trade, had in the last few years had a considerable amount of money spent on them, and they were now making a large expenditure in buildings and machinery to be prepared to supply the increased demand which they had expected for Palmer cord motor tires. In some lines of business at Silvertown they were suffering from a congestion which would doubtless require to be dealt with and would entail further expenditure. This question was having the most serious consideration of the board, but he did not now propose to lay before them any details on this subject, as their ideas for the present were quite immature. The raw rubber market, after touching a price of 9s. 2d. per lb. for the fine hard Para grade, had fallen away to 7s. 2d. per lb., but he did not care to venture a prediction of what was likely to be the position three months hence. In the report the board had made some provision for a possible fall in the selling prices of such of their stocks as might have been manufactured at a time when the standard price of the raw material was higher than at the date of realising their manufactured goods. The chairman then formally moved the adoption of the report and the distribution of a dividend of 5s. per share, or at the rate of 5 per cent. per annum, payable on the 1st prox. on the preference shares, and of a dividend of 15s. per share free of income-tax, payable on 16th inst., to the holders of ordinary shares.

Mr. R. Kaye Gray seconded the motion.

A shareholder said there was some talk in the daily Press some months ago about their intending to open a new factory. Was this still in contemplation?

The Chairman: That is really the point to which I alluded in my remarks—that further expenditure may become necessary at any moment to meet our growing trade. But at present we have come to no definite decision. The matter is, as I say, being most carefully considered by the board, and directly we come to any definite conclusion we shall let the shareholders know on the first available opportunity; but there is nothing at present decided. Our trade—especially, I think I may say, in bicycle tires—has been growing very rapidly, and it may be absolutely necessary, in the interests of the shareholders, to extend our premises; but at present we have made no final decision.

The motion was carried unanimously.

Major Darwin was re-elected as a director.

In responding to a vote of thanks to the board and staff, the Chairman reminded them that they had strengthened the board by adding two extraordinary directors, the two brothers Gray, and he might say that there was no one who knew the details of the working at the works better than those two gentlemen. Their addition to the board as extraordinary directors added strength to their deliberations.

Western Telegraph Co., Ltd.—The directors have declared a first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1910, being at the rate of 6 per cent. per annum.

Manx Electrical Railway Co., Ltd.—The directors have declared a dividend of 5½ per cent. on the preference shares.

Melbourne Electric Supply Co., Ltd.

The directors report that during the year ended August 31st, 1909, capital expenditure in Australia on additional land, buildings, plant and mains, &c., has been incurred as follows:—On the Melbourne undertaking, £22,807; on the Geelong undertaking, £1,745 = £24,552. The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings was £23,013. Adding the dividend received on the company's holding of ordinary shares in the Adelaide Electric Supply Co., Ltd., together with discounts, transfer fees, &c., the total gross profit for the year amounted to £29,733, which compares with £22,030 for the previous year. Management and general expenses at the London head office absorbed £2,045, and interest on debenture stock and sundry loans amounted to £14,218. After payment of these charges, there remains a balance to the credit of profit and loss of £13,470, to which must be added the amount of £1,772 brought forward from the previous year, making a total credit balance of £15,242. Of this sum the directors have applied amounts of £979, £504 and £1,037 in writing off the special charges, expenses, and losses, as shown in detail in the profit and loss account, leaving an available balance of £12,722, which the directors recommend should be applied as follows:—Dividend on 20,000 7 per cent. first preference shares to August 31st, 1909, paid on September 1st, 1909, £1,821; transfer to depreciation and general reserve account, £5,124; writing down suspense account, £2,039; writing down head office furniture, £43; leaving a balance to carry forward of £3,694 = £12,722. In order to pay off loans from the company's bankers and others, and to make provision for future necessary expenditure, the capital account of the company has been readjusted during the past year. With the consent of the debenture stock and share holders, an issue of a further £100,000 5 per cent. first mortgage debenture stock, and of £100,000 7 per cent. first cumulative preference shares of £5 each, ranking in priority to the existing £150,000 6 per cent. cumulative preference stock, was made in May last. Out of the proceeds of this issue all outstanding loans have been paid off. Simultaneously the 30,000 6 per cent. cumulative preference shares of £5 each were converted into £150,000 6 per cent. cumulative stock. The board have under consideration proposals for dealing with the arrears of dividend on this stock, amounting at August 31st, 1909, to £71,950. The following table shows the progress made by the Melbourne and Geelong undertakings:—

Date.	Lighting in 30-watt lamps.	Motors in rated H.P.	Total equivalent connections expressed in 30-watt lamps.	Total units sold.	Gross profit.
MELBOURNE.					
August 31st, 1907 ..	76,278	1,553 H.P.	125,974	1,820,879	£14,290
August 31st, 1908 ..	90,088	2,150 H.P.	157,412	2,326,307	£16,053
August 31st, 1909 ..	104,900	2,434 H.P.	182,788	2,716,174	£20,573
GEELONG.					
August 31st, 1907 ..	22,150	701 H.P.	44,582	344,501	£2,064
August 31st, 1908 ..	26,942	818 H.P.	51,864	312,661	£1,623
August 31st, 1909 ..	28,336	893 H.P.	56,920	364,770	£2,439

Further illustration of the growth of the Melbourne undertaking is afforded by the curves given in the report. It will be seen from the foregoing that there is good ground for satisfaction with the growth of the company's business during the past year, the results comparing favourably with those of similar undertakings in Australia and elsewhere. The Adelaide Electric Supply Co., Ltd., has continued to make satisfactory progress during the year; and a dividend at the rate of 6 per cent. on the ordinary shares was declared and paid on the 6th inst., for the year ended August 31st, 1909, credit for which has been taken in this company's profit and loss account. Mr. David Finlayson has joined the board of the company in London, and a local board has been formed in Melbourne, consisting of the Hon. W. L. Baillieu, M.L.C., the Hon. Agar Wynne, M.H.R., and the company's engineer and manager, Mr. F. W. Clements.

Allgemeine Elektricitäts Gesellschaft.—At the annual meeting of the A.E.G. on December 9th, it was mentioned that a large new site had been acquired near the Hennigsdorf suburban railway station, with a frontage of 5,000 ft. to the Ship Canal between Berlin and Stettin. The land was intended for the erection of new and the amplification of existing departments. Questions as to whether porcelain ware, aeroplane and airship works were projected on the site failed to elicit any information. It was stated that a number of schemes were in preparation in connection with the projected utilisation of foreign water-powers, but no details were given. As far as the prospects of the company for the current year are concerned, it was intimated that the orders coming to hand in the new financial year had experienced an increase, and if the progress continued the stock of orders would soon overtake those in the previous year. The turnover and orders on hand on October 31st amounted to £12,650,000, as compared with £12,850,000 on the corresponding date in 1908. It was explained that the slight reduction was due to the end of the remainder of the orders resulting from the late period of general prosperity, as well as of orders from the Berlin Electricity Works, which were restricting extensions. If unforeseen events did not occur, the A.E.G., which was fully employed, could look forward with confidence to the working results for 1909-10.

Eastern Telegraph Co., Ltd.—The directors have declared a third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax.

British Columbia Electric Railway Co.

The annual general meeting of this company was held on Thursday of last week at the Great Eastern Hotel, Liverpool Street, Mr. R. M. Horne-Payne presiding.

Mr. Brown, solicitor to the company, read the chairman's speech, which stated that the traffic increases for the past few months had been enormous. A considerable part of this increase had been due to the thousands of visitors who had come to Vancouver and Victoria, after visiting the great World's Fair at the neighbouring City of Seattle in the United States, and they had also been benefiting abnormally from the very large salmon run this year. The company served a great many of the largest salmon canneries, and it was a peculiarity of this trade that every fourth year a very large catch was secured, whereas in the following year the catch was correspondingly small. When, therefore, they came to the summer of next year, it was not to be expected that they would show increases over the traffics of the present year, and he wanted to forewarn shareholders of this, so that they might not be alarmed. They had had increases in traffic, week by week and month by month, for so long that, unless forewarned, a decrease or two might possibly have an unsettling effect on the shareholders, and be magnified into almost a disaster, and he would therefore point out that they could afford to lose a considerable amount of the exceptional earnings of the last few months without their dividends being in the least endangered. Behind, and in addition to, this exceptional increase in business, there was a steady and regular progress in the normal development of the cities and territory which they served, which was indicated in many unmistakable ways, such as the increase in building in the cities and the increase in land settlement in the rural districts, and the enormous increase in the number of electric lights and the amount of electric power which the company supplied. During the year the City had greatly expanded, and settlement in the surrounding country had enormously increased. Many large and costly mercantile buildings, banks, offices, warehouses and shops had been erected, and the whole of the residential sections of the City were now entirely built up, with the result that building operations had been very largely extended to the outlying districts served by the company, and it had become necessary to extend their services to these newly settled districts. They had done this under agreements with the various municipalities which amply protected them, and afforded guarantees that they would in years to come reap the reward of their energy and enterprise, but as new lines of railway through newly settled country could not be expected to pay their way from the outset, they must expect that their working expenses would bear for the next few years a higher proportion to profits than they had hitherto done. The board had gone into this policy of extension with the utmost caution, and were absolutely satisfied of its wisdom, and again this year one of the directors had given his entire time for months to visiting British Columbia, and studying conditions on the spot with their invaluable local board and the management. It was satisfactory to know that the increased receipts had been obtained in spite of the reductions in railway charges, and in spite of a reduction of no less than 17 per cent. in their electric lighting tariff—reductions which placed the company's charges on as low a basis as those prevailing in any city in Canada or the United States with but one solitary exception. Those reductions were made spontaneously by the company without waiting for any outside pressure, in pursuance of their definite policy of giving the best and the cheapest service that they could afford to, and they were only rendered possible by the economical administration of the past, by the firm basis on which their old friend and former general manager, Mr. Buntzen, built up the enterprise, and by the skill and the devoted service to the company of the present officers, staff and men. The total investment had been increased during the year by $2,500,000, and they now had over $13,500,000 of cash invested in British Columbia, on which they were this year paying an average of 5·29 per cent. in interest and dividends. Last year the average return paid on their investment was 5·66 per cent., and the reduction was accounted for by the fact that they had raised during the year and invested $2,500,000 by the sale of debenture stock, yielding a little over 4½ per cent. The shareholders would have heard a great deal during the year of threatened opposition and competition. The directors viewed this forthcoming competition with great complacency, and he might say with satisfaction. They were absolutely confident that no other enterprise could supply as good and as cheap services as they did, and they welcomed the advent of a competitor, as it would demonstrate to the public more clearly than anything else could, that there was nothing in the cry which was sometimes raised by various cantankerous and ignorant individuals, against their having a monopoly of the electrical business. They stood entrenched against competition behind very low rates, good services, and a constant study of the rights of the public.

Mr. G. P. Norton seconded the motion for the adoption of the report.

Replying to questions by shareholders as to whether the directors could account for a recent article which appeared in the financial papers, Mr. Brown said that it was a reckless and an unfounded rumour that the company had realised its investments and that the directors had been getting rid of their holdings. Of the three directors mentioned, Mr. R. K. Spurgeon was deceased, and his shares had passed to his executors; the Hon. M. R. Gifford had actually increased his holding, and Mr. R. M. Horne-Payne held 16,500 deferred shares of the market value of £20,000, and the Misses Horne-Payne and their trustees held close on 10,000 shares. A more wild and reckless statement had never been made in the British Press, and the directors emphatically repudiated the right of any newspaper or shareholders to probe into their private affairs. If such was to be the case, it would mean that every director would be compelled to absolutely limit his interest in a company to the requirements of the articles of the association. The directors had a fairly shrewd idea as to the quarter in which the article really originated, but under the circumstances they thought it would be better to keep their mouths closed.

Answering a question as to the threatened competition, Mr. Brown said it was the development of a water power. They had had an offer for it, but had declined it. Their company already had a water-power supply which was more economical to them.

The report was then adopted.

A resolution was passed authorising the directors to increase the capital of the company to £2,500,000 by the creation of 700,000 new shares of £1 each.

Subsequently, at a special meeting, the articles of the association were altered so as to give the company power to "acquire, construct and own gas plants, systems, works and apparatus, and to supply gas and to carry on the business of a gas making and gas supply company in all its branches, and to deal in, and dispose of, all residual and other products arising in the course of carrying on such business," and, further, "to purchase, take on lease or in exchange, hire or otherwise acquire, own, utilise, turn to account and develop and sell, or otherwise deal in, land and immovable property and rights of every description relating thereto, and in particular to turn any such property and rights to account by prospecting for winning and working coal, iron, ironstone and any other metallic or mineral substances, and generally any constituents of the soil, and by cultivating and dealing in and with timber and lumber and any other products or fruits of the soil."

Provincial Tramways Co.

The fifty-second ordinary general meeting of this company was held last Friday, at the offices, Moorgate Station Chambers, Moorfields, Mr. Andrew Beattie presiding.

The Chairman, in moving the adoption of the report, said he was pleased to say that the result of the year's working had been just about the same as in the previous 12 months. They did, however, at one time anticipate that there would have been an improvement, but owing to the wet summer and autumn that anticipation had not been realised. However, they had been able to hold their own, and the receipts and the profits were equally as good as in the past. The directors had been comparing their accounts with those of other similar companies, and they found that their company showed the lowest working expenses—that was to say, they were the most economically managed. Out of every £100 they received there was a gross expenditure of £55, or 55 per cent. on the net earnings. He would like to draw their attention to the articles of association, which were more than 37 years old, and had now become almost obsolete. It was the directors' intention to bring their articles up to date and in conformity with modern usages. The shareholders would remember that some time ago the question of altering the value of the shares was considered. The company's shares were of a face value of £10, but for many years they had never stood on the market at higher than £6 or £7, and at the present time they were down to £4 10s. or so. They had nearly a quarter of a million ordinary shares, and about three years ago a proposal was made that every shareholder, in exchange for his £10 share, should receive one of £5 value. The majority of the shareholders at that time were in favour of that proposal. The scheme, however, was never proceeded with, but the directors had been considering another proposal, which was, that every £10 share should be exchanged for five £1 shares. They proposed to submit that scheme to the shareholders shortly, and he thought everyone would agree that £1 shares would be more advantageous than the £10 shares. Their reserve fund now stood at £47,500, and that account was used for renewals and depreciation, and was altogether apart from the ordinary maintenance of the lines. As to the future, they believed that if the weather was at all fine the accounts would show an improvement.

Mr. S. Hern seconded the motion, and after a short discussion the report was adopted.

Prior to the above meeting, the annual meetings of the respective local companies were held, under the presidency of Mr. A. Beattie, at which the reports and accounts were adopted.

Russian Electrical Companies.—It is reported from St. Petersburg that all the electrical companies in that city in which German capital is interested are satisfied with the working results in so far as the present year is concerned. These undertakings are the United Cable Works Co., which has a capital of £430,000, and in which the Berlin A.E.G. and the Siemens and Halske Co. are large holders; the Russian Siemens & Halske Co., with a share capital of £500,000; the Electric Lighting Co. of 1886, with a capital of £2,400,000; the Russian Schuckert Co., with £200,000; and the Russian General Electricity Co., with £700,000. It is estimated that the Electric Lighting Co. of 1886 will be able to pay a higher dividend for 1909 than for 1908, that the rate of distribution of the United Cable Works Co. will be 8 per cent. as compared with 7 per cent. in 1908, and that the Schuckert Co. and the Siemens & Halske Co. will again pay 3 and 4 per cent. respectively.

Winnipeg Electric Railway Co.—The British Empire Trust Co. announces that this company has declared a dividend of 2½ per cent. for the quarter ending 31st inst.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Dec. 8	2,408	— 64	26	39,094	— 909	..	..
Ayr	,, 11	344	— 21	80	9,957	— 147	8	..
Bath	,, 11	1,273	+ 22	49	37,645	+ ,337	..	..
Belfast	,, 10	7,420	+ 53	85	139,226	+ 5.291	37	..
Birkenhead	,, 12	2,173	+ 113	36	39,228	— 441	13·63	..
Birmingham Corp.	,, 4	13,223	+ 256	36	235,116	+ 6,735	..	..
Blackburn	,, 8	1,903	..	37	40,865	— 1,243	..	..
Blackpool Corp.	,, 9	688	+ 17	..	49,324	+ 4,121	..	..
Blackpool-Fleetw'd	,, 11	450	— 4	23	22,315	+ 1,367	..	..
†Bolton	,, 5	2,220	+ 120	36	84,092	+ 255	26	..
Bournemouth	,, 8	2,490	+ 36	36	61.900	+ 367	21·96	..
Bradford	,, 4	8,722	+ 703	35	174,414	+ 5,927	54·81	..
Brighton	,, 12	1,452	+ 64	37	36,861	+ 1,650	9·5	..
Bristol	,, 10	10,404	+ 864	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 3	422	— 18	48	10,530	— 180	3·65	..
Barnsley	,, 3	328	+ 11	,,	8,113	— 373	..	..
Barrow	,, 3	400	+ 1	,,	11,150	— 592	5·37	..
Cavehill	,, 3	101	— 5	,,	4,098	— 105	..	..
Devonport	,, 3	661	— 222	,,	17,675	— 4,691	8·85	..
Gateshead	,, 3	1,943	— 8	,,	47,889	— 532	11·25	..
Gravesend	,, 3	375	— 20	,,	10,138	+ 26	6·5	..
Greenock	,, 3	971	+ 62	,,	26,700	+ 1,528	7·25	..
Hartlepool	,, 3	425	+ 28	,,	11,344	— 75	6·72	..
Kidderminster	,, 3	180	+ 22	,,	5,179	— 144	..	..
Leamington	,, 3	323	+ 54	,,	8,526	+ 211	..	..
Merthyr	,, 3	364	— 60	,,	10,083	— 182	2·9	..
Metropolitan	,, 3	11,737	+1,110	,,	299,809	+22,858	22	..
Middleton	,, 3	545	— 49	,,	16,027	— 983	8·5	..
Mid. Joint Com'tee	,, 3	11,056	+ 140	,,	275,161	— 739	..	..
Oldham—Ashton	,, 3	1,000	— 23	,,	26,968	— 1,196	9·13	..
Peterborough	,, 3	190	— 1	,,	5,695	— 431	5·31	..
Potteries	,, 3	8.804	+ 70	,,	86,738	— 414	29	..
Rothesay	,, 3	71	— 10	,,	9.842	+ 116	2·75	..
Southport	,, 3	411	— 21	,,	13,772	— 447	8·17	..
S. Metropolitan	,, 3	1,331	— 33	,,	88,366	— 590	..	..
Swansea	,, 3	1,948	+ 198	,,	47,054	+ 1,606	12·5	..
Tynemouth	,, 3	256	— 6	,,	11,670	+ 848	3·75	..
Weston-s Mare	,, 3	54	+ 2	,,	7,119	+ 399	3	..
‡Worcester	,, 3	457	— 5	,,	13,412	— 139	5·75	..
Wrexham	,, 3	175	— 12	,,	4,728	— 204	..	..
Yorks. Wool. Dist.	,, 3	1,777	+ 153	,,	44.408	— 503	17	..
Miscellaneous	,, 3	363	+ 8	,,	10,060	+ 236	..	..
Burnley	,, 11	2,257	+ 196	..	..	..	..	..
Burton-on-Trent	,, 12	509	+ 34	37	9,818	— 207	6·63	..
†Bury	,, 5	1,013	+ 63	35 4/7	41,979	— 317	22·5	..
Cardiff	,, 4	4,052	+ 114	36	79.505	+ 1,224	..	..
Carlisle	,, 11	3 2	— 15	49	8,075	— 443	..	..
Chatham and Dist.	,, 9	4,158	+ 1	49	40,256	+ 1,597	14·98	..
Cork	,, 9	822	— 16	..	22,029	— 643	9·89	..
†Croydon	Nov. 26	2,863	+ 362	..	54,648	+ 4,649	11·25	4·75
Darlington	Dec. 11	356	— 1	37	6,838	— 488	..	..
†Darwen	,, 3	484	+ 30	35	8,890	— 105	4·36	..
Dover	,, 4	307	+ 12	36	7,763	— 406	4·75	..
Dublin	,, 10	9,862	+ 122	..	129,036	+ 1,995	54·25	..
Dundee	,, 8	2,195	— 96	29 4/7	35,172	— 763	15·5	..
East Ham	,, 11	1,876	+ 168	36½	36,920	+ 4,514	8·52	·77
Exeter	,, 10	544	+ 9	37	12,443	+ 576	..	..
Glasgow	,, 11	31.712	+1,6 0	..	463,141	— 9,081	94½	5
Hastings	,, 9	1,338	— 149	.	..	..	..	..
Huddersfield	,, 11	3,1 6	+ 341	36	61,151	+ 2,748	28·5	·5
Hull	,, 11	5,362	+ 604	36	94,754	+ 3,920	14·5	1·5
Ilkeston	,, 8	117	+ 1	36	4,928	— 238	..	..
Ipswich	,, 11	628	+ 42	37	14,972	+ 181	10·5	..
Kilmarnock	,, 4	259	— 19	29	4,281	— 168	4·25	..
Lancashire United	,, 8	2.259	+ 30	49	64 297	— 739	..	..
Leeds	,, 4	12,717	+ 71	35	243,743	+ 6,984	..	..
Leicester	Nov. 27	4 0 7	+ 109	..	..	..	..	..
Leith	Dec. 11	1,023	+ 75	30	18,418	+ 2,191	9	3
Liverpool	,, 4	20,937	+ 276	48	518.120	— 1,482	..	..
‡L.C.C.	Nov. 27	72,559	+4,614	..	1.279,116	+56,917	..	..
London United	Dec. 11	10,113	+ 73	.	295,942	—28,866	..	..
Lowestoft	,, 11	322	+ 30	11	1,769	+ 30	3·5	..
Manchester	,, 11	28,374	+ 143	36	549,701	— 7,627	..	..
Newcastle	,, 11	7,759	+ 133	..	142,732	— 1,204	14·5	..
†Newport	Nov. 26	592	— 36	35	22,995	— 348	14·5	..
Oldham	Dec. 12	3,211	— 256	37	68,611	— 4,819	23·75	..
Pontypridd	,, 11	758	+ 12	36½	15,137	+ 1,077	5·5	..
†Portsmouth	,, 4	1,661	+ 79	36	76,668	— 2,331	14·5	..
Preston	,, 8	1,327	+ 3	..	..	..	..	..
Rotherham	,, 9	1, 27	+ 22	36	21,381	— 1,037	10	..
Salford	,, 6	8,842	— 77	36	163,915	— 4,474	..	..
Sheffield	,, 12	11,427	+ 896	..	..	..	..	..
Southampton	,, 8	1,884	+ 63	36	59,091	— 322	..	..
Southend-on-Sea	,, 8	685	+ 35	36	19,979	+ 2,615	..	..
South Shields	,, 11	1,049	+ 56	36 3/7	20.747	+ 15	..	..
†Swindon	,, 8	126	+ 12	37 1/7	211,307	+ 2,244	..	..
Tyneside	,, 8	7 6	— 11	23	9,991	+ 318	..	..
Wallasey	,, 11	1,597	+ 3	26 3/7	84 074	+ 692	..	·22
Walthamstow	,, 11	1,155	+ 117	37	24,411	+ 552	9	..
West Ham	,, 2	4,347	+ 127	85	82,920	+ 4,919	15·25	·43
Wolverhampton	,, 8	1,690	+ 191	36	30,383	+ 189	14·25	1·75
Baker St.-Waterloo	,, 11	7,205	+ 680	23	72,475	+ 2,265	4·25	..
Cen. London Rly.	,, 11	11,778	+ 138	23	121,947	—42,939	6·82	·55
Char. +, Eus. Hamp.	,, 11	7,665	+ 535	23	86.295	+ 8,775	7·75	..
City & S. Lon. Rly.	,, 12	6 888	+ 432	23	72,744	+ 2,792	7·3	..
Dublin-Lucan Rly.	,, 10	199	— 18	23	3,331	+ 40	7	..
G.N. and City Rly.	,, 11	3 046	+ 93	23	31,090	+ 244	3.5	..
G.N., P'y. & Brmtn.	,, 11	12,545	+1,105	23	124,325	+ 5,560	9·25	..
L'pool Overh'd Rly.	,, 12	2,528	— 54	23	33,332	— 80	6·8	4·8
†Llandudno-Col. Bay	,, 10	108	+ 11	1⅓	157	— 1	..	..
Mersey Railway	,, 11	3,953	— 21	23	44,908	+ 1,641	4·5	..
Metropolitan Rly.	,, 12	35.472	+1,844	23	373,872	— 2,105	24·5	..
Met. District Rly.	,, 11	21,8 8	+2,152	23	228,594	+12,815	24	..
Anglo-Argentine	,, 9	86,680	+2,734	..	1,941.081	+117.412	..	..
§Auckland	,, 8	14,816	+1,292	48	164.769	+14.899	22·3	1·38
Bombay (B.E.T.)	Nov. 11	5,644	+ 90	45	113,855	+ 5,518	..	..
§Brisbane	,,	16,170	+1,666	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Dec. 11	6,943	+ 214	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Nov.	8,899	..	..	41,472	..	20·5	..
Madras	Nov. 15	1,869	+ 220	..	27,088	+ 1,156	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Dec. 10	2,934	+ 57	..	68,790	+ 873	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE very unexpected reduction in the Bank Rate last Thursday led to a general hardening up of prices which, just before, had been disposed to sag. Its effect, however, was short-lived, for Consols turned downward, and other investment securities followed their lead.

Much of the recent strength has already been exhausted in the Home Railway boomlet. Reared on a slender foundation, the base of the rise gave signs of shaking after the market had enjoyed about four days of something like activity. People took their profits, business became normally quiet, and once more the attitude has fallen into mere expectation.

Market authorities profess to be fully satisfied with the results achieved by the London, Brighton and South Coast Railway from its electrified portion. The price of the Deferred stock ranged between 81½ and 86½ last week, and now stands about 85¼, carrying a full year's dividend payable in February next.

Central London Ordinary stock has improved, and there is ½ rise in City and South London Ordinary. On the other hand, Metropolitan Consolidated shed ¼ of its recent swift spurt, although the Surplus Lands is up a point to 67. Districts at 18 are ½ to the good, and Underground Electric Railway securities have risen. The prior-charge stocks maintain their strength, being mostly full of dividend, and with a further reduction in the Bank Rate to anticipate as an early occurrence in the New Year.

It is remarked upon as somewhat singular that the Stock Exchange—usually so ready to discount possibilities that may affect its markets—is not speculating upon the chances of a Protectionist victory at the forthcoming General Election, in spite of the difference which such an event would exercise upon the fortunes of numberless industrial undertakings. And this is considered all the more surprising in view of the fact that the House, as a whole, is ardently anti-Budget.

The British Empire Trust has issued a pamphlet containing useful details of the companies comprised in its group, but the publication has not gone so far as to influence quotations. British Columbia Electric Railway Deferred has recovered part of the dividend deducted on December 10th, and the Preferred is a point higher, the same gain being secured by Auckland Trams 5 per cent. Debenture stock. Anglo-Argentine shares and Debenture stock are also a shade harder. Mexico Trams lost a small fraction, and Rio Trams fell back to 93. Mexican Light and Power is a trifling amount to the good.

British Electric Tractions, Brush shares and London United Trams are without quotable change. It is worth noticing that London General Omnibus stock has risen within a week from 17 to 25, whence it fell again to 23, the view being taken that the company has seen the worst of its black days.

Amongst electricity supply issues, Smithfield Markets are nominally $\frac{3}{16}$ lower, but the widening of the official price causes that quotation to become so much the less reliable. One or two of the London Companies' shares have hardened, on the assumption, mentioned here last week, that the little advertising campaign in favour of radiators is already bearing useful fruit. City Lights are ⅛ better, and so are Metropolitans. Chelseas, on the other side of the sheet, have declined 5s. A moderate inquiry for Central Electric Debenture stock found there was little in the market, and the price has been marked up 2, to 100½.

In the telegraph department there is a general quietude. Eastern Ordinary stock and Western Telegraph shares are better. Anglo-American Telegraph 6 per cent. Preferred hardened to 100¾, and as a speculative stock it cannot be thought extravagantly valued, even at that. The Deferred is rather easier. Marconi shares fell 2s. 6d. to 11s. 3d. middle. Globe Ordinary, *ex* 2s. dividend, are quotably unchanged, but the Preference marked the deduction of the 3s. dividend by a 5s. fall. National Telephones are good. American Telephone capital stock rose 1½. Mackay issues, allowing for the dividends, are practically without alteration.

Manufacturing and miscellaneous shares are a trifle irregular. British Aluminiums have receded. Henley Preference lost 2s. 6d. Castner-Kellner shares at $2\frac{5}{16}$ show a small rise, and Dick, Kerr Preference are $\frac{1}{32}$ better. Telegraph Constructions eased off. Rubber shares are mostly quiet, the market being subdued in view of the latest auction prices for the product.

Shawinigan Water and Power Co.—The directors have decided to offer $500,000 common stock to shareholders on the register on December 9th on the basis of one new share for each 13 old shares held. The new shares will not participate in dividend payable in January.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Dec. 7th.	Closing Quotations Dec. 14th.	Business done week ended Dec. 11th, 1909.		Rise + or Fall −	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3⅜ — 3⅞	68/1½	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 — 103	100 — 103	..	..	..	4 17 1
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143 — 146	145 — 147	144¼	..	+ 1½	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅞%	8½%	£3 4s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 — 101	100¼ — 101¼	101	100¼	+ ¼	5 18 0
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21⅞ — 22⅛	21⅜ — 21⅝	22 5/16	21 1/16	— ½	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 — 103	101 — 103	102¾	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾ — 8¼	7¾ — 8¼	..	..	+ 1/16	4 18 6
2,431,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88½	86½ — 88½	87¾	86⅞	..	4 10 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	8 — 8½	..	..	..	5 11 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ — 102½	100½ — 102½	..	..	..	2 8 11
60,710*l*	Direct United States Cable	20	4¼%	4⅜%	4¼%	4¼%	13 — 13½	13 — 13½	..	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 — 102	100½ — 102½	..	..	+ ½	4 7 10
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	131 — 134	132 — 135	134	131¼	+ 1	5 3 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½ — 86½	84½ — 86½	85¾	84½	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 — 104	102 — 104	103	..	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ — 12¼	11¾ — 12¼	12¼	11⅞	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 — 104	102 — 104	..	..	..	3 16 11
200,000*l*	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 — 102	100 — 102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅝%	5¾%	10¼ — 10¾	10¼ — 10¾xd	10 11/16	10 19/32	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 14	13¼ — 13¾	13⅝	13⅜	— ¼	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	30 — 31	30 — 31	31¼	..	..	5 16 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 — 102	100 — 102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	18 %	18 %	13 %	51 — 53	51 — 53	52¼	..	..	7 1 2
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	96 — 98	95 — 97 xd	..	..	..	4 2 6
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	76 — 78 xd	..	..	..	5 2 7
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝ — ¾	½ — ⅝	..	..	— ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾ — ⅞	¾ — ⅞	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — ⅞	¾ — ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ — 108	106½ — 108	107	..	..	5 11 1
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120½ — 122½	122 — 124	123	123	+ 1½	4 16 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼ — 11	10¼ — 11	10¾	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ — 10⅞	10⅛ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5 15/32	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 — 100	98 — 100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	100 — 102	100 — 102	100½	..	..	3 18 5
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ — 1½	1⅜ — 1½	27/6	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87½ — 89½	87½ — 88½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 — 102	100 — 102	..	..	..	3 18 5
11,839*l*	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	101 — 103	101 — 103	102¼	101½	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 — 132	129 — 132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 — 7½	7 — 7¼	7 3/16	7	..	5 10 4
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5½ — 5¾	5½ — 5¾	..	..	..	4 6 11
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 — 102	100 — 102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13⅝ — 13⅞	13½ — 14	13⅞	13½	+ ⅛	5 0 0
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 — 105	103 — 105	103	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝ — ¾	⅝ — ¾	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾ — 9¼	8¾ — 9¼	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	6 13 4
80,000*l*	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 — 104	102 — 104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Dec. 7th.	Closing Quotations Dec. 14th.	Highest	Lowest	Rise + or Fall −	Present Yield per cent. £ s. d.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 7/16 — 4 11/16	4½ — 4¾	91/10½	90/-	+ 1/16	5 5 3
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼ — 4½	4¼ — 4½	..	..	..	5 11 1
978,230	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	90½ — 92	91½ — 93	92⅜	91¾	+ 1	4 6 0
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 — 106	104 — 107	..	..	+ 1	4 13 6
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅝ — 4¾	4⅝ — 4¾	95/7½	93/9	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16	30/-	29/9	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	Nil	¾ — 1¼	½ — 1	..	..	— ¼	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	3½%	1¾ — 2¼	1⅝ — 2⅛	40/-	..	— ⅛	7 15 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	8 %	6 %	6 %	3⅜ — 3⅞	3¼ — 3¾	..	..	— ⅛	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	2 %	2½ — 3½	2½ — 3½	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	141 — 145	138 — 142xd	..	..	..	5 12 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 — 124	121 — 125	122	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 — 110	107 — 110	107¾	..	..	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 — 104	102 — 104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 — 105	102 — 105	104	..	..	4 6 2
183,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝ — 1	⅝ — 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅝ — 3	2⅝ — 3	..	..	..	5 0 0
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	84⅜	81½	..	6 14 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 — 65	60 — 65	61	..	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 8 % Cum. Pref.	5	6 %	6 %	8 %	6 %	6⅛ — 6½	6¼ — 6⅝	6 11/32	..	+ ⅛	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 — 106	103 — 106	..	..	..	4 4 11
304,940*l*	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	9/6	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 18 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — ⅛	1/16 — ⅛	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	8 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	41½	41¼	..	9 15 8
125,000*l*	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 5	4½ — 5	..	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 — 104	101 — 104	..	..	..	4 6 7
86,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¼	10 — 10¼	..	..	..	6 19 1
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½ — 5⅝	5½ — 5⅝	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 — 107	105 — 107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	6/-	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 3/16 — 2 5/16	2¼ — 2⅜	46/3	45/-	+ 1/16	5 [illegible] 8
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 — 109	105 — 108	107	..	— 1	3 14 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 — 63	62 — 64	63⅛	62⅞	+ 1	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 — 46	46	45½	..	5 8 8
1,480,000	City and South London Railway	Stock	1¾%	2¼%	2¼%	1½%	30½ — 31½	31 — 32	32	31	+ ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 1 8
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Dec. 7th.	Closing Quotations Dec. 14th.	Business done week ended Dec. 14th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	6 %	1 — 1⅛	1 — 1⅛	20/-	..	..	6 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 1/32 — 1 5/32	22/6	22/3	+ 1/32	5 4 4
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	Nil	3/32— 7/32	3/32— 7/32	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4⅛%	4⅛%	2½%	Nil	1 — 1½	1 — 1½	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	5/16— 9/16	5/16— 9/16	7/6	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾— 1	⅝— ⅞	..	..	— ⅛	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½— 10¾	10½— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12¾	12 — 12¾	12½	12 7/16	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5½	5 — 5⅜	..	..	— ⅛	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¾— 16½	15¾— 16½	16 5/16	..	..	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾— ⅞	¾— ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2¼— 2¾	..	..	..	13 12 8
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	62 — 65	62 — 65	63½	63⅜	..	6 3 1
5,782,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	38¾— 39¼	38½— 39	40¼	38⅜	— ¼	1 5 9
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	65 — 67	66 — 68	67½		+1	4 0 11
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¼— 17¾	17¾— 18¼	18¼	17⅝	+1½	Nil
891,837	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32— 11/16	19/32— 11/16	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32— 5/32	1/32— 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16— 13/16	11/16— 13/16	15/9	15/3	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	95¼	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124 —126	123½—125½	124½	..	— ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	92¼	92	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ⅜	⅛— ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½— ¾	½— ¾	10/6	10/3	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34 — 35½	35	34½	— ½	5 4 6
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	8 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100½—101½	101	100¼	+ ½	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	87 — 89	..	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	30 — 32	32 — 34	33	32½	+1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	5 %	¼— ½	¼— ½	..	..	+2	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	1¾— 2¼	1¾— 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4¾	4¼— 4¾	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7 — 7½	7 — 7½	7⅜	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	7 5/16	..	..	4 13 4
816,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	99 —102	..	..	+2	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3¾— 4¼	3¾— 4¼	..	..	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼— 4¾	4¼— 4¾	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 — 101	98 —101	..	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅜— 3⅞	3⅛— 3⅝	..	..	— ¼	6 4 2
175,000*l*	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	100¼	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛— 10⅝	10¼— 10¾	10⅞	10 7/16	+ ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	..	..	..	4-12 4
100,000*l*	Do. 5 % Db. Stk.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7½— 8	7½— 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	..	..	..	5 7 10
400,000*l*	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	105¾	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— 5/16	⅛— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	8 %	Nil	Nil	½— ¾	⅝— ⅞	10/7½	..	+ ⅛	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$3,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	101 —103	101 —103	102½	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4¾— 5⅛	4¾— 5⅛	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	..	..	..	4 4 8
100,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3¾— 4¼	3⅞ — 4⅜	83/1½	80/-	+ ⅛	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½ — 86½	..	..	..	4 0 11
$5,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	81 — 83	81 — 83	82	..	..	6 0 6
8,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	69 — 71	69½— 71½	70¼	..	+ ½	4 17 11
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	101 —105	101 —105	103	101¾	..	6 13 4
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	86 — 87	86¾	85	..	5 14 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 — 100	98 — 100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	98 —100	98 — 100	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼— 13¼	12¼— 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1½— 1⅝	1½— 1⅝	..	..	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32— 1 7/32	1 3/32— 1 7/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000*l*	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1 13/16— 2 3/16	1⅝ — 2⅛	40/-	..	— ¼	Nil
85,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 9/16	5/16— 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅞	⅜— ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	..	5 %	⅞— 15/16	⅞— 15/16	..	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅜— 8⅞	8⅜— 8⅞	8⅝	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5½	5 — 5½	5⅜	5 3/16	..	4 1 11

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent., December 9th. 1909.

ELECTRIC TRAMWAY COSTING AND STATISTICS.

[COMMUNICATED.]

(*Concluded from page* 953.)

The introductory page deals with the revenue receipts and expenditure, the second page with the revenue expenditure in detail, both for the same period, and the final page with statistics. The receipts are abstracted daily from the way bills into the Traffic Summary book, which is in the usual form, and from which a daily return (Schedule 10) is prepared of the receipts taken and the amount paid into the bank, for the information of the head office. The payments into the bank of traffic receipts are debited in the cash book from this return, the entries being posted to the credit of a traffic receipts account. All receipts are banked, and any difference that there may be at any time between the banked and the sum received, is accountable for by the traffic manager. A weekly return of receipts may be prepared in the form of Schedule 11.

Schedule 10.

Daily Return of Receipts for....................19 .

Below are particulars of receipts for the above date. I have to-day paid into the .... Bank to the credit of the Company £................

State of weather..................................

State of weather corresponding day of previous year ....

..................Date. ....Manager.

Route.	Total Receipts.	Receipts per car-mile.	No. of cars.	Miles run.	Total No. of passengers.	Remarks.
Traffic Receipts.						
Sundry Receipts.						
Total ..						
Corresponding day of previous year						
Increase — Decrease						

Schedule 11.

Statement of Receipts for the week ended............19 .

Route.	For corresponding period of previous year.				For week ended				Increase.				Decrease.			
	Amount	Per car-mile.	Route mileage.	Per passenger.	Amount.	Per car-mile.	Route mileage.	Per passenger.	Amount.	Per car-mile.	Route mileage.	Per passenger.	Amount	Per car-mile.	Route mileage.	Per passenger.
Traffic Receipts																
Sundry Receipts																
Total ..																

State of weather—This year......................

Last year......................

....

It will be seen that a column is provided in each of the statements—viz., stores, wages and salaries—for allocations to capital. Petty cash is similarly treated. Details of the capital expenditure included in the schedules are furnished in the form given in Schedule 12.

Schedule 12.

Details and appropriations of Stores charged to Capital for the ended...............19 .

Date.	Details of issues and work done.	Capital Account to be charged.

Summary of Capital Expenditure.

(Accounts to be debited.)

	£
Power house buildings	
Other buildings	
Permanent way	
Cars and car equipments	
Engines and boilers	
Dynamos, exciters, &c.	
Other machinery, instruments, &c. ...	
Accumulators	
&c., &c.	
Total as per details above	

Similar statements are provided in respect of Wages, Salaries, and Petty Cash.

In the case of an undertaking which generates its own current, a statement of power-station statistics and generation costs may be prepared in accordance with Schedule 13, the method of preparation being similar to that already described. In the case of a combined undertaking—*i.e.*, tramways and lighting—the accounts of the tramway and lighting sections must be kept distinctly. Where there is no public or private lighting the cost of generation is practically the cost of the current supply to the undertaking. It will be seen that the cost statement is of a continuous nature, and that subject to any necessary adjustments it should agree fairly closely with the actual profit and loss of the undertaking for the financial year. There may be

Schedule 13.

Power-Station Statistics and Generation Costs.

For the ended ....

(1) Power-Station Statistics.

1. Plant installed ... ... KW.
2. Condensing, partially condensing, or non-condensing
3. Maximum demand on power station ... ... KW.
4. Station load factor $\dfrac{\text{Units generated} \times 100}{\text{Capacity of power station in KW.} \times 24 \times \text{number of days represented by the return}}$ ... %
5. Running plant load factor $\dfrac{\text{Units generated} \times 100}{\text{Capacity of plant run in KW.} \times \text{hours run}}$ ... %
6. Price of coal or other fuel delivered ... ...
7. Number of pounds of fuel per unit generated ...
8. Units:—
   - I. Generated ... ...
   - II. Used in station ... ...
   - III. Sent out ... ...

Schedule 13.

(2) Generation Costs.

Description.		Amount.	Total.	Per unit generated. This year.	Per unit generated. Last year.	Per unit sent out. This year.	Per unit sent out. Last year.	Remarks.
Coal or other fuel								
Oil, waste, water and engine room stores								
Wages								
Salaries								
Repairs and maintenance—								
Power station buildings	wages ..							
	materials							
Engines and boilers	wages ..							
	materials							
Dynamos, exciters, &c.	wages ..							
	materials							
Other machinery, instruments	wages							
	materials							
Accumulators, &c.	wages ..							
	materials							
Sundric								
Total								

of course an odd number of days or weeks at the end of the year for which a return will be necessary. In the event, however, of an undertaking combining the simultaneous characteristics of promotion, construction and running or operation, as it often does, there is frequently much expenditure, the allocation of which is not determined, and much that is not ascertainable until after the termination of the year, and to that extent, at any rate, the profit and loss account in such cases will differ from the Cost Returns. Expenditure and Income may be plotted in the form of a graph, and though it may be nice, it is only of theoretical importance and hardly worth the labour which its preparation involves.

Such costing and statistics are frequently of assistance, directly, or indirectly, in the consideration of proposals submitted from time to time, which have for their object the establishment of electric tramway systems, and it may be interesting to notice briefly some of the investigation and promotion considerations which precede the creation and consequent inauguration of electric tramway undertakings. That there is but little new tramway ground to prospect in this country is readily admitted, with the result that some promoters of tramways have turned their attention abroad in search of pastures new for the purpose of exploiting the *prima facie* objects of the undertakings with which they claim association, whilst others have in view possibly not so much tramway enterprise as the necessity for creating promotion profits, with a view to the restoration and display of attractive credit balances on revenue account.

POPULATION AND PASSENGER TRAFFIC.

One of the primary factors which may be considered under this sub-title is the number of passengers that are likely to be carried on the lines proposed. Premising that the population of our hypothetical scene of operation numbers 100,000 inhabitants, we may obtain some guidance from the experience of existing undertakings, and with a view to adopting such experience, select a number of instances containing as nearly as possible the elements of similarity of population to be served, as well as of general conditions, or we may take a larger number of instances of a promiscuous nature, with varying, and in some particulars little, semblance of similarity, and reduce them to a comparative denominator, which obviously, however, will not enable us to arrive at a result as reliable as the former, though it may be sufficiently accurate for all practical purposes. We may proceed thus :—

$$\frac{\text{No. of passengers carried in each year}}{\text{Population}} = \text{No. carried per capita of population,}$$

and if we feel inclined to compute the mean of, say, half-a-dozen instances, letting each instance be denoted by a_1, a_2, and so on, we may do so by—

$$\sqrt[6]{(a_1 \times a_2 \quad . \quad . \quad . \quad \times a_6)}.$$

To arrive at a still more reliable estimate we may of course take the mean of each selected instance over a corresponding number of years, and the final mean of the ascertained results.

This figure representing per capita of population having been carefully extracted, let it be 50, and the town being one of 100,000 inhabitants, we should be reasonable in asserting that the probable number of passengers per annum would be 5,000,000, viz. (100,000 × 50).

CAR-MILES.

The next convenient matter is that of car-miles, and here, *inter alia*, some of the governing incidental considerations are : (*a*) location and distribution of population : (*b*) service to be rendered ; (*c*) mileage of routes ; (*d*) speed of cars ; (*e*) daily working hours. Let us assign to (*b*), (*c*), (*d*) and (*e*) the following data, viz , 10 minutes, 12 route miles, 10 miles an hour and 16 hours respectively.

A speed of 10 miles an hour means that the outward and return journeys of 24 miles would occupy 2·40 hours or 160 minutes, and a 10-minute service would require the daily use of, say, 16 cars (160 ÷ 10). With the aid of these figures of 16 cars, 12 route-miles and 16 daily operating hours, we obtain the number of car-miles per diem, which is 3,072 (16 × 12 × 16), and multiplying this number by 365, we are in possession of 1,121,280 car-miles per annum. On the other hand, we may extract, in the manner described in the previous section, from our selected instances the number of car-miles run per capita of population, and adopt the mean of the two methods. That is to say—

$$\sqrt[2]{\begin{array}{c}\text{Car-miles obtained}\\ \text{per capita of}\\ \text{population.}\end{array} \times \begin{array}{l}\text{Car-miles obtained by number}\\ \text{of cars in daily use} \times \text{route}\\ \text{mileage} \times \text{number of daily}\\ \text{operating hours} \times \text{number}\\ \text{of days per annum.}\end{array}}$$

ANNUAL EARNINGS.

The annual revenue may be estimated by (*a*) taking from each selected instance the average fare per passenger carried in each year over a specific number of years, then the mean of the years, of each instance, and finally the mean of all the instances chosen, viz. : Supposing three instances over a period of three years, *a*, *b* and *c*. Now, the mean in instance *a* is—

$$\frac{\text{Passenger earnings}}{\text{Total No. of passengers carried}} = \text{Average earnings per passenger carried.}$$

Let the average earnings per passenger carried be represented by *r*, then we have as the mean of instance *a* for a period of three years—

$$\sqrt[3]{r \times r \times r}.$$

And, finally, let the mean of each instance over a period of three years be denoted by *s*, we have as the mean of all the instances—

$$\sqrt[3]{s \times s \times s}.$$

We thus arrive at the estimated receipts per passenger and multiplying the figure which we may assume for the purpose of our illustration as 1·15d. by the estimated number of passengers, we arrive at our calculated annual revenue from the conveyance of passengers, viz. : £23,958 6s. 8d., say, £24,000.

(*b*) In a similar manner we may exercise a check upon this result by dividing into the passenger earnings the number of car-miles which will afford us the earnings per car-mile, which, multiplied by the estimated number of car-miles, provides the probable yearly revenue from passenger transport only, *i.e.*, exclusive of receipts from potential parcels traffic and other sources.

ANNUAL REVENUE EXPENDITURE.

We can base, of course, our estimate upon the experience of similar undertakings, or we may enter into detail and compute the local salaries, wages of conductors and motormen, inspectors, storekeepers, power station staff, repairs and maintenance, and other inevitable items of expenditure of tramway undertakings, not omitting such head office charges as directors' fees, rents, salaries, &c., and any periodical sums which may be payable to the Government or the municipality under the contemplated concession, and last, but not least, in many cases the exchanges. For all practical purposes, however, we shall find that a percentage of tramway receipts will be sufficiently accurate, and this ratio we may take for the purpose of our illustration as, say, 60 per cent.

CAPITAL OR CONSTRUCTION EXPENDITURE.

This is a matter entirely for the engineer, who will be required to take into consideration physical conditions, cost of materials and labour, Customs duties, and many other points which will arise in the course of preparing the data for his estimate. With the view of completing our illustration, however, we shall assume that our hypothetical system of 12 route miles is partly of single and partly of double track, and that the estimated cost, including power station, car-sheds, cars, &c., is, say, £11,000 per route-mile, which will make the initial cost of construction and equipment £132,000. Adding to this sum, say, £5,000 for preliminary expenses, our capital expenditure may be expressed as £137,000.

Assembling the results at which we have arrived, we have—

(*a*) Estimated annual income, say		£24,000
(*b*) Estimated annual expenditure, 60 per cent. of (*a*)		14,400
		£9,600
Depreciation, ½ l. per car-mile on 1,121,280 car-miles	£2,336	
5 per cent. on capital	6,850	
Carry forward	414	
		£9,600

The depreciation allowance is, of course, insufficient, whilst the 5 per cent. return is but a miserable yield if the capital takes the form of the ordinary or preference description, and consequently the carry forward is paltry.

There are at least two points to bear in mind as between the lessor and lessees, the description of which should be free from ambiguity in the concession. They are (1) adequate provision for depreciation on the part of the lessees in addition to ordinary repairs and maintenance, and (2) if the undertaking may be taken over as a going concern, it should be expressly stipulated in the concession that the liabilities will be borne by the lessors, inasmuch as they are included in the assets whose value will be paid for in the valuation. If such a stipulation be omitted, the probability is that the authority will have to pay the liabilities as well as the agreed amount for the assets.

Where no reasonably comparative instances are available the estimate naturally will be much more approximate in its results; but on the lines indicated it can, with such other considerations as a local study of each proposition suggests to the experienced investigator or prospector, be framed with such an approach to safety as will be sufficient to enable at any rate a fairly accurate opinion to be expressed upon it.

The average earnings per passenger or per car-mile of foreign undertakings are productive of much variety. For the year 1907 the earnings of that ably managed undertaking, the Lisbon Electric Tramways, Ltd., consisting of traffic and sundry receipts, but excluding revenue derived from investments, transfer fees, &c., exceeded 1,472 contos of reis, which at par gives, roughly, an average of 1·77 per passenger carried. A slight reduction, however, is necessary in making allowance for the exchange at the rate of valuation adopted for the conversion of the currency credit balance of the local profit and loss account. After deducting Lisbon working expenses, amount payable to the Camara de Lisboa, and expenditure under the lease from the Companhia Carros de Ferro de Lisboa, from whom the present company leases the undertaking, which includes interest and amortisation due on the debentures of that company, there is a credit balance on the local profit and loss account of 552,560·993 rs., which at par gives approximately a little over 7d. as the average receita por trem kilometro.

With regard to the undertaking of the Companhia Carros de Ferro do Porto (Sociedade Anonyma de Responsabilidade Limitada), which is owned locally, the receitas de exploracao—that is, tramway receipts proper—excluding dividendo de accoes em carteira and materiaes vendidos, amounted to 449 : 182\$444 for the same year, which, with the income from the two sources named, make a total of 452 : 643\$524. Os resultados da exploracao na Antiga rede e na Linha de Gaya give about 172 rs. as the recita por trem kilometro. In analysing the expenses and other details of this undertaking, however, the Ganhos e Perdas requires some adjustment. For instance, the receita liquida em 1907 must be omitted, which is merely the difference between the receitas de exploracao and despezas de exploracao, and substitute therefor 449 : 182\$444 as already indicated, whilst on the deve side to the individual despezas shown must be added the despezas de exploracao, &c.

A statistic that is sometimes useful for check and comparative purposes is the average receipt per car per day. It is sometimes calculated by dividing into the average receipts per day for the period the result of car-hours divided by operating hours.

Bishop's Stortford Electric Lighting.—The U.D.C. is applying for powers to purchase the Bishop's Stortford and District Gas Co.'s undertaking; also for an extension of time for laying electric light mains under 1905 order.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

(*Continued from page 955.*)

It is well known that in any circuit where the impressed voltage is periodic, and a simple harmonic, if V represent the instantaneous value of the voltage after time t, and if V_m represent the maximum value to which the voltage rises, then—

$$V = V_m \sin pt,$$

and
$$\frac{dV}{dt} = p\,V_m \cos pt,$$

but
$$\begin{aligned} p\,V_m \cos pt &= p\,V_m \sin(90 + pt), \\ &= i\,p\,V_m \sin pt, \\ &= i\,p\,V, \end{aligned}$$

where i represents $\sqrt{-1}$ and indicates the rotation of the quantity to which it is attached through 90°. So that—

$$\frac{dV}{dt} = i\,p\,V.$$

Similarly it may be shown that—

$$\frac{dC}{dt} = i\,p\,C.$$

Inserting these values in the equations (1) and (2) for $\frac{dV}{dx}$ and $\frac{dC}{dx}$ respectively—

$$\frac{dV}{dx} = C\,R + i\,p\,L\,C,$$

$$\frac{dC}{dx} = V\,S + i\,p\,K\,V,$$

or,
$$\frac{dV}{dx} = (R + i\,p\,L)\,C, \quad . \quad . \quad . \quad . \quad (3)$$

$$\frac{dC}{dx} = (S + i\,p\,K)\,V. \quad . \quad . \quad . \quad (4)$$

The quantity $R + i\,p\,L$ is an *impedance*, and if, as stated above, i indicates the rotation of magnitude through 90°, then the expression may be represented by a right-angled triangle as shown in fig. 5, where I denotes impedance; so that—

$$I = R + i\,p\,L.$$

or
$$I = \sqrt{R^2 + p^2 L^2}.$$

The quantity $S + i\,p\,K$ is the reciprocal of an impedance, and is called the *admittance*. It also may be represented by a right-angled triangle, as shown to the right in fig. 5, where it is indicated by A. In this case—

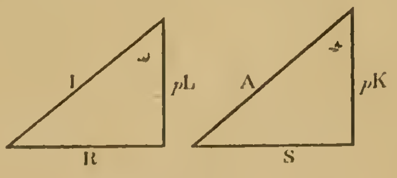


Fig 5.

$$A = S + i\,p\,K,$$

or
$$A = \sqrt{S^2 + p^2 K^2}.$$

Putting
$$I = R + i\,p\,L,$$

and
$$A = S + i\,p\,K$$

in the equations (3) and (4)—

$$\frac{dV}{dx} = I\,C, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

and
$$\frac{dC}{dx} = A\,V. \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

---

* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

These equations, (5) and (6), show, for any element of the loop, how the difference of potential between the wires varies, and how the current strength changes. To determine how the voltage and current strength vary with the distance from one end of the circuit, it is necessary to differentiate again with respect to distance. It will be convenient to take any distance, x, from the receiving end of the circuit—say, that shown in fig. 2—because, as this distance increases, both voltage and current strength increase, and the use of negative signs is avoided. Thus—

$$\frac{d^2 \text{V}}{dx^2} = \text{I} \frac{d \text{C}}{dx},$$

$$\text{and} \quad \frac{d^2 \text{C}}{dx^2} = \text{A} \frac{d \text{V}}{d x}.$$

Inserting the values for $\frac{d \text{V}}{dx}$ and $\frac{d \text{C}}{dx}$ shown in equations (5) and (6)—

$$\frac{d^2 \text{V}}{dx^2} = \text{I A V},$$

$$\frac{d^2 \text{C}}{dx^2} = \text{I A C}.$$

Let $\text{I A} = a^2$,

$$\text{then} \quad \frac{d^2 \text{V}}{dx^2} = a^2 \text{V},$$

$$\text{and} \quad \frac{d^2 \text{C}}{dx^2} = a^2 \text{C}.$$

Both of these equations are of the form—

$$\frac{d^2 y}{dx^2} = a^2 y,$$

and from earlier considerations it is concluded that the solutions are—

$$\text{V} = \text{M} e^{ax} - \text{N} e^{-ax},$$

$$\text{C} = \text{M} e^{ax} - \text{N} e^{-ax}.$$

As both V and C vary in the same way, it is only necessary to consider one of them. Let it be V.

Taking a particular point in the circuit, it will be seen that the nearer it is to the *sending* end, or the greater x becomes, the greater will be the term $\text{M} e^{ax}$, and the less will be $\text{N} e^{-ax}$. The latter term, in fact, represents the reflected wave or impulse from the receiving end. It will be assumed that x is so great that $\text{N} e^{-ax}$ becomes negligible or, in the alternative, that there is no reflection; in which case—

$$\text{V} = \text{M} e^{ax}.$$

All the following results will, therefore, be understood to apply only to the case where the whole energy received at the end of the circuit is absorbed. In Part II will be found the description of a means of practically determining what is lost by terminal reflections, &c.

The distance x has been taken as that between the element under consideration and the receiving end of the circuit. To express the results, already obtained, in terms of the distance from the sending end, it is only necessary to put $x = m - d$ where—

m = total length of circuit in miles,

d = distance of the point from sending end, in miles.

$$\text{Taking} \quad \text{V} = \text{M} e^{ax},$$

$$\text{then} \quad \text{V} = \text{M} e^{a(m-d)},$$

$$= \text{M} e^{am} \,.\, e^{-ad}.$$

Now, at the sending end itself, $d = 0$, so that V then equals $\text{M} e^{am}$. In other words, $\text{M} e^{am}$ is the voltage at the sending end. Let this be represented by V_0; then—

$$\text{V} = \text{V}_0 e^{ad} \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

It has been stated that $a^2 = \text{I A}$, so, therefore, $a = \sqrt{\text{I A}}$. But any quantity such as a^2 may be written equal to the sum of two other squares; thus—

$$a^2 = \beta^2 + \alpha^2 = \text{I A},$$

and since α is at right angles to β,

$$a = \beta + i \alpha.$$

Inserting this value for a in equation (7)—

$$\text{V} = \text{V}_0 e^{-(\beta + i\alpha) d},$$

$$= \text{V}_0 e^{-\beta d} \,.\, e^{-i\alpha d} \quad . \quad . \quad . \quad (8)$$

The factor $e^{-\beta d}$ represents a decaying quantity, and indicates the way in which the difference of potential between the wires of the loop decreases with the distance d from the sending end; but $e^{-i\alpha d}$ is of a different nature. By De Moivre's theorem—

$$e^{-i\alpha d} = \cos \alpha d - i \sin \alpha d,$$

$$\text{so that } \text{V} = \text{V}_0 e^{-\beta d} (\cos \alpha d - i \sin \alpha d).$$

It is known that any quantity multiplied by $\cos \alpha d + i \sin \alpha d$ is advanced by an angle αd in a positive direction, and that one multiplied by $\cos \alpha d - i \sin \alpha d$ is retarded or turned through an angle αd in a negative direction. The meaning of $\text{V} = \text{V}_0 e^{-\beta d} (\cos \alpha d - i \sin \alpha d)$ is, therefore, that the difference of potential, V, between the wires of the loop at distance d from the sending end is $\text{V}_0 e^{-\beta d}$ where V_0 is the difference of potential at the sending end; and V lags behind V_0 by an angle αd.

It is scarcely necessary to emphasise the fact that the greater the distance d, the greater will be the lag. It will also be clear that, as the distance from the sending end is increased, a point will be reached at which the voltage between the wires is one complete cycle or period behind that impressed at the sending end. Now, from the fact that the phase changes uniformly with the distance, it follows that the waves are travelling along the circuit with a constant velocity, and if at distance d the phase has been delayed by one period, then—

$$\alpha d = 2 \pi,$$

$$\text{and} \quad d = \frac{2 \pi}{\alpha}.$$

Suppose that f complete periods have been passed through by the E.M.F. at the sending end, then $f - 1$ periods will have been passed through by the difference of potential at the distance d where the phase is one cycle in arrear. Obviously, the time taken for a wave to reach the point at distance d is the same as that occupied by one period. The velocity, v, of the waves is, therefore, shown by—

$$v = \frac{d}{t} = \frac{\frac{2 \pi}{\alpha}}{t},$$

where t is the time of one period. If there be f periods per second, then $t = \frac{1}{f}$.

$$\text{So that} \quad v = \frac{\frac{2 \pi}{\alpha}}{\frac{1}{f}} = \frac{2 \pi f}{\alpha},$$

$$\text{also wave length} = \lambda = \frac{\text{velocity}}{\text{periodicity}},$$

$$\lambda = \frac{\frac{2 \pi f}{\alpha}}{f} = \frac{2 \pi}{\alpha}.$$

From the immediately preceding consideration, it will be gathered that α is a constant which determines the velocity with which the waves travel along the circuit, and from equation (8) it will be seen that β is a constant determining the attenuation of the waves at any distance d from the sending end.

α is therefore called the velocity constant.
β „ „ attenuation „

It has been stated that—

$$a^2 = \beta^2 + \alpha^2 = \text{I A},$$

$$\text{where} \quad \text{I} = \sqrt{\text{R}^2 + p^2 \text{L}^2},$$

$$\text{and} \quad \text{A} = \sqrt{\text{S}^2 + p^2 \text{K}^2},$$

$$\text{therefore } \beta^2 + \alpha^2 = \sqrt{(\text{R}^2 + p^2 \text{L}^2)(\text{S}^2 + p^2 \text{K}^2)} \quad . \quad . \quad . \quad . \quad (9)$$

Also $a = \beta + i\,\alpha = \sqrt{\mathrm{I\,A}}$,

$$a^2 = \beta^2 - \alpha^2 + 2\,i\,\alpha\,\beta = \mathrm{I\,A},$$

where $\mathrm{I} = \mathrm{R} + i\,p\,\mathrm{L}$,

and $\mathrm{A} = \mathrm{S} + i\,p\,\mathrm{K}$,

therefore, $\beta^2 - \alpha^2 + 2\,i\,\alpha\,\beta = (\mathrm{R} + i\,p\,\mathrm{L})\,(\mathrm{S} + i\,p\,\mathrm{K})$,

$$= \mathrm{R\,S} - p^2\,\mathrm{L\,K} + i\,p\,(\mathrm{K\,R} + \mathrm{S\,L}).$$

In an equation like this, the real and unreal quantities on the one side are equal to the real and unreal on the other, respectively; so that—

$$\beta^2 - \alpha^2 = \mathrm{R\,S} - p^2\,\mathrm{L\,K}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

By subtracting equation (10) from (9)—

$$2\,\alpha^2 = \sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)\,(\mathrm{S}^2 + p^2\,\mathrm{K}^2)} - (\mathrm{R\,S} - p^2\,\mathrm{L\,K}),$$

$$\alpha = \sqrt{\tfrac{1}{2}\left[\sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)\,(\mathrm{S}^2 + p^2\,\mathrm{K}^2)} - (\mathrm{R\,S} - p^2\,\mathrm{L\,K})\right]}, \quad (11)$$

which is the expression for the velocity constant.

By adding together equations (9) and (10)—

$$2\,\beta^2 = \sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)\,(\mathrm{S}^2 + p^2\,\mathrm{K}^2)} + (\mathrm{R\,S} - p^2\,\mathrm{L\,K}),$$

$$\beta = \sqrt{\tfrac{1}{2}\left[\sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)\,(\mathrm{S}^2 + p^2\,\mathrm{K}^2)} + (\mathrm{R\,S} - p^2\,\mathrm{L\,K})\right]}, \quad (12)$$

which is the expression for the attenuation constant.

These expressions for the velocity and attenuation constants were given by Mr. Oliver Heaviside; see page 400, Vol. II, "Electrical Papers," Macmillan, 1892.

(*To be continued.*)

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in the Transmission of Electrical Energy.

By Prof. E. W. Marchant, D.Sc., Member, and E. A. Watson, M.Sc., Student.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, November 30th,* 1909.)

(*Concluded from page* 958.)

Economic Limits of Transmission.

The capital charges in connection with hydro-electric schemes are by far the most important in determining the cost of generating energy. The running charges are invariably low. In the Ontario Power Co.'s station at Niagara the whole plant of 50,000 kw. was in charge of three men and two switchboard operators. At Niagara, although the problem of conveying the water to the station only involves the boring of a short tunnel, and the plant capacity is large, the cost was given at from £20 to £30 per kw., including the transmission line; it was a good deal higher for the older stations where an expensive type of machine with a shaft 130 ft. long between turbine and generator had been installed. The lowest figure for capital expenditure, including transmission line, was £15 per kw. The charge for the transmission line is usually a very serious matter. The Ontario Electric Development Co., for example, sell their energy at Niagara for less than half of what they charge for it at Toronto.

One of the most interesting points about the transmission line is the determination of the most economical voltage at which it should be worked. Kelvin's law is based on the condition that the total charge for transmitting energy along the line shall be a minimum, but a sounder condition to apply to a transmission line is that the ratio of the total cost of transmitting energy to the revenue earned shall be a minimum, and if this condition is applied we find that the cost of wasted energy must be equal to the whole charge for interest and depreciation on the transmission line. If we assume a cost for the station of £30 per kw., a load factor of 50 per cent., and interest and depreciation charges 12½ per cent., the cost per B.T.U. will be 0·261. On a 20,000-kw. transmission, allowing 10 per cent. copper drop, the cost of waste energy will correspond with a capital charge of £120,000, if 15 per cent is allowed for interest and depreciation on the line, or a capital charge of £800 per mile. The cost of poles and insulators on an 8,000-volt line will be about £200 per mile, and the balance will pay for a three-wire line, each conductor of which is 0·30 sq. in. in area. This corresponds fairly closely with the actual section necessary to give a 10 per cent. drop—*i.e.*, 0·35 in. of copper. The calculation shows that the use of these voltages is economically sound, and that for a transmission of 200 miles and over, a pressure of the order of 100,000 volts must be employed.

The second factor which determines the size of the conductor is the working pressure. With the high pressures used (as is shown above) the possibility of the formation of a corona and the loss of considerable energy by a brush discharge is one that requires careful consideration, and it would be impossible to reduce the section of the conductor used for the transmission below that for which such effects are produced. The cost of insulators is a comparatively small item in the total cost of a pole-line, and the working voltage is settled by the economic considerations detailed above. The common practice is to work the line to give a known percentage drop, and to increase the voltage on the line as the load on it increases, until at the full load the pressure on the line is the maximum for which it was designed at a predetermined drop. The usual efficiency of transmission on most of the schemes seems to be about 90 per cent., the copper drop being of the order of 10 per cent., and the total drop due to resistance and inductance about 15 per cent.

Modern Practice (Hydro-electric Plants Only).

The design of a hydro-electric power station is affected by local conditions to a much greater extent than if any other form of motive power were employed. In some favoured cases an actual waterfall has been found ready to hand, but in many cases long lengths of flume, pipe, or tunnel have been necessary, especially in the western and central districts of America.

In some cases the river follows such a winding course that a short tunnel driven through a mountain will tap the stream many miles further along its course.

The flumes are generally built of wood, although the use of reinforced concrete is now being considered, as the life of a wooden one only averages about five years, and the flume requires constant watching and patrolling.

The choice of prime mover adopted depends very much upon the head of water available. Pelton or Doble wheels are generally used on high heads of 500 ft. and over, and reaction turbines on the lower ones. Pelton or Doble wheels are invariably installed with horizontal shafts, but turbines are used with either vertical or horizontal ones, although the vertical-shaft type is the most favoured at the present time.

Great care must be taken to protect the pipe-line from the effects of water hammer or stress due to the load being suddenly thrown off. There have been cases of stations having their pipe-lines completely wrecked by the sudden closing of a valve at the lower end. The chief function of the governor in a hydraulic station as generally installed in the western and central States is to prevent the machines from running away if the whole load is suddenly thrown off. During normal operation it is common practice to keep the machines running at full load and look after the variations by means of a steam plant installed at some other point on the system.

If governing is done by checking the flow of water, it is necessary to have some form of relief valve or surge pipe installed.

With high-head plants using Pelton or Doble wheels, governing is almost invariably obtained by swinging the nozzles so as to partially clear the buckets.

So difficult is the problem of satisfactory governing that on some of the older plants arrangements are installed for putting on artificial load in order to keep the total draught on the station steady. In the case of Pelton wheels driving exciters and fed off the main pipe-line, spear-rod governing is employed, as the quantity of water used is only small. In a small (300-kw.) station at Cornell University, the water was allowed to compress a column of air in a steel cylinder, which thus acted as a buffer.

General practice in the most recent stations appears to favour generation at about 11,000 volts, with oil-insulated water-cooled transformers of large capacity raising the pressure to that of the line. Taps are frequently provided for working at less than the full voltage, if desired, and this is often done during the early stages of the plant, before it gets its full load. In some cases the transformer is considered as forming one unit with its generating plant. In one case the transformers were treated as forming part of the line, a bank of three single-phase transformers being connected thereto without any high-tension switchgear at all; this, however, is not usually the case.

In only one case were direct-coupled exciters found. Separate machines driven by small turbines or Pelton wheels are practically universal.

Considerable diversity exists in the design of the switchgear, both cell type and open-pattern arrangement being found.

If the Niagara plants are left out, the majority of the stations visited had their high-tension gear and bus-bars quite exposed, although neighbouring parts were generally separated by brick partitions. Copper or aluminium rods supported on large pin-type insulators were used in all the plants except that of the Central Colorado Co., where the rods were hung from above by means of suspension insulators such as were employed on the line. Just outside the station are placed the lightning arresters. Inside the station the line goes to a choking coil, usually a plain copper spiral hung in the air. In all cases but one the line was fed through oil and disconnecting switches from the high-tension "bus." The disconnecting switches are usually plain knife switches, opened by hand by means of a wooden rod about 8 ft long. The insulation of this rod is quite sufficient to allow the user to touch live parts with perfect safety.

Instrument transformers are frequently employed on the high-tension side of the station, although they tend to assume rather formidable proportions. Small electrostatic potential indicators are used on the high-tension conductors to indicate to the operators whether these are alive or not. They consist simply of a pivoted aluminium vane moving in front of a fixed sector, and acting on a similar principle to an ordinary electroscope.

The generators employed in modern stations are all revolving-pole machines of fairly high speed, a 10,000 KW. machine generally running at about 300 R.P.M. Salient-pole rotors and natural ventilation seem to be universal. Both three-phase transformers and banks of single-phase units are employed, and practice does not seem to be decided as to which of these is the best.

Air-cooled and insulated transformers are used in some of the older stations working at 40,000 volts and under, but not in any of the newer or very high-voltage plants. The fire risk from oil insulation does not appear to be great, although it is usual to place each transformer in a separate brick chamber with a steel door that can be closed if required.

The insulation of the high-tension leads where they pass through the case of the transformer is a most difficult problem. A terminal for 100,000 volts is quite a large thing, even if condenser type insulation be adopted. The object of the so-called condenser-type insulation is to obtain a terminal over the surface of the insulation of which the potential gradient shall be as nearly as possible uniform. This is done by embedding in the insulating material metal laminæ whose dimensions are so chosen that the capacity between any two laminæ is the same, this giving a number of equal increments of potential from the case of the transformer to the live conductor.

With the exception of a 33,000-volt line feeding Schenectady, all plants in the State working at less than 65,000 volts appear to use pin insulators, while above this the suspension type is employed.

Brown porcelain is very general, but a slate-coloured glaze is now being introduced, which is said to give a very inconspicuous insulator. Glass insulators are not used on the highest voltage lines. Lack of mechanical strength and liability to cracking by the action of frost seem to be their chief disadvantages.

Suspension insulators and steel towers are the latest development in line construction, and are always used for the very high voltages—*i.e.*, 100,000 volts or so. There are two types of suspension insulators in common use, viz., the Locke and the General Electric patterns (figs. 2 and 3). These are generally used either four or five in series on a 100,000-volt line, which gives ample insulation even if one insulator should break down. They are hung from the cross-arms. Generally if only one line is installed, the three conductors are placed in one horizontal plane. When two lines are run, three conductors can be placed on each side of the tower and suspended from three cross-arms.

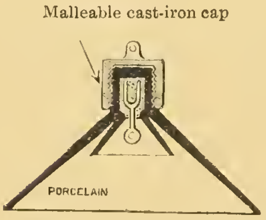


FIG. 2.—LOCKE PATTERN SUSPENSION INSULATOR.

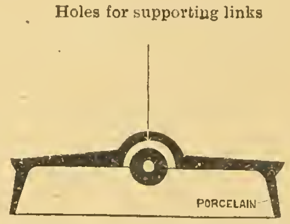


FIG. 3.—GENERAL ELECTRIC SUSPENSION INSULATOR.

The towers are generally galvanised steel, shipped in sections which are bolted together at the site. Each section is galvanised completely after construction, so that the risk of corrosion is very slight. It is usual to test insulators to at least 50 per cent. above their working pressure before leaving the works.

Salt sea fogs and dust storms deposit salt on the insulators, and cause short circuits. Heavy rains do little harm, and keep the insulators clean. Snow and sleet occasionally cause trouble. Instances occur every winter of eastern districts being shut down for periods which would be thought excessive in England. Wooden pins are being steadily displaced by iron pins, which are now universally employed in new installations.

With a wooden pole-line the length of span is usually from 120 to 150 ft., but with a steel tower construction it is no unusual thing to have as long a span as 1,200 ft. for the normal line. Where a canyon or strait has to be crossed spans as long as 3,000 ft. are installed, but in this case steel wire is used instead of aluminium or copper. The wires oscillate very little when they are deflected by the wind, and swing in unison. The normal clearance on a 60,000-volt line is 6 ft., on a 100,000-volt line 10 ft. The sag allowed may be very large, as much as 30 or 40 ft., at the highest temperatures.

Where the transmission line crosses a railroad or road, the usual practice is to arrange two towers as near together as possible on each side, so that a wire breaking will not be able to reach the ground. A cage such as is common in England is rarely, if ever, seen, and in some parts no special precaution is taken against risk from falling wires.

The two metals chiefly used for an overhead line are aluminium and copper. The tendency in the newer stations on the Pacific Coast is to use copper. The conductor used is, in nearly every case, a stranded one. Even when stranded with seven or 19 wires the cable is often too stiff for convenient handling, and a hemp core is inserted; by having the conductors regularly arranged around a central core the stress is more uniformly distributed, and the cable has greater strength for a given cross-section of material than if it were built up in the ordinary way.

Steel, in spite of its relatively high resistance, is used on all very long spans of 3,000 ft. or over.

SUB-STATIONS.

Direct-current distribution is unknown except in one or two of the largest towns, and then only in the central districts. The universal system of distribution is by means of overhead wires strung on wooden poles and working at 2,300 volts; these are carried along all the streets. At intervals a small transformer is bolted on the pole, and steps the pressure down to 110 volts for service to the neighbouring houses. In consequence of this there is a large number of sub-stations which simply contain static transformers for reducing the pressure to the 2,300 volts required for distribution, and induction regulators for regulating the voltage on the outgoing side. In some of the sub-stations of the Pacific Gas and Electric Co., regulation was obtained by the use of tapping points on the transformers.

In some towns the 60,000-volt current is stepped down to 12,000 volts or so before entering the city.

Underground cables are used occasionally in the busier districts of the large cities, but are, generally speaking, very uncommon.

Sub-stations converting from alternating to direct current are chiefly used for railway work, but also for city supply and series-arc lighting. The machinery installed presents no special interest. Rotary converters are used on 60 cycles up to quite large sizes.

Vertical shaft machines are found in some stations, an interesting example being some rotary converters now being built in which the shaft is stationary and the armature spins on it as a pivot.

Stations supplying current for series-arc lighting are peculiar to the American Continent, quite high voltages (up to 10,000 volts) being employed. Rotating machinery is sometimes employed to effect the conversion, but extensive use is also made of mercury vapour rectifiers combined with constant-current transformers. These rectifiers appear to be very successful, having a life of 3,000-4,000 hours and being built up to a capacity of 10,000 volts and 30 amperes.

Batteries do not appear to be much used except in some of the larger towns.

It is very rarely that separate generating plants are provided for traction and lighting service. One company usually operates the whole, from one system, and this, combined with the large use of power for heating, power and elevator service, probably tends to the realisation of a better load factor than obtains on the average English station.

When low-frequency current has to be distributed for lighting purposes it is the usual practice to install frequency-changing plant. It is remarkable that very little lighting has been attempted at the lower frequencies. With incandescent lamps, either of the carbon or Nernst pattern, the flicker when the lamps are supplied with current at 25 cycles is imperceptible, and even with metal-filament lamps this effect is hardly noticeable. The only lamps with which such a low frequency becomes a matter of importance are arcs; but as, on an alternating current, all arc lamps are notably inefficient as compared with direct-current ones, it hardly seems worth while changing frequency in order to make alternating lamps effective. In some places sub-stations containing machinery of 35,000-40,000 KW. have been installed to change the frequency of supply from 30 to 60, and to an impartial observer it would seem a far better plan to have spent the money so invested in improving the distributing system.

DISCUSSION.

MR. T. L. MILLER said that, where it was possible to use the deflecting type of nozzle for water turbine governing, that was probably the safest method. In a number of cases it was arranged for the governor to open a by-pass on the load being thrown off, allowing the surplus water to get away. Relief valves should be fitted on the main pipe line, as, in the event of the governor sticking, serious trouble was sure to occur to the pipe line. The surge pipe only protected the tunnel and not the lower length of pipe. Regarding poles, the latest practice was to use concrete poles; they were lighter than iron, and were not subject to the same amount of depreciation as wood or iron poles. They were also of considerable value where insects attacked wooden poles. On a job in India, he had obtained prices for towers for the following spans:—

Length of span, in feet ...	300	400	900
Price	£14 5s.	£47 10s.	£109 10s.

MR. J. S. PECK said that one reason that had developed long-distance transmission in America was that it was easy to obtain wayleaves, and there were no Board of Trade regulations. He did not see that the pneumatic switch should be any more rapid in action than the electromagnetic switch. Transposing the circuits should eliminate troubles on telephone lines, if they were transposed at the proper points, so that the voltage generated at one part of the line was neutralised at another. At Niagara they had experienced a great amount of trouble with ice and snow. He had seen about 100 men engaged at one time pulling up the ice, blasting with dynamite, and doing everything possible to keep the ice clear. Many different devices were employed, and there was very little trouble now.

MR. S. L. PEARCE said that the capital costs of these water-power schemes should not be lost sight of. In connection with the station at Niagara, the cost was given at from £20 to £30 per KW., including the transmission line; comparing these with a modern steam turbine station, and including £10 per KW. for distribution, it appeared that the steam station would still have some substantial advantage, remembering what an important bearing the question of capital costs had on the supply rates. As far as he knew, the average rates for power supply in the States were in excess of those in this country. The question of way-leaves was an important one. Some two or three years ago, he considered the advisability of supplying some of the outlying districts of Manchester by means of an overhead transmission line, and found that at the best something like 20 per cent. only could be saved as compared with an underground system. Moreover, certain restrictions were laid down, certain roads would not be allowed to be crossed overhead, and by the time all these difficulties had been met there was practically no saving to be effected. He believed 25 periods was being used for lighting successfully in this country at the present time. The advantages lay with delta connections for power work; the main point was one of the reliability of supply. If the consumer wanted lighting as well there was an arrangement (which he thought was due to Mr. Peck) viz., the introduction of interconnected star balancing coils giving the neutral point for lighting purposes.

Prof. Schwartz said he had made some experiments, and found that if steam was discharged through a pipe on to a wire carrying a pressure of 100,000 volts, the steam was deflected very strongly away from the wire. He had made experiments on specimen test pieces of vitreous H.T. porcelain, and found that in tension the strength of a rectangular test piece ranged from 3,136 lb. per sq. in. with a section of 0·2 sq. in. down to 2,000 lb. per sq. in., with a cross-sectional area of about 0·6 sq. in. The reason that the tensile strength diminished with the larger size test piece appeared to be the fact that in firing the porcelain the action of the heat had not been so great at the centre of the cylinder as it was on the outside, and consequently with the large test piece, the porcelain was not so vitreous throughout as in the case of the smaller test pieces. He found the same effect with cylinders tested in compression. With cylinders 2 in. long and 2 in. diameter, the breaking load was about 10,000 lb., for 1 in. it rose to 40,000 lb., and for $\frac{7}{16}$ in. diameter it rose to 52,000 lb. Considering that such a great difference existed between the strengths of porcelain in tension and compression, they ought to design insulators so that the porcelain was in compression at the point of support. Fig. 2 showed the Locke pattern suspension insulator with the porcelain in tension, whereas fig. 3 gave the G.E. suspension insulator with the porcelain in compression. In the latter type of insulator the support was formed by two wire cables interlinked with one another, with the porcelain between them in compression.

Mr. Miles Walker said he was sure that within the next ten years overhead transmission would come. Considering the question of transmission to London from the coalfields 100 miles north of London, if a large aluminium wire were used, say 1 in. diameter, at a pressure of 100,000 volts and a triple line consisting of 9 wires 1 in. diameter by 100 miles long, the total weight of aluminium worked out at about 2,000 tons. Supposing the cost to be £300 per mile, they would have a total cost of £440,000. Taking interest and depreciation at 10 per cent., they got £44,000. Considering the cost of transmission of electricity as compared with that of the transmission of coal from the coalfields of England by land or water, the efficiency of transmission was a great deal less than 50 per cent. The cost of coal in London per KW.-hour generated had never been reduced below 0·2d.; with large steam turbines the cost of coal could be got down to 0·1d. Taking it at 0·1d. at the pit mouth and 0·2d. in London, they had 0·1d. to play with, and with 10,000 KW. [? 100,000.—Eds.], taking the load factor at 0·3, this worked out to a total of £120,000 per year as the saving in coal.

Mr. Chamen said that overhead lines at 10,000 or 20,000 volts worked very satisfactorily, and he thought that no mains men who had worked both overhead and underground systems would disagree with him when he said it was not the overhead system which gave them the greatest trouble or that cost them the most money in maintenance. An overhead line was very easily repaired if trouble occurred. He had known 10,000-volt lines, without any protection whatever except spark gaps and carbon rod protection devices, to live through the worst thunderstorms which he had experienced in this country, and which did damage in the vicinity of the lines. He felt assured that in adding lightning arresters, one was only asking for trouble. As regarded the earth wire being run over the top of the H.T. lines, this was the very reverse of a lightning arrester, but even in the use of this it appeared to him that trouble was more or less asked for as lightning would use this path, and even if it found this path of sufficient capacity, might still induce a high potential to earth on the line itself in so doing.

Mr. A. B. Mallinson said one of the weakest points of an overhead transmission line, as at present installed in this country, was due to the guard nets required when crossing the public roads, &c. He gathered that in American practice, they rarely, if ever, used them. If the line was well designed and carefully erected, there was little or no reason why breakages should occur, but the addition of a number of guard nets must sooner or later cause interruptions of supply from short circuits caused by broken wires.

Mr. A. P. M. Fleming said with reference to the choice between star and delta connections, a point had been raised in the discussion in regard to the use of an interconnected star balancer on delta lighting systems, where it was desirable to obtain a neutral point for lighting voltages. He pointed out a further use of this apparatus and its influence on the choice of star or delta connections for step-down transformers supplying mixed power and lighting loads. A three-phase transformer combination was cheapest and most efficient when connected in star on both H.T. and L.T. sides, but for balanced lighting on the low-tension between outers and neutral, it was necessary to bring the neutral back from the lighting distribution to the star point of the transformer, and also to connect the neutral point of the H.T. side to that at the generator end, in order to avoid unbalanced ampere-turns on the different phases of the transformer and consequent unbalancing of voltage. When the interconnected star balancer was used, the neutral connection on the H.T. side was unnecessary, and it could also be dispensed with on the L.T. side between the main transformer and the balancer. A similar economy as regarded cost and efficiency of main transformer was obtained when the latter was connected in star on the H.T. and delta on the L.T. side, and in this case the balancer provided the neutral point for the lighting voltage. With regard to line construction, the voltages employed in this country had not been high enough to demand serious consideration of the relative merits of the pin-supported and the suspension types of insulator. The authors stated that the prevailing practice in America was the use of the pin-supported insulator for voltages up to about 60,000, and he would like to have their opinion as to whether the suspension type could not be economically employed for much lower voltages. From an electrical point of view, the maximum voltage for which the pin type of insulator was suitable was limited by the intensity of stress in the comparatively small thickness of porcelain between line and ground, *i.e.*, pin head, since for voltages of the order of 60,000 a metal pin was necessary. The thickness of material above the pin head could be made ample for low voltages, but could not be safely increased in proportion to the voltage, as the stability of the support was weakened and difficulties were met with in the manufacture of the porcelain. This steep potential gradient between line and pin head, in addition to stressing the material at its thinnest section, tended to produce a discharge over the outer surface of the insulator, which might cause a flash-over from line to pin and also tended to produce heating around the pinhead, unless the fit in the porcelain was very good. The contour of the petticoats of the insulator could be so designed as to reduce the tendency to flash over to a minimum, but the insulator became a complicated affair, and required to be built up in several parts cemented together, and a material having a very doubtful insulation value at high voltages at the point where the stress was greatest, was introduced. In the case of the suspension type of insulator, the entire stress between line and ground was more or less equally divided over a number of separate units, ample surface insulation could be provided without undue increase in weight or complexity of design, and if one unit was mechanically damaged, the insulation value of the entire insulator was not destroyed, also a great factor of safety could be obtained without much increase in cost.

Dr. E. Rosenberg said the advantages of the asynchronous type of generator was very often over-estimated. It was assumed that the induction generator could be thrown straight on to the line without synchronising. This might be right for very small machines, but with machines of any appreciable output, great precautions must be taken in order to avoid the dangerous rushes of current which otherwise would occur. This was true of induction generators of a few hundred horse-power. Readers who would refer to Mr. Rider's paper on the L.C.C. tramway system would find that in the case of 500-KW. motor generators, the machines were brought up to synchronous speed from the D.C. side, and a stroboscopic device was used to ascertain the exact synchronous speed before switching the induction motor on to the line. Even then a rush of current occurred, just the same as when connecting a transformer suddenly to full voltage, and in order to reduce heavy rushes, choking coils were temporarily inserted.

The chairman, **Mr. S. J. Watson**, said that in Lancashire towns the power consumption in individual centres run from about ½ to 1 H.P. per inhabitant, and in Manchester alone there was half a million to a million horse-power in use. He did not think that power to this amount was going to be produced in the colliery district, as the capital cost of transmitting it was so great.

Mr. F. V. T. Lee (Pacific Gas and Electric Co., San Francisco) in a communication to Dr. E. W. Marchant, said that they had a large number of asynchronous generators on their system, and used them in all their large power houses; they were not used for their value as energy producers, but merely for the purpose of taking advantage of their characteristics for the purpose of governing the exciter water-wheels. The history of the introduction of these units had never been definitely published. About 1898 or 1899, in the installation of hydro-electric plants, a great deal of difficulty was experienced in obtaining a satisfactory water-wheel governor for the purpose of obtaining regulation to admit of parallel operation. The exciter sets were then, as now, almost entirely water-wheel driven, being the successors to the belted exciter with its inherent difficulties. With the water-wheel driven exciter the cost of a good governor seemed prohibitive, and the ordinary induction motor-driven exciter, due to poor speed regulation of the induction motors then commercially obtainable, was almost, if not quite, as bad as the belted unit. Another difficulty that was experienced, in the high-head plants particularly, was that owing to the smallness of the nozzle on the exciter wheel it was very readily choked up by twigs and other small articles, with the result that it was not infrequent that the plants shut down from that cause. In the East, at Niagara, the difficulty of regulation was taken care of by placing an artificial load in the form of a resistance in shunt with the generator fields. The exciter wheel then was run at constant load, which was divided between the resistance and the generator fields, as conditions required. A constant load, however, was kept on the water-wheel at all times. The late Mr. Theodore E. Theberath and the writer, in order to do away with the induction motor, developed a scheme using a synchronous motor, water-wheel and exciter coupled together on the one shaft, and operating the other water-wheel at full load at all times. The difficulty with this, however, was that if for any reason there was trouble with the water-wheel, the synchronous motor fell out of step, and it would be difficult to start it again. About this time Steinmetz's paper on the induction generator was published, and Theberath immediately recognised that this machine had the characteristics that they were looking for. A set was installed, and the results obtained were so good that they had been used ever since on this system, and, in fact, the Theberath exciter set would be found in use on most systems in the West. Anybody who would consider the matter would appreciate that they were ideal and gave a guarantee of operation that could not be obtained otherwise. The writer had expanded this idea in connection with turbine stations, and proposed in their steam turbine station, when it was extended, to put in a small steam turbine direct connected to an exciter, with an induction-motor on the same shaft. This would then operate exactly as did the water-wheel sets, and would eliminate the governor troubles that had been apparent with steam turbines in small sizes due to the smallness and delicacy of the parts involved.

MESSRS. MARCHANT and WATSON, in reply (communicated), said the spigot and socket pipe joint was the most common. Very little trouble appeared to have occurred from leaking pipes. At Island Bar the pipe was protected by relief valves, and the surge pipe served to prevent inertia effects due to the large mass of moving water in the tunnel. The air compressor for protecting the pipe line was not at all common; with proper precautions for maintaining air in the cylinder, it would appear to be an excellent protective device. No reinforced concrete poles were seen; the prices given by Mr. Miller for the 900-ft. span tower were much higher than those quoted for these towers where they were used in large quantities. Electrolytic arresters were almost universal, and the common practice was to charge them every other day. Delta connection was more common than star, and was stated to be the most satisfactory. In spite of this, the star would seem to be the best arrangement on general grounds. Breakdowns were usually caused by ice and snow on the transmission line rather than at the power stations. The induction regulators were usually automatically operated by direct-current motors. Transformer tapping regulators were hand operated. Prof Schwartz's remarks tended to confirm the belief that the dielectric strength of air in bulk was very much lower than 38 kilovolts per centimetre. The figures for "R" given in the paper were derived from experiments made at the University of Liverpool on the brush discharge from a wire in a concentric tube. They were also confirmed by experiments made by Prof. H. J. Ryan at Cornell University. Prof. Schwartz's experiments on the behaviour of steam blown against a high-tension wire appeared to give a striking illustration of the way in which the ions were shot away from the charged wire. These ions would presumably act as nuclei on which the steam would condense, and would thus be rendered visible. Dr. Rosenberg stated that with large asynchronous generators, it was not only necessary to bring them up to speed before switching in, but also to have them in phase. This surely was incorrect, for a squirrel-cage machine could not be said to have any "in-phase" position at all. The surge caused by throwing such a machine unexcited on to the circuit would probably not be any greater than if a transformer of the same size were suddenly switched on. They did not actually see any asynchronous machines acting as generators pure and simple, but saw quite a number of the asynchronous exciter sets mentioned in Mr. Lee's contribution. They also understood that the Interborough Rapid Transit Co., of New York, had installed a 5,000-KW. machine of this type. In considering the relative capital costs, the expenditure on hydraulic works, pipe line, &c., must be set against the cost of boilers. In almost every case the hydraulic work was much more expensive, though, with particularly favourable conditions and large powers, the hydraulic station might be the cheaper of the two. The cost per KW. of the new Winnipeg station would, it was estimated, be very little in excess of the cost of the most modern steam turbine station. For the case quoted in the paper, the length of transmission line was about 50 miles. The cost of electrical energy per B.T.U. was usually higher in America than in England, though the charge for power purposes at Niagara was only £2 per H.P.-year. The climate of San Francisco was very foggy, and some trouble had been caused by damp on the insulators, but the difficulties had not been at all serious. The question of long-distance distribution was largely a matter of wayleaves. The overhead earthed wire not only tended to protect the line from direct lightning stroke, but also screened it from the effects due to electrostatic induction. Lightning seemed to cause much less trouble at 100,000 volts than on transmission lines working at 20,000 or 30,000 volts. There was considerable lack of confidence among station engineers in any form of lightning arrester as a protective against direct lightning stroke. The water-jet arresters, unless the water was not very clean, appeared to give quite ineffective protection against lightning, although in the case of a system running entirely insulated from earth without any grounded point, they might serve to prevent the accumulation of any static charge on the line or apparatus. It was quite likely that it might be found good practice to have suspension type insulators for lower voltages than that for which they had hitherto been employed. Guard nets in America were only employed where a line crossed a very busy road, and were the exception rather than the rule. The requirement of guard nets in this country where a transmission line crossed a little-used footpath in a remote mountain district seemed possibly a little overdone. There were very few cases where the transformers were tied straight through. High tension switching was the rule, and was absolutely necessary where duplicate lines were installed. The 110,000-volt plant of the Ontario Power Co. was not yet installed, although the plans had been prepared. The cost of land for the transmission line was not merely the cost of the patch of land on which the pole stood, but of all the land under the line for such a width as was considered to ensure sufficient protection against falling wires. The chief fuel used on the Pacific Coast, both on the railways and in the power stations, was Californian oil.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. LEPINE and A. R. STELLING, Dipl.Ing., Students.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, December 9th*, 1909.)

IN this paper it is proposed to enumerate the salient factors in the cheap methods of production which render the Germans such serious competitors in the world's markets.

Prior to 1899 the industry in Germany was divided up among a great many firms. Even at this early date German financiers seem to have realised the advantages which would accrue from association of interests, and they commenced a policy of amalgamation. With each of the more financially powerful firms was associated a trading or investment company; the majority of the shares in the latter were held by the manufacturing company. With the capital at their disposal the investment companies were enabled to finance supply undertakings, the electrification of tramways, &c., and so obtain markets for the parent manufacturing firm. The remainder of the shares in the investment company were, as a rule, held by syndicates of financiers or by banks. Banks in Germany are of a different constitution to English banks. In the first place, their capital is usually much larger than is customary in England, and a large portion of this capital is always at the disposal of the directors for investment in industrial concerns. There are other so-called banks which are purely trading syndicates, and whose capital, or rather financial power derived from their capital, is solely used for the purpose of financial industrial undertakings.

As regards the electrical industry, the principal sphere of action of both wholly industrial banks and deposit banks having an industrial development department was in connection with supply companies and electric tramways or railways. When such a company was floated, the bank or investment syndicate took up or underwrote a certain number of shares. The necessary capital was obtained by the issue of bonds on the share capital of the bank and on the shares already held in other companies. The manufacturing company also took up a number of shares, shares already held being mortgaged for the purpose of obtaining the ready money. Where advances were made to companies for extensions, these were redeemed later by mortgages on the new plant or by a new issue of capital.

This system, as will be observed, readily lends itself to reckless speculation. During 1899 and 1900 a boom in electrical engineering led to much speculative promotion of electrical schemes and exaggerated extensions of existing ones; the result was an inevitable reaction. Depositors became alarmed at the investments made by their banks, and two banks, the Dresden and Leipzig Credit Banks, had to go into liquidation. It should be noted that both these institutions were deposit banks. The feeling of insecurity which succeeded caused a set-back in all branches of electrical engineering, and we may describe the period from 1901 to the end of 1903 as one of reconstruction and amalgamation. In the first place, several firms had to undergo entire reconstruction, but the investment companies and private financial syndicates enabled other firms to successfully weather the depression. Many of the smaller firms which suffered were absorbed by the larger and more influential ones, and there are emerged from this period the three great German combinations of Allgemeine Elektricitäts Gesellschaft, the Siemens-Schuckert group, and Felten-Guilleaume-Lahmeyer. The amalgamated firms proceeded to strengthen their position and prevent *injurious* competition by completing certain working agreements. At the same time they left certain branches open to competition among themselves, especially those in which they found rivals in the smaller firms, whose interests were purely local.

During the years that followed, the trade in Germany as a whole slowly recovered. The direct result of the amalgamation and working agreements was that these powerful combinations and their associated syndicates were able to control the market, cause a steadying of prices and an ultimate recovery of confidence.

The heavy electrical machinery trade in Germany is now almost entirely in the hands of four large companies—the three already mentioned and the Bergmann Co.; the latter to a certain extent are a party to these working agreements. The capital of these firms stands at the following figures:—

A.E.G. ...	£4,200,000 share. £1,930,000 bond.	F. & G.-Lahmeyer ...	£2,750,000 share. £1,250,000 bond.
Siemens-Schuckert	£4,500,000 share. £990,500 bond.	Bergmann ...	£1,050,000 share. £500,000 bond.

The best proof of their success is to be found in the dividends paid by these firms. We give the dividends for the last two years:—

	1908.	1907.
A.E.G.	12 per cent.	12 per cent.
Siemens Schuckert	10 "	10 "
F. & G.-Lahmeyer	8 "	10 "
Bergmann	18 "	18 "

One great advantage of their large capital is their ability to meet sudden demands caused by the advancement of engineering science, such as the erection of special plant for the construction of turbo-generators.

As another example may be cited the participation of German firms in the Victoria Falls power scheme. Not only have they contributed a large portion of the necessary capital, but they are also erecting special shops for the construction of the generating plant, *i.e.*, 20,000-KW. sets.

Turning to the investment companies, many of these became entirely merged in manufacturing concerns, and were thus enabled to substantially reduce their capital; others improved their financial position by disposing of their shares in unremunerative concerns and opening up new fields.

A glance at the latest report of one of these investment companies shows that no supply company in which they are interested pays less that 6 per cent dividend; the investment company themselves pay 10 per cent. dividend on a share capital of £1,600,000.

In the improvement of the trade the material assistance afforded by financial syndicates has been of such value that during 1908 a further step in electrical finance was taken. This was the establishing of two electro-trustee banks (Elektrotreuhandbanken) under the control of the large German electrical companies.

The principal object of these "trustee" banks is to advance to large consumers in the electrical industry the money they may require for beginning and carrying out costly works. The capital needed for the loans is to be obtained by mortgage bonds, secured in the first place by the stocks held by the bank, and in the second place by the share capital of the latter which is to be invested in trustee stocks. As the shares, however, will most probably be retained by the electric works concerned, the entire business resolves itself into a transaction enabling these companies to raise the funds they need in order to assist and open larger credits to their customers, the formation of separate banks evidently having been decided upon as the most likely method of facilitating the placing of bonds. These facilities for obtaining cash advances are to be extended principally to municipalities and other public bodies, so that the bonds will be to all intents perfectly secure, while at the same time these authorities will be encouraged to proceed with any plans for the erection of new or the extension of old electrical plant which they may have under consideration, without the necessity of issuing new loans for that purpose.

The present situation is one which in spite of the general trade depression must be described as satisfactory; electrical undertakings are readily able to find working capital independent of the state of the money market and of the manufacturing industry in general. Looking ahead, developments of a less pleasing nature appear to threaten. The various financial institutions, by providing the manufacturers with working capital and credit, enable them to compete successfully in all markets and render each firm independent of the others where capital is required; but should the activity of the banks be reduced from any cause, or should foreign and local competition become so keen as to cause repeated price-cutting, then the great disadvantages of over-capitalisation will make themselves felt, and the large firms will be driven to the formation of a huge trust with their associated banks as a nucleus, their existing intimate relationship rendering the accomplishment of this all the more easy.

INTERNAL ORGANISATION.

In the offices of the firms in question a bureaucratic rule obtains. The keynote of the whole system is that each man's work is specialised.

Each branch of manufacture is an organisation in itself, having its own drawing office, designing, costing and clerical staff. Alternating-current induction motors, alternating-current generators and synchronous motors, direct-current small and large machines, and turbo-generators are treated in separate departments, as are also alternating-current and direct-current instruments, wattmeters and switchgear. There are separate drawing offices for estimating purposes for transmission schemes, lighting schemes and cental station designs.

A publicity department run by University graduates in literature is responsible for the catalogue and journalistic work. This department is officially termed the "literary" or "propaganda" department.

Besides this department and the estimating offices for the home trade, each firm has a foreign department which deals exclusively with inquiries from abroad, and which is in correspondence with the branch offices (outside Germany) and the subsidiary companies. The value of this department cannot be too highly estimated. All these various departments are subject to the "Verwaltung" or central authority, which also deals directly with the employés.

The average technical employé is more highly theoretically trained than in England. All members of the technical staff go through one of the drawing offices; in fact, it is in these departments where all German engineers start on a level footing, the chances of promotion depending chiefly on the quality of their training. Technical employés are usually bound under a contract which is all in favour of the employer. In this contract the employé agrees to publish no technical matter without the consent of his firm, to give no private tuition on technical subjects, nor to divulge any methods of the firm by whom he is employed. Further, all designs which may be patented are the property of his employer. The draughtsman is usually forbidden to enter the shops.

Salaries are kept low; after leaving college the engineer commencing work at about 24 years of age receives £5 5s. a month. This increases with machine-like regularity until it reaches the maximum wage for the department. Holidays of more than three days either from head office or from a branch office must be granted by the central authority.

EXTERNAL ORGANISATION.

Each firm's trade in Germany is attended to by the head office and branch offices, while to subsidiary companies with their own branch offices is entrusted the control of their trade with other countries.

In dealing with their home trade the German method of working up connections is thorough. Besides obtaining business by the ordinary methods which are employed in England, they spend considerable sums of money in educating the masses. For instance, the following procedure is employed in districts where electricity is an unknown quantity.

Invitations are sent out to the principal householders to attend a lantern-slide lecture on the benefits to be derived from the application of electricity in the home or factory, and the interest of the population is thus aroused. The engineer then approaches the local mayor and other officials and persuades them to apply (either alone or in conjunction with other villages, as the case may be) for the necessary grant and powers to finance and erect the plant required. In this way many overland central stations have been erected in which the manufacturers have a pecuniary interest. Not only do they then supply the power plant, but also the whole of the fittings required by the consumers, and this on a very profitable basis.

With regard to European trade, this is developed chiefly by means of subsidiary companies having share capitals varying from £100,000 to £600,000, according to the country. These companies are all provided with branch offices, which are controlled by the subsidiary company financially, but which deal directly with the factory in technical matters.

Again, complete staffs are maintained in the countries outside Europe where many competitive English firms are content to employ agents; often enough the latter have but the faintest ideas on the subject of electricity and its application. It will be seen from this and the foregoing paragraph that German firms are always in a position to treat inquiries from all countries with the utmost consideration, and to furnish very complete tenders which are sure to meet customers' requirements. They make a point of accurately ascertaining these requirements; to put it figuratively, "if a screw is required, they are not content with being told the size; they want to see the place into which it is to fit."

As the English firms rarely trouble to send experts to investigate proposed schemes, but are content to let branch managers or agents muddle through as best they can, it is not to be wondered at that German firms obtain so many profitable orders in open competition.

The following figures, taken from Board of Trade returns, will perhaps be of interest; they are given for the last few months:—

	Electrical imports to Great Britain from Germany.	Electrical exports to Germany from Great Britain.
May	£72,843	£3,933
June	89,779	4,494
July	93,708	2,137
August	73,321	881
September	82,313	1,841

These figures show a pretty good average of the trade done between England and Germany, as is evident from the following table:—

ELECTRICAL EXPORTS OF GERMANY AND GREAT BRITAIN.

—	From Germany.		From Great Britain.	
	To Great Britain.	To other countries.	To Germany.	To other countries.
1907	£553,882	£7,673,118	£45,532	£3,419,583
1908	712,251	8,394,750	46,873	3,240,249

The sums included in the figures under "Exports, to Great Britain" for electrical machinery are, for 1907, £227,931, and 1908, £250,402, these being the largest figures in any one section.

Lamps also account for large amounts, viz., £129,244 and £240,989 respectively, these large figures being accounted for by the advent and popularity of the tantalum lamps.

(*To be continued.*)

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"ELECTRICAL ENGINEER" writes:—"Under the Electric Lighting Act, 1882, a local authority may make by-laws or wiring rules, but such by-laws cannot be enforced unless they have been confirmed by the Board of Trade.

"What power, therefore, has a council to insist that certain wiring rules, say, the Institution of Electrical Engineers, shall be observed? It is true that under the Model Order, supply may be refused under Sec 22, which states that the undertakers shall not be compelled to give a supply of energy unless the lines, &c., are in good order and condition, and not calculated to affect injuriously the use of energy supplied by the undertakers by other persons.

"There is a great difference between our right of refusal under this Clause, and our right to refuse supply because the consumer has not observed a reasonable wiring rule. (The actual offence is that he has carried out extension wiring work himself, without notice or application or testing, has connected up same to existing installation, and his method of wiring is in defiance of ours and I.E.E. rules.) But if we have no such right, how are we to keep up a good standard of work?

"So far as my experience goes, I have not found it to be the practice to submit the local wiring rules and regulations for the Board of Trade's approval. Is it asking too much of you to deal with this in your 'Legal Query Column,' without any names being mentioned?"

⁂ The above query appears to be met by Sec. 6 of the Electric Lighting Act, 1882, which provides that a local authority may, in addition to the regulations which may be made under the preceding provisions of this section for securing the safety of the public, from time to time make, rescind, alter or repeal by-laws for further securing such safety; and there may be annexed to any breach of such by-laws such penalties to be recovered in a summary manner as they may think necessary; provided always that no such by-laws shall have any force or effect unless and until they have been confirmed by the Board of Trade, and published in such manner as the Board of Trade may direct. No by-laws under this clause had (up to 1903) been submitted to or approved by the Board of Trade —and the by-laws of local authorities have seldom been approved. There appears to be no reason, however, why a local authority could not adopt the I.E.E. rules and impose penalties for their infringement, but no penalties could be enforced unless the rules were approved by the Board.

"W. G. T" writes:—"I shall be much obliged if you can inform me at an early date through your Legal Column, what liability an electric lighting company, working with a provisional order, is under to supply electrical energy in the event of a failure of supply through a prolonged coal strike."

⁂ The point has not been definitely decided. Undertakers are liable for failure to supply unless it is due to *force majeure* or inevitable accident (Electric Lighting (Clauses) Act, 1899, Sec. 30). A strike is a thing to be provided against by laying in a supply of coal, and if a failure arises owing to lack of coal, it is certainly not *force majeure* (which means an act of God or the King's enemies), nor is it due to inevitable accident.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—(*Continued from page 9[illegible]9*)

	Lire per 100 kg.
Machinery of various kinds actuated by motors and forming a single entity with them (provided that the motor does not predominate in weight in the entire article): Weighing up to 1,000 kg.	19
Weighing more than 1,000 kg.	13
Regulators, switches, resistances, interrupters, commutators, controllers, speed regulators, cut-offs, &c.: Weighing up to 100 kg.	30
Weighing more than 100 kg.	25
Detached parts of dynamo electric machines and of transformers: Of iron or steel and weighing more than 1,000 kg. each	16
Other	25
Cords or cables formed of one or more metallic conductors covered with textile material and varnish, with or without india-rubber or gutta-percha	50
Cables formed of one or more metallic conductors covered with insulating materials, sheathed or protected with iron or any other metal, including submarine cables...	28
Arc lamps	60
Incandescent electric lamps	5 per 100
Earthenware, common	6
„ fine	18
Porcelain, white	16
India-rubber and gutta-percha, in tubes or sheets combined with wire or metallic gauze	40
Other articles including those of hardened india-rubber (ebonite)	50
Graphite wares...	7
Celluloid in plates, sheets, rods, &c., manufactured ...	15
Aluminium and its alloys with copper in wire: More than ½ mm. in diameter	50
½ mm. or less in diameter	75
Nernst electric lamps and parts thereof	60
Burners or radiators for Nernst electric lamps ...	5 per 100
Carbons for electric lamps, with a metallic thread in the interior destined to facilitate the combustion of the carbon	10
Mercury vapour electric lamps	60
Regulators for electric arc lamps	60

(*To be continued.*)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,705. "Dental applicator for use with any electric massage vibrator." C. Brice. November 29th.

27,715. "Improved methods of wireless signalling applicable to telegraphic and telephonic purposes." W. E. Hitch. November 29th.

27,755. "Improvements in electric arc lamps." F. M. Lewis. November 29th.

27,757. "Improvements in or relating to supports or insulators for carrying electric conductors or cables." B. G. Navarro. November 29th.

27,759. "Electric fire alarm." J. Carter. November 29th.

27,796. "Improved process for insulating contacting electrical conductors from one another." D. Timar. November 29th. (Complete.)

27,816. "Improvements in or connected with electric irons and other similarly-heated devices." J. Smith, H. L. Mitchell, W. H. Askham and H. Hey. November 29th.

27,827. "Improvements relating to automatic regulators for dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. November 29th.

27,901. "Improvements in apparatus to control the heat of electrically-heated chambers, ovens and the like." J. A. Abbott. November 30th.

27,909. "Improvements in provisions for electrically-heating apparatus for incubating, propagating, and cultivating micro-organisms and sterilising." C. E. Hearson. November 30th. (Complete.)

27,913. "Automatic switch for electric batteries." A. G. Bruty. November 30th.

27 922. "Improvements in and relating to electric resistances." Clarke, Chapman & Co., Ltd., and R. C. Harris. November 30th.

27,925. "Device for ventilating, heating and purifying and creating radio-activity in its operation." C. Schmidt. (Date applied for under Sec. 91 of the Act, December 1st, 1908, being date of application in Germany.) November 30th. (Complete.)

27,937. "Improvements in controlling appliances for the electric lighting of vehicles." H. Grob. (Date applied for under Sec. 91 of the Act, January 2nd, 1908, being date of application in Germany. An invention comprised in application No. 28,120, dated December 24th, 1908.) November 30th. (Complete.)

27,972. "Improvements relating to electric furnaces." J. A. Day. (Date applied for under Sec. 91 of the Act, June 19th, 1909, being date of application in United States.) November 30th. (Complete.)

28,022. "Appliance to attach to motor-cars, electrically-propelled vehicles and the like, to give audible indication of excessive speed." H. G. W. Brinsley. December 1st.

28,024. "Improvements in and relating to overhead electric traction conductors for electric railways." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m b.H., Germany.) December 1st. (Complete.)

28,105. "Improvements in and connected with switches for electric circuits." H. W. Handcock and A. H. Dykes. December 2nd.

28,143. "Improvements relating to the insulating of electrical conductors." Siemens Bros. & Co., Ltd., and C. R. Riber. December 2nd. (Complete.)

28,053. "Improved device for controlling an auxiliary electric circuit requiring a voltage which is lower than that of the source of electrical supply." H. W. Hill and W. G. Harding. December 1st.

28,169. "Improvements in electric telegraphic signalling installations." Siemens & Halske Akt-Ges. (Date applied for under Sec. 91 of the Act, December 3rd, 1908, being date of application in Germany.) December 2nd. (Complete.)

28,184. "Improvements in and relating to electric switches." Sterling Telephone and Electric Co., Ltd. (Telephon Fabrik Akt-Ges. vorm J. Berliner, Germany.) December 2nd. (Complete.)

28,210. "Electric variator for advertising purposes." A. W. Leonard. December 3rd.

28,333. "Improvements in electric ceiling fans." W. Hunt (P. S. Swan, India). December 4th.

28,340. "Improved commutator grinder for dynamos and motors." L. Newitt. December 4th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Means for Electrically Operating Points, Switches, and the like on Electric Tramways. R. Hacking and H. W. Hill. 12,614. August 15th. (Post dated August 15th, 1908.)

Control of Alternating Electric Current Motors of the Commutator Type. British Thomson-Houston Co. (General Electric Co.) 19,299. September 14th.

Apparatus for Electric Signalling in Connection with Mine Haulage and Winding or Operations of a Similar Nature. R. Rutherford. 21,693, October 14th.

Electrical Wiring for Houses and the like. J. S. Highfield. 24,533. November 14th. (Cognate application 27,145 of 1908).

Means for Regulating Polyphase Electric Commutator Machines. Allmanna Svenska Elektriska Aktiebolaget & La Cour. 24,581. November 14th. (Date applied for under International Convention, November 1[illegible]th, 1907).

Dynamo-Electric Machines. British Thomson-Houston Co. and F. P. Whitaker. 24,854. November 18th.

Combined Telephone and Electric Light or other Equipment for use in Connection with Diving Apparatus. R. H. Davis, E. A. Graham and A. W. Cox. 26,857. December 10th.

Electric Ignition Devices for Internal Combustion Engines. C. Cecil and H. P. Drondson. 27,212. December 15th.

Means for Attaching Shades and Reflectors to Incandescent Electric Lamps. C. W. Dawson. 27,659. December 19th.

1909.

Automatic Regulating Devices for Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.) 315. January 6th.

Electric Hand Lamps. H. J. Fuller. 803. January 13th.

Rail-Sanding Apparatus to be fixed to Electric or other Tramcars and the like. R. Carrick and C. Procter. 1,305. January 19th.

THE
ELECTRICAL REVIEW.

VOL. LXV. DECEMBER 24, 1909. No. 1,674.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers.

Cheques and Postal Orders (on Chief Office, London) to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE INDUSTRY AND THE INSTITUTION.

WE complete in this issue the publication of our abstract of Messrs. Lepine and Stelling's paper read at the Institution on the 9th inst., and of the discussion thereon. The paper is entitled "Notes on Methods and Practice in the German Electrical Industry," and gives some most useful information within the limits of its title. Covering as it does important features in factory, office, and business methods, it offered a wide scope for profitable discussion, but its concluding paragraph expressed the opinion that "if the English financiers and commercial leaders of the electrical industry were as enterprising and as successful as their German rivals, English manufacturers, supported as they are by the superiority of their productions, would not have to fear German competition in the open market." In consequence of this expression of opinion, the majority of the speakers regarded the occasion as affording an excellent opportunity for calling attention to grievances against the Institution, its Presidents, the Legislature, and the fiscal system of the country, and only a minority dealt with the practical features of the paper. Mr. Garcke took exception to the paragraph which we have quoted above, and then proceeded to find fault with the President and the past-president for the opinions they had expressed upon the condition of the electrical industry, and with the Institution itself for its reliance "on the efficacy of scientific discussion," and its omission "to undertake those active duties which are necessary in order to secure beneficent legislation and vigorous and healthy development." The demonstration of the wisdom of the Council in placing reasonable limits to the Institution's functions is to be found in Mr. Garcke's speech. He raised questions of economics and politics which we do not question the ability or the readiness of members of the Institution to discuss, but such discussions should take place elsewhere, and the aloofness of the Institution from political questions is justified on the grounds of its own welfare, and its ability to confer the maximum benefit upon its members.

It has been said of Burke that he was too apt to defend bad causes with a scream of passion, and that a politician who screams makes but little impression upon a legislative assembly. It is often otherwise elsewhere, and the applause given to a speaker who is in earnest should not be grudged him. But when great interests are involved, the invective needs to be ignored, and the arguments require to be carefully considered. Mr. Garcke and his associates (who contrived to get in political speeches in spite of the President's ruling) would have us believe that any depression which may exist in electrical manufactures is the result of restrictive legislation, or municipal enterprise; "that chaos of prejudices known as public opinion"; the need of financial facilities such as are afforded in Germany, for instance, by industrial banks or kindred institutions; and, finally, the absence of that protection for the home market which our international competitors enjoy.

For some years past the same line of argument has been industriously pursued with the object of leading to the formation of some organisation which shall represent the whole of the industry and promote its welfare by ameliorating "many of the difficulties under which it labours." Such an organisation has not been formed, and, from the nature of things, cannot be formed. And now on the first opportunity that presents itself the Institution is appealed to to "abandon the erroneous belief that the scientific interests of the electrical industry can be best advanced by an attitude of apathy towards the commercial aspects." We doubt if the Council of the Institution have any such belief as is here presented. The relationship of the scientific and commercial sides the one to the other is far too obvious to escape the attention of those concerned. What is not so obvious is the most suitable method of promoting those interests.

What are Mr. Garcke's methods? First, to make our flesh creep by a demonstration of the deplorable condition of the electrical industry; secondly, to demonstrate that non-success of any enterprises is not to be attributed to any lack of foresight, prudence, or careful management, but to the overmastering conditions with which the responsible persons are powerless to contend. And what are the underlying principles of the remedies? Just exactly what might be expected from the diagnosis of the alleged disease. The tendency of the remedies is to lead the mind from internal causes and to seek amelioration from external aid. Capital, it is said, does not flow into the business. Capital does go into paying sections, but if there is no flood of capital for new, though promising, enterprises, how much of the cause may be attributable to that campaign for "amelioration of disabilities" of which the first article is a recital that electrical enterprises do not pay, the second that they cannot pay unless conditions are changed, and the third that the changes alleged to be required go to the root of the principles of English business? Capital is sensitive, and its possessors are liable to form impressions from the prevailing talk of the market-place. When those interested in electrical enterprises not only talk about their disabilities, but positively shout them and persistently continue to do so, some at least of the available sources of capital must be dried up. The order placed in Germany for the electrical material required for what is, or was, called the Victoria Falls Power Scheme, was mentioned during the discussion. Regarding this plant a correspondent of the *Daily Telegraph* "believed that every effort was made by the British South Africa Co. to secure that the contract for the Victoria Falls electrical materials should be placed with a British company, and that the failure was entirely due to the lack of the necessary financial support to the contracting English firm." The result of our own inquiries is that whatever efforts were made in this direction must have been of a somewhat perfunctory character, since firms perfectly able to manufacture the plant had no such opportunity as was afforded their German competitors. The incident is purely financial, and is in no sense indicative of manufacturing "disabilities" or the need of any revolutions in methods, unless it be in the direction of financial conduits, such as are referred to as Industrial Banks. The City editor of the *Daily Telegraph* summed up the matter in the words, "The British public did not respond to the Victoria Falls Co.'s invitation to provide some £900,000 for the installation of a big electric plant for the mines on the Rand. The Germans willingly agreed to provide the amount, but on the express condition that the necessary plant, which involves an expenditure of nearly a million sterling, should be obtained from German manufacturers." The English financial market, to whom the scheme was openly offered, regarded it coldly. Would they have received it any the more warmly if approached from the side of manufacturing interests instead of as presented? We put the question. The answer must be left, and it will probably vary with the varying views of our readers. There is, however, no reason why English electrical interests should be lectured or any electrical financier put on the cap and wear it any more than Rothschild or the more modest investor. Anyone with available cash had his chance and refused it, either on the merits of the investment itself or by reason of the auspices under which it was presented. The manufacturing work has gone, but the earning stage has not yet begun, and we should wait awhile before congratulating our German friends upon their enterprise or condemning our English friends for their excess of prudence. Meantime it may be hoped that financial interests which rejected the opportunity of investing directly will not too greedily swallow the investment when presented indirectly, in which case the Industrial Bank concerned, or other German financiers, will have considerable funds locked up and will perhaps be willing to let others have a chance of financing any similar enterprise which may offer.

It is well to remember that the mere fact of securing orders on speculative terms does not justify the injunctions to follow all the methods of our German friends which we are implored to do. We are told that the firms are large and have become large by a series of amalgamations. This is a free country, and there is nothing to prevent the amalgamation of any firms who find it to their advantage. Enormous engineering works are not such a novelty in England as to justify any sentiment of awe at the extent of electrical factories in Germany or elsewhere. So long as we are equipped for the manufacture of any machinery in demand, it is immaterial whether our factories are few and large or numerous and comparatively small. It is early yet to determine that the large is necessarily the most economical, since the principal examples have developed rather as the result of fiscal conditions than from purely economic causes. There may, nevertheless, be room for connecting links of a semi-financial character.

The advocates of German methods are, of course, expecting to reap all the advantages without any of the drawbacks. Our Chancellor of the Exchequer has not yet placed a tax on incandescent lamps, such as exists in Germany. Our students who look wistfully to the time when they may embark on practical work, and plenty of it, as they are persuaded to expect, may ask themselves whether employment on the terms indicated by Messrs. Lepine and Stelling entirely satisfies their aspirations for the future. Those concerned in electrical manufactures may wonder whether, after all, the industrial banks lauded by Mr. Raworth are just the institutions by which it is desirable that electrical finance should be controlled. It would appear, from Mr. Raworth's remarks, that these institutions are engaged not only in developing some enterprises, but also in deterring the development of others. There is reason to still further inquire whether these methods can be profitably transferred to this country. An absence of freedom of action and freedom of choice runs through them all, until we reach conditions which fetter not only those within, but also those without.

No surprise need be felt that those who seek adventitious aid for business enterprises should look to Tariff Reform for help, but as we have remarked, it is to be regretted that a meeting such as the one addressed should have such subjects forced upon it. We have expressed our views on this question before, and have no intention of intruding them now. It is only necessary to meet the arguments advanced by remarking that the electrical industry is dependent upon the general prosperity of the country, and any direct benefit it might appear to receive from Tariff Reform would be as nothing compared with the loss which might accrue from a change in our fiscal policy. The subject needs to be approached very broadly, which can hardly be claimed for it in the discussion to which reference is made.

We hope, but are hardly justified in expecting, that electrical interests may be allowed a respite from the efforts of its anxious friends such as we have dealt with above. We do not deny that there have been some essential drawbacks, but they have been lived down. We do not say that there are no legislative restrictions which are not capable of improvement, but they should be defined and amendment sought in a direct way from the proper quarters and not by the attempt to create a fictitious public opinion. We are far from suggesting that there are no weak members, but we assert that there is no occasion to mix them up in a general way and thereby besmirch a whole industry. Some weak branches have died off; a little pruning will save some others. "Vigorous and healthy growth" comes from the rigorous and drastic application of sound business principles and not from seeking props or dwelling on drawbacks.

"CHRISTMAS CHEER."

In wishing our readers who are within 24 hours' postal reach of these offices "A Merry Christmas," we remember that large number of our friends farther off, who will not see these pages until Christmas-tide has been all but forgotten. To these, therefore—and, indeed, to all—let us employ the more comprehensive expression "The Compliments of the Season." Though the year is not yet quite dead, in the words of the politician its "sands are running out," and for foreign reasons, if for no other, in this last issue but one for 1909 the Electrical Review heartily wishes to all of its supporters everywhere "A Bright and Prosperous New Year in 1910."

"A passing compliment from editor to supporter—a courtesy and nothing more"—some cynic may remark in these empty unbelieving days. We will let our cynic say his say, and proceed, for we are content to believe that there is still some genuineness, some cordial heartiness, some hope and confidence left even among those who endeavour to watch over the interests of our electrical affairs. We are not all of us so caught in the trammels of self-interest as to be entirely oblivious of the interests of others. Not all of us suspect all of our fellows of saying one thing and meaning another, whatever we may suspect of some. We have no difficulty in believing that the improvement in the state of British electrical engineering and industry which began in 1909 is going to continue in 1910. We also hope that the signs of general improvement which are now so apparent both in the Trade Returns and in the increase of employment, will put heart into some who have allowed their hopes to droop, and will disturb or silence those whose constant complainings have excited anxiety in the minds of men whose own concerns bear no actual evidence of depression.

A few years ago prophets of decadence took our tin-plate trade in hand and wrapped it in a shroud ready for burial—one almost heard the words "Dust to Dust." But a temporary disability had been mistaken for dying gasps, and the poor corpse was no corpse at all. A corpse indeed—mark its vitality, its energy, in the closing months of 1909! Well may the affectionate embalmers now flee in fright. Never did any industry stand up more erect, more ready for the fray—and why?—the superiority of Welsh tin-plates for export meat-packing is bringing such important orders from America that 45 sheet and tin-plate mills are in course of erection or projected. Two out of eight new mills were started only last week and the others will be ready directly. In what more emphatic manner could an industry denounce its detractors?

We do not propose to produce here for Christmas reading and digestion an examination of the factors that have been present making for good and evil in our industry during the year. All we desire just at this point is to say that whatever the past may have been, we arrive at Christmas-tide with figures which indicate that the tide has turned, that the trade of the country is growing again, that more of our people are finding work, that the depression in the curve is past. Various departments of the electrical trade are directly dependent upon improvement in other and more general branches, and some of them have already told us that they are feeling the benefit of that awakening. It is reasonable therefore to expect better things for the British electrical trade in 1910 than it experienced in 1909.

The trade returns for the month of November showed an increase of £11,700,745 (23·4 per cent.) in imports, of £4,174,000 (14·3 per cent.) in exports, and of £69,697 (1 per cent) in re-exports, as compared with the corresponding month of 1908. Taking the 11 months of the year there have been increases of 5·1 per cent. and 14·3 per cent. in the imports and re-exports respectively. The exports are still a shade below those of 1908, namely, 0·9 per cent., but if we add that the month of November showed large increases in manufactured goods, and a reduced price per ton for export coal, the export position is better than it appears from a mere percentage figure. Incidentally, it may be added that the 0·9 per cent. is not accounted for by any fall in electrical exports, for these have increased considerably during the current year, as we have repeatedly shown.

The statistics issued by the Labour Department of the Board of Trade for November, show that employment was better than in October, the improvement being observed in the pig-iron, tin-plate, engineering and shipbuilding industries; indeed, all the chief industries of the country, except cotton spinning, reflected improvement as compared with the corresponding month of 1908. The Trade Unions returned their unemployed members at 6·5 per cent., as compared with 7·1 per cent. in the preceding month, and with 8·7 per cent. in the month of November, 1908. This is exceedingly satisfactory. The pauperism figures issued a few weeks ago for the metropolitan district also reflect an altogether happier state of things.

We print the foregoing figures at this moment in the belief that their appearance in our pages on the eve of Christmas may go far to give those of our readers who wish it "A Merry Christmas," and to encourage a more hopeful outlook, based upon actual statistical evidence, for the year that is coming.

Capital and Labour Co-partnery.

About a year ago we discussed the scheme of co-partnery proposed by Sir Christopher Furness, and gave it our support. We pointed out that, in agreeing to give the system a trial, the men were ahead of their leaders, who look with suspicion on all schemes of profit-sharing proposed by the masters; and we expressed our opinion that the trial could be productive of nothing but good, because, in the first place, it meant steady and continuous employment for the men, who would thus be assured of a full year's wages; continuous occupation of the yard, thus tending to economy in production; and finally, because the facts learned by experience would serve to dispel many of the fictions born of prejudice. Such practical experiments as that which has completed almost a year's successful run at the Hartlepool shipyard should do a great deal to dispel many erroneous ideas from the minds of thinking workmen as to the relationship between labour and capital. The period for which it was agreed that the co-partnership should be tried is now drawing to a close, and the secretary of the company has addressed a letter to the employé shareholders setting forth the results so far achieved.

In this letter it is shown that all departments have been well employed, and that in the shipbuilding department there have been no cases of delay in delivery, as was, unfortunately, often the case before. On the contrary, not only has every ship built and repaired since the commencement of the co-partnership scheme been completed and delivered within the contract time, but in one important contract in which the company undertook to lengthen a steamer within six weeks, so that it might resume its position by a fixed date on the line in which it was engaged, the work was completed in six days less than the stipulated time. This is most gratifying evidence as to the value of the scheme, and of the loyalty of the men.

Turning to the financial side, the results are no less satisfactory. The success, or otherwise, of schemes of co-partnership or profit-sharing depends very largely upon the part which the cost of labour plays in the total costs of production, and depends still more on the nature of the labour. In the making of standardised plant and machinery, such as engines, boilers, or electric generators, the costs of labour can be very closely and accurately estimated, but, in shipbuilding and repairing, where so much manual labour is employed, and where the supervision cannot be so close as in a workshop, the cost of labour can, by the deliberate act of the men, be made much more than it ought to be. It is clear then that for work of this character any scheme which gives the men a direct interest in the profits, not only makes them more contented, but must inevitably tend to reduce the cost of labour to a minimum for each job. It is the recognition of this fact which prevents the Trade Union leaders from lending their support to such schemes. It is supposed that if the costs of labour be reduced, there will be less labour employed. Whilst this may be true of any particular job, it is not true as applied to the whole works, or as applied to the industry generally. It is to be sincerely hoped that the results at the Hartlepool yard will do something to promote a more liberal attitude towards profit-sharing schemes of working.

According to the terms of the agreement, the employé shareholders in the Furness co-partnership scheme were guaranteed 4 per cent. on their holding, and, after the ordinary shareholders had received 5 per cent., any surplus was to be divided equally between the employé and the ordinary shareholders. As a result of the nine months' work there will be a bonus all round at the rate of 5 per cent. per annum, so that the workmen receive 9 per cent. and the ordinary shareholders 10 per cent. per annum for the nine months ending December 31st, 1909, which, for convenience, has been made the end of the financial year.

This state of things is in marked contrast to that which existed prior to the co-partnership experiment. Before, owing to sectional strikes and disagreements, in which the employers had no part or lot, the company found it impossible to give any definite guarantee as to time of delivery of a vessel. In several cases considerable penalties had been incurred by reason of the contract time being greatly exceeded. Specific instances are referred to in the secretary's letter to the employé shareholders, viz., the steamer *Victoria* and the three Hamburg-America steamers which were respectively 152 days, 273 days, 304 days and 273 days late.

Under these circuumstances the directors are desirous now of knowing at an early date whether it is the desire of the employé shareholders to continue working under the co-partnership system. It is pointed out that sufficient time has now elapsed to enable the men of practical thought to form a sound judgment, and it is imperative in view of the necessity of looking forward to the securing of future contracts, that the directors should know whether or not they may count upon the co-operation of the men, without which it will be impossible to guarantee delivery within a specified time, and thus valuable work will be lost to the yard.

We do not overlook the fact that a good start was given to the co-partnership working by the orders given for vessels by the chairman, Sir Christopher Furness. But this is not the only work accomplished since the scheme was put in hand. During the period of co-operative working nine steamers have been launched and six others are in various stages of construction. At the Middleton shipyard 119 steamers have been docked and repaired, at the harbour dockyard 157, and at the public docks 8, making a satisfactory total of 284 steamers for the period. In addition to this a considerable amount of salvage work has been done.

We shall be interested in hearing the men's side of the story, and, if they are as satisfied with the results as are the directors and ordinary shareholders, there is no doubt that the co-partnery method of working will be continued. In this event there is every likelihood that other yards will inaugurate similar systems, and it will be very gratifying if proposals for such should emanate from the men. Bearing in mind, however, that the Trade Unions are very strong in the shipbuilding and engineering trades, it is doubtful if the men will be encouraged by their official leaders to take the initiative.

Fire and Flexible Cord.

WHATEVER may have been the cause of the fire at the premises of Messrs. Arding and Hobbs, Clapham Junction, we tender to the firm and the bereaved and to all who have suffered in any way in consequence of this sad calamity, our heartfelt sympathy.

As to the cause of the fire, we know no more than is to be gleaned from the daily Press. We have become so accustomed to read the unconsidered remark, "the fire was caused by the fusion of an electric wire," that we should be surprised to hear of any fire for which electricity was not saddled with the blame. In the lamentable case referred to, an explanation has been given which, at any rate, is a possible one. One version is that an assistant dropped an umbrella on to an electric lamp, causing a fusion of the wires, whilst another account says "the fire started in a window of the fancy linen goods department by the fusion of an electric wire, the outside of which was decorated with cotton wool." Now, without offering any opinion as to the origin of the fire, we take this occasion to repeat what we have so often said before—viz., that it is high time that the use of flexible cord in shop windows containing inflammable articles such as every draper's shop contains, to say nothing of celluloid goods, should be absolutely prohibited. Shop window lighting is, perhaps, the cheapest possible kind of electrical work, and is also, as generally carried out, the most dangerous. The surprising thing is that the accidents and fires arising from it have been so few. Electrical contractors are not altogether free from blame in the matter, but unless they absolutely decline to carry out work at the prices which are current for this class of lighting, it is difficult to see how the standard is to be raised, except, indeed, by drastic action on the part of the insurance companies.

Speaking quite generally, it is an amazing thing that whilst a man will spare no expense on his building and furnishings, willingly paying an architect's fee to ensure structural safety, he will place his electric light contract with any Tom, Dick or Harry at the lowest price tendered, begrudging the nominal fee which any responsible consulting engineer would charge him for drawing up a specification and supervising the work. He is quite prepared to accept the contractor's assurance that the work will be in accordance with insurance requirements, and having paid his insurance premium, he feels satisfied that both his risk and his responsibility are covered.

And what of the insurance companies? With one or two exceptions, they profess to insist on the rules of the Institution of Electrical Engineers being complied with, but how many of them will refuse a risk because the work is not in strict compliance therewith? If any difficulty is raised, it is generally enough for the insurer to say, "Very well; if you won't insure me, someone else will," in order to bring the insurance company to heel. Insurance is no guarantee of security, and it requires to be emphasised that the insuring of any premises, whilst it covers financial risk, does not insure against moral responsibility.

Electricity in Mines.

IN our "Notes" will be found a reference to the forthcoming inquiry into the use of electricity in mines, which we commend to the notice of those interested in this subject.

THE RAWTENSTALL ELECTRIC LIGHTING AND TRAMWAYS UNDERTAKING.

The history of the electric lighting undertaking of the Borough of Rawtenstall dates back to the year 1899, when the Corporation obtained a provisional order. No steps were taken, however, until 1904, when negotiations commenced between the Corporation and the Lancashire Electric Power Co. for a supply in bulk. In 1905 the Corporation applied for, and obtained, the Local Government Board's sanction to a loan for the purchase of sub-station machinery and distributing mains. Early in 1906 the Corporation had under consideration the purchase of that portion of the Rossendale Valley tramway system lying within their borough, and after considering a report by their engineers, Messrs. Lacey, Sillar and Leigh, decided to introduce a Tramways Bill in Parliament authorising the reconstruction and extension of the old tramways system and its conversion to electric working. At the same time, the original scheme for a bulk supply from the Lancashire Electric Power Co. was abandoned, and in August, 1907, a fresh application for borrowing powers in connection with the electric lighting scheme was made, sanction to the loan being obtained subsequently. The Act authorising the reconstruction and extension of the tramways was obtained in 1907.

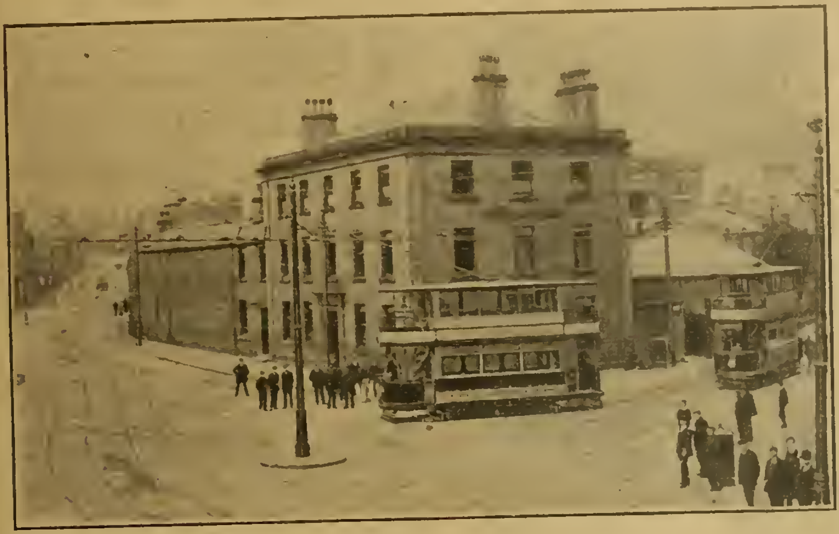


Fig. 1.—View in the Town, showing the Tramways.

In the meantime the engineers prepared the plans and specifications for a generating station for the supply of electricity to the tramways, and for general lighting and power purposes. Tenders were received by the Corporation and the various contracts let during the early part of 1908. In July of that year an agreement was come to between the Corporation and the Rossendale Valley Tramways Co., as to the purchase price for the lines, car depôt and rolling stock, and the work of reconstruction was commenced in August. At this period negotiations were also in progress between the Rawtenstall Corporation and the Corporation of the adjacent Borough of Haslingden for a supply in bulk, and for the working of their tramway system, but the negotiations fell through.

Similar negotiations were entered into between Rawtenstall and the Corporation of Bacup, and in September, 1908, an agreement was arrived at between the two Corporations as to the reconstruction and working of the tramways in Bacup.

The first portion of the reconstructed tramways were inspected by the Board of Trade on December 10th, 1908, and the final portion in Bacup was inspected on July 20th, 1909.

The completion of these lines allows of through communication by tramway between Blackburn, Accrington, Haslingden, Rawtenstall and Bacup, all of which are important manufacturing towns. There is also a tramway running in a northerly direction from the centre of Rawtenstall to a point about two miles from the present termination of the Burnley Corporation's tramway system.

The lines are all single track, with turn-outs, and comprise the following: Reconstructed lines in Rawtenstall, 5 miles 2·2 chain; new lines in Rawtenstall, 1 mile 4·4 chains; reconstructed lines in Bacup, 2 miles 3·1 chains; total, 8 miles 7·7 chains.

There are numerous steep gradients and many curves, the steepest gradient being 1 in 15; the curves have, for the most part, a fairly large radius.

The track is laid to a gauge of 4 ft., with British standard rails weighing 100 lb. per yard. So far as possible, the rails are in 60 ft. lengths, each length fitted with three anchors secured to the rail flanges by Warner's patent anchor clips.

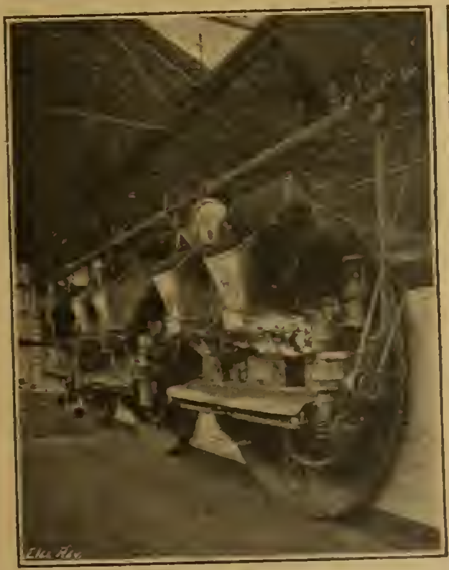
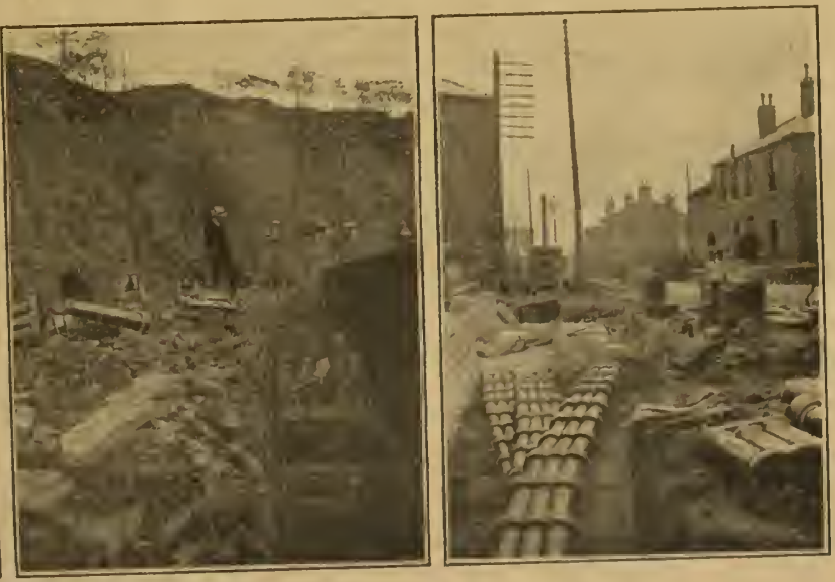


Fig. 2.—The Boiler House.



Figs. 3 and 4.—Laying the Mains.

The rails are of high silicon steel, made to Sandberg's specification, the chemical constituents including: Carbon, ·53; silicon, ·292; sulphur, ·055; phosphorus, ·051; and manganese, ·83.

The joints between rails are all welded by the Thermit process.

The points and crossings are of Hadfield's manganese steel, and the inner rails on the sharpest curves are fitted with Bulfin's patent renewable lip.

The joints, where welded, have no bonds, but at junctions between rails and points and crossings two solid copper pin type bonds are employed on each rail, with supplementary long bonds over the points and crossings. Cross bonds are provided between rails at intervals of 20 yards, and between tracks at intervals of 70 yards.

On some portions of the route it was found that the old concrete bed was quite sound, and in these cases the old bed was re-used, elsewhere a new bed has been put down ; the old granite setts have also been used where possible.

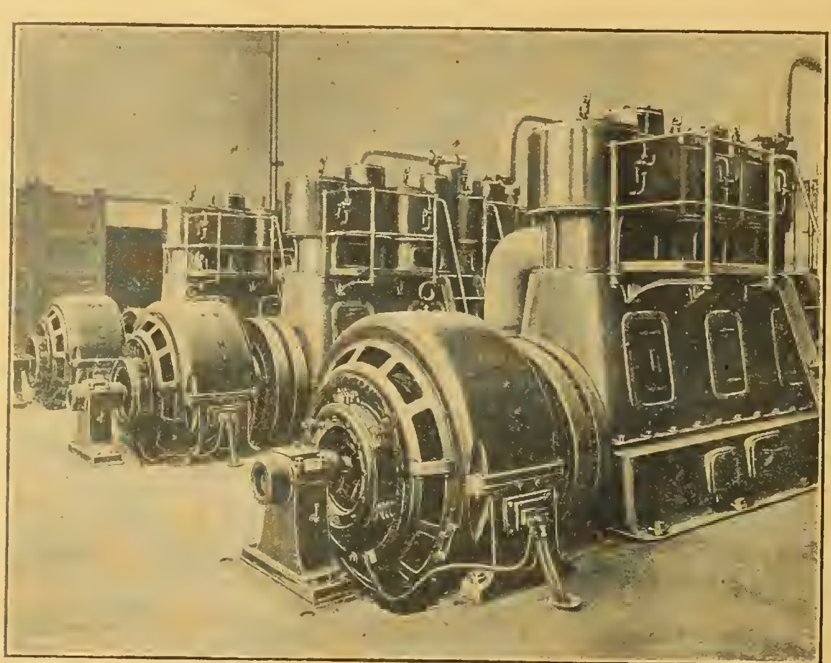


Fig. 5.—View in the Engine Room.

The contractors for the permanent way work were Messrs. Underwood & Brother, Dukinfield.

The overhead equipment is on the span-wire system, supported on tubular steel poles made in one piece, 31 ft. long, the overhead conductor being erected so that it is never more than 48 in. from the centre of the track.

The trolley-wire is of No. 000 grooved section, with B.I. & H. non-fouling ears. The whole of the overhead equipment was carried out by the British Insulated and Helsby Co.

The cable work for both lighting and tramway systems was carried out by Messrs. W. T. Glover & Co. The cables are paper insulated and lead covered, the feeders being drawn into stoneware conduits and the distributing cables laid solid in bitumen in wood troughing. The two high-tension feeders are three-core armoured cables laid direct in the ground.

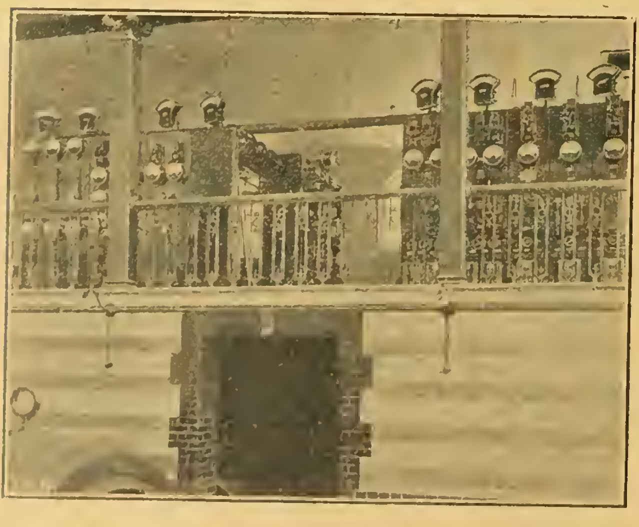


Fig. 6.—The Switch Gallery.

Return feeders are used for the tramway system in conjunction with track boosters at the power station.

The feeder pillars were also supplied by Messrs. Glover ; each section box is fitted with the usual switches for dividing the overhead line into half-mile sections and with a telephone by which communication can be held with the generating station. Telephones are also provided on each terminal pole on the different routes and at the car depôt.

The rolling stock comprises 16 cars, by the United Electric Car Co., each car being fitted with two Westinghouse motors, and arranged for the Raworth regenerative control. The cars are of the double-deck four-wheel type with canopy covers and have seating capacity for 51 passengers.

The hand brakes are fitted with the Peacock patent brake spindle, and mechanical track brakes of Spencer's latest pattern are also fitted ; the regenerative control provides for electric braking.

The trolley poles are of the Brecknell, Munro & Rogers's swivelling type with specially low bases. The results in actual working with the regenerative control have been very satisfactory, the current consumption, as metered at the station, being only 1·1 units per car-mile.

The power station is a handsome brick building on the bank of the River Irwell at Hareholme, about a mile from the centre of Rawtenstall.

It comprises engine, boiler and switchrooms. Adjoining the switchroom is a block containing the offices and stores, with a basement beneath forming a battery room.

The station is designed and equipped for the supply of current for lighting and power purposes at 460 and 230 volts on the direct-current three-wire system and at 400 volts and 230 volts alternating current to the outlying parts of the borough, also at 500 volts for the tramways.

In the engine room are installed three three-crank Browett-Lindley enclosed type triple-expansion engines, each coupled to an E.C.C. generator. The engines have a normal full-load rating of 440 i.h.p., and are capable of working up to 530 i.h.p., the speed being 400 r.p.m. and the steam pressure 175 lb. per sq. in.

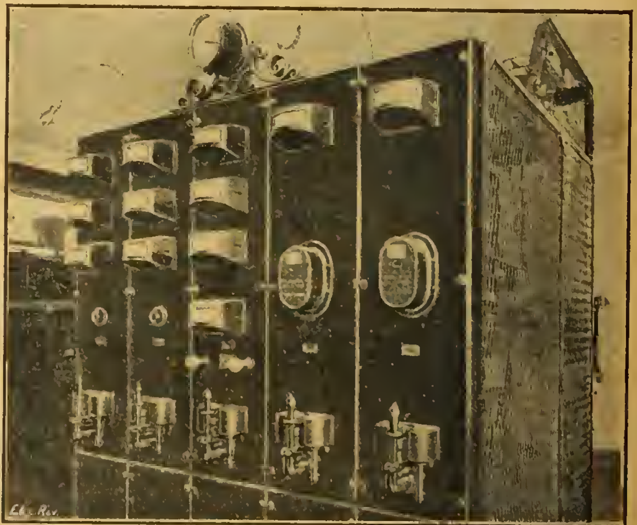


Fig. 7.—The h.t. Switchboard.

The generators are six-pole compound-wound machines with interpoles, and have an output of 277 kw. at normal load. The pressure can be regulated between 475 and 560 volts, and the machines are used compound on the lighting and traction systems.

Each engine is fitted with a Korting ejector condenser with motor-driven circulating pumps of the Rees Roturbo type.

Steam is supplied by three Yates & Thom Lancashire boilers, 30 ft. long × 8 ft. diameter, fitted with McPhail and Simpson superheaters and Bennis automatic stokers with compressed air furnaces. There are also installed a Green economiser with 192 tubes, two of Hall's compound feed pumps, each having a capacity of 3,000 gallons per hour, and an injector for 2,000 gallons per hour. The steam pipes, valves and other accessories in connection therewith were also supplied by Messrs. Yates & Thom. The auxiliary machinery comprises an inverted rotary converter set by the British Westinghouse Co., of 100 KW. output. This machine consists of two 100-KW. rotary converters mounted on one bed-plate, and arranged so that they can be coupled together by a clutch. The machine runs normally with the clutch in gear, one half being used as a direct-current motor on the traction system, and the other half as a double-current generator supplying direct current for the three-wire lighting system and three-phase alternating current, which is stepped up by static transformers to 3,000 volts for transmission to the outlying parts of the borough where three-phase transformers are installed for reducing the pressure to that required for the alternating-current distribution system. The middle wire of the direct-current system is connected to the neutral point of the step-up transformers, thus dispensing with the usual rotary balancing set.

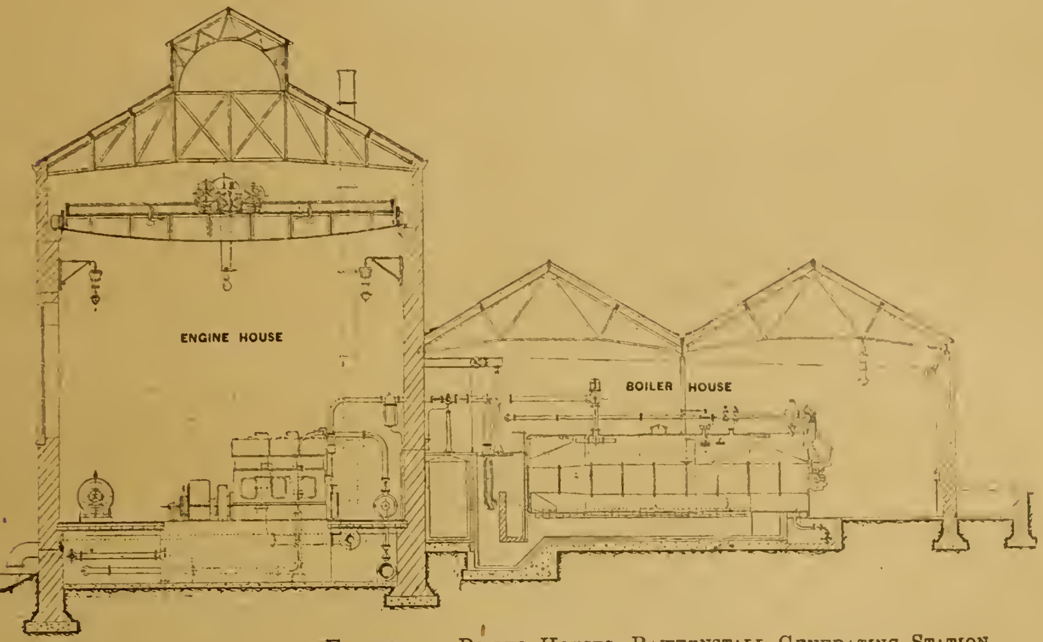


Fig. 8.—Section through Engine and Boiler Houses, Rawtenstall Generating Station.

After the tramway system is shut down only one-half of the machine is run, this acting as an inverted rotary taking current from the battery (which is then connected to the lighting system) and generating three-phase current for the A.C. supply.

In addition to the above, there is installed an automatic reversible booster by the Lancashire Dynamo Co., used in conjunction with the battery, two track boosters by Crompton & Co. for the tramway return feeders, and an ordinary E.C.C. three-wire balancing set.

The battery was supplied by the D.P. Battery Co., and comprises 240 cells with a discharge capacity of 56 amperes for 10 hours. This is used normally in conjunction with the booster on the traction system, but is transferred to the lighting system for the night load.

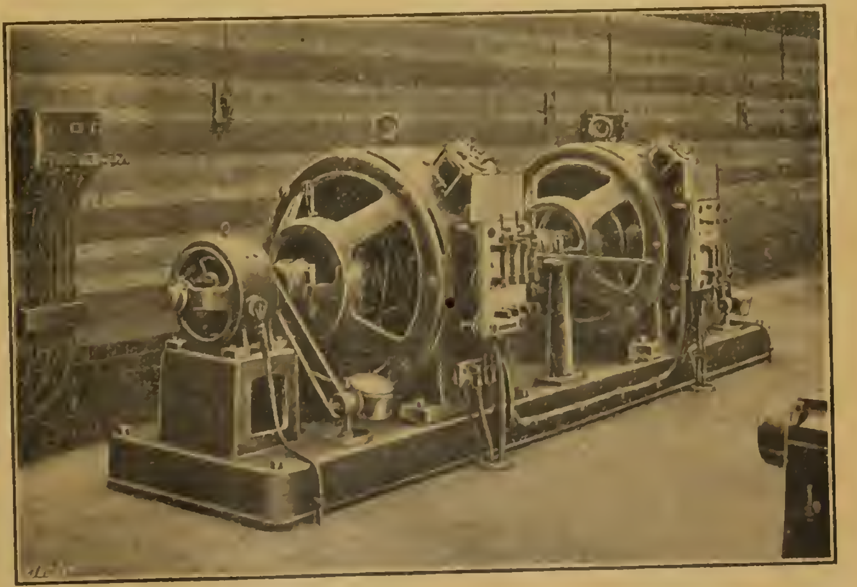


Fig. 9.—Westinghouse Inverted Rotary Converter for A.C.-D.C. Supply.

The L.T. switchboards were supplied by Messrs. Whipp and Bourne, of Castleton, and the H.T. switchgear by the B.T.-H. Co.

An overhead travelling crane with a capacity of 15 tons spans the engine room, and was supplied by Messrs. Thos. Larmuth & Son, of Salford.

The reconstruction and extensions of the permanent way, the electrical equipment, power house and all other work was carried out to the plans and specifications of Messrs. Lacey, Sillar and Leigh, of Westminster and Manchester.

The laying of the permanent way was supervised by Mr. James Johnson, the borough engineer, and the electrical work by Mr. C. L. E. Stewart, the engineer and manager.

THE ELECTRIC LIGHTING ACTS, 1882 TO 1909.

By a Central Station Engineer.

Twenty-seven years is no trifling span of time to those who have seen it pass from their working lives, but short, indeed, to have covered the creation and development of an art and industry whose ultimate influence on the life of civilised communities promises to be more far-reaching than that of any previous adaption of the forces of nature to the service of man.

In observing the growth of the electric supply industry in its relation to public opinion, it must be remembered that in spite of the novelty of the medium and methods, the general application of electrical energy to the production of light and power only constituted a new means of obtaining conveniences already in general use, and this immediately surrounded the new industry with an atmosphere of competition and no little opposition. Then, as even now to some extent, it suffered from friends who hoped too much for it, and from enemies who saw in its rivalry dangers which have hardly been realised and whose feelings have been reflected in the legal enactments which control the industry. Few in number and comparatively small in scope as these are in comparison with the present magnitude of the interests involved, their tendency has been restrictive, and for many years supply undertakings have urgently-felt the need for wider powers and more complete legal support in their dealings with competitors and the electricity consuming public. After many delays a considerable measure of relief has been obtained by the passing of the Amendments Act of 1909, which from April of the coming year will modify existing electrical law in many directions, particularly in regard to the needs of public supply authorities; the consumer, actual or prospective, is favoured rather by the spirit than the letter of the Act, which in its provisions suggests a full if somewhat tardy recognition by Parliament of the importance of electricity supply as a utility which no section of the public should be avoidably deprived of.

Of the 27 sections of the Act, 12 are devoted to the larger issues of the industry, facilitating the establishment of works and bulk supplies, and making provision generally for removing any obstructions to the natural growth of the business; six sections deal with accountancy and finance and purely formal requirements of the measure, whilst the remaining nine are devoted to strengthening the position of the authority in relation to its consumers. Some of the latter items suggest the reflection that whilst electricity is subject to such active competition from other sources of light and power, its new rights should be asserted only with care and judgment, too much harm having already been done by approaching consumers in the spirit of the tax collector.

The establishment of generating stations is dealt with by Secs. 1, 2 and 3, which provide for the acquisition of sites within or without the area of supply, compulsorily if need be, by permission of the Board of Trade, and after due notice and advertisement; similarly the right may be obtained to break up roads, railways or tramways for the purpose of laying mains between the area of supply and outside generating stations without the consent of the authority controlling such roads if it can be shown that such consent is unreasonably withheld, these powers being qualified by Clauses 22 and 24, which respectively provide protection against nuisance and damage to public buildings and parks under control of the Commissioners of Works, and secure water and gas undertakings against compulsory deprivation of land required by them for the purposes of their undertaking. The vision conjured up by the latter clause, wherein the Board is solemnly restrained from allowing an electricity undertaking to acquire the gas company's property for the erection of a works, comes as a welcome relief after 10 tedious pages.

The important question of bulk supplies is dealt with in Clauses 4 and 5, which make it possible to obtain powers and carry out the necessary road work in the face of local opposition if the Board can be satisfied that such supply is needful and desirable. A liberal interpretation of these provisions should greatly assist electrical development in villages and the residential communities often found just beyond the boundaries of cities, and hitherto isolated electrically by the lack of power to supply and run mains rather than by distance.

By the use, where permissible, of overhead transmission, many new markets can be opened up, and some further impetus given to the healthful tendency, which already exists, for residential property of the better class to spread outward into the country.

Clause 5—allowing supply to be given to a railway, tramway or canal situated partly within and partly without the area—opens up interesting possibilities; presumably the supply company of a mining village in Wales might offer to the L. & N.W. Railway to run its system by electricity! Certainly, cases must arise where the prospects and value of an undertaking will be much enhanced by this provision. Of immediate interest to many station engineers is the permission contained in Sec. 6 to supply premises outside their area, subject to the consent of the local authority and any undertaker in whose territory such premises may be situated. It must be noted that such extensions will become part of the supplier's system for the purposes of the Electric Lighting Acts, and such supplies will be subject to the usual responsibilities.

On the fringe of most urban districts there are houses, and frequently factories, which are at present deprived of the advantages of electricity, although within a short distance of mains. Incidentally, the extensions which may be made under this clause will offer an inducement to manufacturers, of light goods at least, to seek positions beyond the boundaries of the town to which they are confined by the need of a convenient fuel supply; presumably when the electricity works are under municipal management it will be necessary for the engineer to so adjust his charges to "Outlander" consumers that too strong an inducement is not offered to pass beyond his rateable area.

Where a supply area adjoins, or is surrounded by the territory of power companies, the latter will not view with favour any attempt to connect up outside premises which may in the future development of their systems become desirable consumers; in such cases it should be possible to find some equitable arrangement whereby such consumers could be handed over after a term of years, or a royalty paid upon them by the supplier to the undertaking in whose area they are situated. Quite a considerable amount of business has been lost to suppliers and electrical manufacturers, owing to the inability of power companies to reach the limits of their areas within a reasonable time, and their not unnatural disinclination to allow the mains of other undertakings to enter their territory.

A case in point was recorded in the ELECTRICAL REVIEW of December 17th, where the Lancs. Power Co. gave permission to the Oldham Corporation to supply a number of townships in the company's area.

In these leading clauses of the Act there is a satisfactory admission of the universal utility of a public electricity supply and an intention to make it equally available to all, irrespective of geographical situation, and further the tendency for generating centres to become reduced in number and increased in size whilst gravitating to positions physically suited for their operation will be strengthened by the provisions of this measure.

Problems of management receive attention, and some new and useful powers are given.

The maximum price, hitherto open to revision at intervals of seven years, can now be the subject of appeal by a representative body of consumers every five years (Clause 10). In (11) dealing with certification of meters, the "unfixing or disconnecting" of a certified meter no longer renders it uncertified as under the Clauses Act of 1899, the amendment merely providing that the meter shall cease to be a certified meter where any alteration has been made in it. The duties of the electrical inspector in respect of a disputed meter are now restricted to certifying it if correct, and also certifying the manner in which it is connected up—a not unimportant detail, in view of the confusion which is sometimes wrought by ignorant attempts to insert metallic lamp transformers in existing supply connections. Previous to this amendment, it devolved upon the inspector to determine the value of the supply given through disputed meters. This is presumably now left to supplier and consumer, and recent cases show the Courts to be undecided as to the justice of forcing a claim for payment on the evidence of a meter where such is widely-different to previous or anticipated registrations. Forty-eight hours' notice now becomes compulsory before a meter may be connected or disconnected, and it is of importance to note this in connection with changing meters for various reasons.

The stand-by supply difficulty is now provided for, and consumers may be called upon to pay a minimum sum per annum sufficient to cover standing and up-keep charges in proportion to the extent of their possible demand; this protection, which now becomes general, has been secured in special cases by clauses in local Acts.

Apparatus and wiring installations on hire or being paid for by instalments are fully protected against seizure by creditors of the hirer, provided that they are clearly marked with the name of the authority to which they belong. In view of the fact that such apparatus may be removed by the owners, it would appear desirable to secure a landlord's sanction before fitting up any installation which involves structural alterations or much cutting and fixing to the fabric of a building, as presumably the owners when removing it would be obliged to make good any damage to property.

Clause 17 makes it incumbent upon consumers to give 24 hours' notice before removing, failing which they become liable for energy registered up to the next usual meter reading period, or at least until the next occupier takes up the supply; the effect of this provision is to be duly intimated to consumers upon all demand notes. It hardly need be pointed out that, in practice, such notice is often indirectly given by the consumer calling for a supply at a new address in the same area; in such cases the organisation of the undertaking should be sufficient to realise that the premises have been vacated and the necessary steps can be taken to avoid giving annoyance to the consumer by putting into effect powers which are only intended to protect the undertaking.

In Clause 18 power is given to cut off or refuse to supply any person at all of his premises, if payment is in arrear for any of them, save in the case of *bona fide* disputes; presumably this can, in any case, be done where the several premises are served by agreement under the same name or trading title, but too much insistence upon the principle of electrically combining distinct premises under common ownership is apt to lead the consumer to expect his combined demand and consumption to be taken into account when fixing rates, a principle which may often be contrary to the interests of the supplier, and one which engineers often have to refute.

Clause 19 removes the necessity for stamping consumers' agreements, by rating electricity as goods or merchandise, contracts for the sale of which are exempt by the provisions of the Stamp Act of 1891. Some undertakings already neglect to stamp ordinary agreements in view of the rarity of any occasion to take them before the Courts; it seems, however, possible that they thereby render themselves liable to action by the Inland Revenue authorities for this neglect, and, even under the new Act, where the agreement provides for a minimum charge, or for fixed sums to be paid at intervals, as in a rental per KW. system of charging, it is not clear that an *ad valorem* stamp can be legally dispensed with.

The treatment of electrical energy as "goods or merchandise" in the clause in question suggests that certain other facilities might be logically claimed on the same basis, for example, the right to lay cables across private lands where a recognised public right of way already exists; inasmuch as it is permitted to convey ordinary goods over such lands, it should not be unreasonable to demand the right to lay or erect lines for the conveyance of electricity, which is becoming as indispensable as the commodities generally transported by road.

The necessity for stamping "hiring or deferred payment" agreements for apparatus and wiring remains unchanged by this amendment.

Clause 23 protects the undertaker against future attempts of competitors, but allows companies or persons to supply electricity, providing that such supply does not constitute their principal business. Framed, possibly, to protect those who already supply their neighbours from their own private plants, it has the disadvantage that it remains competent for the owner of generating machinery to dump his surplus units at any price he deems it worth while to accept. Most engineers are familiar with this class of competition, arising, as it often does, from some business established in a large block of buildings, and causing a considerable loss to the supply authority by providing light and power to the various occupiers at prices which are only remunerative because the vendors are disposing of what is, to some extent, a by-product of their main business.

Similarly, it would appear possible for a gas or hydraulic power company to provide and work an electric plant by arrangement with any consumer who wished for electricity. One instance, at least, has already arisen where a gas company has provided and maintained a plant for lighting a public building by means of electricity, the prime mover being, naturally, the gas which the consumer prefers to see burnt in the cylinder of an engine rather than in his premises.

Generally, the provisions of the Act are of real value to the industry, and those engineers who are not already familiar with it by virtue of having assisted in its production, may peruse its clauses with advantage and reflect upon the expenditure of effort and patience which has slowly crystallised out into its formal pages.

CORRESPONDENCE.

Letters received by us after 5 **P.M. ON TUESDAY** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Socialistic Bogey.

For your views on all engineering questions I have the utmost respect. I have diffidence in criticising anything carrying the authority which attaches to a leader in the ELECTRICAL REVIEW.

But your recent incursions into the realms of party politics, and even of religion, call for a respectful protest, more particularly as your reference to Socialism was certainly calculated to give offence to that considerable section of your readers who are Socialists.

Of necessity, the treatment which can be accorded to such a subject by an engineering journal as such, is so cursory as to be totally unproductive and even misleading, and the only result which can accrue is that all parties are distressed by the inadequate presentation of their case.

To attempt in the space of a letter to refute the contentions of your leader would be almost as futile as your attempt to erect and demolish a dummy Socialism in a couple of columns; but if you are willing that the other side shall not remain unheard, and are prepared to accord space, it will be a pleasure to me to make a short contribution in support of my economic convictions.

As, however, my complaint is directed against your introduction of such topics rather than against your attitude on this particular subject, I do not press this offer upon you.

Le Caporal.

[We are sorry that we have given annoyance to our correspondent, whose courtesy disarms rejoinder. We fear that to open our columns to the discussion suggested would result in the absorption of a vast amount of space—without convincing either party.—EDS. E.R.]

Auto-Transformer Design.

When a technical reviewer has to write an unfavourable critique and comment on glaring errors, he does so with the consciousness that his remarks will not meet with the approval of the author. Having finished his work, it remains for the Editor to decide whether or not his critique is a just and competent one before publishing it, and it is to be presumed that the Editors of the ELECTRICAL REVIEW discharged their duties in dealing with Mr. Avery's book, "Auto-Transformer Design."

The writer freely concedes that what he does not know would fill a larger book than the one under discussion, but it is without any vanity that he points out that what he *does know* enabled him to see the defects in it.

The reviewer does not wish to defend his critique, as the points raised in it must be very well known to many who have considerably less technical experience than he has (15 years) of the various phases of transformer work.

Now Mr. Avery can have had no knowledge whatever of the reviewer other than what may have been supplied him by a certain interested third party, and the writer having carefully read through Mr. Avery's book (he might say he has read two of his works) unhesitatingly acquits him of the charge of real authorship of the letter appearing in last week's ELECTRICAL REVIEW.

Such remarks as Mr. Avery is made to indulge in cannot in the least contribute to an understanding of the rights or wrongs of transformer design. There are plenty of indifferent transformers in every-day use, but the industry would not have advanced so far if anyone had not thought fit to point out how certain features might be improved upon.'

The reviewer has much pleasure in returning Mr. Avery's good wishes for the coming festive season.

The Writer of the Review.

Cable-Fault Localisation.

With reference to Mr. Raymond-Barker's articles in your paper on his Calculator Board, in which he describes a method of locating defects in submarine cables re-devised some years ago by myself, I should like to point out the following facts which, I think, will be of interest, and perhaps helpful, to those who use the test and are unable to account for occasional inaccuracies such as Mr. Raymond-Barker cites in his article in your issue of November 19th, 1909.

In that article he mentions a test that he took by the method under consideration, which gave a result 19 ohms higher than the correct resistance up to the defect. Mr. Raymond-Barker's explanation of the cause of this error cannot, I think, be correct. He supposes the extra resistance to be located between the copper exposure and the iron wire acting as earth connection to the artificial fault. The extra resistance cannot be here, as in that case the apparent resistance up to the fault given by this test would be too small rather than too large.

A possible explanation of the error is that there was a constant resistance situated at the actual exposure, due to a deposit of CuCl, or otherwise, between the conductor and cable sheathing, which did not vary in the same relation as the artificial exposure. This, however, is an unlikely explanation, as the Kennelly and other tests show that the fault was behaving in a normal manner.

The writer is of the opinion that the error was due to an earth current assisting the testing current, which thus did not allow the conditions of "other things being equal" to be fulfilled.

It can easily be shown that with the earth current assisting the testing current, and a battery of negligible resistance, the current passing through the balancing arm of the bridge will never be greater than that indicated by the applied E.M.F. flowing through it in a direct circuit. To take Mr. Raymond-Barker's results of Test 5, tabulated on page 755 of your issue, it will be noticed that the two currents for 20 and five cells are in the ratio of 13/4·1 = 3·2, whereas with no E.C. as in Test No. 2, with other conditions apparently identical, we have ratios of 11·6/2·8 = 4·1. We may, therefore, take 11·6 and 2·8 M.A. as the maximum values of the currents passing through the Art. Exp. in Test 5, whereas 13·1 and 4·1 M.A., respectively, pass through the actual exposure. It is evident from the above figures, in fact, it is always the case, that the lower the applied E.M.F. the greater the effect of the E.C. in altering the value of the current passing through the cable. Taking these figures as representative of the proportional amount of current through the actual and artificial exposures respectively, we note that with the higher current the resistance of the cable exposure will be less than it should be by a certain amount proportional approximately to $\sqrt{13/11\cdot6} = 1\cdot03$; and that with the lower current the deficit in resistance will be proportional to $\sqrt{4\cdot1/2\cdot8} = 1\cdot23$. This means that the deficit in the inserted resistance on the artificial exposure side will be considerably less with the lower current than with the higher. This makes it probable that, under the conditions as above stated, an artificial exposure, actually much larger than the cable exposure, will appear to balance the latter and thus give erroneous results.

This theory seems to be borne out in Tests 4 and 5 above referred to; for it seems probable that an erroneous result would have been obtained in both cases, even when the exposures were apparently correctly balanced. It will be noticed in Test 5 that with 1 in. exposure a balancing resistance of 1,218 ohms was obtained with indications that the exposure was too small. It is known that the test with the highest current gives the nearest correct resistance up to the fault; and if the artificial exposure is altered in the direction indicated, it follows that the resistance inserted to balance it will be greater than this amount. As the true resistance was 1,240 ohms, it is thus probable that there would be a considerable error in this case. It seems likely that a similar error in the reverse direction would be the final result of Test 4.

As to the remedy—a simple way would be to equalise the potentials in both circuits by applying an E.M.F. to the galvanometer circuit, in some such way as indicated by Mr. Winkfield and mentioned by Mr. Raymond-Barker. A second way would be to use reversed currents and take the mean of the results; this might not be applicable to small exposures. The simplest way of all would, perhaps, be to reverse the positions of the galvanometer and battery so that the current passes in series through the actual and artificial exposures; care, of course, being taken that the current passes through the actual and artificial exposures in the same direction. The only other thing to guard against with these connections would be to be careful that too large a current did not flow through the galvanometer circuit; and for this reason it would be advisable to reduce the current flowing through the galvanometer to within scale limits, by the insertion of resistance in series with the galvanometer rather than by a shunt upon it.

A rough determination as to whether this error is likely to be present can be made when a milliammeter is available; for if the current (with batteries of low internal resistance) passing into the cable is proportional to the applied E.M.F., then the E.M.F. due to earth currents must be negligible.

I should like to mention that I was not aware that this test had been previously suggested until my attention was called to Mr. Raymond-Barker's article.

It is hoped that the above suggestions may make the test uniformly reliable through a very large range of conditions.

E. S. Heurtley.

Montreal, *December 11th*, 1909.

[Mr. Raymond-Barker is, we believe, at sea on a cable-repairing expedition, and will, therefore, be unable to reply for some time.—Eds. E.R.]

The Present Aspect of Electric Lighting.

The paper by Messrs. H. W. Handcock and A. H. Dykes opened up many new and interesting points, but the one which I found a difficulty in appreciating was the information given in Appendix A ("Typical Gas Consumers' Accounts"), for at first sight I came to the conclusion that consumers did not pay as much for gas as for electricity, and that the examples could not represent an average. In order to obtain some information on this point, I issued forms containing a series of questions to 200 of my firm's employés, and as they consist of mechanics and labourers, the results should represent a fair average for the artisan class. I was a little disappointed, for out of the 200 forms only 51 were returned; the majority could not ascertain how much they spent, while the others were using "penny-in-the-slot meters," and did not know the total amount which passed the opening.

Of the 51 who supplied information, they represented an average over the whole of the metropolitan area, and some extended to Ealing, Wimbledon and Enfield, &c. I give herewith the tabulated results for the quarter ending Christmas, 1908:—

Houses or consumers...	51
No. of rooms, not counting bath room and scullery	190
" gas jets	225
" electric lamps...	31
" gas cookers	29
" oil lamps	8 rooms

Total amount paid for quarter ending Christmas, 1909:—

Gas lighting and cooking	£38	9	10
Electric light	3	4	5
Oil...	1	4	4

One consumer used oil for lighting and gas for cooking, and his bill per quarter for gas amounts to 5s. 11d., which sum is, so far as I can ascertain, a fair one, but rather under the average.

Taking as a basis that 6s. per quarter is a fair rate for gas cookers, the foregoing works out as follows ;—

Gas light per quarter	2s. 8d. per burner.
Electric lighting	2s. 1d. per lamp.
Oil for eight rooms	3s. per room.

In order to ascertain if 6s. was a fair average for a gas stove, I separated the 28 gas-stove consumers from the others, and still deducting the 6s. from each, the lighting average works out at 3s. 1d., so that a mean average would be somewhere between 2s. 8s. and 3s. 1d. (say, 2s. 10d.) per quarter per burner for gas lighting, a sum which far exceeded my anticipation, while with electric light the average as before given is only 2s. 1d. per lamp per quarter.

Those who are keenly interested in tariffs may find these results useful, and this is my apology for taking up so much of your space.

W. R. Rawlings.

London, S.W.

Accumulators for Central Stations.

Our attention has been called to a note headed "Battery Contracts" in "Business Notes" of your last issue, in which, among many others, one for Manchester Corporation is mentioned. As it is possible that your readers may confuse this with the large battery which, as is well known, is being put down by the Manchester Corporation electricity department, we wish to state that the battery referred to in the note is for Manchester Corporation water-works department, and has only a capacity of about 60 KW. for 1 hour. The electricity works battery, which is the largest single battery in this country, will be a Tudor battery, and will have a capacity of about 3,200 KW. for 1 hour.

Tudor Accumulator Co., Ltd.

London, S.W., *December 20th*, 1909.

The Fetish of the Steady Job.

I am loth to prolong the discussion on this matter, and probably it would serve no useful purpose to do so ; indeed, I feel it to be almost unnecessary, as I can scarcely imagine that any of your readers will have had the patience to read through the tiresome tirade of your contributor, "R. E. N."

I hardly think that he is justified in seemingly dedicating his shallow and ill-considered principles to myself, since, as far as I can follow it, his rambling and disconnected article has no real bearing whatsoever on the main points which I raised in my contribution to the ELECTRICAL REVIEW on November 19th.

A. P. C.

London, E.C., *December 20th*, 1909.

Protection of Tramway Trolley Standards.

Your correspondent "Nemo" raises an important point when he draws attention to the fact that the red lamp does not in any way prevent a passenger from receiving a shock. There are, in fact, several serious drawbacks connected with its use :—

1. The filaments are liable to break, and such breakage cannot be detected by a casual inspection.

2. The lighting-up of the lamps may remain for some time unnoticed by the driver, who already has quite as much as he can do in other directions.

3. Perhaps the most serious objection of all is that a high resistance fault may allow the trolley standard to be raised to a potential of 300, or even 400, volts above the earth without the lamps lighting sufficiently to be noticed.

As to the query "Then why do the Board of Trade sanction lamps with an audible signal ?" The answer seems to be that the addition of such an audible signal largely removes objections (1) and (2), though not objection (3), and further, that, contrary to the commonly accepted idea, the Board of Trade are anxious to avoid running tramway undertakings into greater expense as regards altering existing equipments than is absolutely necessary. They, however, fully recognise the disadvantages of the arrangement, and although for these reasons it is at present *sanctioned*, what they *recommend* is that the standard should be normally connected to earth through a low resistance.

It was for this reason that Mr. A. H. Pott introduced the device which is now extensively used on his system (the Metropolitan Tramways), which arrangement overcomes all three of the disadvantages enumerated above :—

1. In place of the fragile lamp filament, there is a continuous wire resistance and "buzzer." Moreover, a test key is provided, by means of which it can be at once ascertained whether the whole is in working order.

2. A distinctive audible signal is given, which cannot possibly be overlooked or mistaken.

3. It is impossible for the standard to rise above earth's potential without the signal being given.

This system is, we believe, the only one possessing these features.

With reference to your editorial note, the solution there proposed—*i.e.*, to connect the trolley standard permanently to earth through an indicator—has been extensively tried, but it has in practice proved itself to be too drastic a remedy, and several serious shut-downs have been occasioned by it.

Everett, Edgcumbe & Co., Ltd.

Hendon, *December 20th*, 1909.

[We are aware that our proposed remedy is drastic ; but the first consideration must always be the safety of passengers, shut-down or no shut-down. If an attendant in the power station were in danger of losing his life, would anyone hesitate to shut down the whole system ?—EDS. E.R.]

Some Points in Relation to Arc Lamps.

With regard to the above-named article appearing in your last week's issue, the writer communicating it must have had very little practical experience concerning hire-of-arc-lamp schemes, for the veriest trimmer employed on such a scheme would know that the figures he quotes are ridiculous.

1. According to the figures given, each lamp is assumed to take 600 watts. The actual wattage of the average "Flame" arc lamp hired to consumers is 400 watts or less.

2. The assumed figure of £6 per lamp is more than 60 per cent. higher than the average market figure, as also are the figures given for the transformer.

3. The assumed life of arc lamps on hire is given as three years. Two years is none too long a period to allow.

4. No mention is made of the carbon cost, which is a most important item in a "Flame" arc lamp hire scheme.

I could point the writer of the said article to a "Flame" arc lamp scheme, the charges for which are £8 4s. per year per lamp, including current, carbons, trimming, maintenance, and the hire of the lamp itself, for a maximum period of 800 hours per year, which pays its way on a basis of 3d. per unit for current consumed.

It seems a great pity that your valuable paper should be the publishing medium for an article quoting such misleading and inaccurate information to the discouragement of progressive supply undertakings.

H. H. Holmes,
Sales Manager.

Borough of St. Marylebone Electric Supply.
December 20th, 1909.

With reference to the communicated article in last week's issue of the ELECTRICAL REVIEW, as manufacturers of flame lamps we entirely disagree with most of the writer's statements and conclusions.

He states that the cost of a first-class flame lamp and transformer is £8 to £8 10s., but this is certainly not the net trade price for even a lamp of such handsome appearance and high reputation as our "Beacon" flame lamp, let alone the fact that there are many cheaper and cheaper-looking flame lamps on the market.

With reference to preferential rates, which he states are allowed by numerous supply companies, we think he entirely overlooks the value of arc lighting, when well done, from the point of view of advertising the use of electricity, as, despite all the claims of the gas industry, there is no form of lighting which can compare in brilliance or effective illumination with that given by flame arc lamps.

The third point to which we must take exception is the cost of the current, which is apparently based on a 600-watt lamp. This is a totally unnecessary consumption, and a brilliant flame effect can be obtained with a consumption of 350 watts or less with suitable lamps and carbons.

The writer also states that it is necessary to call every morning to trim the lamps, whereas in the case of a lamp burning 12 to 13 hours this would, of course, be quite unnecessary.

We think, therefore, that your readers will agree that all the disadvantages raised by your contributor are practically non-existent, and that there is every reason to think that the installation of flame lamps by the supply companies is bound to stimulate their demand and increase the output of electricity.

The Gilbert Arc Lamp Co., Ltd.
J. Hecht, *Director*.

Chingford, *December 21st*, 1909.

[We understood our contributor to criticise the rates offered to consumers, on purely financial grounds; his conclusions are, of course, open to criticism, but we do not think his article was intended to be hostile to the use of arc lamps.—Eds. E.R.]

THE INSTITUTION AND THE ELECTRICAL INDUSTRY.

We have received from Mr. E. Garcke copies of the following letters that have passed between himself and the secretary of the Institution of Electrical Engineers, regarding a recent discussion at the Institution:—

December 10th, 1909.

P. F. Rowell, Esq., *Secretary*,
Institution of Electrical Engineers,
92, Victoria Street, S.W.

Dear Sir,—I am sorry that at the Institution meeting last night the President disparaged the statement I made by describing it as "politics," and that he warned other speakers not to discuss the paper before the meeting on the same lines. I maintain that it was impossible to express disagreement with the conclusions of the paper without touching on matters which might be called politics. His ruling was equivalent to saying that disagreement must not be expressed with the conclusions suggested by the paper.

Some statements were made by Mr. Mordey, Past-President, which, in the general interests of the industry, should, I think, be further explained. I understood him to say that it was not the province of the Institution to undertake the protection of the industry in legislative and commercial matters. At the same time, in reply to my statement that the Institution had neglected to deal properly with the Electric Lighting Bill of this year, he said that a special Committee had been appointed which had made representations to the Board of Trade on the subject, but that it was the duty of the Institution to look at these matters not from the point of view of the industry alone, or of any particular section of it, but also from the point of view of the consumers and the general interests of the community.

If this is the accepted view of the province of the Institution in regard to these matters, then I can readily understand that the special Committee would allow the draft audit clause and the draft clauses dealing with competition between local authorities and companies in the Bill to pass, for inactivity would, in that case, be the best policy for the Institution.

But as representing very important and considerable interests in the industry, and I am aware that there are other and no doubt equally representative members who agree with me, I say unhesitatingly that, in my opinion, this view of the province of the Institution ought not to prevail with the Institution. Such exalted functions pertain to Legislative and Government Departments.

As matters stand at present, a large proportion of electrical men are under the impression that the Institution recognises and undertakes the responsibility of safeguarding the interests of the electrical industry in the battle of life.

We ought not to be left in any doubt upon the subject, and in my view the province of the Institution in legislative and industrial matters should be settled and definitely stated.

So long as there is any doubt about the matter it is impossible to make other arrangements for the performance of these necessary duties. The position of the electrical industry in its legislative and industrial aspects is so unsatisfactory, and the attitude of the Institution in regard to these questions so uncertain, that with due regard to the large interests involved, such uncertainty ought not to continue, and I trust, as I stated last night, that the President and the Council will give the matter their early and serious consideration.

I am, dear Sir, yours faithfully,
(Signed) E. Garcke.

P.S.—The reporter of the Institution asked me to send a copy of the statement I made—this was sent you yesterday.

The Institution of Electrical Engineers,
92, Victoria Street, London, S.W.
December 17th, 1909.

E. Garcke, Esq.,
Electrical Federation Offices,
Kingsway, W.C.

Dear Sir,—I am instructed to inform you that your letter of December 10th was read to the Council at the meeting held yesterday, and that it will receive consideration.

I am, yours faithfully,
(Signed) P. F. Rowell, *Secretary*.

THE PHYSICAL SOCIETY'S EXHIBITION.

In the following notes we give some particulars of interesting apparatus shown at the recent exhibition of the Physical Society of London, at the Imperial College of Science, South Kensington.

Harry W. Cox & Co., Ltd.

Amongst the apparatus shown by this firm was a new form of the Cox mercury-jet interrupter, which we illustrate; it includes several important improvements, of which the chief are:—(*a*) Any current up to 30 amperes may be passed without injury to the break, while the regulation is so complete that the current passing through the coil can be varied from practically zero to the maximum, with no other control; (*b*) By an ingenious mechanism, a large resistance, approximately 200 ohms, is put into circuit at the moment the current is "made," and is gradually taken out, so that when the current is "broken" the resistance in circuit is practically nil; consequently a minimum amount of inverse current is induced in the induction coil. This is a most important factor in X-ray work. The inverse current usually produced by mercury-jet breaks blackens and destroys the focus tube, and also causes blurring of the image on the plate. In the present case the desired effect is obtained by the simple device explained in the accompanying diagrams, figs. 1 and 2.

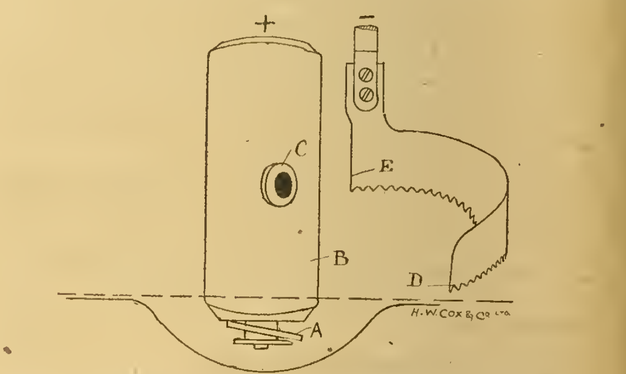


Fig. 1.—Elevation of 1910 "Anti-Inverse" Interrupter.

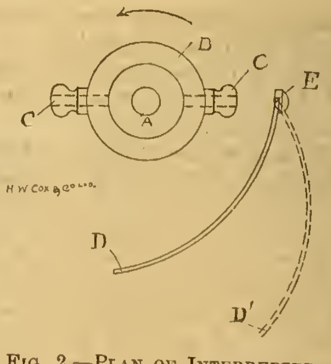


Fig. 2.—Plan of Interrupter.

A quick screw thread, the end of which is shown at A, fig. 1, is cut internally upon the barrel B, which, being driven by an electric motor, pumps up mercury from the reservoir and discharges it from two nozzles C. The mercury stream during part of its revolution strikes against the curved blade, making contact at the point D and breaking at E. By swinging the blade the arc of contact is increased or decreased, and the time allowed the current to grow in the primary circuit of the coil is varied at will. The nozzle is shaped in such a manner that shortly after leaving it the mercury stream begins to split up and to form nodes or constricted portions having a high resistance; consequently, at D or D^1 the resistance in circuit is very considerable, and this resistance is gradually removed until at the break at E the only resistance is that of ¼ in. of solid mercury jet, which is practically nil. Fig. 2 is a horizontal section of the apparatus, and fig. 3 shows the device complete.

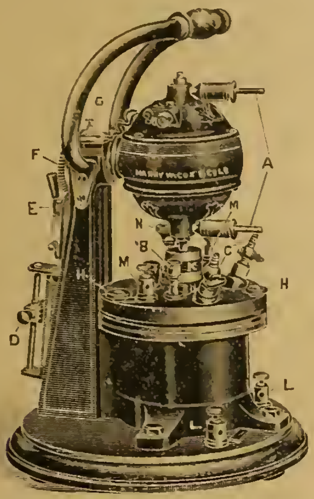


Fig. 3.—Cox 1910 Jet Interrupter, Complete.

One of these new interrupters was shown working a 14-in. "Instantaneous" coil (fig. 4), giving a flame spark at full contact. Another was shown interrupting the current to a metal-filament lamp, instead of to the primary of an induction coil. It is interesting to note that this is a much more delicate test for the evenness and regularity of an interrupter than the lighting-up of an X-ray tube. Every interrupter made by the firm is tested by this method before being sent out. The slightest irregularity of contact would be shown by a flickering of the lamp, especially when it was run at a dull red. The steadiness of the light showed the regularity of contact, due to the fact that each particle of mercury strikes the blade approximately at right angles at all points.

The induction coils exhibited were of an improved design adopted by the firm in consequence of their experience of two years with coils giving a very heavy discharge, which have begun to be designed since the introduction of instantaneous radiography. The firm build all types of induction coils, and the two essential types were shown, namely, "multisection" coils, and "two-section." The latter have long been a speciality of the firm, who have brought the art of winding it to a high state of perfection. They claim that though it requires more careful winding and insulating, and, therefore, is rather more expensive to make than the "multisection" type, yet the increased output for the same primary current makes this type most suitable for X-ray and vacuum-tube work. Their endurance is shown by the fact that their makers can guarantee all their coils for five years. The "multisection" type is used when large condensers have to be charged, *e.g.*, for wireless telegraph work. A two-section coil was shown which could take a radiogram of the chest in half a second, pass 150 milliamperes through the spark, and take a primary current of 90 amperes. The firm make a speciality of portable coils, and coils for hot climates, and a 12-in. portable coil was shown for work on the Indian plains, which is tested after being kept for 10 hours in a damp atmosphere of 130° F.

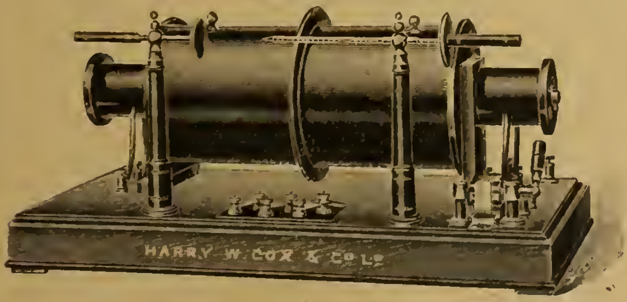


Fig. 4.—14-in. Variable Primary "Instantaneous" Coil.

An improved form of medical high-frequency machine was shown. This machine is usually worked from the same induction coil that lights the X-ray tube, and it has been found that the high-tension oscillating current from the primary circuit of the high-frequency transformer travels back to the secondary circuit of the induction coil; as the maximum pressure of the oscillatory current is considerably greater than that of the uni-directional coil current, it tends to destroy the insulation and break down the secondary circuit of the coil, and many breakdowns have been traced to this cause. To remedy this, the oscillating currents should be prevented from reaching the coil, and a new device for effecting this was shown, consisting of a pair of "high-frequency protection coils." These are simply large inductance coils wound in sections, and very carefully insulated, which are clipped in the high-frequency terminals. The effect of the large inductance is to absorb the high-frequency oscillations, while allowing the direct current from the coil to pass unimpeded. There was also shown a Tesla coil, and a neatly designed wireless telegraph receiving apparatus.

The firm have recently established a glass-blowing department, and examples of their work were on the stand, including an X-ray tube which had been fitted with a new glass bulb and re exhausted.

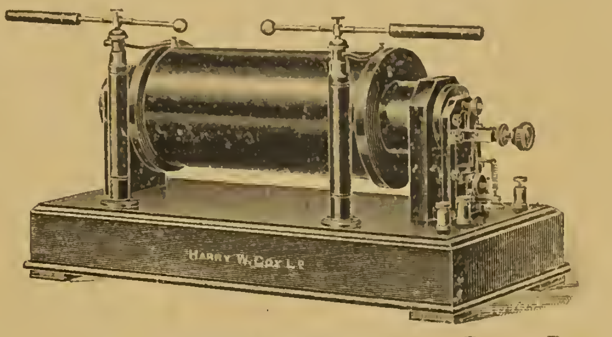


Fig. 5.—Wireless Telegraph Coil, with Cox Patent Break.

A considerable amount of expense is thus saved to X-ray workers, who can have their old tubes, hitherto useless, reblown and made equal to new. All the apparatus exhibited, with the exception of three X-ray tubes, was of English design, make and materials.

Owing to the illness of Mr. Cox, the business is being carried on by Mr. H. E. Donnithorne, A.M.I.E E., and Mr. V. H. Donnithorne, who were responsible for the design of all the apparatus shown.

Everett, Edgcumbe & Co., Ltd.

A large exhibit was prepared by Messrs. Everett, Edgcumbe & Co. including several novel features. The "Universal" pattern Trotter photometer was shown arranged for the measurement of daylight illumination, the attachment for this purpose consisting of a tube 10 in. high, with a side tube for inspection as shown (fig. 6). The illumination measured, therefore, is that of the sky at the zenith. Graduated stops are provided, marked with the ratio of their area to that of a hemisphere of 10 in. radius. After taking a reading out of doors with a suitable stop, the attachment is removed, and the daylight illumination inside a building can be measured in the ordinary way, the ratio between the results being independent of all the variable factors concerned, such as the season, the weather, the condition of the lamp or battery, &c. For example, the daylight illumination in the House of Commons is 0·0009, and in the British Museum reading room 0·007, of what it would be if the roof and all other obstructions to light were removed.

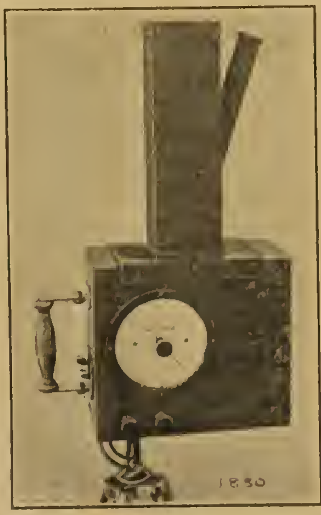


Fig. 6.—Daylight Illumination Photometer.

A 10-ft. photometer bench for laboratory and central-station use was exhibited, with an adjustable screen photometer head capable of use as a flicker or a comparison photometer (fig. 7). A special feature of the head is the fact that the adjustment of illumination can be made by altering the angle of incidence of light on one of the two screens. The advantage of this is that instead of its being necessary to move a heavy carriage with a standard lamp, &c., both lights can be fixed and the entire adjustment made on the photometer head itself. This is particularly useful when dealing with flame standards; it is also much easier to obtain a balance by this means than with the comparatively slowly moving lamp carriage. A further advantage possessed by this arrangement is that it affords a ready means of reducing the illumination from one of the lamps, so that it is easy to test high-candle-power lamps, such as arcs and so forth, in a comparatively small photometer room. For comparing a number of almost similar lamps, where it is merely wished to know by what percentage they are above or below a given value, it also affords an extremely rapid means.

A portable direct-reading lamp photometer was shown, consisting of a wooden case measuring $11\frac{1}{2} \times 18\frac{1}{2} \times 4\frac{3}{4}$ in., and weighing only 12 lb. It has been designed for the rapid testing of metal-filament and other high-efficiency lamps. The scale is direct reading, and is almost evenly divided; it has a very extended range, and can be used for taking measurements up to 100-c.p., or for testing arc and other lamps which can be placed in the photometer itself. The photometer can be checked on an ordinary photometer bench against either an electric or a flame standard.

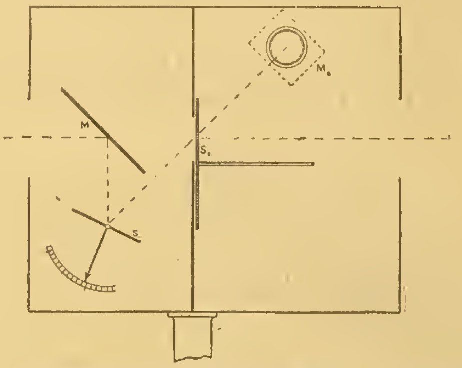


Fig. 7.—Section of Adjustable-Screen Photometer Head.

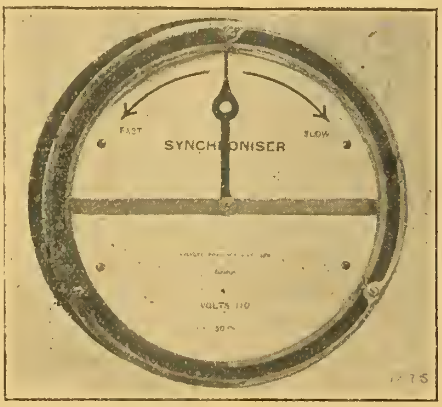


Fig. 8.—Rotary Synchroniser.

Dynamometer ammeters and voltmeters were exhibited, which were equally accurate on a.c. or d.c., a great convenience in calibration, and could be made astatic.

We illustrate in fig. 8 a new rotary synchroniser, of reduced size compared with previous patterns, and greater sensitiveness, in spite of the smaller diameter of dial, since one complete cycle difference in frequency corresponds to one revolution instead of to half a revolution, as was formerly the case. There are in this instrument no slip-rings or other rubbing contacts, all the windings being fixed, and only the pivoted iron armature rotating; and the power consumption has been very greatly reduced.

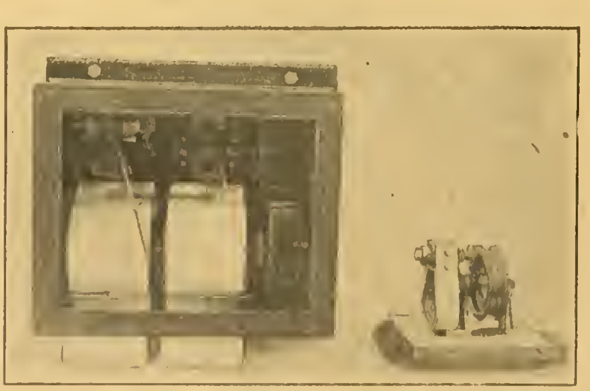


Fig. 9.—Power and Speed Recorder, and Generator.

A speed indicator was shown for use in cases where the indication of speed must be made at some distance from the machine itself. For this purpose a small magneto-generator is driven by belt or direct coupling from the shaft whose speed is to be measured, and is connected by two small wires to the indicator, which can be fixed in any convenient position. The scale of the latter is evenly divided, and can take any required form. The indicator is dead beat, and the speed is instantaneously indicated.

Several indicators can be fitted at different points, a water-tight one being installed on the bridge of a ship.

When it is wished to record the speed on a paper chart, a recorder of the ordinary pattern with either 24-hour or weekly charts is provided. The accompanying illustration, fig. 9, shows such an instrument, arranged to record simultaneously power and speed.

Our last illustration shows the Trotter accelerometer, a simple little combined gradient and acceleration meter, devised by Mr. A. P. Trotter in 1904. It consists of a specially-shaped glass tube sealed at each end, and completely filled with water, except for a small air bubble. A double scale is fixed along the tube, and when the tube is at rest or in steady movement, the bubble indicates the gradient, or when held horizontally the instrument indicates any acceleration to which it may be subjected. It is usually graduated in gradients of so much per cent., and in accelerations expressed as feet/sec^2. Among other uses to which this instrument can be put, are the measurement of power losses in trains, tram-cars, and motor-cars, when running at various speeds, draw-bar pull, and the brake-horse-power given out by battery motors as used on cars.

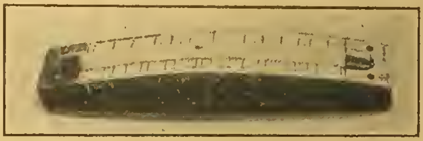


Fig. 10.—Trotter Accelerometer.

The Lithanode Co.

This firm showed a collection of accumulators fitted with Lithanode plates, and adapted for use with hand-lamps, medical apparatus, &c. The firm's patent "Unspillable" arrangement consists of a small chamber at the side of the celluloid container, connected with the internal space and the exterior of the box by tubes in such a way that it is impossible for any of the electrolyte to escape, no matter how the cell is handled, though the gases can escape freely. The construction of the plates gives lightness and rigidity combined with low resistance and freedom from buckling, and a special terminal insulator is used to prevent corrosion. Sets of cells for laboratory use, hand-lamps equipped with removable cells, a battery for medical use fitted with a rheostat for cautery and lighting, and small switches, &c., of Gallalith, were also shown.

The London Electric Firm.

This firm showed the ingenious arc-lamp lowering gear, without ratchet or gear wheels, associated with its name, which achieves remarkable results, considering its compactness and simplicity.

(To be continued.)

LEGAL.

The Electrical Co., Ltd., *v* Oliver H. Thomas, Son and Co., Ltd.

(Continued from page 973.)

Mr. Sankey concluded his opening, and read a mass of correspondence, in the course of which he referred to a letter in which the machinery stipulated for was a Roby vertical engine, capable of developing 120 h.p. with 80 lb. steam at the stop valve, with a generator capable of an output of 90 kw., 50 periods, 500 volts at 720 r.p.m., also two centrifugal pumps with an output of 250 gallons per minute.

Mr. Jacob Stottner, of Hendon, was called, and stated that he was formerly general manager for the plaintiff company, but had since resigned, his resignation taking effect in March of last year. Witness was general manager to the plaintiffs during the time of the contract in question, he went down to the colliery in June, 1907, for the first time, and took the matter into his own hands. When he arrived he inspected the plant, which he found standing idle, and it seemed to be in good condition mechanically, but was in a neglected state. They got steam up and found everything was all right with the exception of the exciter, the commutator of which was dirty and the surface slightly oxidised. Plaintiffs' mechanician, Johnson, who also came down, took the machine to pieces and cleaned it throughout.

Mr. Abel Thomas: What is the commutator?—The vital part of a direct-current machine, and if it were not kept scrupulously clean, especially on small machines like the one in question, difficulty would be encountered in getting the machine to excite.

What was the state of the brushes?—They were as dirty as the machine. The plant had been standing for a long time.

Further examined, Witness said that when he examined the machine in question, there was absolutely nothing wrong with the exciter, and if defendants had employed a competent driver it would have given no trouble. At the time he went down, the pumps and motors were on the surface, but the latter appeared as if they had been under water, because there was some slime which had dried upon them and a deposit from the water. The effect of these two things was, of course, very detrimental to the insulation of the machines.

The Official Referee: Water is a good conductor of electricity, is it not?—Pure water is not but dirty water is, and in the dirty water which was upon this particular motor there was a very dangerous element.

Has your firm supplied many motors for pumping in mines? —Witness replied that they had, and that they had a reputation to maintain.

Further examined, Witness said that on one occasion he saw Mr. Thomas and suggested that they should come to an amicable settlement in the matter; at the same time he endeavoured to convince that gentleman that the plaintiffs' machinery was not in any way defective, and offered to supply defendants with a skilled electrician to unwater the mine if defendants would supply the necessary labour, &c. This Mr. Thomas agreed to, and an arrangement to that effect was entered into.

Counsel: What was the reason, in your opinion, for the drowning out of the mine?—After the occurrence it was impossible to examine the starting arrangements of the pumps, because they were in the flooded part of the mine, but his opinion was that it was caused by the bad condition in which the starter was in, and that it was making bad contact. Later on, when they were able to get the starter up out of the mine, he found that he was right in his opinion. The starter was in a bad condition, and only made contact in two phases, instead of three. The contact fingers were very badly burnt.

In answer to Counsel, Witness said that these contact fingers frequently wanted replacing.

Counsel: What do you say about using a starter for close upon 12 months, without doing anything to it?—That was a very long time. The contact fingers were usually replaced every three months, but, of course, it depended greatly on how often the machine was started.

Witness was then questioned at very great length as to the working of the pumps, the state of the delivery pipes, the train rails, &c. The latter, he said, which were supplied by the defendants, were very defective in condition, and caused considerable delay in carrying out the contract.

Mr. Stottner, in the course of further examination, said that one occasion the driving belt came off. It was the duty of the engine driver in charge to see that the belt was properly fixed, and on a previous occasion Witness had warned defendants' man with regard to the matter. He had noticed that a lot of fat was being used to make the belt stick to the pulleys, and that was a very bad thing to do. Witness had told defendants' men not to put any more on, because if too much fat was used the belt would slip on the pulley surface, with the result that the friction caused heat which warmed the fat, and then the belt slipped right and left.

Cross-examined by Mr. Williams, K.C., Witness said the plant was to consist of two centrifugal pumps, complete with motors and switch gear, capable of raising 250 gallons per minute against a 24 ft. head. Witness believed Mr. Thomas elected to have an electrical plant, acting on the advice of Prof. Galloway.

The hearing was continued during the week, when Mr. Stottner, was further cross-examined by Mr. Williams, K.C., for the defence.

Questioned as to the trouble which arose with regard to the centrifugal pump, Witness said that with clear water the pump might have worked ever so long without corroding on the inside.

Mr. Williams: Do you expect to find when a mine is flooded that the water you have to pump will be entirely clean water?—The corrosion of the pump depended largely upon the chemical composition of the water.

Is it a fact that there was a very small profit on the contract?—Yes.

Did you cut down the price as low as possible?—We were cut down by Mr. Thomas.

But you would not have been cut down without your consent?—Of course, we agreed to it. We agreed to take the order on a very small profit.

In order to secure the contract?—Quite so.

And you bought cheaply?—Of course, we tried to buy as cheaply as possible.

And cheapness involves nastiness?—Witness denied that this was the case. Referring to the visits of plaintiffs' representatives to the mine, Witness said that Mr. Thomas liked to see as many of plaintiffs' representatives there as possible while the work was in progress. It was business diplomacy and created a good impression. About this time plaintiffs' firm had various contracts for the erection of electrical mining installations in South Wales, but he denied that they did not send enough men to look after and do the work at defendants' colliery.

Counsel then proceeded to cross-examine Witness with regard to the complaints as to the working of the exciter, and read a report from a Mr. Blake, one of plaintiffs' own engineers, in which he expressed the opinion that the field coils of the exciter were wrongly connected.

Witness denied the accuracy of the report, but admitted that if such had been the case, the fault would be in plaintiffs' works.

Counsel: I suppose your firm, being a big company, would not employ men on work of this kind unless it was satisfied as to their skill?—Quite so; we don't employ them unless they are skilled.

Counsel asked if a wrong connection of the field coils was a mistake a skilled man would be likely to make, and Witness replied that he did not know enough about field-coil work to express an opinion. He should say, however, that if they had been wrongly connected the machine would not work at all. It was quite true plaintiffs took no steps to inquire into Mr. Blake's suggestion, because they were certain that there was nothing in it. They had the test sheets of every machine, and it would be impossible for such a mistake to arise.

Counsel: Would running the engine about 10 per cent. below its normal speed account for trouble with exciter?

Witness admitted that it might do so, because the exciter would be running at a lower speed, and would thus make the excitation a difficult matter. Small machines sometimes excited very slowly. When he was at the mine, however, he had no trouble whatever with the machine, and the fact that it excited once satisfactorily showed that the machine was in order.

Counsel: And therefore it ought always to excite?—Quite so.

Witness admitted he could not understand Mr. Blake's suggestion; the machine was quite all right, and if it had been properly attended to there would have been no difficulty with the excitation. At a later date, when the machine was taken to pieces and examined, the only suggestion which could be made with regard to any difficulty in starting was that the residual magnetism of the machine was low.

The hearing was continued on Tuesday, December 21st, when Mr. Stottner was cross-examined for the seventh day in succession. At the close of the day the matter was adjourned until after the Xmas vacation. Our report of Tuesday's evidence will appear next week.

Reeves v. Manchester Corporation.

At the Manchester Assizes on the 17th inst., Arthur Henry Reeves, Rusholme Grove, Rusholme, a coachman and chauffeur, sued the Manchester Corporation for damages for the loss of his left arm. His case was that about eleven o'clock p.m. on May 15th he and a friend were about to get on to a Corporation car which was stationary at the junction of Stockport Road and Dickenson Road. It was a single-deck car with a platform at each end. Plaintiff mounted the footboard leading to the platform at the front of the car, and was holding the rail when the guard said to him, "The car is full," put his hand on the plaintiff's shoulder and pushed him. The car started and the plaintiff fell on the road on his back. The wheels of the car passed over his outstretched left arm, which was so mutilated that it was amputated at the Royal Infirmary. The defence was that the plaintiff got on the wrong car, and, finding his mistake, stepped backwards from the platform and fell. It was denied by the plaintiff that he left the car voluntarily, and he called witnesses who said they saw the guard push him. The guard and others denied that he pushed the plaintiff.

Mr. Justice Bray pointed out that it was for the plaintiff to prove his case and to satisfy the jury that the accident happened owing to some negligence or wrongful act on the part of the defendants' servants. In this case no contributory negligence was alleged, and the jury had to decide between the conflict of evidence.

The jury found for the plaintiff and awarded him £275. Judgment for that amount was entered with costs.

Eccles Corporation v. South Lancashire Tramways Co, Ltd.

Mr. Justice Eve, in the Chancery Division on the 16th inst., heard an action by the Corporation of Eccles (Lancs.) against the South Lancashire Tramways Co., by which they sought to restrain the tramway company from trespassing upon a section of about 500 yards of their electric tramway system. The Salford Corporation were also added as defendants, owing to an arrangement which they had made with the Eccles Corporation to work the line, and a licence which they had granted, without the permission of the Eccles Corporation, to the tramway company, enabling them to run over the section in question.

The defendants pleaded that they were acting within the powers conferred upon them by the working arrangement in permitting the defendant company to use the line as they were doing.

Mr. P. Ogden Lawrence, K.C., appeared for the plaintiffs, Mr. Jessel, K.C., for the South Lancashire Tramway Co., and Mr. Clayton, K.C., for the Salford Corporation.

Mr. P. O. Lawrence, in the course of his opening, said that the tramway company were running their tramcars over a portion of the Eccles system without any licence or authority from the Corporation, but they claimed a right to do so as they held a licence from the Salford Corporation, with whom there was an arrangement for running powers. The case, he said, depended mainly upon certain clauses in the Acts of Parliament and the agreement between the two Corporations, and he contended that the plaintiffs were prejudiced by the position taken up by the tramway company.

Evidence was called for the plaintiffs to show the relationship which existed between them and the Salford Corporation in regard to the tramlines, and some of the witnesses stated that damage was occasioned by the vibration of the company's cars, some of which were light and unsteady. The Eccles Corporation, it was stated, not only did not give the Salford Corporation authority to enter into an agreement, but objected to their doing so, although they would not have objected themselves to have granted powers to the company to use the section in question.

For the defence it was argued that the arrangement was for the public convenience, as by it was accomplished the desired object of getting continuity of service from Liverpool through Salford and Worsley to Manchester.

Mr. Clayton, for the Salford Corporation, contended that the rights of the Eccles Corporation, conferred by their Tramways Act, had been passed on to the Salford Corporation, without interfering with the Eccles rights or position. The licence granted to the tramway company by Salford was only a revocable licence, and therefore could not interfere with the rights of Eccles, and by granting it Salford had not committed any breach of their agreement with Eccles. Salford Corporation were acting within their rights when they granted the licence to the company, and if any extra burden were thrown upon Eccles by running the cars over the section in question, the liability would be upon Salford, no doubt.

Mr. Jessel, for the South Lancashire Tramways Co., said that his clients were in the unhappy position of being between the anvil and the hammer, and were the victims of the jealousy which existed between the two corporations. They had Parliamentary powers to work the tramway with the consent of anybody who had power to grant it, and he contended that Salford had such power.

Mr. Lawrence contended that Salford, as lessees, had no power to grant a licence to a third party. Such a licence could only be granted through the Board of Trade. The Eccles Corporation had no power to give the Salford Corporation authority to grant such a licence, even if they so desired.

His Lordship reserved judgment, stating that if possible he would give his decision before the vacation; but if he was unable to do so, two or three weeks' delay could not do harm to any one.

Arthur *v.* Henderson.

In the King's Bench Divisional Court on Wednesday, December 15th, Mr. Justice Darling and Mr. Justice Pickford heard an appeal from the decision of the learned Official Referee, Mr. Pollock, in this action. It appeared that in 1904 the parties entered into negotiations for a lease of the Fulham Theatre. Whilst these negotiations were in progress, Mr. Arthur made inquiries as to the condition of the electric lighting installation at the theatre, with the result that on November 25th, 1905, a letter was written and signed by Mr. Henderson, in which he undertook, if the electric light was not in order, to execute the necessary repairs at his own expense. That was before the lease was executed. Under the terms of the latter, however, Mr. Arthur was pledged to keep everything in repair, and the learned Referee refused to consider the letter, as being inconsistent with the terms of the lease. When the electric light was tested, it was found to be in need of repair to the amount of about £900. Appellant claimed that the letter should have been admitted as evidence.

Their Lordships allowed the appeal, and ordered the matter to be referred back to the Official Referee.

Byatt *v.* Krieger Electric Carriage Syndicate, Ltd.

On Friday last Mr. Justice Grantham and a special jury concluded the hearing of this action, Miss Ivy Byatt and her father, Mr. Henry Byatt, the novelist, being awarded damages in respect of personal injuries sustained by the former.

According to the evidence, it appeared that while cycling along Queen's Gate on June 30th last, Miss Byatt was knocked off her machine by one of the defendant company's broughams, with the result that she was completely paralysed below her shoulders, and, said her Counsel (Mr. Montague Lush, K.C.), nobody could predict anything more for her than a lingering death. The plaintiffs case was that Miss Byatt was overtaken by the brougham, and on hearing a warning sound she swerved to the left, notwithstanding which the brougham ran into her.

For the defence, it was alleged that just before the brougham reached her, Miss Byatt swerved to the right, and the accident was unavoidable.

The jury found for the plaintiffs, and assessed damages at £1,340.

Judgment was entered accordingly, but it was stated that an arrangement had been come to by which, on the defendants paying £500, the plaintiffs would not impede their appeal.

The Phosphor Bronze Company.

The petition upon which on Tuesday last Mr. Justice Swinfen Eady directed the compulsory winding-up of the Phosphor Bronze Co., Ltd., was mentioned again.

Mr. Clauson, representing the petitioners, stated that the company had now made arrangements by which they could pay the whole of the petitioners' debt and costs, and they were prepared to do so within two or three days. They had communicated with the petitioners, and he now asked his Lordship to stay the drawing up of the order for seven days, in order to see whether the debt was discharged.

His Lordship said that he could not make an order in that form. If the petitioners were willing he would dismiss the petition, otherwise the order must stand.

Mr. Grover, for the company, asked his Lordship to allow the order to wait for a few days.

His Lordship said he could not. If the parties agreed out of Court, however, he would dismiss the petition.

Mr. Clauson said he was not instructed to ask his Lordship to do that.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Patent Brush-holder.

Messrs. H T. Boothroyd, Ltd., of Bootle, Liverpool, are bringing out an extremely simple brush-holder, made entirely of wire, the invention of their general manager (Mr. J. H. Woolliscroft). The device, which is known as "The Agile," is shown in the accompanying figure (fig. 1). It will be seen that the carbon is guided by a wire frame, to which it is electrically connected by a flexible tail; the upper end of the carbon brush is provided with a notch, in which lies the pivoted wire presser, preventing the brush from tilting. The pressure is adjusted by sliding the small spring along the presser, and the holder is clamped in position on the carrier by means of the wire toggle clip shown full and dotted at the right hand. There is not a single screw in the holder, and the whole thing can be put on or taken off in confined spaces, such as the interior of a totally-enclosed motor, with ease. The carbon has a long feed, and can be held off the commutator by resting it on the top of the wire guide close to the tail connection. The lightness of the parts enables the brush to follow the surface of the commutator and minimises the effects of vibration, the "agility" of the holder, to which it owes its name, making it especially suitable for use on high-speed machines. Naturally the construction is very inexpensive.

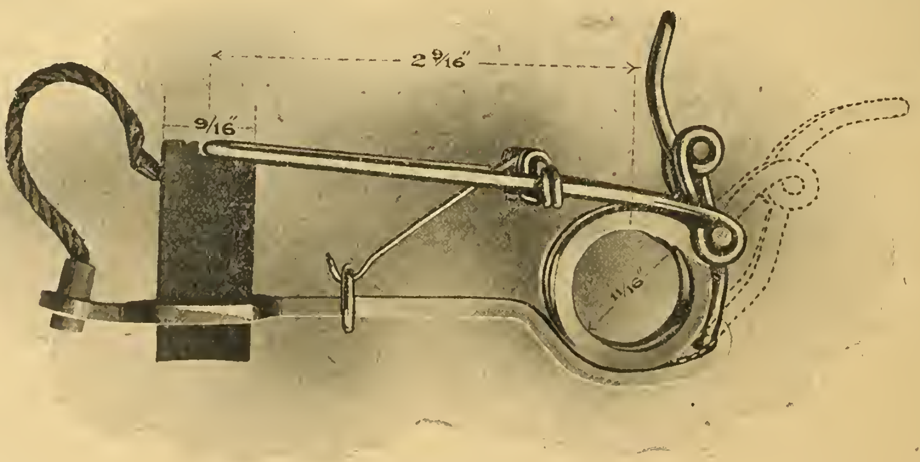


Fig. 1.—The "Agile" Brush-Holder.

Reinforcing Decayed Poles.

A simple method of reinforcing poles which have suffered decay at the ground level is shown in the accompanying section (fig. 2). The pole is supported with a tripod, while a trench is dug round the butt, descending as far as the healthy part of the wood; a cage of steel rods is then formed round the base, the rods, ½ in. n

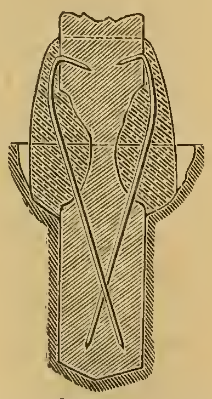


Fig. 2.—Section of Butt of Reinforced Pole.

diameter and 3 ft. to 5 ft. long, being pointed at both ends and driven into the wood as shown. The rotten wood having been removed from the butt, concrete is rammed round and inside the cage, forming a massive socket or pedestal. If the whole of the butt below ground is rotten, a substantial false butt of concrete is formed in its place, to receive the ends of the steel rods, the upper part being finished as before. It is stated that by adopting this method, which was devised by Mr. Orr, of the Allegheny County Light Co., U S.A., a great saving is effected—the cost of strengthening a 30-ft. pole being 14s., compared with £5 for renewing it. The chief item of expense in renewing poles is not the cost of a new pole, but that of changing over the insulators and wires, which is avoided by the method described.

LEAD.

The formation of a combination of lead interests, though apparently it has done little to affect the price of the metal, has the effect of drawing attention to the possibility of a central control in a second of the products affecting electrical machinery. Lead affects the industry particularly through the manufacture of accumulator plates, and its use as a protective sheathing for cables, a covering, too, for which it would be difficult to find a substitute. Its use in fuse wire, though extensive, can hardly be considered important. In the two former branches the electrical industry would be as unpleasantly placed as the building trade and others (water supply, drainage, &c.) to whom lead is indispensable, should a considerable increase of price be possible. The continued steadiness of the metal is reassuring in this respect. Lead, the use of which, of course, dates back to pre-financial times, has, since a record of prices has been kept, never reached what may be called the starvation limit; it rises naturally on the discovery of a new source of demand, but recovers its own level again by the cheapening of means of production, or the opening of fresh or abandoned mines, the supply of it being plentiful, and it being also a by-product to silver mining.

The largest producers are the United States, Spain and Germany. Mexico and Australia come next in importance, England, at one time the leading country for lead-mining, being now very low on the list, with 21,000 tons for 1908, out of a total 1,052,500. The outlook for the home producer is not without encouragement, however, as two mines were reopened in Cardiganshire early in 1909. In fact, the total "obtainable" in this country for 1908 (39,700 tons, including imported ore) bears a curiously small relation to the total consumption of Great Britain, as given by the German Metallurgical Associations in their annual "comparative statistics." Here we find that, for 1908, the consumption of Great Britain was 228,800 metric tons, that of the United States 321,000 tons, Germany 211,300 tons, and France 103,000 tons. This leaves less than 200,000 tons for the rest of the world, supposing the output figures to be accurate.

Of recent years the price has certainly declined, it being now some £6 lower than in 1901.

BUSINESS NOTES.

Calendars and Catalogues.—British Insulated and Helsby Cables, Ltd., Prescot.—New pamphlet (56 pages) (No. P. 104, Supplement No. 2) very finely produced and fully illustrated, relating to the Prescot overhead material for electric tramways. Trolley wire, ears, hangers, pull-offs, splicing tubes, line insulators, mechanical frogs, crossings, section insulators, trolley heads, and trolley line tools, are all shown and priced. The last few pages contain a long list of tramway and railway contracts that have been carried out, and of the firm's numerous branches and sub-agencies in all parts of the globe.

Messrs. Thermit, Ltd., are wishing their friends the Season's Compliments by the medium of another of their handy pocket memoranda books. There are a number of pages describing the Thermit welding system and the progress it is making, and two pages contain calendars for 1910 and 1911; the remainder is all plain for note-making. There is a pocket inside the front cover and a pencil at back edge.

The Electric Construction Co., Ltd., have a happy knack of doing things nicely at souvenir time. Last year they sent to their friends a match-box as though to suggest lighting the pipe of peace, and, we believe, a bulky piece of rubber for erasing any unpleasant recollections. This year they have just favoured us with one of the neatest little vest-pocket diaries that we have ever seen, with card and stamp pockets. The name of the company does not intrude itself—it appears inside the case in small gilt lettering, but nobody receiving it will forget from whom it came, as it is so different from others. With it there has come a handy penknife with which we shall hope to cut out many a newspaper paragraph regarding contracts booked by the company in the coming year.

To the Electrical Power Storage Co., Ltd., of 4, Great Winchester Street, E.C., we are once more indebted for a very serviceable desk blotting pad and diary, with its so familiar top monthly date edging. May our first paragraph to be blotted thereon be one of good wishes to the company, hoping that they will have excellent business to fill, and a capital report to issue, during 1910.

Messrs. Falk, Stadelmann & Co., Ltd., 83/87, Farringdon Road, E.C.—In order to keep the "Efesca" lamp in mind, the firm have issued a small vest-pocket folding card with calendar for the year 1910. There is a turned up corner in the shape of a lamp, behind which you may keep stamps for a time. Firms selling "Efesca" lamps can have quantities of the calendars with their own name printed thereon. A copy of list P. 659 has also been received. It gives prices of, and some other information regarding, high candle-power "Efesca" lamps, which they can supply in 100, 200, 300, 400, 600 and 1,000-c.p. sizes, for 100 to 260 volts for shop front, street, railway station, and other lighting.

The A.E.G. Electrical Co., of South Africa, Ltd., Caxton House, Westminster, S.W.—12-page illustrated brochure (in English) devoted to "Electricity Appiled to Printing." Several electrically-operated German presses are illustrated. A collection of other literature in the firm's standard form deals with the following subjects:—Switchboard measuring instruments (electromagnetic), also continuous current moving-coil instruments, electric ceiling fans, automatic starters for three-phase motors, continuous current interpole railway motors, and lead-covered cable accessories (branch joint-boxes).

Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C.—Leaflet giving latest prices of "Metallik" lamps.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C.—List of luminous electric radiators for the 1909 season. Many designs are shown and prices are stated.

Messrs. L. E. Wilson & Co., 20, Cross Street, Manchester.—Price leaflet of the "Thomson" police lamp.

The C.W. Hunt Co., New York.—Catalogue (No. 096), giving illustrated notes regarding their dumping tubs and grab buckets.

The Electrical Apparatus Co., Ltd., Milford Works, Queen's Road, Battersea, S.W.—Complete catalogue consisting of a collection of lists brought together in a neat binding cover, containing a description with clear illustrations of ampere-hour meters, prepayment meters, motor starters, shunt field regulators, starter regulators, D.C. motor panels, one-minute motor starters, and "Electrostan" fuse wire.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Two new publications. One shows and briefly describes numerous designs of shop window reflectors for use with tantalum lamps; the other gives prices of the new types of low candle power tantalum lamps, to which allusion was made on page 976 of our last issue, and particularises the alterations that have been made in style of bulb. The lamps are now made in voltages ranging from 20 to 240 volts for ordinary use. Copies of this leaflet can be supplied to contractors, dealers, or ironmongers, with their own name printed on if they so desire.

The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—A further batch of publicity literature has been received from this company. The principal item is a finely-illustrated catalogue of electric heating and cooking apparatus, and it includes a number of new designs of radiators (luminous, convector, and conduction types), stoves, chafing dishes, water heaters, ovens, irons, kettles, &c. The second is section C (No. C 1,371) giving prices of "Geekoduct" insulated conduit (especially suited for tropical climates) and accessories. A third relates to A.C. transformers for "Osram" lamps and other purposes; while a fourth details the "Angold" enclosed arc lamps (short shuntless type) of which it is stated there are over 100,000 in use. In all the lists prices are very clearly indicated. The transformer and Angold lists contain reduced prices. Some loose blotters for desk use give a calendar for the months of January and February in out-lined lamps, and an inch measure at foot, and they remind the user of the current-saving qualities of Osrams. We have also received the "G.E.C." Daily Reminder for 1910—a set of calendar slips slotted to fit the wooden stands distributed last year, each slip bearing a reference to some feature of the company's activities—and a handsome writing pad, provided with pockets for stationery and an ample store of blotting paper. A similar souvenir was sent us in 1907, and we cannot better express our appreciation of its admirable qualities than by recording the fact that we have used it continually for the past two years, and have found it a most handy, convenient and durable desk companion, which we should be sorry to part with.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet drawing attention to the "Dusseldorf" counter-current circulation economiser, for which he is agent.

Messrs. Sanders, Rehders & Co., Ltd., 108, Fenchurch Street, E.C.—Leaflet describing a new form of "Sarco" patent feed-water weigher.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—List tabulating particulars of hard-drawn aluminium cables for electrical transmission lines, with copper equivalents.

The Electric Control and Reducer Co., 15, Oxford Street, W.—Leaflet describing the Martin patent regulator, with directions for fixing and use.

We are indebted to Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., for copies of their self-opening pocket diaries for 1910. The 48 pages that precede the diary section are occupied with a variety of useful tabulated matter of a general and engineering character, and particulars of the Siemens companies, their contracts and branches, with illustrations of their manufactures. A serviceable memoranda section appears at the end.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, W.C., have favoured us again this year with one of their very useful and neat breast pocket diaries (black and gilt cover and gilt edging) with ample memoranda space (squared paper). Some 16 pages (quite unobtrusive) of matter relating to Simplex specialities precede the diary pages, and the latter are followed by 32 pages of useful tabular and other information for contractors and electrical engineers generally.

The Electrical Co., Ltd., 121-125, Charing Cross Road, W.C.—Twelve-page illustrated list with prices of electric heating and cooking apparatus, including kettles, water heaters, urns, heating plates, hair curler heating and hair drying apparatus, &c.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster.—New catalogue, No. 512, containing complete illustrated descriptions of their frequency indicators and vibration tachometers, both of which instruments are designed on the vibratory reed principle. The vibration tachometer is designed to indicate the speed of any type of machine.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.—Once again this company has favoured us with one of its desk blotting pads, with convenient top pocket.

Messrs. Hayward-Tyler & Co., Ltd., 99, Queen Victoria Street, E.C.—Pocket diary for 1910, with a small space for every day in the year. A good number of pages are devoted to illustrations of the firm's pumping engines and to tabular data of interest in connection with their manufactures.

The Western Electric Co., Norfolk House, Victoria Embankment, W.C.—Very neat hanging wall or desk calendar for 1910, with a complete calendar for the year unobtrusively printed half on either side of a collection of monthly tear-off slips.

Messrs. Hamilton Bros., Glasgow.—Hanging calendar with monthly slips, drawing attention to the "W H" ironclad electric control.

The District Electric Co., Ltd., 35, Queen Street, Wolverhampton.—Wall calendar for 1910, with monthly slips placed below a print, "The Rising Moon."

Messrs. Nalder Bros & Thompson, Ltd., 34, Queen Street, E.C.—Convenient hanging calendar for 1910, with monthly tear-off slips, in the firm's usual style, with clear figuring for dates.

Bankruptcy Proceedings.—Edward William Barton-Wright, electro-therapeutic specialist, and lately managing director of the Bartitsu Light Cure Institute, Ltd., 1, Albemarle Street, Piccadilly, W.—The first meeting of creditors was held at the London Bankruptcy Court on Monday before Mr. E. Leadam Hough, Senior Official Receiver. The company was promoted by the debtor in March, 1906, with a nominal capital of £10,000, subsequently increased to £22 500, to take over and develop, as a going concern, the business of the Bartitsu Light Cure and Electro-Therapeutic Institute, which he had previously carried on. The chairman reported that it appeared from the debtor's statements when before the Examiner that he acted as managing director of the company until last January, when it went into compulsory liquidation. The business was sold in April last, and the debtor had since acted as manager for the purchaser. He disputed the claim of the petitioning creditor, and did not admit insolvency, although the only assets disclosed were certificates for 6,000 shares in the Bartitsu Light Cure Institute, Ltd., to which no present value was attached. The meeting was adjourned for three weeks to enable the debtor to submit an offer.

Robert E. Walker, electrical engineer and cycle agent, Hereford.—A receiving order has been made on a creditor's petition.

Book Notices.—*Who's Who*, 1910, and *Who's Who Year Book* London: A. & C. Black. 10s. net. and 1s. net.—We cannot remember the number of times that we have to refer to our *Who's Who* in the course of the year, but they are very many. It nearly always tells us what we want to know, and we are quite sure that it is one of the books that it is least easy to dispense with from the reference shelves of any study. Every man or woman who has to do with matters of public or social interest frequently desires or requires to know something about others who are concerned therewith, and perhaps some who have nothing to do with them at all. In this book their case is well met. The *Year Book* is a supplementary companion, in which further matter is arranged in easily accessible tabular form. As the publishers say, "the lesser book is a key to the larger one."

The Englishwoman's Year Book, 1910, 2s. 6d. net, and *The Writers' and Artists' Year Book*, 1910. 1s. net.—These are two reference works of a somewhat similar class to the above, and they are issued by the same publishers. The former is an interesting book which should be increasingly in demand in these days, when women are seeking to turn their days and nights to more profitable account. Our wives and daughters loom somewhat largely on the horizon in the future of political matters, and those whose ambitions lie that way will find something to aid them in their pursuit; but for that greater company who are contented with the domestic, social, religious and charitable occupations or avocations, the book is of most value. Matters educational, professional callings, employment in medical and many other capacities, such as art, music, literature, nursing, and so forth, are handled fully, while sports, pastimes, travels and "animals" are not overlooked. We can imagine many a worse Christmas gift than these four reference books.

"*Mechanical World*" *Electrical Pocket-Book for* 1910. Manchester: Emmott & Co. Price 6d. net.—The new issue of this book has been printed on thinner paper, effecting a decided improvement. The contents have been revised and rearranged, and many new sections have been introduced, the subjects including the Conduit System, Cheap House Wiring, Meters, Carrying Capacity of Cables, and so on. The book contains a great variety of information in tabloid form, covering a wide range of electrical applications, and is remarkably cheap at the price.

"On Some Causes for our Declining Steel Trade and their Remedy." By Benjamin Talbot, managing director of the Cargo Fleet Iron Co., Ltd., Middlesbrough. 20 page pamphlet.

Closed for the Holidays.—Messrs. Brook, Hirst and Co., Ltd., of Chester, announce that their works and offices will be closed from to-night, 24th inst., until Wednesday, 29th inst.

Messrs. Watson, Laidlaw & Co., Ltd., of Glasgow, announce that their works and drawing Office will be closed on December 31st and re-opened on January 7th. The counting-house will re-open on January 4th.

Electrical Enterprise in China.—Reporting on the foreign trade of China, Mr. W. P. Ker, Commercial Attaché to His Majesty's Legation at Pekin, states that the value of machinery imported in 1908, though less than in 1907, was again much greater than in previous years, and is likely to increase as Chinese mills and factories of all kinds are constantly being started. It is impossible to ascertain the origin of the machinery, but there is every reason to suppose that British manufactures take a leading share. The trade is one which demands close attention and vigorous nursing by expert technical representatives in China, and there are welcome indications that British firms are determined not to be left behind. In Shanghai one or two British firms have opened showrooms for machinery, in charge of qualified engineers, where Chinese buyers can see the machines actually working. For cotton mills and oil mills British machinery is almost exclusively used, but orders for flour mill machinery have mostly gone to America. The chief feature of the year in connection with the machinery trade was the number of orders placed for electric light installations. One of the largest installations, that at Hankow, was contracted for by a British firm. Amongst others, electric light was installed at Antung, the plant being of British manufacture imported from Japan; the British Concession at Chinkiang was supplied with light by the native electric light company already lighting the Chinese city; an electric light company was formed with a small capital to light a new street at Chengtu, the capital of Szechuan, and it contracted for an installation which may be extended if successful; electric lighting was started on a small scale at Chungking in June, 1908, with plant purchased from the United Kingdom through a British firm at Shanghai, and this year tenders from various firms were being considered for a large plant to light the whole city; the electric light company at Swatow was reconstructed with a capital of $140,000, and new engines were ordered from Europe for relighting the town in July, 1909; a Chinese electric light company, formed two or three years ago at Wuhu, commenced operations in April, 1909, with 3,000 lamps, but with plant sufficient for 6,000 16-candle lamps—machinery mostly of British manufacture. The electric light company and the waterworks company at Hankow imported over £260,000 (? dollars, Eds.) worth of fittings direct from the United Kingdom in 1908; and the extensive electric lighting systems already at work at Shanghai, Canton, Tientsin and Pekin continued to extend their operations. Electric lighting at Newchwang begins this year, and a project for lighting Amoy was mooted in 1908, but failed for want of capital. Tientsin led the way in electric tramways some years ago, and in 1908 about nine miles were open to traffic, nearly all double tracks, worked by the Compagnie de Tramways et d'Eclairage Electriques de Tientsin, a Belgian concern. The spring of 1908 witnessed the inauguration of two electric tramway services in Shanghai, one in the International Settlement covering 26 miles, and one in the French Settlement covering 15 kiloms. The former has 65 cars, and carries nearly 30,000 passengers per day; the latter has 20 cars in service carrying a daily average of 7,450 passengers.

Trade Announcements.—Messrs. Babcock & Wilcox, Ltd., are to-day removing their Manchester office from 14, Deansgate, to more commodious premises at 30, Cross Street, Manchester. The telephone number will remain as before—No. 3,112 City, and the telegraphic address "Babcock, Manchester."

The Soho Scientific Instrument Co. report that their new building, containing offices and showrooms, is now complete, and they request that all communications be addressed to 175, Wardour Street, W. The works were closed from December 6th to December 20th during removal to Wimbledon, S.W., where additional new plant has been installed.

Messrs Neville, Williams & Co., are removing from to-day's date to larger and more convenient premises at 80a, Southwark Street, S.E.

The registered offices of the National Telewriter Co. have been removed to 20, Bucklersbury, E.C.

We learn that, after official inspection of "Imperial" water-tube boilers under construction in the works of Edwin Danks & Co. (Oldbury), Ltd., the Admiralty have placed the company upon their list of manufacturers of water-tube boilers. The Water-tube

Boiler and Engineering Co., of 11, Queen Victoria Street, E.C., will furnish any further information desired concerning these boilers.

Dissolutions and Liquidations. — The Bradford Electrical Engineering Co., Ltd., carrying on business as electricians, at 65, Manningham Lane, Bradford.—A meeting of the creditors in connection with this liquidation was held on Wednesday, December 15th, at the Queen's Hotel, Leeds, the chair being occupied by Mr. Houston (representing Mr. G. E. Corfield, of London, joint liquidator), and there were also present Mr. Walker, on behalf of Messrs. Poppleton, Appleby and Turner, representing J. H. Tucker & Co., Simplex Conduits, Ltd., Messrs. Davis, Smith & Co., and the Electric and Ordnance Co., Ltd.; Mr. Wallis, representing the Electrical Contractors' Association; Mr. Scaife; representatives of the General Electric Co.; Siemens Bros. Dynamo Co., Ltd.; Wilson & Co.; Mr. Barclay, representing the Tudor Accumulator Co.; Mr. G. H. Lougee, representing the Bradford and District Bank; Mr. Douthwaite, representing Mr. C. A. Muller, of Bradford; and Mr. J. H. Haley, joint liquidator. Mr. J. H. Haley said that Sec. 188 of the Act enabled creditors to determine the necessity or otherwise of making an application to the Court for the appointment of fresh liquidators. other than the ones which had been appointed at the meeting in November, or to appoint a committee of inspection. If the creditors decided on either of these two courses it would involve considerable expense, and in order to obviate this they could, if they wished, appoint an advisory committee to act with the liquidators. At the meeting in November, the larger creditors had been called together to consult with the directors as to what steps should be taken in regard to the affairs of the company, the two managing directors having, on the wish of the directors, resigned their positions on November 18th last. A proposed scheme for establishing the business on a proper basis was laid before the meeting, whereby the creditors would have received 20s. in the £, and the business would have been continued. Unfortunately, certain creditors thought it advisable to wind up the business, and therefore the proposed scheme fell through. It was also decided that Mr. Corfield should act along with him (Mr. Haley) as joint liquidator in the winding up, and a meeting of shareholders was held on November 29th, at which it was decided to wind up voluntarily. The company was incorporated on October 30th, 1907, with a nominal capital of £3,000 divided into 3,000 shares of £1 each, of which 1,182 were issued, 732 being issued against cash and outside shareholders, and 450 to the vendors against the purchase amount as part consideration. The vendors were Mr. C. J. Cassé and Mr. H. H. Cassé, and the contract was based on a balance-sheet showing the following position on June 30th, 1907:—Assets, £278; stock, fittings, &c., £420; due by bank, £90; total assets, £788; deduct from this creditors for £222; assets shown over liabilities, £566. A trading account prepared at the same time by a firm of Bradford accountants showed a trade profit for three years of £770, or an average annual profit of £259. This balance-sheet was put forward as having been prepared and investigated for the purpose of forming the business into a limited liability company. Unfortunately for the shareholders, when he came to audit the statement of December 31st, 1907—two months after the company's incorporation—he found the accounts named to be incorrect. It appeared that there was an amount owing by the vendors under their contract with the company, which sum they were unable to make good. A prospectus was issued for private circulation, which stated that the vendors had agreed to accept £1,200 for the assets of the business, including £700 for goodwill. This prospectus, together with the accountant's balance-sheet, was submitted to him by the present chairman of the company, and he (Mr. Haley) told the chairman that in his opinion any payment for goodwill was not justified, and he advised that the amount of the goodwill should be taken out, and then, perhaps, the business could go on. This was agreed to. When, however, the accounts to December were taken, they showed a deficiency of £340 against the vendors, which they could not pay, and the shareholders were thereupon consulted, and it was agreed that the £340 should be dealt with as a loan. The amount owing had since been reduced to just short of £300. Ever since the company was formed the trading had not been profitable, and on September 30th last there was a deficiency of £303. The directors, having been for some time dissatisfied with the managers, determined to make a change. Subsequently he was consulted, and stated that he was not satisfied with the stock-taking. He was, nevertheless, of the opinion that the stock should be independently valued, and he instructed a valuer to go over it, and it was valued at £316 on October 31st, as against £600 on September 30th. The shareholders' capital having vanished, the directors, after consultation with the shareholders, decided that they would endeavour to pull the affair round, and they, therefore, decided on the meeting previously referred to in November. The statement of affairs to November 29th, 1909, now presented to the meeting was as follows:—Liabilities to unsecured creditors, £1,238; debenture-holders (deducted in contra), £100; contingent liabilities, £71, estimated to rank, £71; preferential creditors (deducted in contra)—rates, £13 9s. 5d., rent, £24—£37, total liabilities, £1,309; assets: book debts (£820) estimated to produced £650; furniture, fixtures, plant, &c., as valued by Mr. C. F. Scott, £56; stock-in-trade as valued by Mr. C. F. Scott, £317; work in progress, £25; cash at bank, £14; total, £1,062; deduct debenture-holders' £100, and preferential claims, £37 (per contra), £137; total assets, £924; leaving a deficiency of £385.

In answer to creditors, Mr. Haley said the scheme which was laid before the directors, and to which he had referred, could not possibly be revived now, and he did not think the creditors would get anything like 20s. in the £. The scheme had not been adopted, and he considered that it was a foolish step that had been taken. The stock had been valued as a going concern and not at stock price.

The Chairman stated that there was some slight hope of selling the business as a going concern.

Mr. Haley said the affair had been valued at what would be considered a fair price as a going concern.

A creditor asked if any explanation had been given by the previous managers as to the over-valuation of the stock, and Mr. Haley replied in the negative. The managers had left rather abruptly, and he had got as much information as he could out of them, but, of course, he could not get much.

After some discussion it was unanimously agreed that the appointments made at the November meeting should be confirmed, and on the motion of Mr. Lougee, seconded by Mr. Walker, an Advisory Committee, including Mr. Douthwaite and Mr. Barclay, was appointed to act in conjunction with the liquidators.

The following were the creditors over £10:—

Aland & Co.	£11	Haley, J. Herbert	£17
Atkinson	32	Johnson & Phillips, Ltd.	47
Braulik, G.	28	Krupka & Jacoby	1
Brit. West. Elec. Mfg. Co.	87	Muller, C. A.	2
Barwell, J., & Sons	16	Northern Electric Wire Co.	1
Bradford Corporation	18	National Telephone Co.	1
Bradford District Bank	176	Premier Accumulator Co.	2
Connolly Bros., Ltd.	38	Reavell & Co.	5
Crabtree, W. I.	30	Scattergood & Johnson	4
Eureka Conduits & Fittings Co.	22	Sun Electrical Co.	3
E.M.F. Manufacturing Co.	26	Strauss, G., & Co.	1
Electrical Co., Ltd.	34	Standard Cable Mfg. Co.	1
Electric and Ordnance Accessories, Ltd.	10	Tudor Accumulator Co.	3
		Tucker, J. H., & Co.	2
Frankenberg, I., & Sons	43	Union Cable Co.	4
General Electric Co.	43	Veritys, Ltd.	2
Hunt, J. A. H.	10	Wilson, G., & Co.	13

C. H. S. Naylor & Co., electrical engineers, 49, Ducie Street, Manchester.—Messrs. C. H. S. Naylor and H. Broadhead have dissolved partnership. Mr. Naylor will attend to debts, and continue the business under the old title.

With reference to a note appearing under this heading last week, regarding the Morris-Hawkins Electrical Co., Ltd., and its liquidation, we have pleasure in stating, in order to prevent any of our readers holding a wrong impression, that the Morris-Hawkins Electrical Co. has no connection whatever with Morris-Hawkins, Ltd., whose works are at Dagenham, in Essex, the head office being at 30, St. Mary Axe, E.C.

The Electro-Peat Coal Co., Ltd.—This company is winding-up voluntarily, with Mr. Lacey Downes, 11, Ironmonger Lane, E.C., as liquidator. A meeting of creditors is called for January 5th.

LIGHTING and POWER NOTES.

Argentina.—A concession has been granted by the Mendoza Government to the Cia. de Luz y Gnerza de Mendoza, Sociedad Anonima, giving the company right to use the water of the Rio Mendoza adjacent to the Transandine Railway, in a hydro-electric plant for the supply of energy for industrial purposes. The concession carries with it the right to construct electric railways, and the first (15 km. long) is to be inaugurated at the same time as the hydro-electric station. The concession is for 50 years, afterwards becoming the property of the province.

Ashton-in-Makerfield.—The U.D.C. has agreed to energy being supplied to the Co-operative Society for lighting and to a biograph exhibition by the South Lancs. Tramway Co., but only "through the U.D.C."

Barnsley.—The T.C. has received from the L.G.B. sanction to a loan of £2,955 for E.L. purposes.

Bath.—With reference to the scheme for extending the area of supply into the R.D.C.'s area, the T.C. has decided to pay the R.D.C. £100 and certain costs, on condition that that body will support the application of the Corporation for powers, and that the E.L. Order of the R.D.C. shall be dropped or revoked as to the area covered by the application.

Beckenham.—The Council has agreed to extend the cables in Slurtt Way and Hayes Way in the Garden City of Park Langley, to supply 100 houses by March next; the Council has also agreed to join in the publicity scheme promoted by the Associated Municipal Electrical Engineers of London.

Belfast.—At the weekly meeting of the Tramway and Electrical Committee, the question of arc lamps for street lighting was postponed pending the abolition of the central poles already decided upon. A deputation appeared before the Committee to urge upon it the immediate extension of the tramway system in the Old Lodge Road. The deputation was informed that this extension would be included in the schedule.

Bishop's Stortford.—The post brings to hand a report by Messrs. May & Hawes, of Westminster, in the matter of electricity supply in the Council's area, which is to be discussed in January. The report is a straightforward document, and it shows that, without being too sanguine, there is a reasonable possibility of an electricity supply on the lines suggested for this small township of 8,000 people, being commercially successful in the course of a year or two. The engineers rightly favour a simple crude oil engine plant and battery for carrying the light loads; distribution is to be on the three-wire system at 480 and 240 volts, and 111 metal-filament street lamps are included for an estimated capital outlay of £12,750. The estimated revenue at 5¾d. per unit (gas being about 4s. per thousand), with a low average consumption, allows of an 8 per cent. gross profit and small surplus (£110) in the second or third year. The report is well worth the consideration, not only of the Bishop's Stortford authorities, but also of others similarly placed, we only regret that it omits all reference to overhead distribution.

Brighton.—The T.C. on December 16th adopted the recommendation mentioned in the Electrical Review last week to provide extra plant at Southwick power station and North Road sub-station, at a cost of £20,000.

Hanley.—The T.C. has decided to supply energy to the North Staffs. Railway Co. for new sidings and workshops at Cliffe Vale. The company will guarantee a minimum payment of £80 a year for a minimum of 19,200 units, and pay 1d. per unit for all above that amount.

Messrs. Wedgwood, Ltd., of Etruria, have informed the Council that they will shortly proceed with an electrical scheme at their works.

Canada.—An application will be made to Parliament next session for an Act incorporating a company, under the name of the St. Lawrence Power Transmission Co., Ltd., with a capital of $250,000 (about £50,000). The head office of the company is to be at Cornwall, Ontario.

According to *Canadian Machinery* for December, the Dominion Iron and Steel Co. is contemplating the erection of a number of new mills. A new power plant is to be erected capable of generating 4,000 KW. The pumping station at Sydney River is being equipped for electrical power. It is expected that these extensions will be followed by further additions of furnaces, ovens and mills.—*Board of Trade Journal.*

Cardiff.—The L.G.B. has sanctioned the borrowing by the City Council of £2,000 for the purposes of developing the electricity undertaking.

Continental Notes.—Germany.—The negotiations with the Rhenisch-Westfälischen Elektricitäts Werke for the electric lighting of the important mining town of Remscheid having fallen through, owing to difficulties as to the length of the concession, and the erection of a large and costly municipal station having been deprecated, the authorities have decided to join forces with the neighbouring mining centre of Barmen, which already possesses an electrical installation. A contract has been entered into whereby current is supplied by the latter to the extent of 600,000 KW.-hours per year, at a cost of 6 pfennige per KW.-hour, and above that quantity at the rate of 4·6 pfennige. The high-tension current will be forwarded by underground cables, the cost of which will be borne in the proportion of two-thirds by the town of Barmen and one-third by Remscheid. This arrangement is considered by local experts to augur well for the eventual linking up of all the electric stations between Solingen, Lennep, Ronsdorf and Barmen.

Coventry.—At the meeting of the City Council on Tuesday, the Electric Light Committee minutes were confirmed, stating that the manager had reported as to the increase of the demand upon the works, and that he had been instructed to prepare a scheme of extensions for the consideration of the Committee.

Croydon.—It is proposed to spend £1,150 out of the revenue of the electricity undertaking for sinking a well to provide water for the generating station. It is estimated that the probable saving will be £325 a year. Gas lamps in St. James' Road and Sydenham Road are to be converted to incandescent electric lamps.

Devonport Dockyard.—The authorities at the Dockyard express some fear that the main switches which are placed in each building for controlling the lights, may inadvertently be left in the "on" position at the close of the day, though the various lights may have been switched "off." To ensure, therefore, that at the close of each working day the electric current shall be shut off in all buildings not in use, electrical tell-tales are being fitted to all buildings having separate controlling switches. These tell-tales consist of two electric lamps enclosed in red shades placed against the outside of the buildings over the main entrance. They are so connected up that should the switch be left "on" contrary to the regulations, the lamps will continue to burn, and thus warn the police on duty. When the switch is turned to "off" the tell-tale lamps go out.

Doncaster.—The R.D.C. has approved sewage disposal schemes for the parishes of Adwick-le-Street, Oston and Skellow; the schemes have been designed by Messrs. D. Balfour & Son, Newcastle-on-Tyne, and in both cases pumping stations, with electrically-driven automatically-controlled centrifugal pumps, will be employed.

Dundee.—In accordance with the Provisional Order, the Electricity Committee of the T.C. has given permission for the laying of the cable for the electric light supply in Downfield. The cost will be £3,000 and the work is to be done gradually.

The Electricity Committee has also decided to carry out and spend money on a scheme of stair and close lighting at an inclusive charge of 8s. per lamp per annum. The lamps are to be switched on and off from the electric station, thus doing away with the vexed question of tenants' obligations.

Eastleigh and Bishopstoke.—In consequence of a letter from the B. of T. as to whether there was any probability of the U.D.C. putting the Electric Lighting Order into operation within the next 12 months, if the Board extended it for that period, the surveyor and Councillor Shepherd are to visit Basingstoke, Fareham, and New Barnet, to inspect the schemes adopted there, and report on the same.

Evesham.—The T.C. has been petitioned by 37 ratepayers in favour of an E.L. scheme for the borough, and the Stratford-on-Avon Electricity Co., Ltd., has put before the Council a proposal. The Corporation has decided, however, not to take any action in the matter at present.

Greystones.—At the meeting of the Rathdown (No. 2) R.D.C., Mr. R. S. Fry, secretary to the Greystones Electric Lighting and Power Co., wrote, stating that his company was prepared to supply electric current for the purpose of public lighting on the roads along which the company's mains were laid, provided the Council supplied the necessary standards and paid the company for light according to schedule. Mr. Hewson said he understood that the company was going to lay cables where it liked, and he suggested that the Council's secretary should be directed to communicate with Mr. Fry with a view to ascertaining if a B. of T. licence for lighting had been granted to his company. This was agreed to.

Hastings.—The T.C. has decided to apply for powers to supply electrical fittings, but, on the request of the local contractors, the powers will only be exercised through a contractor.

Heston and Isleworth.—The U.D.C. has agreed to the proposal of its electricity department to hold an exhibition of electrical plant and appliances in February, on condition that half the profits go to the Baths, in which it will take place. After some deliberation the U.D.C. has decided to extend its mains to a new building estate, but conditionally on the builders wiring the houses for electric lighting purposes. Only six candidates sat for the U.D.C.'s first free pupilships at the electricity department and other departments, and of these only three satisfied the examiners.

Hollingbourne (Kent).—The R.D.C. has consented to electricity being supplied from Maidstone to a new house being built at Boxley by Mr. F. R. Howlett.

Kiveton Park.—The U.D.C. has decided to apply to the L.G.B. for a loan of £3,316 for the provision of a refuse destructor with electric light plant.

Llandudno.—The U.D.C. has decided to have plans prepared for a permanent extension of the electricity works, so as to provide for additions during the next 10 years.

Llanidloes.—At a recent meeting of the ratepayers, a resolution was carried unanimously in favour of lighting the town with electricity.

London.—Marylebone.—The general manager of the electricity undertaking reports that there is a large field for freezing and ice-making plant in the borough, as it is now cheaper to make ice by electricity, for even a medium-sized house or shop, than to buy it. Upon his recommendation the Committee has decided that as ice making and freezing are mainly required in the summer, current for these purposes will be charged at 1d. per unit without any KW. charge. The present tariff for power is 2d. per unit for the first 125 hours per quarter of maximum demand and 1d. per subsequent unit. An equivalent tariff is 40s. per H.P. per annum, plus 1d. per unit for all units used, the annual charge to be added to the quarterly hire of motors charge. Subject to a separate meter being fixed for recording power units supplied, the alternative form of tariff above is to be adopted, as it appears more acceptable to consumers. Mr. Seabrook has prepared a statement showing the position of the undertaking to September 30th. The chief figures are as follows, the figures in parentheses being those for the corresponding period of 1908:—Units sold to private consumers, 3,463,304 (2,869,493); units sold for public lighting, 117,510 (57,220); average price per unit, private consumers, 3·00d. (3·35d.); revenue from sale of current to private consumers, £43,120 (£40,078); revenue from meter rentals, £2,873 (£2,742); revenue from public street lighting, £1,267 (£661); total revenue from all sources, £48,356 (£44,104); expenditure on revenue account, £20,7 3 (£20,895). Mr. Seabrook goes on to say that although the September quarter is a lower revenue-earning period than the June quarter, the increase in the balance available on September 30th for capital and special charges had advanced from £1,909 to £4,434. As the estimates for the current year were based on the assumption of an increase in available balance of £6,786 for the year, and the six months to date, represent about 34 per cent. on the annual output, they might look forward with confidence to a marked betterment on the year's estimate, even after meeting the whole cost of sundry expenditure of a capital nature.

Battersea.—Application is to be made to the L.C.C. for sanction to the borrowing of £4 500 for mains and services.

The E.L. Committee has withdrawn its application for a loan of £5 362, for mains, &c., for public and private lighting on the Battersea Rise House Estate.

In a statement of the work carried out by direct labour during the six months ended March 31st, 1909, submitted by the various Committees of the L.C.C., some 50 items of an electrical nature appear, mainly in connection with the maintenance or installation of electric light or telephones.

Mexico.—According to the *Mexican Herald*, the Chapala Hydro Electric and Irrigation Co., headed by Messrs. Fernando Pimental & Fagoaga, of Mexico City, will shortly carry out a scheme for the transmission of electrical power to the Aguascalientes district from the Santiago River. The company will probably install a large power plant at Las Juntas, and construct a canal from the Juanacatlan Falls to that place, a distance of 26 km. (about 16 miles). At Las Juntas the head of water would be sufficient for the generation of 90,000 H.P.

Neston.—The U.D.C. has approved of a licence applied for by Sir Alfred Jones and Mr. O. H. Williams for an electricity scheme for the district.

Penmaenmawr.—The District Council proposes to light the Promenade with electricity, and the work will probably be taken in hand in the early spring.

St. Anne's.—Instructions have been given that all meter readers and other workmen who have occasion to enter electricity consumers' premises must wear a distinctive badge.

Saltcoats.—The application of Mr. George Balfour to the Board of Trade for a prov. order to supply electricity for lighting purposes within an area of supply including the burgh of Saltcoats, has received the consent of the Town Council. The district which the order covers is Ardrossan, Saltcoats and Stevenston.

Surbiton.—The L G.B. has sanctioned the raising of a loan of £2,191 for additional machinery at the generating station.

Swindon.—The T.C. has adopted a supplemental assisted wiring scheme for the wiring of consumers' own premises, where the cost of the installation will not exceed £10. The consumer will repay by an extra charge for energy.

Stockton Heath.—The Council has decided to approach Warrington T.C. with reference to a supply of electricity. The parish is scheduled in the application of the Salt Union for a prov. order for E.L., but the Council prefers to have a supply from Warrington.

Taunton.—At a meeting of the T.C. recently a discussion took place on what Councillor Alms described as the indictment made by the Chamber of Commerce as to the manner in which the accounts of the electricity department were kept. The town clerk replied that the accounts were kept in accordance with the requirements of the L.G B., and the Council had invited the Chamber of Commerce either to inspect the accounts for themselves, or to ask the L.G.B. to hold an inquiry. A communication has been sent to the Board as to an inquiry by the Chamber of Commerce.

Torquay.—The electrical engineer reports that in spite of the increased use of metallic-filament lamps, the output for lighting purposes has been maintained. The position of the works to deal with the lighting demand is much better now than last year, as the whole of the alternating-current plant is available for lighting purposes, whereas last year it was liable to be called upon at any time to supply power for traction.

Whitchurch.—The U.D.C. has decided to ascertain if any company will undertake an installation for electrical street lighting.

Widnes.—The T.C. has decided to transfer the E.L. Order to the Salt Union, Ltd.

TRAMWAY and RAILWAY NOTES.

Ardrossan and Saltcoats.—The Saltcoats T.C. has received and considered a communication from Mr. A. W. Tait, one of the promoters of the Ardrossan and Saltcoats Tramways Order, stating that he has secured the co-operation of Mr. Balfour, who was applying for the lighting orders in the district, and that as soon as these orders were obtained, the construction of the tramways would be proceeded with. While it was not proposed to begin the construction of the first section until after the New Year, arrangements will be made to have the lines in Saltcoats and Ardrossan burghs in operation within the period mentioned in the order.

Argentina.—It is expected that the first section of the La Plata tramways will be in service in the New Year, and the remaining five sections at three months' intervals.

Canada.—Application has been made for the incorporation of a company to build an electric railway from Port Hope to Toronto, with branches and lines south to Lake Ontario. The new company is to have $1,000,000 capital, mostly raised locally.

A large deputation of representative men from New Brunswick and Quebec waited on the Government Railway Commission recently to discuss the proposal that the Grand Trunk Pacific Railway, now near completion, should operate its trains through the New Brunswick forest region by electricity generated at Grand Falls on the St. John River. This matter was discussed in the New Brunswick Legislature last year, the plan being suggested as a means of protecting the valuable lumber areas from fire.

The Montreal Street Railway Co. is about to commence the erection of new shops in the northern part of the city, costing $1,000,000.

It is announced that the British Columbia Electric Railway is to erect a 20,000-H.P. steam auxiliary plant in Vancouver.

Cardiff.—The city treasurer has issued a report dealing with the question of tramways depreciation. He states that the capital expenditure on March 31st, 1909, reached £768,088, which is equivalent to £24,138 per mile of single track, or about double what is usually found. The report refers particularly to the track, for which the loan period is 30 years, but which, in the opinion of the city engineer, will not average more than 15 years' life, or up to 1917. The tramways department possesses a nucleus depreciation fund of £28,957, which will go towards meeting the estimated sum of £89,320 required by the city engineer for track renewals by 1917. Under these circumstances, the city treasurer considers it imperative that the sum of £6,604 shall be set aside annually until the year mentioned. The city engineer's estimates, however, contemplate further renewals in 1920 (£14,000), 1922 (£19,320), 1926 (£36.320), and 1932 (£58,720), and neglecting the latter sum, which could be re borrowed owing to the expiration of the original loan, the treasurer estimates that an annual sum of £6,946 would be required for depreciation up to March, 1926. It remains for the Committee to decide whether the present system of renewing cars, overhead work, cables, and other plant is sufficient to ensure a life long enough to dispense with depreciation in those sections.

Colwyn Bay.—By order of the Light Railway Commissioners, an inquiry was held on Saturday, December 18th, relative to the proposed extension of the electric railway from the present authorised terminus at Gross Bridge, to the Queen's Hotel, Old Colwyn. The promoters, the Llandudno and Colwyn Bay Electric Railway Co., were represented by Mr. Sellon (chairman of the board). Col. Boughey, R.E., presided. It seems that after the hearing on November 6th, 1907, the Commissioners decided that the Abergele Road, along which it was proposed to lay the railway, should be widened at various places, but the further proceedings were adjourned in order to see if reasonable arrangements could be made for the widening. In the meantime the parties had been unable to come to terms.

For the District Council, it was stated by Mr. Amphlett, that every effort had been made to come to terms with the company, but they had failed, for the reason that the promoters endeavoured to put upon the Council the onus of acquiring the land needed for widening purposes. The Council had already spent £600 on account of widening between the present terminus and Gross Bridge, and it had been paid £383 on account, but the company, through Mr. Sellon, now threatened not to construct another yard of the line, and so deprive the Council of the £3,000 due under an agreement with the company.

Mr. Sellon said the case was that the company preferred to construct the railway right through to Old Colwyn at one operation. The line had been stopped by the Board of Trade at Gross Bridge. The company was quite willing and ready to make a contribution towards the cost of land, such as it could afford, but it was no part of his duty to agree to construct a line which meant bankruptcy as far as that scheme was concerned. It was a monstrous proposal that they should make a 30-ft. wide roadway and provide a 9-ft. wide footpath in addition.

The Chairman said that as unfortunately the parties had not agreed, the Commissioners had to decide what conditions should be imposed before the line could be sanctioned. They were satisfied that the extension would not bear anything on account of general public improvements, and they had therefore decided to grant an order in which a condition would be inserted that where any land could be obtained at a reasonable cost the company should be required to acquire such an amount as would widen the road to 24 ft., plus replacing the footpath where any existed, and plus a 6-ft. footpath where none existed before. The company was not to be compelled to buy any houses. Narrow places would have to be passed under the double-line system, subject to any B. of T. restrictions as to speed, &c. The Commissioners hoped that the conditions now laid down would enable the parties to come to a friendly agreement with the Council.

Continental Notes.—GERMANY.—The T.C. of Bonn is considering a scheme for the conversion to electric working of the existing steam tramway running between Bonn, Godesberg and Mehlem. The cost is estimated at 1,750,000 M., to be borne in equal amounts by the T.C.'s of Bonn and Godesberg.

The good results, technical and economic, obtained by the State Railway Administration from the working of accumulator locomotives, are likely to lead to their increased adoption. Of the 87 on order, the greater number have been delivered, and the balance is being completed as rapidly as the works will allow. The first 100 estimated to be required by the pressing traffic requirements will shortly be in service.

SWEDEN.—The Swedish engineer, Quitsgaard, has drafted an important scheme for the construction of an electric railway under the Baltic Sound. The new line will unite Malmö with Copenhagen, and be of a length of 230 kilometres, of which 16 will be formed by a tunnel excavated under the Sound which separates Sweden from Denmark. A Special Commission has been nominated by the Swedish Government to examine the scheme, and as soon as its decision is announced, which it is anticipated will be favourable, the Danish Government will join in a convention for the construction of the line.

ITALY.—The Railway Administration has sanctioned the scheme for the construction of a central station at Vado, on the Ventimiglia-Savarne line, at an estimated cost of 1,500,000 lire.

SPAIN.—An application has been presented by the Compania Nacional de Tranvias, of Barcelona, for a concession for an electric tramway designed to join up Gárriga and Muntaner Streets, Barcelona.

An application has also been submitted for a concession for the construction and working of an electric tramway from Renteria to the French frontier *viâ* Irun and Behovia.

TURKEY.—The permanent way of the Constantinople tramways, which belong to the Société des Tramways de Constantinople, has for a long time past been allowed to remain in an unsatisfactory condition, but in order to comply with the terms of the concession, the whole of the route is now being reconstructed at an expenditure of £200,000. A further outlay of £280,000, according to statements made in circles associated with the company, will be necessary to equip the lines for electric traction. The commercial prospects of the undertaking are not referred to favourably by a German correspondent, who also points out that the Ministerial Council has just granted a concession for the institution of a service of motor-omnibuses, which would prejudicially affect the receipts of the tramways.

Devonport.—The Devonport and District Tramway Co. restarted on Saturday a service on the leased lines of the Devonport Corporation. It will be remembered that the cars on these lines ceased running on January 17th last. The leased lines extend from Milehouse to Tor Lane, Camel's Head to St. Budeaux, and from the North Keyham Gates along St. Levan's Road to Milehouse.

East Ham.—£926 is to be spent in alterations to 15 cars, so that they may be used on the through route to Aldgate.

Glasgow.—Rapid progress is being made with the T.C.'s new tramway depôt at Newslandsfield. The building will be ready in the spring, and the plant, &c., transferred from the old depôt at Pollokshaws, which the extension of the cars to the south has rendered inconvenient. The Committee has now approved of plans for the extension of the depôt at Maryhill.

The Committee of Works and Stores has had under discussion, along with the general manager (Mr. Dalrymple), the question of providing protection for motormen on the driving platforms during inclement weather. Consideration has been adjourned in the meantime.

The general manager has reported to the Committee that the valuation for the year 1910-11 of the T.C.'s tramway undertaking, as valued by the Assessor of Railways and Canals, amounts to £258,918.

Leigh.—The electrical engineer is preparing a report for the members of the Tramways and Electricity Committee on the question of establishing a motor-'bus service.

London.—The L.C.C. Highways Committee states that the abortive expenditure on the Aldgate-Bow tramways, due to the discarding of the G.B. surface-contact system, is £25,265; this is to be charged against the reserve fund. The cost of reconstructing the above route on the combined conduit and trolley system has amounted to £110,849; had the lines been constructed in the first instance on the conduit-trolley system, the cost would have been £86,530.

Owing to the increasing competition of the electric tramways and motor-'buses, the Great Eastern Railway has decided to extend its policy of fare reductions over a still wider area than originally introduced in March, July and November of this year.

Lowestoft.—The T.C. has agreed to reduce the price of energy for traction to $1\frac{3}{4}$d. per unit, the reduction to date from October 1st last and to continue to September 30th next. The Tramways Committee must agree to take a minimum consumption of the same number of units as last year. The reduction is also subject to the price of coal not being increased in the 12 months. Should either of these factors be altered to the detriment of the electricity undertaking, the charge is to be reconsidered.

Middlesbrough.—The town clerk has reported to the T.C. that the Act of 1904, empowering the tramway company to extend the tramways to South Bank, Eston and Grangetown, has lapsed through the default of the company to carry out the work by August 15th.

Sandgate.—The Council has decided to assent to the S.E. & C. Railway Co. working the local tramway with petrol motor power, conditionally on its not prejudicially affecting the Council's rights under the Act of 1906.

Spen Valley.—Notice has been served on the Cleckheaton U.D.C. of a renewed application by the B.E.T. Co. for a ccssor of powers in reference to a projected tramway between Cleckheaton and Hightown Heights, Liversedge, which was included in a previous scheme. The U.D.C. has appointed a sub-committee to go into the matter, the feeling being that the line should not be abandoned.

Middlesex.—At the meeting of the County Council on December 16th, the Tramways Committee submitted the annual report. The total length of lines authorised was 43 miles 1 furlong 7·85 chains, of which up to March 31st last, 30 miles 6·7 chains had been constructed and opened for public traffic. The contract price for several of the tramways had been exceeded, chiefly because extra concrete was required to secure good foundations for the track work and roadway. The Metropolitan Electric Tramways, Ltd., during the year ended March 31st last, expended £42,506 on the tramways, the chief items of which were: cables, £15,778; rolling stock, £15,778; overhead equipment, £5,491; and buildings, £2,730. The company's total expenditure up to December 31st last on the tramways was £274,743. The approximate amount of the capital expenditure of the County Council on tramways amounted up to March 31st last to £1,518,197. This figure is arrived at after crediting the amounts received from the sale of surplus properties. The amount reserved by the company in respect of the reconstruction and renewals fund to date, and charged in the revenue account, amounted to £37,066. During the year ended December 31st, 1908, the traffic receipts were £304,747 or 11·497d. per car-mile, the figures for the preceding year being £244,445 and 11·828d. The working expenses during the 12 months under review were £190,601, or 7·191d. per car-mile, the figures for the preceding 12 months being £146,450 and 7·087d. The chief items making up the working expenses came out as follows per car-mile, the figures in parentheses being for the preceding year:—Running expenses, 2·778d. (2·834d.); power and purchase of energy, 1·973d. (1·969d.); repairs and maintenance, 1·231d. (1·061d.); rates, ·277d. (·328d.); rent of Highgate Archway tramway, ·093d. (·97d.); rent of Hertford Light Railways, ·091d. (—); insurance third party, ·321d. (·308d.); general expenses, ·427d. (·490d.). The car-mileage run was 6,361,253, as against 5,037,204 in the previous year; the passengers during the same periods were 57,369,307 and 48,242,404 respectively. The route-mileage in operation was $42\frac{3}{8}$, as against $40\frac{3}{4}$ in the previous year.

Uruguay.—Mr. E. C. Steer has deposited a guarantee of $10,000 gold in relation to his proposal to build an electric railway from Monte Video to Colonia.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted and Repaired.—Cape Hayti-Mole St. Nicholas repaired December 16th; Obok-Djibouti interrupted December 20th.

Telegraph Memorial.—The Bureau International de l'Union Télégraphique has issued the rules governing the tenders from artists of the world for the design and erection at Berne of the monument to commemorate the establishment of the Union, the total cost of which is not to exceed 170,000 fr. Expenses of Transport Customs, and in connection with foundations, will be met by the Federal Council. The conditions of tender have been approved by the Judging Committee, and designs, &c., must be delivered at the Palais Fédéral, Pavillon Central, Berne, by August 15th, 1910.

Wireless Telegraphy.—A dockyard draughtsman and wireless telegraph expert named Knowlden has been charged with stealing a wireless receiver from the Vernon wireless school at Portsmouth, where he was employed. The prisoner explained that he was taking the receiver home in order that he might study it.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

MELBOURNE.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

MELBOURNE.—February 22nd. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

CANTERBURY.—March 16th. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

SYDNEY.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" December 10th.

SYDNEY.—Two junction-line sections of common-battery switchboard for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—Telegraph and telephone material for the P.M.G. See "Official Notices" to-day.

Belfast.—January 10th. One 1,500-KW. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" December 10th.

Belgium.—The municipal authorities of Grace-Berleur (province of Liége) are inviting tenders until the 27th inst. for the concession for the supply of electrical energy for the lighting of the municipal buildings and for private lighting purposes in the town,

Bridlington.—January 1st. 300-KW. steam dynamo for the Corporation. See "Official Notices" December 10th.

Brighton.—January 10th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c.; one 1,300-H.P. 8,000-volt three-phase induction motor; one 300-KW. induction motor-driven balancing set; high-tension switchgear, &c., for the Council's North Road sub-station. See "Official Notices" to-day.

Dublin.—January 14th. Electric lighting scheme for the new Crooksling Sanatorium of the Dublin Joint Hospital Board. Patrick Nally, Clerk to the Board, Municipal Buildings, Cork Hill, Dublin.

Eccles.—January 15th. 150-KW. steam engine and D.C. dynamo for the Corporation electricity undertaking. See "Official Notices" to-day.

December 31st.—Electric light installation at the Beech Street Council School, Winton, now erecting, for the Corporation. Specification from the Town Clerk (10s. returnable).

Erith.—January 10th. High-tension three-phase alternating-current switchboard for the U.D.C. See "Official Notices" to-day.

Italy.—January 11th. The Ministry of Marine invites tenders for the supply of electric lamps and lampholders. The upset price is put at 150,000 lire (£6,000), and 10 per cent. of this sum will be required as a deposit to qualify any tender. Tenders to the "Ministero della Marina," Rome.

London.—I.E.E.—January 10th. The Council of the Institution of Electrical Engineers is inviting tenders for the interior wiring and fittings for lighting and power at its new premises. See "Official Notices" to-day.

Spain.—The municipal authorities of Albesa (province of Lerida) have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

CLOSED.

Admiralty.—Messrs. Smith, Major & Stevens, Ltd., have just been instructed by the Lords Commissioners, of the Admiralty to supply and erect on board the Dreadnought Battleship, H.M.S. *Neptune*, four of their electric passenger lifts, the order having been obtained after an exhaustive inquiry into the merits of the lifts in question.

Cape Town.—The Cape Government Railway has accepted the tender of Messrs. R. B. Hendry & Co., of Cape Town, for five 20-H.P. electric motors, at £61 8s. 6d. each, and three 15-H.P. electric motors, £49 17s. 6d. each, delivered ex ship's slings, Algoa Bay.

The tender of Messrs. E. A. Shaw & Co., of Cape Town, has been accepted for the electric lighting of Messrs. Hepworth's premises. The installation will comprise flame arc lamps outside, 300-C.P. Osram lamps in the shop and 32-C.P. Osram lamps in the windows.

Edmonton.—In connection with the Edmonton Union electric light and power installation, the Guardians have accepted the tender of the Edison & Swan United Electric Light Co., at £575, for cables and switchboard, this being the lowest tender for British manufactures. By a special resolution the Guardians decided to give the preference to British cables which, it is understood, involved an extra of about 10 per cent. over the prices for foreign cables.

Government Contracts.—The following tenders have been accepted by the Government Departments named:—

WAR OFFICE.

Electric light fittings, lamps, &c.—Armorduct Manufacturing Co., Ltd.; Barton & Sons, Ltd.; Credenda Conduits Co.; Foote & Milne, Ltd.; General Electric Co., Ltd.; Nettlefold & Sons, Ltd.; Perfecta Seamless Steel Tube and Conduit Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; Spagnoletti, Ltd.

GENERAL POST OFFICE.

Bell sets.—British Insulated and Helsby Cables, Ltd.
Cable, india-rubber and cotton-covd.—Callender's Cable & Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.
Cable, paper-covd.—British Insulated and Helsby Cables, Ltd.; Western Electric Co.
Insulators.—Doulton & Co., Ltd.

Glasgow.—The Tramways Committee has recommended that the T.C. accept the following:—

Special track work. Newlandsfield Depôt.—Hadfield's Steel Foundry Co., Ltd.
Gear cases.—British Westinghouse Electrical and Manufacturing Co., Ltd.
Trolley wheel bushes.—Fleming, Birkby, & Goodall, Ltd.
Heating, Newlandsfield Depôt.—Jas. Cormack & Son, Ltd.
Portable crane.—Butters Bros. & Co.
Car brake chains.—Weldless Chains, Ltd.; D. Watson & Co.
Armature coils.—British Westinghouse Electrical and Manufacturing Co., Ltd.
Mica.—Geo. Schultz & Co.; Micanite and Insulators Co., Ltd.
Vertical boiler.—Muir & Findlay.

Hungary.—Messrs. Ganz & Co., of Budapest, have secured a contract for the establishment of a municipal central electric lighting station in the town of Orsova.

Hyde.—The T.C. has accepted the tender of Messrs. Russell & Sons for the E.L. and motive power installation at the Town Yard.

Italy.—The Italian Post and Telegraph authorities in Rome have just placed a contract with Messrs. Richard Johnson and Nephew, of Manchester, for the supply of 110 tons of galvanised iron wire.

Hindhead (Surrey).—The following is an analysis of tenders received for cables, feeder pillars, and all accessories for the high-tension extension of the Hindhead Electric Light Co. Messrs. Handcock & Dykes, of Westminster, are the consulting engineers:—

	Amount of tender.	Extra if oil-break switches.	Amount of tender with oil-break switches.
Callendor's Cable and Construction Co., Ltd.	£4,885	£74	£4,959
British Insulated and Helsby Cables, Ltd.	4,776	29	4,805
Henley's Telegraph Works Co., Ltd.	4,753	55	4,808
Siemens Bros. & Co., Ltd. (accepted)	4,669	64	4,733

For the Diesel engine, alternator, and all fittings and attachments, and motor-alternators, switchgear, cables and connections complete, the following were the tenders:—

Contractors.	Engine.	Alternator.	Total.	R.P.M.
Ferranti, Ltd.	Mirrlees	Not stated	£2,322	214
Diesel Engine Co.	„	E.C.C.	2,445	214
Electric Construction Co. ..	„	„	2,462*	200
Mirrlees, Bickerton & Day ..	„	„	2,475*	200
Brit. Thomson-Houston Co.	„	B.T.-H.	2,507	200
Brush Elecl. Eng. Co. ..	„	Brush	2,520	200
Brit. Thomson-Houston Co.	„	B.T.-H.	2,531	200
Mirrlees, Bickerton & Day ..	„	Brush	2,532	200
Mirrlees, Bickerton & Day ..	„	G.E C.	2,542	200
Siemens Bros. & Co.	„	Siemens	2,552	200
Mirrlees, Bickerton & Day ..	„	B.T.-H.	2,557	200
British Westinghouse Co. ..	„	B. West.	2,583	200
Electric Construction Co. ..	Sulzer	E.C.C.	2,587	214
Mirrlees, Bickerton & Day ..	Mirrlees	Siemens	2,597	200
Diesel Engine Co.	Sulzer	E.C.C.	2,603	200 or 214
Brit. Thomson-Houston Co.	„	B.T.-H.	2,632	214
Brit. Thomson-Houston Co.	„	„	2,656	214
Siemens Bros. & Co.	„	Siemens	2,696	214
Diesel Engine Co.	„	E.C.C.	2,716	—
Dick, Kerr & Co.	Mirrlees	Dick, Kerr	2,744†	200
Dick, Kerr & Co.	Sulzer	„	2,877†	214

* Accepted. † Incomplete, excludes 10-KW. motor-alternator.

London.—WANDSWORTH.—The Guardians some time ago appointed Mr. E. R. Dolby, M.I.C.E., M.I.Mech.E. (Dolby and Williamson), of Westminster, as consulting engineer for the installation of the heating and hot water service and boiler house plant in their new Infirmary. The L.G.B. approved the engineering scheme, and from among the tenders obtained from seven firms of contractors, the lowest tender, that of Messrs. Moorwood, Sons and Co., Ltd., of Sheffield and London, was accepted.

L.C.C.—The following tenders were received for roadwork and platelaying, exclusive of supply of rails and special trackwork, in connection with the reconstruction, on the underground conduit system, of the tramways from Rainton Road to Chapel Street, Woolwich, and Farringdon Road:—

	Tramway works.	Retaining walls, &c., for street widenings.	Total.
Dick, Kerr & Co. (accepted)	£40,210	£583	£40,793
John Mowlem & Co. ..	40,449	598	41,047
W. Manders	43,620	646	44,266
R. C. Brebner & Co. ..	44,273	675	44,948
G. Percy Trentham ..	46,057	600	46,657

Messrs. Dick, Kerr will sublet certain portions of the work as follows:—Yokes, Anderston Foundry Co., or Wilsons, Pease & Co.; insulators, Doulton & Co. or Bullers; tie-bars, bolts, &c., to Bayliss, Jones & Bayliss or Guest, Keen & Nettlefolds; cement, Associated Portland Cement Manufacturers (1910), Ltd.; plough boxes and drain boxes, Harrison & Co. (Lincoln), Ltd., or Hadfield's Steel Foundry Co.; bonds, Forest City Electric Co.

In connection with the electrification on the overhead trolley system of the Woolwich to Eltham tramways, the tenders are as follows:—

Alex. Stark & Sons (accepted)	£32,528	Kirk & Randall	£38,331
Dick, Kerr & Co.	33,226	W. Manders	40,040
Robert W. Blackwell & Co. ..	36,663	William Griffiths & Co. ..	40,191
John Mowlem & Co.	36,725	Daniel T. Jackson	40,197
R. C. Brebner & Co.	37,332	G. Percy Trentham	42,455

Messrs. Stark will sublet the tie-bars, bolts, &c., to Bayliss, Jones and Bayliss; and the drain boxes to Hadfield's Steel Foundry Co.

For the overhead electrical equipment for the Woolwich-Eltham line the tenders received were:—

British Insulated & Helsby Cables	(accepted)	£5,760
S. G. Smith		5,8'0
R. W. Blackwell & Co.		5,901
Dick, Kerr & Co.		5,909
National Electric Construction Co.		6,056

The British Insulated and Helsby Cables will sublet as follows:—Poles, Jas. Russell & Sons; bases, collars and finials, R. A. Bradshaw and Sons; brackets, Naylor Bros.

For special trackwork on the same section the tenders are:—

Hadfield's Steel Foundry Co.	(accepted)	£114
Edgar Allen & Co.		122

Twenty movable platforms required for the cleaning of electric cars at the Abbey Wood tramway car-shed are to be supplied by Messrs. G. Hayward & Co.

Messrs. Back & Hickman are to supply an electrically-driven power hammer for the Greenwich generating station, at £206.

The Stores Committee has recommended for acceptance tenders from the following firms for electric fittings:—Dorman & Smith; Edison & Swan United Electric Light Co.; Elco Recording Press; General Electric Co.; A. P. Lundberg & Son; Nettlefolds & Sons, Ltd.; Perfecta Seamless Steel Tube & Conduit Co.; Siemens Bros.

and Co.; Siemens Bros. Dynamo Works, Ltd.; G. Straus & Co.; Veritys, Ltd.; W. White & Co.

The tender of George MacLellan & Co., of Glasgow, for electric insulating materials is recommended; and those of W. B. Dick and Co., and Ragosine & Co., for lubricating and lighting oils.

Lowestoft.—The T.C. has accepted the following tenders:—

Electric Construction Co., balancers, £105; Drake & Gorham, annual supply of lamps; Aubert Grenier & Co., annual supply of service cables; Elliott Bros.

ELECTRICAL (?) FIRES.

Following closely upon the disastrous fire at Clapham Junction, to which we refer in our leading columns, come two others, fortunately unattended by loss of life, but entailing the destruction of much valuable property—and all, as usual, have been attributed to electricity by the daily Press, which appears to have a standing order to follow this course. Regarding the Bute Hydro we have as yet no reliable information; but as we go to Press we learn, on good authority, that the destruction of the Pavilion could not possibly be due to electricity, for the main switch at the entrance to the pier was off. It is most unfair that, without a particle of evidence to go upon, the blame is always cast upon electricity in the first instance.

NOTES.

Use of Electricity in Mines.—The Council of the Institution of Electrical Engineers are considering the evidence to be submitted to the Home Office in connection with the inquiry on the use of electricity in mines. The secretary of the Institution will be glad to receive in writing on or before January 10th next any observations which members may wish to make on the Special Rules of the Home Office for the Installation and Use of Electricity (Coal Mines Regulation Act, 1887), now in force.

Arc Lamp Patents.—With reference to the note entitled "German Patent Cancelled," appearing on p. 984 of our last issue, a wrong impression is conveyed by the information given to us by the Regina Arc Lamp Works, of Cologne. The patent in question is not a fundamental one, and it was declared invalid because one of the English patents was regarded as prior publication. An appeal has been lodged.

The Anglo-Japanese Exhibition.—As an illustration of the interest that is being shown in Japan in next year's exhibition at Shepherd's Bush, it is stated in a Reuter dispatch from Tokio that the private exhibitors number 1,180, and their exhibits about 18,000. The actual transportation of exhibits was to commence on December 8th.

The Penalty Ought to be Greater.—At the Chatterley Whitfield Colliery on Thursday last week, Thos. Smith, a pit-hold youth, was filled with a desire to experiment with the electric current, and obtained a wire, which he inserted into the electric junction box, holding it by means of his cap. A short circuit resulted, the current in that district was cut off and the dip pump was stopped. At the Tunstall Police Court Smith was fined 10s. and costs. The manager told the Court that the pressure amounted to 500 volts, and had it not been for the fact that the lad insulated the wire with his cap he would have received a serious, if not a fatal, shock.

Dinner.—The annual dinner of the Electrical Engineers (London Division) was held at the Café Monico, on Saturday, December 18th. Col. R. E. Crompton, C.B., occupied the chair, supported by Brigadier-Gen. F. Rainsford Hannay, Major H. M. Leaf, and Dr. Gisbert Kapp. The hall was comfortably filled with the officers, non commissioned officers and men, to the number of over 200, the absentees being principally men at present on service, and the String Band of the Royal Engineers rendered an excellent musical programme. The toasts were few, and the speeches brief. Col. Crompton proposing "The Imperial Forces," posed as a man of peace, and in that capacity called for preparedness for war as the surest means of securing the continuance of peace. Brigadier-Gen. Rainsford Hannay, in responding, notified to the usefulness of the Corps as Volunteers in South Africa, and hoped that army changes would not decrease that usefulness or diminish the numbers of the Corps. The remaining toast, "Science and Engineering," was proposed briefly by Major Leaf, and responded to by Dr. Kapp and Major Dumbell, the late Adjutant, who has now gone over to the London General Omnibus Co., to which fact he made jocular allusion. The proceedings terminated with hearty cheers for Col. Crompton, whose popularity was evident.

Institution and Lecture Notes.—The Tramways and Light Railways Association.—As from December 25th the offices of this Association will be at Caxton House, Westminster, S.W.

Institution of Electrical Engineers, Newcastle-on-Tyne.—The annual dinner of the Newcastle-on-Tyne Local Section was held on the 15th inst. at Newcastle. Dr. H. Stroud, the chairman, presided.—Prof. L. Weighton, in proposing the toast "The Institution of Electrical Engineers," said he believed practical applied electricity had had a great effect on the older branches of engineering, and upon constructive engineering generally. Economy in the use of steam was very much due to the requirements of the electrical engineer, and the steam turbine itself owed its origin very largely to his needs. Its first obvious purpose was to generate the electrical current for which it was so clearly adapted, but since it had been applied to marine engineering there was a promise in the future that the gross propulsive efficiency of steamships propelled by turbines might be considerably increased by connecting the high-speed turbine with the comparatively slow reciprocating engine.—Prof. Kapp, responding, said that electricians owed a great deal to the mechanical engineer. Electrical engineering was only mechanical engineering with a little bit of electricity grafted on. But the grafting on had been a most successful process. They were fortunate in Newcastle in having electricity supplied to them at a lower price than anywhere else. In Italy, where he was lately, the price was 8d. or 9d. per unit, while in the City of Newcastle it was only 2d. per unit. That result had been brought about because they had men there who knew how science should be applied, and the world had been specially indebted to that city for the men it had brought forward. The application of electricity had completely changed the character of industry. There were indications of an improvement in trade, and there was no doubt that with the great practical advantages, which had been demonstrated up to the hilt in that district, of electric driving and electrical processes generally, the movement for the spread of electricity would advance.—The chairman also responded to the toast.

Huddersfield Society of Engineers.—Mr. A. W. Bennis recently gave an address to the Society on "Modern Developments in Mechanical Stokers," including an account of the new patent balanced double shovel arm introduced to the well-known "Bennis" sprinkling stoker. One of the advantages of this new adaptation is that the shovel arm can be instantly detached without the removal of the shaft, which has hitherto been necessary in actual operation. He also dealt with coking stokers, and gave a number of instances of their adoption resulting in improved efficiency and the abolition of smoke nuisance.

Electric Time Service.—We are informed that the system in use at Portsmouth, referred to in our "Notes" last week, is that of the Magneta Time Co., of which a preliminary installation has been in successful operation for the past seven months.

Appointments Vacant.—Junior assistant, to take shift at Haslingden tramways sub-station (15s.); assistant engineer, for Leek U.D.C. electricity department (£100); instructor in electrical wiring for the Walthamstow Higher Education Committee. See "Official Notices" to-day.

Electric Shock Fatalities.—According to news received from South Africa, it appears that Mr. Bantjes, who had been engaged for some time on Witbank colliery as assistant electrician on some electrical work underground, met his death by coming in contact with a 500-volt wire.

While a machine-man was attending to one of the coal-cutting machines in the Hartley seam of No. 2 pit at Millwall, Stirling, he came in contact with a live wire and was instantly killed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Morecambe Corporation have appointed Mr. Lionel B. Hogarth, assistant engineer, Bermondsey Electricity Works, as resident borough electrical engineer. Mr. Cragg, third engineer-in-charge, has been promoted to the vacant position at Bermondsey, at £120 per annum. Mr. Ingram, junior engineer and switchboard attendant, will take Mr. Cragg's place at £110, and a junior engineer-in-charge and switchboard attendant is to be appointed.

Mr. W. H. Miller, chief assistant electrical engineer at Wakefield, has been appointed electrical engineer to the Fleetwood U.D.C. Mr. Miller had been five years at Wakefield, and prior to that he was for nine years at Belfast. He is a native of Fleetwood.

Mr. W. P. Hooper, who has resigned his position as shift engineer at the Eccles Corporation Electricity Works in order to take up another appointment under the Doncaster Corporation, was recently presented by his colleagues with a dressing case.

Mr. Tylecote, assistant electrical engineer at Llandudno, has resigned. The U.D.C. has appointed Mr. Daniel Hughes, second assistant, to be assistant engineer.

Tramway Officials.—The staff of the Wakefield and District Light Railway Co. have presented a timepiece to Mr. C. J. Stewart, engineer at Castleford, on his marriage.

General.—The Waterloo U.D.C. has appointed Mr. Wm. Shaw, of Waterloo, as electric inspector for the district under the Great Crosby and Waterloo E.L. Order, 1896, at a fee of 5s. for each test, to be paid by the consumer.

Mr. H. T. Wilkinson has resigned his position as assistant manager of the Chloride Electrical Storage Co., Ltd., and has joined the Wardle Engineering Co., Ltd., of Manchester, as managing director, conjointly with Mr. C. H. K. Chamen.

Obituary.—We regret to learn of the death from pneumonia, on December 10th, at Loughton, Essex, of Mr. Frank L. Rowe, for many years manager of the Edwards Air Pump Syndicate, Ltd.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided on Monday at the offices, Finsbury Pavement House, E.C., over the tenth annual general meeting of the above company.

The Chairman, in proposing the adoption of the report (see Elec. Rev., December 17th), said his task was a more pleasant one than on any previous occasion. They had had many years of adversity, but this year it seemed as if they had at last emerged into daylight. The balance-sheet presented some very important changes since last year. On the debit side of the account, whilst the authorised capital remained the same, there was a fresh item under issued capital which was owing to the issue of 20,000 7 per cent. first cumulative preference shares of £5 each, which brought in £99,855. The old 6 per cent. preference stock and the ordinary stock remained the same, but the 5 per cent. first mortgage debenture stock had been increased by £100,000. The result of the reorganisation of the capital account had been that they had been enabled to wipe out the heavy loans which had been such an incubus in the last few years. Last year they had loans against security and bills payable amounting to £150,804. That item had now disappeared, and in its stead they had cash at banker's and in hand amounting to £14,966. On the credit side the expenditure on the Melbourne undertaking had gone from £293,356 to £321,163, and at Geelong from £56,216 to £57,903. Their Adelaide ordinary shares had been reduced in number because they had sold a certain number of them in order to create a market for them in Adelaide. To make that market they had to begin selling a few shares at a discount, and the total result of the sale had been a loss of about £1,000, which they had written off. The price of the shares was now par, and recently there had been a bid at a slight premium for them, so that the policy had been entirely successful, and the asset in the balance-sheet represented by Adelaide ordinary shares might be taken as equivalent to cost. This had warranted them in transferring £11,750 out of their reserve account, which represented part of the profit they made in paper on the formation of the Adelaide Co., to the reduction of the suspense account. The suspense had been increased very largely by the cost of obtaining the fresh capital. They would understand that, in the condition in which the company was they were unable to obtain the same terms that a company of high credit would have done. They had to pay (and it was worth paying for) for having the capital account reorganised, and the whole cost was £19,358, in addition to stamp duty and a payment of £3,434 to the Debenture Corporation, Ltd.—a total of £22,789. They wanted to extinguish the item as quickly as possible, and they had transferred the sum of £11,500, which reduced it to £11,039, and they proposed to write off out of revenue a further £2,039, leaving them an even amount of £9,000, which they proposed to extinguish in three annual payments of £3,000 each. Turning to the separate accounts, the result of their operations in Melbourne had been to earn £20,573 13s. 4d., instead of £16 053 last year, and that increase of profit had been distributed over every branch of the business. The revenue from lighting had risen from £19,688 to £22,878; from power, from £8,685 to £10,090; and from public lighting, from £3,154 to £3,253; so that the total revenue had advanced from £31,528 to £36,222. There had been a corresponding increase in the minor items of revenue, and the total income was £37,494 9s. 11d. On the other side the generation of electricity had cost £8,579, against £9,129, so that they had done more business at a reduced cost of between £500 and £600. That was due mainly to having their new turbine in operation. The cost of distribution was slightly lower, but repairs and renewals were slightly up. The net result was that they had £4,523 from Melbourne, as compared with last year. At Geelong they had the same thing on a smaller scale, and taking the two together, they had an increased profit of £5,339. In addition to this, the Adelaide undertaking had given them a greater return, and they had received £6,666 from that source, against £4,239 last year. The result was that after paying interest on debentures, and on sundry loans, directors' fees, &c., they had an available balance of £13,469, against £5,288 last year. There were various items they were providing for this year, which would not recur. There were special charges, including legal expenses, and a fee of £210 to two directors for special services in connection with the raising of the new capital, which amounted to £978; the cost of guaranteeing the loan which they had to raise pending the creation of the new capital, £503, and the loss on the shares of the Adelaide undertaking, £1,037. The result was that they carried to the general balance £12,721, as against £1,771. They proposed to pay the full dividend on the new 7 per cent. preference shares, amounting to £1,821 10s. 6d.; to transfer to the depreciation and general reserve account £5,123 17s. 6d. (which would make this account an even figure of £12,000); to write down the suspense account by £2,039; to write down the head office furniture by £42 13s. 1d.; and carry forward £3,694 9s. 3d., which approximately represented the half-year's dividend on the 100,000 7 per cent. preference shares, which they had recently issued, and which would be due on March 1st next. They believed this disposition of their surplus to be sound and conservative. The Chairman proceeded to read the figures of the progress of the undertaking, which are set out in detail in the annual report, and said they had reason to feel satisfied with the prospects both at Melbourne and Geelong, whilst at Adelaide they were doing extremely well. As regarded the old preference shares the board was sorry that they just failed to obtain the three-fourths majority to carry the proposal for finding the arrears of interest and putting them on a dividend-paying basis, but the matter was still receiving their serious consideration, and they hoped to put the same proposals, or slightly amended proposals, before the shareholders in the new year.

Mr. D. Findlayson seconded the motion for the adoption of the report.

A Shareholder pointed out that no reference had been made to the item of £2,727 for carbon and lamp renewals appearing in the Melbourne accounts.

The Chairman said they supplied carbons to their customers as part of their method of doing business.

Mr. Tuckett congratulated the board on the improved position, but asked his fellow-shareholders not to be too eager to divide profits before proper provision was made for depreciation and renewals. Whilst he was anxious to see a dividend, yet a premature declaration might mean losing profits in the long run.

The Chairman said the board were fully conscious of this point, but it would be satisfactory to shareholders to remember that the Melbourne station was equipped with turbine machinery which was most economical in operation, and, so far as they knew, the least liable to obsolescence. In addition, most of their lines were overhead, and were not so liable to depreciation in one sense, although the cost of maintenance might be greater.

Mr. R. P. Sellon said that where lines were laid underground experience had shown that provision must be made for depreciation. The electrical supply industry was not a great age, but experience had shown that india-rubber, which was thought at the beginning to be the right insulating material for copper, had had to be almost entirely replaced by paper; so that where they had a large system of underground mains provision must be made for not merely keeping them in order, but for obsolescence—to provide for the contingency that at some future time a new insulating material would be found. At Melbourne a large proportion of their mains were overhead, and it was not necessary to make the same provision. He might say, however, that this question of depreciation was receiving the very careful consideration of the board, and they hoped very shortly to have their managing engineer, Mr. Clements, over here, and it was the intention of the board to review the whole subject with his assistance.

The report was then adopted.

On the motion of Mr. J. F. Albright, seconded by Mr. W. Parker, the retiring directors, Mr. D. Finlayson and Mr. R. Percy Sellon, were re-elected directors.

Mr. Sellon, in reply, said he had been associated with the company for many years, during which period they had had great difficulty and anxiety. He was sure there was sound ground for hoping that they had now definitely turned the corner and were entering upon a period of steadily increasing prosperity.

On the motion of the Chairman a hearty vote of thanks was passed to the engineer and manager, Mr. Clements, and the staff in Australia for their loyal services to the company.

United River Plate Telephone Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share) on the ordinary shares for the half-year.

Telephone Company of Egypt, Ltd.—The register of transfers of 4½ per cent. redeemable debenture stock is closed from December 18th to 31st inst., both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1910.

Barbados Telephone Co.—At the recent half-yearly meeting the accounts for six months to September 30th, 1909, were presented. The Hon. W. K. Chandler was in the chair, and said that the number of instruments in use was a record one—716. He had pleasure in recommending a dividend of 4 per cent. Construction account had been reduced by $821. Their poles already carried so many wires that it was necessary to place intermediate poles, and £200-£300 was spent in this way. Rental of instruments produced $9,522, while the total revenue was $9,805, and the expenditure $6,050. The dividend would absorb $3,072, and $39 was carried forward. The dividend and accounts were passed.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 26th, 1909, were 581,567, compared with 358,911 units in the corresponding four weeks of 1908.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

The ordinary general meeting of the shareholders of this company was held on Thursday last week at Winchester House, Old Broad Street, E.C., Lord Arthur Butler presiding.

The Chairman, in moving the adoption of the report, said he thought he might fairly congratulate the shareholders on the substantial improvement in the position of the company which the accounts disclosed. The profits amounted to £15,053, being the best results yet attained, and an increase of £1,663 over the previous year. The improvement in the profits was due both to increased receipts and reduced expenditure. The revenue from tramway traffic showed an increase of £656, as compared with 1908, and he thought it was a most satisfactory feature that the increase was not due to exceptionally good weather during last season. The weather conditions were, in fact, exceptionally bad, especially during the August Bank Holidays, when they dropped £300 in their receipts compared to the same Bank Holidays in 1908. The revenue from the sale of light and power also showed an increase of £398, equivalent to 10 per cent. in one year. That they might also look upon with satisfaction, as he was informed that, owing to the growing use of metallic-filament lamps, most of the electric supply companies, whose chief income was derived from lighting revenue, showed a falling off in receipts, while few showed increases. The general expenses were £10,524, against £10,688, a reduction of £164. This saving was mainly due to the better terms they obtained for third-party and workman's compensation insurances, and he expected they would be able to effect a further reduction under this head at the next renewal period, if, as he sincerely hoped, they continued to enjoy the immunity from serious accidents with which they had been blessed for the past four years. The power station expenses were £6,003, against £6,680 in the previous year, a saving of £677, equal to 10 per cent., and at the same time the output of the station had increased from 1,573,074 units to 1,654,452 units, being an addition of 5 per cent. This increased consumption of electric current was accounted for by the greater volume sold to consumers, and to some 1,400 extra miles run by the cars. The works cost per unit of electricity generated was ·97d., and having regard to the character of the lighting load, which was at its maximum in August, when the traction load also reached its highest point, and that the railway carriage and town dues on coal amounted to 12s. 3d. per ton, their electrical engineer and manager, Mr. Forde, deserved every credit for the result. The directors had again waived half their fees, but if the improved condition of the company continued during the current year, they would feel justified in reconsidering the question of their fees. In the report submitted last year, they put before the shareholders the urgent need for an additional installation of electric plant, estimated to cost £7,500, and they had since installed, at a cost of £6,772, the plant and cable extensions they then contemplated. This gave them all the generating power they were likely to want for some time, but the expenditure on cables would have to be added to from time to time in order to extend the business and to get new customers in roads and districts not hitherto supplied, wherever profitable lighting or power business could be secured. Although they had paid away more than £6,000 for this new plant, the amount of their liability on loan account had only increased by £1,000, as they had had the balance in hand from their improved profits. The position of the loan accounts remained practically the same as it did last year, the bankers having renewed the loans on the security of the debentures. It would have been more satisfactory to the directors to have the debentures permanently placed, though they could not procure the money on such favourable interest terms as their bankers charged, owing to the low Bank Rate prevailing for some time past. It would not, however, be in the interest of the shareholders that the debentures should be issued at a sacrifice, and they believed that the value of these securities must before long considerably appreciate. It would be within the recollection of those shareholders who were present at the meeting last year that the directors were subjected to some criticism on the management of the company, and as to its financial position in connection with the loans. A resolution was then passed asking the directors to invite four gentlemen named in the resolution to confer with the board on the general position of the company. The directors in accordance with that resolution lost no time in inviting the gentlemen named to a conference. After this conference they supplied them with every information they desired, and a long correspondence and some further conferences ensued. The result was a series of recommendations, some of which they considered impracticable or of doubtful advantage. Some other recommendations referred to matters which the directors had already considered, and would have been glad to carry out, but they involved the expenditure of money which the directors had not at their disposal. The subject mainly discussed at the shareholders' meeting last year was the question of the indebtedness of the company, and the desirability of placing the loans on a permanent basis at a moderate rate of interest. They accepted the suggestion of the shareholders to call into conference the gentlemen named in the resolution of the meeting, as they knew them to be connected with large financial affairs, and they hoped that they would be able to give them material aid in the financial side of the business. He regretted to say, however, that they got no practical assistance, or offer of assistance, in this direction. The committee pressed very strongly on them one of their recommendations, viz., that the system of electric supply to lighting consumers should be changed from the direct to the alternating current system, with a view to the more extensive use of metallic-filament lamps. Though the directors were satisfied that this was not practicable, owing to the large capital expenditure involved, and that even if it was practicable, it was not desirable, they yielded to the pressure of the Committee, and appointed Mr. Sparks, of the County of London Electric Supply Co., nominated by the Committee themselves, to report on the subject. Mr. Sparks, who was a gentleman of the highest eminence in his profession, had given a report which in every respect confirmed the opinions previously formed and expressed by the directors and their engineer and manager, Mr. Forde, on this subject. He had received a communication from a shareholder suggesting the adoption of ½d. fares. It did not appear that the system had yet been adopted anywhere, and therefore it was impossible to say how it would work out. The directors would give the question their best attention, and consider whether or not it was desirable to introduce the system on their lines.

Mr. H. R. Monks seconded the motion.

Mr. C. Lock, one of the shareholders' committee which conferred with the directors, in a long speech detailed the negotiations which he and his colleagues carried on with the board, and said that they were of opinion that a more energetic policy might be adopted to the advantage of all concerned. He believed the committee had already done some good, the results of which were reflected in the improved accounts. He was sorry that the board had not seen their way to do something in the direction of placing the heavy loans of the company on a permanent basis. The committee were also of opinion that the board might be strengthened by the addition of two experienced business men, one of whom should be a man of local knowledge and influence.

Mr. W. M. Murphy, a director, replying to the criticisms, said he was quite convinced that the directors were carrying on the tramway in as economical and efficient a manner as possible, and they were not in need of any further assistance in that direction. As to the extension of the electric lighting, that had shown a substantial increase last year, and metallic-filament lamps were being used on the system. It would not pay them to transform their system from the direct to the alternating current, as recommended by the committee. As to the debt charges, if the company was let alone and it continued to progress as it had done last year, he believed that in a very short time the debentures would be at such a price that they would be able to place them permanently with the public.

The report was then adopted.

Shanghai Electric Construction Co., Ltd.

The report of the directors, which was presented at the third annual general meeting held at Basildon House, E.C., on Thursday, December 16th, said that a new scale of fares drawn up by the general manager was sanctioned by the Council, and came into operation on February 1st last. As a condition of obtaining the revision of fares, it was found necessary for the company to withdraw its claim for compensation for delay on the part of the Council in supplying power and in opening the bridges for traffic. Apart from the cost of power, the operating expenses of the tramway are low, and compare favourably with those of other systems. The price fixed in the concession agreement for cost of power was based on the estimated cost of production at the time, but the actual cost has been much lower, owing in great part to the company's large demand for power. The Council has consequently been able to reduce the price charged to the public, but the old rate is charged to the company, notwithstanding that it is the largest consumer. In the following statement of the company's traffic receipts since the opening of the tramways, the figures given in the first column show the takings at their nominal value, those in the second column the actual value in Mexican currency, and the difference, shown in the third column, represents loss by exchange:—

	1908.			1909.		
	Nominal value. Mex. $.	Amount realised. Mex. $.	Loss by exchange Mex. $.	Nominal value. Mex. $.	Amount realised. Mex. $.	Loss by exch'ge. Mex. $.
January..	—	—	—	44,630	37,122	7,508
February ..	—	—	—	40,726	32,998	7,728
March (27 days in 1908)	115,512	101,105	14,407	42,695	34,440	8,255
April				43,461	34,684	8,777
May				47,900	37,646	10,254
June				41,982	32,889	9,093
July	37,732	31,962	5,770	47,359	36,986	10,373
August	37,823	31,792	6.031	47,812	37,419	10,393
September	37,811	31,612	6,199	48.279	37,707	10,572
October	38,357	32,370	5,987	*50,000	*38,500	*11,600
November	39,042	32,847	6,195	*51,000	*40.000	*11,000
December	38,264	32,258	6,006			

*Telegraphed.

About five-sixths of the fares are collected in Chinese copper and small silver coins, on which the loss by exchange, when converted into Mexican dollars, is now about 25 per cent., as against 10 per cent. when the tramways were opened. The balance of the traffic revenue is from season tickets and books of coupons, which are paid for in Mexican dollars. It will be seen that there has been a steady growth of traffic, and that notwithstanding the increasing rate of loss by exchange, the receipts for the nine months, from March to November, show a substantial improvement in 1909 as compared with 1908. The heavy payments to the Council for power, royalty and road maintenance have, however, made serious inroads upon the balance which would otherwise be at the disposal of the company. These matters have been the subject of representations to the Council, and in July last a meeting was held between sub-committees of the Council and of the company's local board. It was then arranged to convene a special meeting of ratepayers to consider a resolution to be brought forward on behalf of the company, with a view to improving the conditions under which it now works. The matter is in course of active negotiation, but the date of the ratepayers' meeting had not been fixed at the time of the issue of this report. Arrangements have been made with the French Shanghai Tramway Co. for an exchange of traffic by means of through services on certain routes, but this cannot be carried into effect until negotiations between the Councils of the foreign and French settlements with regard to the strengthening or rebuilding of two bridges over the Yang-King-Pang Creek have been concluded. It is believed that the exchange of traffic will be beneficial to both companies. Mr. R. S. Portheim, a director, offered himself for re-election.

At the meeting Sir Alfred Dent, K.C.M.G., presided. In moving the adoption of the above report, he pointed out that there were no accounts to present, as it had been decided in future to make them up to December 31st, which would enable the annual meeting to be held about the end of March. The report gave the approximate receipts month by month from the opening of the tramway service in March, 1908, until November 31st last. They had suffered an enormous loss in exchange, as they had to take fares in depreciated Chinese silver and copper currency, which was practically useless to them, and sold daily at the best price available in exchange for the standard Mexican dollar. They managed to collect season tickets and coupons, which formed a small portion of their income, in Mexican dollars, but the loss in exchange had been steadily increasing during the last two years, until it now stood at over 25 per cent. on the great bulk of their receipts. The Municipal Council recognised that depreciation and sanctioned alterations in the sections and increases on the original fares named in the concession, but the improvement thereby obtained had been largely neutralised by the continued fall in exchange. The operating expenses were at the rate of 20 Mexican cents per car-mile. The statement of traffics was of an encouraging character so far as the gross receipts were concerned, and showed an average increase of more that $10,000 per month from July to November inclusive. While that meant growth of traffic and increasing popularity of the tramway service, it did not represent in the same degree an accession to the company's income, since the loss by exchange had increased almost without a break until the last two or three months, and their effective takings had not increased in proportion to the work they had done in carrying passengers. The expenses were lower now than they were during the first half of the year, and for the four months from July to October they had been earning about $7,000 profit a month in Shanghai, subject to provision for depreciation. It was satisfactory that while they had never had to remit any money to Shanghai they had recently received a remittance of £4,000 from that country, which considerably more than recouped all the expenditure they had made there outside the works contract for stores and other items which formed part of the working expenses. They were asking for an alteration in the concession under the following heads: (1) reduction in the price charged by the Council for power; (2) relief from their present obligation to maintain a portion of the roads traversed by the trams; and (3) a substantial modification of the way in which the royalty was computed. As regarded the arrangements with the French Co., the general manager had gone very fully into the question, and the agreement for mutual running powers was drawn in a way which it was believed would safeguard their interests and secure to them a due advantage in respect of the relatively denser traffics on their system as compared with that of the French Co. The payment to the Council from the start to the end of September for power, royalty and road repair, amounted to £20,500, and over the same period the company had run 2,533,084 car-miles, and carried 14,667,698 passengers. The average number of passengers per week, and the receipts per car-mile were steadily improving, whilst the car-mileage and consumption of power was being reduced, so their position was gathering strength, but they were a long way off any substantial surplus unless the payments to the Council were modified.

Mr. Emile Francqui seconded the motion, and the report was adopted.

S.P. Syndicate, Ltd. (Suchostawer Patents).

At the first ordinary general meeting, held at Winchester House on December 10th, the following report by the directors for the period ending November 15th, 1909, was adopted: "The directors are satisfied that you will consider the report exceedingly encouraging in every way. The syndicate was started on a provisional protection, supported by the assurances of several well-known tramway experts that the patent would be granted, and that it was of practical application and would prove to be the most efficient system of electric traction. The first step was made when a line was built at Southall, one-sixth of a mile long, which would be used for demonstration purposes, and on which practical improvements could be worked out. This line has been in running order for about six months, and works uniformly satisfactorily. The line has been left standing on various occasions for weeks on end in all weathers, and has been used at very short notice, and inspected by some of the most experienced and critical engineers in the country. Even when specially sent to make destructive criticism, if possible, they have been unable to do so. In fact, no expert has ever given an adverse opinion after inspection. In addition, four British patents have been obtained, besides patents in the United States, Canada, Austria-Hungary and India, and protections in other countries. Various municipal authorities have thoroughly investigated the track, and, as the results of the careful tests by those from Dover, as well as by the experts sent by the owners of the Light Railway Order from Dover to St. Margaret's and Martin Mill, the directors have made a provisional contract with these gentlemen. Under this contract the syndicate will construct five-eighths of a mile in Dover, and will electrify the remaining 4½ miles. The railway is very strongly backed, and will certainly be brought to a good paying condition. The first portion of the line will be run in direct connection with the tramways of the Dover Corporation, and will bring sailors from the jetty at which they are landed from the fleet, and the men employed for the East Cliff Works of Sir Weetman Pearson & Co. The directors are negotiating other contracts in Great Britain and in other countries, including Holland, Mexico, France and Russia, which they hope to be able to obtain on advantageous terms. One of the directors, Mr. Drummond, was recently in Canada and the United States on a visit extending from the Atlantic to the Pacific, and during the course of that journey he had the opportunity of discussing the principles involved in the system with leading engineers and users. He was able to favourably impress engineering friends with the advantages and economy of the S.P. system, and obtained reasonable business assurances of support in New York, Chicago, Toronto, Winnipeg, the Western Provinces of British Columbia, and the various engineers at those places are awaiting the development of this company to take advantage of and use the S.P. system as soon as this company is prepared to lay before them not only the detailed plans for the special conditions of each place, but the terms upon which these are to be fulfilled. The shareholders will remember that in view of the very recent date of the present patents the position has yet to be made strong and unassailable in these countries; and although there is time in which to ensure the company's safety, yet the directors would urge upon the shareholders the advisability of early action, quite apart from the limit of time at disposal. Mr. Drummond's report to the board is available to any shareholder, and a copy of the same can be seen at the office. These successful results have been achieved by the expenditure of only two-thirds of the working capital of the syndicate, and it is now necessary to make arrangements for the syndicate to construct the Dover line and put itself into a strong financial position. To further this end the directors trust that every shareholder will make a special effort to be present at the meeting."

The capital issued is £5,619.

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

United River Plate Telephone Co. further issue of 30,000 ordinary shares of £5 each, fully and partly (£3) paid, Nos. 120,001 to 150,000 (these are also to be officially quoted); Para Electric Railways and Lighting Co., £700,000 5 per cent. first debenture stock (*ex* all interest paid previous to June 1st, 1909).

Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

New York Telephone Co., Scrip, fully-paid, for £2,000,000 4½ per cent. first and general mortgage 31-year bonds (London issue).

Prospectuses.—*Kerala Rubber Co., Ltd.*—12,000 shares out of an issue of 33,000 shares of £1 each have been offered to the public this week.

Premier Re-Forming Co., Ltd, Rubber Manufacturers.—This company has lately offered for subscription 100,000 shares of £1 each. It has been formed to acquire the British patent, provisional protection for an improvement, and the secrets in connection with a process of manufacturing within the United Kingdom, rubber articles of every description from waste rubber, indistinguishable from ordinary rubber articles.

Chota Rubber Estates, Ltd.—An issue of 270,000 shares of 2s. each have been offered at par.

The Bradwall (F.M.S.) Rubber Estate, Ltd.—45,000 shares of £1 each have been offered for subscription at par.

Malacca Rubber Plantations, Ltd.—An interim dividend of 10 per cent. is to be paid on January 1st for the year 1909 on the ordinary and preference shares. It is stated that the net profits are estimated at £75,000.

Berlin Telephone Co.—According to a financial daily, a dividend of 11 per cent. is to be paid for the financial year just closed. The report states that orders from home and abroad are abundant.

Continental Notes. — Belgium. — La Compagnie d'Electricité d'Ixelles et Extensions, of Ixelles, Brussels, reports a profit for the last financial year of £3,948.

France.—The balance sheet of the Compagnie Générale d'Electricité, of Paris, for the last financial year shows a net profit of £95,365, as compared with only £90,914 in the preceding 12 months. A dividend of 30 francs per share is being declared.

Switzerland.—The Oerlikon Akkumulatorfabrik Gesellschaft, or Zurich, is increasing its capital from £22,000 to £48,000.

Germany.—A company has just been formed at Ludwigsburg with a capital of £125,000, and the title Die Electricitätswerk Beihingen, Bleidelsheim Gesellschaft, to establish a large central electricity generating station for the supply of current for lighting and power purposes in the town and district of Ludwigsburg. The Felten-Guilleaume-Lahmeyer Co., of Frankfort, is interested in the new undertaking.

MARKET QUOTATIONS.

Wednesday, December 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	10/- inc.
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£28 10	£1 inc.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„		..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c „ Tube (brazed)	„	9d.	..
c „ „ (solid drawn)	„	7⅞d.	..
c „ Wire, basis	„	6¾d.	..
c Copper Tubes (brazed)	„	9d.	..
c „ „ (solid drawn	„	9d.	..
g „ Bars (best selected)	per ton	£73	£1 inc.
g „ Sheet	„	£73	£1 inc.
g „ Rod	„	£73	£1 inc.
e „ (Electrolytic) Bars	„	£61	..
e „ „ Sheets	„	£77	..
e „ „ Rod	„	£65 10	..
e „ „ H.C. Wire	per lb.	7⅞d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	7/6½	1½d. inc.
i Iron Pig (Cleveland warrants)	per ton	51/6	11½d. inc.
i „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 10	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
Mercury	per bot.	£9 14	2/- dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£151 10 to £152	£8 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:— "White Ant" brand	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.

Companies to be Struck Off the Register.—The following are to be struck off the register, and accordingly dissolved, unless cause is shown to the contrary within three months:—

Electrical Bleaching Co., Ltd.
Electrical Regulating & Lighting Syndicate, Ltd.
Electrical Supplies, Rubber & Ebonite Co., Ltd.
Electric Lamp Regenerating Co., Ltd.
Electric Railways Co., Ltd.
Electro-Voelker Syndicate, Ltd.
Hillgrove & Armidale Electrical Corporation, Ltd.
McGuire Manufacturing Co., Ltd.
Meyra Electric Co., Ltd.

Canadian General Electric Co.—The directors have declared a dividend of 1¾ per cent. on the common stock for the three months to the 31st inst., being at the rate of 7 per cent. per annum.

Oriental Telephone and Electric Co., Ltd.—The register of transfers of 4 per cent. redeemable debenture stock is closed from December 18th to 31st inst., both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1910.

STOCKS AND SHARES.

Tuesday Afternoon.

NOTWITHSTANDING the holiday influences that make for restraint of Stock Exchange business, there is a reasonable, unseasonable amount of activity in various sections round the House, and the electrical departments are by no means left out in the cold. It is recognised that money will become cheaper in the New Year, and, as usual, the Stock Exchange looks forward with gay optimism to a good time coming, after the turn of the twelvemonth. Investment securities are not easy to buy at low prices, and speculation, especially in rubber shares, is tolerably active, although trade will, of course, diminish each day nearer the holidays.

The death of King Leopold lead to a slight feeling of apprehension amongst certain of the Canadian-Mexican descriptions, which are held to a considerable extent in Belgium. It quickly became apparent that the Belgian proprietors were not to be forced into selling by the death of their ruler, and accordingly, the little spasm of weakness passed away without having much effect.

In the Home Railway market there has been a resumption of the better tone, after some dulness at the latter end of last week. Very fitfully the market begins to attract public interest and public purchases. Brighton Deferred stock is strong on the success of the electrified "Elevated" section. Metropolitans have hardened on account of dividend prospects, and the steady progress of the Metropolitan District encourages buying on the part of those who like a gamble in Home Rails. It would appear, however, as though there were some kind of a "tap" running in the case of Districts, and on balance the Ordinary stock shows no change. Underground Electric Railways Income bonds are 2 points higher, and in spite of the rise they have experienced since their speculative attractions were commented upon in this column, as a speculation they still look not too dear.

City and South London Ordinary rose 1. Central London's are each a point higher. London United Tramways Preference at 45s. show a 5s. fall.

Dealers in the Electricity Supply market report their department as "firm," but Westminsters are the only shares in the list to have any advance to their credit. Other London shares are easier where changes have occurred. Charing Cross Preference and the "City Undertaking" shares are lower. Smithfields again receded after their sharp rise. Edmundson's Preference lost their gain of last week, and Newcastle-on-Tyne shares are easier. The new Rosario Electric issue went extremely well, and the price is 15s. premium.

Mexican Light and Power Common stock is 1½ points down, thanks to the Belgian business; Mexico Trams are down ½, and the 5 per cent. bonds are ½ to the good. Rio Trams at 92 are 1 lower. Sao Paulo remains at 153½. The strongest section in the tramway market is that for Anglo-Argentine issues, both classes of Preference shares and the 4 per cent. Debenture stock being again better, on steady buying on behalf of investors. British Columbia Deferred and Preference stocks are each up a point.

The principal movement in the telegraph market has been a fall of 10s. in Great Northern shares, it being stated that the Governments of Great Britain and Norway will take over one of the company's cables in about a year's time. The market is somewhat perplexed as to what the precise effect of this step is likely to be, and motives of prudence rather than those of selling have led to the price being reduced. Anglo-American Telegraph Deferred has see-sawed a little, but on balance the change is no more than ⅛ up. Eastern Telegraph stocks are strong.

American Telephone and Telegraph capital stock fell a point; the company has declared a quarterly dividend of 2 per cent. National Telephones are better. Mackay Companies' Common and Preference stocks have moved in opposite directions. Marconi's are unaltered at 11s. 3d. middle.

Castner-Kellner shares again improved, and Telegraph Constructions regained their decline of a week ago. Rubber shares are the main objects of interest in the Industrial section. The market in these is strong once more, and the recent weakness caused by the result of the last fortnightly sales has disappeared. Holders can now make quite sure that their shares will in no way disturb a Merry Christmas.

Blackpool, St. Annes and Lytham Tramways Co., Ltd.—The annual meeting was held at the beginning of last week at Blackpool. Although at the beginning of September there was a slight decrease on the year's receipts, the increase on the total year's revenue amounted to £2,299, which was largely due to the aviation meeting. Mr. Blare was re-elected a director of the company.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Dec. 14th.	Closing Quotations Dec. 21st.	Business done week ended Dec. 21st, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	144 —146	147	..	—1	5 9 0
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8¼%	8⅞%	8½%	£3 4s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100½—101½	100 —101	101	100¼	..	5 18 0
3,220,770	Do. do. do. Deferred	Stock	⅜%	1¾%	1 %	8/-	21⅝ — 21⅞	21¾ — 22	21¾	21 5/16	+ ⅛	1 16 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾ — 8¼	7¾ — 8⅛	7 13/16	..	..	4 18 6
2,481,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88½	86½ — 88½	87½	86½	..	4 10 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅜ — 9⅛	8⅜ — 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
60,710l	Direct United States Cable	20	4¼%	4⅝%	4¼%	4¼%	13 — 13½	13 — 13½	..	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100½ —102½	100 —102	100½	..	..	4 7 10
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	132 —135	133 —136	135¾	134	+1	5 2 11
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84½ — 86½	85 — 87	85¾	85	+ ½	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102½	102	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ — 12¼	11¾ — 12¼	12⅛	11 15/16	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103	..	..	3 16 11
900,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ — 10¾ xd	10½ — 10¾	10 9/16	10 3/16	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼ — 13¾	13¼ — 14	13 9/16	13½	..	4 7 8
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	30 — 31	29½ — 30½	29⅞	29½	— ½	5 18 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	13 %	51 — 53	51 — 53	51⅞	..	..	7 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	95 — 97 xd	93 — 95	..	..	—2	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 78 xd	78 — 80	..	..	+2	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	½ — ⅝	½ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾ — ⅞	¾ — ⅞	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ — ⅞	¾ — ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ —108	106½ —108	107¾	107	..	5 11 1
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122 —124	123 —125	123⅞	123⅛	+1	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼ — 11	10½ — 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ — 10⅞	10⅛ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5 7/16 — 5 11/16	5 9/16	5 7/16	+ 1/16	4 8 7
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98½ —100½	99	..	+ ½	3 9 8
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100½ —102½	102⅛	..	+ ½	3 18 1
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ — 1½	1⅜ — 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87½ — 88½	87½ — 89½	..	..	+ ½	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 — 7½	7 — 7½	7 9/16	7	..	5 10 4
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5½ — 5¾	5½ — 5¾	..	..	..	4 6 11
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13½ — 14	13½ — 14	13 15/16	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	104½	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝ — ¾	⅝ — ¾	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾ — 9¼	8¾ — 9¼	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	6 13 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. *	1905.	1906.	1907.	1908.	Closing Quotations Dec. 14th.	Closing Quotations Dec. 21st.	Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4½ — 4¾	4⅝ — 4⅞	95/-	93/1½	+ ⅛	5 2 7
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼ — 4½	4⅜ — 4⅝	90/7½	88/9	+ ⅛	5 8 1
978,230	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	91½ —93	92 — 93½	93¼	92½	+ ½	4 5 7
832,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅝ — 4¾	4⅝ — 4¾	93/9	92/6	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	Nil	½ — 1	½ — 1	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	3½%	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	7 15 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¼ — 3¾	3¼ — 3¾	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	2 %	2½ — 3½	2½ — 3½	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	97 —100	..	..	+1	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	138 —142 xd	139 —143	141½	141	+1	5 11 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	122½	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	108 —111	110¾	..	+1	4 10 1
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 6 2
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝ — 1	⅝ — 1	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅝ — 3	2⅝ — 3	55/7½	..	..	5 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 14 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 — 65	60 — 65	62	61¾	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼ — 6⅝	6¼ — 6⅝	6 13/32	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	50¾	50¼	..	7 18 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 5	4½ — 5	..	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	97/6	95/7½	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	102½	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10 — 10¾	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2¼ — 2	2 5/16 — 2 7/16	49/-	46/-	+ 1/16	5 2 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —10	—102	..	..	..	3 14 1
1,990 690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	62 —	63 — 65	..	..	+1	5 0 0
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 —	85 — 87	86	85⅜	+1	4 12 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	45 — 47	..	..	+1	5 6 5
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1⅛%	31 —	32 — 33	32½	31¾	+1	4 10 0
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	Nil	½ —	½ — 1	..	..	..	Nil
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 —	90 — 98	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Dec. 14th.	Closing Quotations Dec. 21st.	Business done week ended Dec. 21st, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	6 0 0
605,000	Do. do. 6 % Cum. Pref., 1 to 605,000	1	6 %	6 %	6 %	6 %	1 1/32 — 1 5/32	1 1/32 — 1 5/32	..	..	..	5 4 4
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾— 13¾	12¾— 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £6 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	Nil	3/32 — 7/32	3/32 — 7/32	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4⅛%	4⅛%	2½%	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	5/16 — 9/16	5/16 — 9/16	..	..	..	Nil
61,690	Do. do. 7 % Cum. Pref., 1 to 61,690	2	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
2[illegible]0,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10¾	10¼— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12¾	12 — 12¾	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	15¾— 16½	15¾— 16½	16⅜	..	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾ — ⅞	¾ — ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	6 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
699,980	Do. do. 60,008 to 100,000	10	3 %	6 %	3 %	Nil	1½— 2½	1½— 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2¼— 2¾	2 — 2½	41/3	..	— ¼	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	62 — 65	61 — 64	..	..	— 1	6 5 0
5,732,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	½%	38½— 39	39½— 40	39⅞	39	+ ¾	1 5 0
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2⅝%	2¾%	66 — 68	66 — 68	67½	66½	..	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	17¾— 18¼	17¾ — 18¼	18	17¾	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 11/16	19/32 — 11/16	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32 — 3/32	1/32 — 3/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	123½—125½	123 —125	125	123¾	— ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91½— 93½	92⅝	91¾	+ ½	5 6 11
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34 — 35½	34½— 36	35¼	34½	+ ½	5 8 0
140,000l	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	100½—101½	100½—101½	101⅛	100¾	..	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	88 — 89	90	88½	+ ½	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	34 — 36	..	..	+ ½	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	10 %	5 %	¼ — ½	¼ — ½	8/9	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	6 %	1¾— 2¼	1¾— 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4¼— 4	4¼— 4¾	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7 — 7½	— 7½	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
[illegible]0,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3¾— 4¼	3¾— 4½	83/9	78/1½	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼— 4¾	4⅛— 4⅝	..	..	— ⅛	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¼— 4¼	3¾— 4	75/-	..	— ¼	5 0 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅛— 3⅝	3⅛— 3⅝	68/9	66/3	..	6 4 2
175,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4·7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10¼— 10¾	10¼— 10¾	..	..	..	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾— 12¾	11¾— 12¾	..	..	..	4 12 4
400,000l	Do. 5% Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½% 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7½— 8	7½— 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10 11/16	..	..	5 7 10
400,000l	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —108	105 —108	107⅞	107½	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100¾	100	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	Nil	Nil	⅝ — ⅞	½ — ¾	..	..	— ⅛	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	58	..	..	7 10 0
$[illegible],160,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅜	4⅞— 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾— 7¼	6¾— 7¼	7⅛	..	..	5 13 4
$1,676,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	..	5 %	101 —103	101½—103½	102½	..	+ ½	4 16 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4¾— 5⅛	4¾— 5⅛	..	..	..	5 17 1
682,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	94	93	..	4 4 3
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3⅞— 4⅜	3⅞ — 4⅜	85/-	..	..	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	85/-	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000l	Do. 3½ % Mort. Deben. Stock Redem.	Stock	6½%	3½%	6½%	3½%	83½ — 86½	83½— 86½	..	..	..	4 0 11
$[illegible],000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	81 — 83	81 — 83	82¼	..	..	6 0 6
8,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	69½— 71½	68 — 70	69⅝	67½	— 1½	5 0 0
$[illegible],400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	101 —105	101 —105	..	..	..	6 13 4
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	..	5 %	85 — 87	85 — 87	86¼	85⅝	..	5 14 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4½	3¾ - 4¼	..	..	— ¼	2 16 9
167,500	Do. 5 % Pref., 1 to 167,500	5	5 %	5 %	5 %	5 %	4 — 4½	3¾ - 4¼	..	..	— ¼	5 17 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	98 — 100	98 —100	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13¼	12½— 13¼	12¼	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,610	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1½— 1⅝	1½— 1⅝	31/6	30/3	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32— 1 7/32	1 3/32— 1 7/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000l	Do. do. 3½ % Deb. Stock Red.	100	6 %	3½%	6½%	3½%	84 — 88	84 — 88	85½	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1⅝— 2⅛	1½— 2	35/7½	35/-	— ⅛	Nil
35,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜ — ⅞	⅜ — ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼— 1¾	1¼— 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	..	5 %	⅞ — 15/16	⅞ — 15/16	..	..	..	5 6 8
100,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½— 8¾	8½— 9	8 15/16	..	..	5 12 8
[illegible]	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5½	5⅛— 5⅝	5 7/16	..	+ ⅛	4 0 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

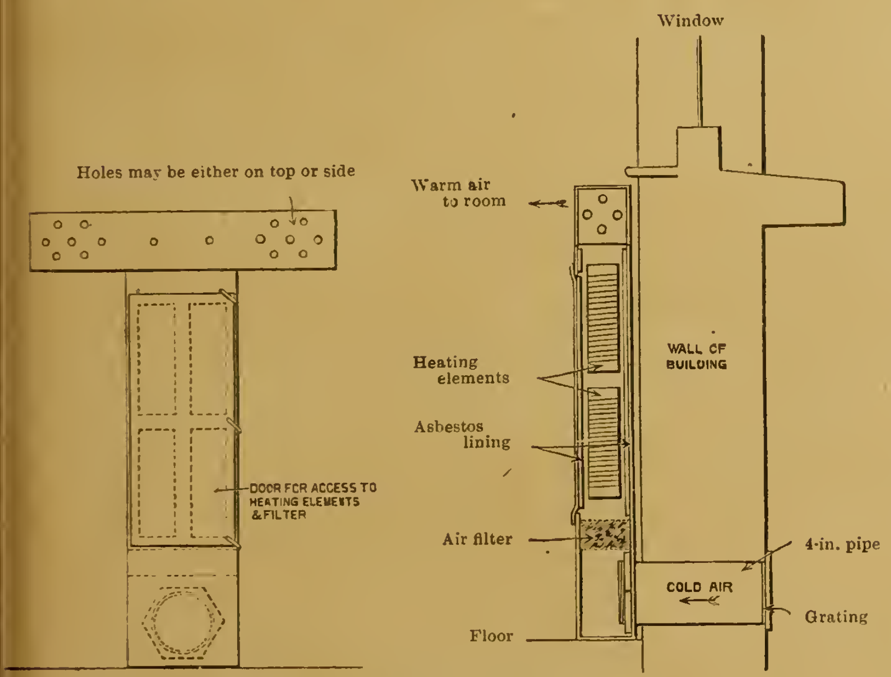
Bank rate of Discount 4½ per cent., December 9th, 1909.

ELECTRIC HEATING AND VENTILATION.

SIMPLE method of heating air for the ventilation of buildings is eing tried by the Westminster Electric Supply Corporation, Ltd. s shown in the accompanying illustrations, a combination of the obin tube and a convector is employed, with or without an air ter. Any electrical heating element may be used, and the appa-tus may be made of any material and any shape. It is intended a permanent fitting, and should preferably be fixed under the indows. The air enters from the outside, and passes through a ter, then through the heating chamber, into the top, and out through oles. The front is either fitted with a door, so that the heating ements may be got at for repairs, or can be arranged so as to allow em to be taken out through the top. The heating chamber is ned with some non-conducting material, such as asbestos, to revent the outside of the chamber getting hot.

Apparatus such as this can be made by anyone, and being inex-ensive, it should appeal to housholders, architects and builders. n calculating the size of heater required for any room, the com-any suggests that 1 watt per cubic foot be allowed. This would enerally give more heat than required if left on, but would be seful for warming up the room quickly. When the room was fficiently warm, one-third or two-thirds of the heat would be nough to maintain the temperature. This apparatus should be specially suitable for London houses, where there is always a ifficulty in opening the windows for ventilation on account of the oise and dirt.

In the pattern to be fitted by the company, there will be three eats, as in most convectors, but this is a matter of detail. Other atters, which can be suited to individual tastes, are the methods f getting at the heating elements and filter, the shape of the top nd arrangement of outlet holes, while some may wish to add a amper, others a baffle plate. The main object is to provide a ystem which is economical both to install and to use, and it is oped this has been achieved. We are indebted for these parti-culars to Mr. L. H. Hordern, the manager.



Electric Heating and Ventilation.

Electric Crane for Lourenço Marques.—We under-stand that the firms who tendered for the contract to supply an electric crane to the Port of Lourenço Marques were:—Dick, Kerr and Co., of London; Cowans, Sheldon & Co., of Carlisle; Ransomes and Rapier, of London; Fried. Krupp, of Magdeburg; and Nagel and Kaemp, of Hamburg. Owing to the manner in which the tenders were drawn up, they could not be compared, and the Director of Port and Railways is giving them a careful study before awarding the contract.—*Commercial Intelligence.*

The Arc Works Benefit Society.—The annual meet-ing of the Arc Works Voluntary Sick Benefit Society was held recently, at which it was shown that the total receipts were £390, and the total expenses £316, leaving £74 for distribution, and a reserve of £101 in the bank. Mr. A. J. Hodgson presided, sup-ported by Mr. Oland Crompton. Messrs. Crompton & Co., Ltd., generously supported the fund. Mr. W. G. Bickmore is secretary of the society.

PROCEEDINGS OF INSTITUTIONS.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. Lepine and A. R. Stelling, Dipl.Ing., Students.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, December 9th*, 1909.)

(*Concluded from page* 999.)

Works and their Systems (Methods in Manufacture).

One is struck when passing through the works of all the four large firms already mentioned by the order and cleanliness which there obtains, though the ventilation leaves much to be desired.

The machinery is most advantageously distributed with regard to light, transport, and the rotation of machinery operations. For instance, in the new shop for building 20,000-kw. sets the scheme is to move stator and rotor along ground and first floor respectively, entering the shop at one end in the rough, and leaving at the other end after testing.

The large machine-erecting shops are also made to serve for advertising purposes in a very effective way. On each large stator or magnet yoke is stencilled its destination and output, so that the visitor or prospective customer is duly impressed in favour of the particular firm as he walks through their shops and finds that his friends or competitors have already placed their orders.

Where narrow and long buildings of four and five storeys are in use, lighting shafts are arranged every 30 ft. or so. The very stringent factory inspection and regulations are responsible for the excellent protective devices on machine tools, these guards being more thorough and efficient than those in the average English works.

Group driving of machines seems to be preferred by most firms, but one of the largest has nothing but independent motor drives.

Each department has its own stores, and the departments are so arranged that a minimum amount of transport is necessary to pass each unit from one stage of manu-facture to the next.

The capital at their disposal has enabled these firms to lay down large numbers of special machines, thereby reducing the time taken in machining and the wages of the machinists. German designers work with a view of adapting their designs to suit their machine tools.

Automatic machinery is largely used, as are also turret lathes, but jig-work does not receive the attention given to it by up-to-date English firms. Large machining plates for portable tools are in evidence. The majority of the machine tools are of American manufacture.

The most striking feature in the works system is the working day. This consists of 18 hours, worked in two shifts of 9 hours each, with ¼-hour intervals in the middle of each shift and half an hour between the two. Thus the shifts are from 7 a.m. to 4.15 p.m., and from 4.45 p.m. to 2 a.m. This system has many great advantages; quick delivery is possible without the necessity of high wages and establishment charges due to overtime and "night shifts," because the rates of pay in the two shifts vary but slightly. Overtime is an unknown quantity, the output per machine tool is doubled, capital charges are consequently reduced, and a larger number of men can be kept in constant employment. We regard this 18-hour day as one of the most important factors of Germany's competitive powers.

The system presents very few technical difficulties in manage-ment; the connection between the shifts can be maintained by means of detailed reports and co-operation between the foremen and charge hands of the respective shifts.

The labour problem in Germany does not present the difficulties that it does in this country, two factors being mainly responsible for this.

The first is the political nature of most of the Trade Unions, these Unions not having arisen as a result of evil conditions in the trades, as was the case in England. When German industries were established, the examples they had from the previous 30 years in England enabled the Government to commence a series of legis-lative measures for the protection of the workman; in this way he was assured the many benefits for which his English brother had had to go through troublous times.

The other factor is the thoughtful legislation on the part of the German Government; the labour question has been tackled in a most scientific way, and measures of great value to the workmen have been made law as a result of thoughtful consideration of the problems arising, without the misery of strikes on the part of the workmen. Strikes there are still, but statistics prove their decrease year by year.

Another important feature in the cheap production is the low rate of wages paid. We have already mentioned the large amount of unskilled labour employed, but even the skilled labourer is paid at an extremely low rate. Thus we find that the average wage for mechanics is 32s., and winders on high-tension stators earn all in all 36s. a week as a maximum. Male winders of small induction motor stators and rotors earn anything up to 30s. a week. Female labour is employed very largely, all the taping of induction motor stators being done by females, as well as the actual winding of small rotors and direct-current armatures. Small coil forming and magnet windings are of course done by girls. We observed girls working turrent lathes, tending automatic machines, testing arc lamps and instruments, and doing many other kinds of work usually done by men in England. We are bound to state that females *can* earn higher wages than those employed in English works, and they possess especial privileges under a very thoughtful legislation.

Piecework is the rule, with the "Kollonnen system" in erecting. This system, under which one man is given finished units, a number of assistants and a fixed sum for the erection, out of which all wages are to be paid, is in vogue in England in the machine-tool trade.

As regards individual workmanship, the German electrical engineering firms do not compare favourably with the English; "deep scratch and high polish," careless and untidy taping and stringing of coils and a lack of finish are too often noticeable in the work of many first-class firms.

General Features and Design of Machinery.

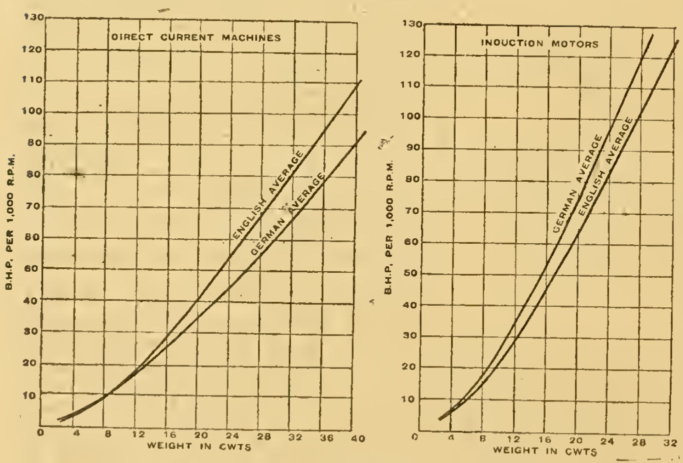
Almost all German firms insist upon the acceptance of their own specifications, and will rarely if ever depart from these. Under this system makers stand or fall by their own designs and productions; they do not suffer the annoyance of petty alterations, and the experience of their experts in each branch enables them to supply an adequate article without having to submit to outside individual ideas. However strict a specification may be, bad workmanship will destroy its object.

Direct current Machines.—The designers differentiate between slow, high and extra-high speed machines, the latter being classed as "turbo-machinery." The line of demarcation between slow and high speeds is 20 m./sec. peripheral speed.

Slow-speed machines are designed with a moderate ratio of iron to copper, and are often fitted with laminated poles. High-speed have a larger ratio of iron to copper, and are often fitted with solid poles, either cast in or cut from a steel billet.

For smaller sizes of motors up to 40 and 50 B.H.P., cast-iron yokes seem popular. On larger sizes cast-in poles find very little favour, the most popular form being laminated poles in a steel yoke.

The practice in winding field coils differs somewhat from the English. Large field coils are wound in three or four layers, with ventilating spaces between the layers. Bare strip for interpole winding has not yet been even experimented with, though varnished wire has become practically universal for small-size interpole coils. Brass bridges between the main pole-tips are used wherever interpoles are fitted.



Figs. 1 and 2.—Comparison of Weights.

Slot insulation varies considerably, but presspahn and micanite on cloth seem to be the most extensively used materials.

Core plates are still insulated by means of thin layers of paper pressed on to the plates. The plates are held together in almost every case by bolts, insulated where they pass through the laminations.

Taken all round, the English direct-current machine shows more modern principles of design, and except for slow-speed haulage motors, with which the Germans are very successful, England is in no way behind as regards design and workmanship.

Fig. 1 shows a set of curves plotted for the purpose of comparison of English and German direct-current motors up to 100 B.H.P., with the horse-power per 1,000 R.P.M. plotted against the weights. The motors were all taken on a 440-volt rating. It will be seen that the average German machines appear to be heavier than the English above 30 B.H.P., but under 30 B.H.P. there is not much difference.

With regard to machines above 100 B.H.P. it was rather difficult to make a comparison, owing to the fact that German makers favour slow-speed machinery, while the tendency in England is towards high speed. This variance is the result of the different engine-makers' standards in the respective countries. The German hig speed machines are built chiefly for belt driving.

Regarding the electrical design, German firms used to desig their machines with very large diameters and short length of cor This practice led to a large ratio of iron to copper in the armature the ratio of 2 7 to 1 often being reached. New designs have bee brought out in which the weights of active iron have been reduce and the ratios of 1·8 to 1 and 2 to 1 are now more prevalent. Th saturation of the teeth is carried high, 24,000 lines per sq. c being a good average maximum density.

The following figures, based upon averages taken from about 3 machines by various makers, may be of interest in comparison wit English practice :—

	German Machines Design Data.			English Machin Design Data.		
Output, KW.	0-10	50	150	4·65	50	1
Output, KW /1,000 R.P.M.	4·5	70	300	4·5	65	3
Amp.-conductors per cm.-periphery	90-110	150-250	200-280	130	180	2
Current density amps./sq. mm.	2·7	2·75	2·8	4·3	3·4	3
Air-gap induction lines/sq. cm.	7,000	7,500	8,000	6,700	6,850	7,2
$\frac{D^2ln \times 10^{-4}}{\text{KW. at 1,000 R.P.M.}}$ in cm. units.	100	50-60	40	86	58	4
$\frac{\text{Armature iron}}{\text{KW. per 1,000 R.P.M.}}$ kg.	4·0	2·0	1·5 slow 1·75 high	3·0	1·6-2·2	1
$\frac{\text{Armature copper}}{\text{KW. per 1,000 R.P.M.}}$ kg.	2 1	1·1	0·75	1·6	0 7 0·75	0
Ratio $\frac{\text{armature iron}}{\text{armature copper}}$	1·9	1·8	2 0 slow 2 3 high	1·9	2 3-2·9	2
Ratio $\frac{\text{total active iron}}{\text{total active copper}}$						
High speed	1·5	1·5-2·0	2·0-3 0	1·3	1 8	1
Slow speed	1·0	1·5-1·8	1 8-2 5			

Note.—Active iron includes poles, pole-shoes, and armature cor but not the magnet yoke. This is done on account of the use cast-iron yokes by German firms.

Induction Motors.—The tendency in the design of this class motor appears to be towards long length of core and small diameter, possibly on account of their frequent use in driving hig speed centrifugal pumps, &c.; forced ventilation is becoming mo popular. German engineers have been the first to recognise th vent ducts through the cores parallel to the axis are more efficie than radial ducts, and have begun to adopt this principle.

The motors are very liberally designed with regard to iron, a most designers give a larger ratio of iron to copper than English practice. This applies to inactive as well as active iro there are large spaces between stator core and stator case, a there seems plenty of room for the end windings inside the e plates.

The stator windings of small motors are usually of the threaded through type in closed insulating troughs, semi-enclosed slo being invariably used. Steel rods are used to fill out the trough when winding. All the taping is female labour, and is very oft slovenly. It comes as a shock to an English engineer to see th primitive formers and methods in winding in vogue in Germa works.

Large rotors are often wound with closed circuits as distinc from "squirrel-cage," and rotors are designed with one bar p slot connected in 3, 5, 7, or 11 phases, according to size. Sli rings are almost always gun-metal, held on insulated rods, wi copper gauze brushes as a general rule. They are arranged betwe rotor and bearing as standard practice, and are usually fitted with short-circuiting and brush-lifting device.

The terminals appear to have been very carefully designed, a are arranged on the stator core in a hole cored out of the stat case; this is covered as a standard practice with perforated zi and the whole presents a very neat finish.

Altogether we are more favourably impressed by German indu tion motors than by direct-current motors, though English desig are in no way behind those of Germany.

In fig. 2 we give a curve of weights against outputs of Germa and English induction motors.

Below some design data are given of German motors; the figur are taken from standard machines of latest design. For the purpo of comparison we give a table of data taken from up-to-dat English motors, which are lighter than the average :—

	German Design Data.			English Design Data.		
Output, H.P.	25	52	150	25	60	1
Output, H.P. at 1,000 R.P.M.	25	80	200	25	80	2
Amp.-conductors per cm.-periphery	217	220	200	225	245	2
Air-gap induction, lines/sq. cm.	5,400	5,600	5,770	4,400	4,700	4,8
$\frac{\text{Core-length}}{\text{Pole-pitch}}$	0 96	1·18	0 98	0·84	0·94	0
$\frac{D^2l\,n\,10^{-4}}{\text{H.P. per 1,000 R.P.M.}}$ in cm. units	65·5	53 5	53 0	100	70	
$\frac{\text{Kg. iron}}{\text{H.P. at 1,000 R.P.M.}}$	8	4·5	3 3	7	3·5	2
$\frac{\text{Kg. copper}}{\text{H.P. at 1,000 R.P.M.}}$	2·4	1·36	1·15	2·4	1·5	1
Ratio $\frac{\text{active iron}}{\text{active copper}}$	3·3	3·3	2·85	2 95	2·35	

Alternating-Current Generators.—Owing to the frequent use long-distance transmission and "overland" central stations, the is a larger demand for high-tension alternators than in Englan and manufacturers have consequently gained large experience the design of this class of machine. Here again are noticed t long cores and small diameters, and the axial ventilating duct The air-space between stator core and case is very large.

In the design of rotating fields many variations are noticeab For high-speed alternators the hub is built up of forged slabs 3 i thick, into which the poles are dovetailed. In some cases the pol d hub are built up of slabs, pole-shoes being dovetailed on, and windings held in place by special rings and wedges. In one eresting case, that of an 8-pole alternator 8 or 9 ft. in diameter, whole magnet, yoke, poles, and pole-shoes are formed of slabs cut m solid forgings to the required shape. Grooves 2¼ in. wide are lled along the pole-faces, that is to say, one groove in each slab. this groove laminations are placed whose outer radius is eccentric the stator bore.

The field windings are made as follows:—Copper strip is wound edge on a mandrel so designed that the turns are too long in the is parallel to the shaft. The turns are cut forming two U-shaped eces, and are then placed on the pole (which has been packed th insulation to the exact shape required), alternately with eets of insulation in such a manner that one end of each of two jacent coils overlaps the other without insulation, the pressure ing sufficient to give good contact. Thus a complete circuit is rmed. The coils are pressed against the pole-tips by means of edges, and V-shaped pieces between the poles take up the comnent of the centrifugal force which would tend to pull the coils art. The whole forms a remarkably solid and simple job.

The wire for the high-tension windings, and indeed for all large achines, is baked thoroughly before using, and kept in a warm y storeroom until required. Mica on cloth forms the chief slot sulation, the layers of conductors in high-tension work being ound in separate tubes arranged in the mica trough.

The practice as regards impregnating varies considerably. Wire pregnated before using is rarely employed; in most cases the hole stator is dipped and baked, but on large machines with pen slots the practice is to impregnate and insulate the coils efore placing them in the stator, and we have seen coils wound position taken out to be insulated and impregnated, and then placed. One firm tapes up the coils with a coarse tape which has een previously treated with some bituminous compound. The sult is a particularly porous article, but one which lends itself to ery thorough impregnation and varnishing.

The taping is done by females; it has been found quite practiable to have both men and women working together on big achines, the men winding and the women taping.

On the whole, we are not favourably impressed by the insulation f the end connections of the stator winding, but the ample space hich designers allow for their windings forms their factor of afety.

Forced ventilation of alternators is rapidly being adopted, and he axial cooling ducts already described are becoming almost niversal in their use. The stator plates are invariably held by eans of bolts arranged outside the magnetic circuit. Until recently akers did not make a standard line of medium-speed alternators or large outputs, slow-speed machines for coupling to slow-speed team or gas engines and high-speed machines for coupling to water nd steam turbines being the rule.

The exciters are specially designed, and for direct-coupled units re fitted with an abnormally large number of poles for their output. ompounding of alternators is carried out by all firms, even on edium-sized units.

Turbo-alternators.—No stator cases are made split on the orizontal centre line now, and, further, all large units are so rranged that the hot air from the stator is not delivered into the ngine house, but is driven outside the building. Stator plates are eld together by bolts, and are arranged with axial ventilation ucts. The winding of the stator coils is done by hand by most akers, the only formers for winding the end connections being the supporting clamps themselves.

The winding is otherwise the same as on slow-speed alternators, except that we did not see female labour employed here.

There are several interesting types of rotor construction; each firm has its own design.

Rotor by Firm A.—The rotor is cylindrical, with a distributed winding. The hub or core is one solid forging with the shaft, to which the teeth are attached as follows:—The teeth are built up of stampings in packets of about 6 in. length, so arranged that there is a clear space through from top to bottom on the middle 2 in. The packets are riveted together, and after being ground to size the rivet heads project about ¼ in. outside the packet, so that when the packets are placed together on the core a vent space of about ½ in. is formed.

The excitation coils are former wound, and while subjected to pressure each coil is enclosed in a metal casing which is soldered up, thus rendering the coils watertight (*i.e.*, non-hygroscopic) and affording excellent mechanical protection. The coils are laid on the core and the teeth packets slid into position on either side of the coils. These teeth slide in grooves milled out along the core, the grooves being deep enough to permit a current of air to pass under the teeth to the vent spaces. The coil ends are bound down to the core body by means of banding wire wound on by a special machine under tension. Over the first banding comes a bronze sleeve, and another banding on top of that. Copper wedges are driven over the windings in the slots, and steel wedges are arranged in the empty slots to take up lateral pressure. These wedges when driven in press down the coils into the core with a pressure greater than the maximum pull due to centrifugal force, and they also press the teeth packets against the grooves in the core so as to form good magnetic contact. The bronze sleeve short-circuits the copper wedges, which form amortisseurs.

Rotor by Firm B.—The core of this rotor is built up of steel plates with the slots already punched in. These slots are unequal in width and unequally spaced, the spacing being so arranged as to give the desired flux distribution curve without having any empty slots. In cases of large outputs the whole rotor is forged out of the solid and the slots milled out. In this case the slot is very deep, with a shoulder half-way down on which a metal lining rests to support the winding. The lower half of the slot thus forms an air channel directly under the winding. The coils are wound on the rotor, each coil being separated from the following one by aluminium packing pieces. Pressspahn slot insulation is used, and the coil in one slot is wound in layers, the layers being kept separate by a special compound put on hot. In addition to the aluminium packing there are L-shaped steel plates, the lower limb of the L fitting in grooves turned in the rotor hub. The interstices are all filled with compound, and a bronze ring is shrunk on over all.

Rotor by Firm C.—This firm adopts salient pole rotors from four-pole upwards. They are usually built up of steel slabs (forged) approximately 3 in. thick, with forged-steel pole-piece slabs dovetailed into the hub. The windings are of copper strip wound on edge and insulated with pressspahn. Bronze angle-pieces hold the ends of the winding, and V-shaped packing pieces hold the coils in place laterally. The ventilation is through holes drilled in the slabs.

All rotors are dynamically balanced at a speed of about 50 per cent. above normal.

Exciters are specially designed, and in almost every case their armatures are carried by the extension of the rotor shaft without there being any additional bearings.

Steel slip-rings shrunk on over mica are used in conjunction with one carbon and two copper brushes to each ring. Standard practice is to arrange one ring at each end.

Turbo-Generators for Direct Current.—There is much less demand for this type of machine, and the principal variations from English practice which we observed are in the ventilation of the armature. Here again the axial ducts are used, as many as three rows being arranged concentrically. Field frames are usually built up of stampings. To avoid the use of very long commutators, these are now made in two halves and connected together.

Scientific Experimental Work in Factories.

Referring to the development of engineering since 1872, when Germany began her career as a Great Power, one finds that time and time again the Germans have taken up some design of an English engineer, and after a thorough investigation have devised important improvements. It is this thorough system of scientific investigation and experimental work that has enabled German firms to attain otherwise inaccessible eminence in certain branches.

There are several striking examples of this; perhaps the best known is the experimental high-speed railway, near Berlin, between Marienfeld and Zossen. Another example is the important series of investigations carried out on mining motors, a series with far-reaching results.

Less well known is the important test of the effect of heat and age on insulating materials carried out by one of the large firms. Samples of all kinds of insulation were kept at a constant temperature of nearly 100° C. for one year, some being kept under pressure. This experiment was of the utmost value to the firm concerned, but no results have yet been made public.

A considerable amount of plant has been laid down for experimental and special testing purposes, among the most recent being a water brake of 8,000 h.p. for testing steamship turbines at one works, and a wireless telegraph station at another works.

As an example of the application of scientific method to works practice may be cited the dynamic balancing of all rotors and armatures of high or extra-high peripheral speeds, as well as of all large size rotating parts while in the building-up stage.

Of course capital is required for these experiments; but as the German engineers are so well trained theoretically, and the German firms willing to employ them, the capital is rarely expended without some tangible profit. It is due also to these experiments that they are able to cope with special circumstances, and are able to train the experts referred to in the earlier portion of the paper.

They have proved to the satisfaction of their financial supporters that money spent on careful experiments in the hands of capable well-trained men is capital well invested, and we would like here to insert a plea for the further recognition and better payment of the specialist in our own country.

Conclusion.—We have carefully avoided mentioning, as far as possible, anything relating to the other important branches of the electrical industry in Germany, since a separate paper could be easily written on the management, manufacture and design in each individual branch. The majority of our general remarks, however, apply equally well to other branches, viz., switchgear, instruments, lamp and cable manufacture. It has been attempted in this paper to give a brief survey of the German industry in the manufacture of dynamo-electric machinery, with the idea of investigating the factors of German makers' success, both in the German and the open market. Summarised briefly, we have, first of all, their commercial enterprise, including good general management, close study given to any scheme or undertaking, and the judging of each one on its own merits; secondly, their large capital and the backing-up given them financially by the all-important banks. The large capital at their disposal assists them in their own country, and obtains for them good credit in foreign markets.

Coming to the manufacturing side of the industry, we consider the two shift system, together with cheap labour and the thorough system of specialising, the most important factors in competition. In design, England is in no way behind; in fact, in several cases, the English designers are more far-seeing, and their designs more practical than those of their German competitors.

If the English financiers and commercial leaders of the electrical industry were as enterprising and as successful as their German rivals, English manufacturers, supported as they are by the superiority of their productions, would not have to fear German competition in the open market.

The discussion was opened by Mr. Emile Garcke, who said the importance of the subject only admitted of plain speaking.

The authors rightly emphasised the importance of the German financial conditions, but they did not take cognisance of all the facts; the last paragraph in the paper could not pass without criticism, as the views expressed there were not justified without further evidence. He (the speaker) unhesitatingly said that British commercial men were as enterprising as any, but they lacked profits and organisation. Despite low costs of production, they could not make sufficient profit to enable them to compete with protected countries. Importation would be on an even larger scale if it did not have the effect of reducing prices to an unremunerative level. English manufacturers could not offer enterprise a sufficient reward, and so could not command fresh capital. He had been instrumental in introducing many millions of capital into the electrical industry, and it was quite unnecessary to demonstrate that the profits were too low—the figures were published. Organisation was necessary to progress, and he blamed the Institution for devoting so much time to scientific discussion, to the neglect of legislative and commercial matters. We had no organisation which could speak for the whole industry on legislative and financial matters, and in urging that the I.E.E. should devote more time to these, he appealed to the President for assistance in this direction during his period of office. Scientific and commercial matters were closely allied, and they must be considered together.

The President (Dr. Kapp) warned members not to introduce politics into the discussion, remarking that the Institution was a technical and scientific body.

Mr. W. Rutherford (Dick. Kerr & Co.) intimated that he would not speak, in view of Mr. Garcke having said all that he had intended to say, and of the President's remarks.

Prof. S. P. Thompson thought it would require a lengthy experience in a foreign country to enable one to discriminate as to novelties; he was inclined to think that many things noticed could be attributed to natural development. The two-shift day and no overtime must make an enormous difference in favour of the German manufacturer, but it was probable that the industrial conditions were not the same all over Germany. It did not appear possible to state conditions *en bloc*, and so it was possible to draw incorrect conclusions from a perfectly true statement. Some years ago he had pointed out that manufactures were a reflex of the conditions under which they were produced. We had had to grow our electrical manufactures in the face of the opposition of commercial and industrial men, who ought to have known better. He regretted that there was a tendency in this country to regard the theoretical and scientific work of the factory as unproductive labour.

Mr. J. S. Raworth said that he had read the conclusion of the paper first of all, and did not agree with it. In the early days he had been associated with Mr. Garcke, who had been accused of making a political speech, although he (the speaker) did not know how it could be avoided. Speaking of the English electrical industry in the early eighties, he said that they went to Germany and installed the first electric street lighting; they also equipped a cotton mill and installed 1,260 lamps at the Vienna Opera House, among other work, and yet they were accused of being unenterprising. It looked then as if Germany would offer great opportunities to British engineers, but the German tariff had altered all that. Contrary to the authors' statements, the German banks were father and mother to the works. The Germans had brains, cheap labour and protection, and were able to build up big businesses.

Mr. A. A. Campbell Swinton said the Institution was to be congratulated on its first commercial paper, which appealed to him. He was rather struck by the President's remark on the previous night that we were "not behind Germany." This was scientifically correct, but the instance mentioned, that we supplied electricity at a less price, had no connection; if we made it cheaper, there might be something in it. The real criterion was our ability or inability to make profits. Searching for reasons for our inability to make fair profits, he suggested that the Board of Trade returns gave too much publicity to costs, which were not disclosed in other commercial concerns. Further, to his mind, a most important factor was the insidious form of Socialism known as municipal trading. The municipalities set the pace as regards costs, and they could borrow money very cheaply, which, although good for the consumer, was not so for the supplier. He could not see the good of enterprise when there were no profits and it was, therefore, not possible to raise capital. Additional capital subscribed to the municipal electrical industry was buried under "Municipal stock," which, as far as the investor was concerned, might be for gas or sewers, and he thought that if people knew of the success of electrically-invested capital they would come forward. Newcastle-on-Tyne, he pointed out, had always been served by companies, and its success was well known; it was an electrical centre, and capital was always obtainable for developments.

Mr. W. M. Mordey expressed the view that the only safe course for the Institution was to confine itself to engineering and science, and to avoid financial questions, except in so far as they were engineering and not political questions. Of course, profit-making was a branch of engineering, but the Institution must not allow itself to be made a trade protection society. He thought manufacturing, in some branches, had been unprofitable, because capitalists had put up too many factories, and although there was a great deal of work, there was not enough for all at remunerative prices. It was not correct to state that the Institution had not taken action in connection with the recent legislation. Although it had not advertised the fact, it had had a committee working at the subject, and had sent a deputation of the Council to the Board of Trade. He did not believe in the charge of lack of initiative in this country, and thought the difficulty of getting financial support for electrical enterprises was mostly felt by those whose work had been unsuccessful.

Mr. T. Rich asked why it was that in the case of, say, the Victoria Falls scheme our engineers had had to stand aside. A matter such as this was decided between financiers before the technical men got a look in. The fact was the English engineer had no one to back him up, although he would succeed as well as any engineer, if supported. We found, however, that Chicago, Buenos Ayres and Yokohama were nearer to the London money market than the English electrical industry. The backwardness of our development, as compared with Germany, was largely due to British legislation, which favoured obstructive tactics and unnecessary expense.

Mr. A. R. Stelling, in reply, said that the English manufacturer would not study local conditions, and English agents frequently relied on a good name, while the German went after the work. English firms did not maintain adequate staffs in foreign countries; he knew of one German firm which had a staff of 14 in China. German progress was very marked in India, where their trade had increased 50 per cent. in value during the past year. In Germany it was illegal to issue shares of a less value than £50, and this, of course, tended to keep out the smaller capitalist, leaving the business in the hands of the wealthy. During the past year the Germans had all complained of the effects of restrictive legislature, but despite this had paid higher dividends, and he thought this could only point to expanding trade abroad. In no other country in the world was there such a collection of foreign manufacturing firms as in Britain, and these firms were responsible for the undercutting of prices.

The Present Aspect of Electric Lighting.

The paper on this subject by Messrs. Handcock and Dykes (Electrical Review, December 3rd. p. 912), and a paper on "Metallic-Filament Lamps," by Mr. F. H. Lavender, M.Sc., were read at the meeting of the Birmingham Local Section of the Institution of Electrical Engineers on December 1st, and were discussed together. An abstract of the latter paper will appear in our next issue.

Dr. Sumpner said it was not only of importance to know that a lamp was at its best efficiency at one particular voltage, but also to know how far one could go from that figure before any serious change in efficiency took place. So also with regard to the most economical life, which was given as 1,500 hours. With carbon lamps the efficiency fell off considerably and the smashing point was fairly well defined, but with metal-filament lamps the efficiency was much more nearly constant, and, in fact, the best thing to do was to run them until they broke.

Mr. Maurice Solomon agreed with Dr. Sumpner that the curves showing the economical life did not give much information because they did not bring out clearly the difference it made whether the economical life were exceeded or not. There was another disadvantage—that they arrived at a conclusion which it was impossible to carry out in practice. There were two natural limits which determined the running limit in practice. One was the lamp breaking, and the other was the candle-power falling till it was no longer sufficient for the purpose for which it was required. Such considerations gave something like double the economical life as calculated by curves like those in the paper. Most of the curves in the paper represented the results obtained on a single lamp, but some of the curves given showed that the results obtained with lamps of the same make varied very widely in practice. The curves showed that makers for the most part rated their lamps very closely to the point giving the best results. It was very desirable that a uniform system of plotting such curves should be adopted. To enable comparison to be easily made, the percentage variation in candle-power should be plotted and not the actual variation.

Mr. Lindsay Forster said that a large amount of space had been given to the tantalum lamp as compared to the tungsten, but he thought that there were differences between the various makes of tungsten lamps which should have been brought out. The wire lamp would be a great factor in popularising the electric light.

Mr. R. Orsettich said that the small consumer who used the penny-in-the-slot system for his gas would not be in a position to pay 15s. or 20s. all at once for his electric light per quarter. So long as he only used three or four lamps he would prefer to go on using the light which he could buy with his pennies. In the case of a better class of consumer with 10 or 15 lamps, he could not agree with the statement that 80 per cent of these lamps came on at the worst time; the figure would be nearly 35 per cent. The present price charged by some stations could not possibly pay. From his experience, between 4d. and 4½d. should be charged. It would be impossible for a consumer with 10 or 15 lamps to pay at the rate of 12s. each. At present the charge in Aston worked out at something like 3s. per lamp per year, without taking into account the lamp itself; assuming the life to be 1,500 hours the lamp would last three years. Another disadvantage would be that it would handicap the extension of lighting in any house. The position of central stations was very unfavourable at the present time. His view was that before canvassing the consumer who used only three or four lights there was plenty of scope for those who would put down 10 or 15 lamps, and these consumers would not come upon the station up to the 80 per cent. limit at the worst moment. He considered that the question of canvassing had not been properly tackled, and there was a very large scope for electricity in other directions besides light.

Mr. A. G. Needham noticed that the candle-power of the lamps rose at first. The aim of the maker usually was to get as near the maximum as possible before he sent the lamp out, and to do this most makers aged their lamps considerably. The irregularities shown in the curves were much more likely to be due to changes of measurements than to variations in candle-power. Manufacturers rated their lamps at the best point in order to obtain long life.

The **Chairman** (Mr. M. Railing) remarked that his experience had been that the metal-filament lamp had helped to extend and increase the output in certain stations. To his mind, the problem was not so much to get an increased price from consumers as to get more of them, and that was a matter in which manufacturers should be able to help the station engineers by supplying a small candle-power lamp.

Mr. R. Milne gave some figures with regard to the electricity department's revenue in Birmingham. The growth of revenue in regard to sales had been as follows: In one year they had a 5 per cent. increase, the next year 10 per cent., the next year about 17 per cent., and this year about 27 per cent. They must also remember that, even if there was only a small increase in current, there was a much larger increase in candle-power. In connection with the first paper, some allowance should be made for the voltage variation on town mains. They found, in the centre of the town, where the consumer was near to the central station, that it was advisable to put in 240 or 235-volt lamps, while on the outskirts 230-volt lamps had to be employed. Some of these new lamps were wrongly marked by the makers. A consumer recently complained of the premature failure of his lamp, so they got a dozen he had just purchased from the maker and tested them. They were all marked 110 volts, but they found that if they had been correctly marked, the voltage should have ranged from 87 to 114. Some years ago he had tried the contract system on a block of small houses, charging 6d. a week in summer, and 1s. a week in winter. Each house contained five lights, and the revenue from the current supplied worked out at something like 1½d. per unit. They had experimented in Birmingham on the lighting of small houses with prepayment meters. After about eight months' running, the consumers were quite satisfied. They charged 5d. per unit, which covered service charges, meter rent and cost of current. The consumer was satisfied, because he got a better light than previously with a 60-c.p. gas mantle, and the cost of current was lower than the cost of gas for the same light. The great thing with these small houses was to get paid in advance. If they let a man run for over two weeks, it meant a moonlight flit, and he usually took the lamps with him when he went.

Mr. Fennell (Wednesbury) thought that station engineers became unduly alarmed if their revenue for one year showed signs of coming down. He thought that they ought to be prepared to experience one or two lean years, because they were on the threshold of an enormous boom. He had prepared figures taking the output of the last Saturday in November for the past five years; in 1904-5 there was a considerable increase, in 1906 not a very large increase, in 1907 a considerable increase, 1908 was lower than 1907, and in 1909 the peak was just double that of 1908. There was one class of long-hour consumer hitherto neglected who could profitably be approached, *i.e.*, the big brewery companies; these were now seriously considering the adoption of electricity for lighting throughout their houses. During the last week he had fixed up with one company for two houses and with another for three, and they had several other cases where they were giving supplies with very good results. The contract system rather departed from the Englishman's idea of business, as he was used to buying by measure. To tell people to buy at so much per year conflicted with their ideas of justice, and would create, especially in small towns, a great deal of dissatisfaction. The short-hour consumer would have a grievance against the long-hour consumer. They had fairly good meters and could buy them cheaply—really 10s. 6d. for a meter was not a serious matter. The complication of meters and the work involved would be nothing to the complication of the system of house-to-house-visits that would be required.

Mr. Handcock, in reply, pointed out that the system advocated in his paper had already been fully tried in connection with water supply, and as regarded electric light, it had been in use for some little time past at Harrogate, and some other places. At Harrogate it was so successful that its use was being rapidly extended. The consumers appreciated it, and the station found it paid. As regarded putting in higher candle-power lamps than those originally fitted, that was stealing electricity, which was a felony, and could be guarded against by the use of special sockets and lamps. They contended that the long-hour consumer had grave cause for complaint against the electric light undertakings, who were taking a profit from him that was absolutely unjustified. Station engineers ought to be honest with the long-hour consumer, and as soon as he paid anything like 12s. a light or more, they ought to offer him a supply on a contract basis, or give him something in reasonable proportion to the aid he gave the station. The Board of Trade Returns showed that the gas profits were not made from the big consumers; the average yield per gas consumer was somewhere in the neighbourhood of £5. If the gas undertaking looked to the small consumer for its profits, he thought that they should look in that direction also. He knew of one or two cases where the lighting charge was collected with the rent, an arrangement which had several advantages. Although some stations had maintained their normal output in spite of the introduction of the metal-filament lamp with its increased standard of illumination, there were very many which had suffered a slight setback. On the other hand, they all realised that the setback was only a temporary one. He would be glad if Mr. Fennell could give some information as to the effect of the metal-filament lamps' load not only on the magnitude, but also on the shape of the peaks; in some cases they had found that the peaks had diminished, in others they had increased, but the output did not increase in proportion to the maximum load.

Mr. Fennell remarked that in his case the effect had been to flatten the curves, owing to the long-hour consumers they had been able to obtain.

THE ELECTRIC LIGHTING ACT, 1909.

The terms of this Act, which comes into force in April next, are as follows:—

1.—(1) The Board of Trade may by Provisional Order authorise any local authority, company, or person, who is authorised by the same or any previous Provisional Order or by Act of Parliament to supply electricity in any area, to acquire compulsorily, or to use, for the purpose of a generating station any land specified in the Order, whether situated within or without the area of supply, and, in the case of a local authority, whether situated within or without their district.

2. For the purpose of the acquisition of land authorised to be taken compulsorily under any such Provisional Order, the provisions of the Lands Clauses Acts which relate to the purchase and taking of lands otherwise than by agreement, and to the entry upon lands by the promoters of the undertaking, are, subject to the modifications set out in the First Schedule to this Act, incorporated with the Electric Lighting Acts, as well as the provisions of those Acts already so incorporated by the Electric Lighting Act, 1882.

3. Rules made by the Board of Trade under Sec. 5 of the Electric Lighting Act, 1882, shall provide for proper notice being given of an application for a Provisional Order, by which it is proposed to authorise the compulsory acquisition or use of land for the purpose of a generating station, to owners, lessees, and occupiers of land, and also for public notice being given of the proposal by advertisement.

2. It shall not be lawful for any undertakers after the passing of this Act, except with the consent of the Board of Trade, to construct any generating station on any land acquired by them after March 31st, 1909, unless the construction is authorised and the land is specified in a special Act or Provisional Order, and the Board of Trade shall not in any case give such consent until notice has been given, by advertisement or otherwise, as the Board of Trade may direct, to the local authority of the district in which the land is situate, and to owners and lessees of land situate within three hundred yards of the land upon which the generating station is to be constructed, and an opportunity has been given to such local authority, owners, and lessees, of stating any objections they may have thereto.

This section shall not apply to any station for transforming, converting, or distributing electrical energy.

3. For the purpose of enabling electricity to be brought into an area of supply from a generating station belonging to any undertakers situated outside that area, the Board of Trade may by Provisional Order apply to any roads, railways, or tramways situated outside that area the provisions of the Electric Lighting Acts which authorise, or enable the Board of Trade to authorise, the breaking up of any road, railway, or tramway, so far as those provisions do not already so apply:

Provided that a Provisional Order authorising the breaking up of roads outside the area of supply shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade, in any case in which the consent of any such local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the grounds on which they have dispensed with the consent.

4.—(1) The Board of Trade, unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by private Bill, may by Provisional Order—

(*a*) authorise any local authority or company to supply electricity in bulk;

(*b*) provide for any supply so authorised being compulsory; and

(*c*) make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a local authority or company are authorised to supply electricity in bulk, including the application to roads, railways, and tramways along the route along which lines are authorised to be laid for the purpose of giving the supply in bulk of the provisions of those Acts which authorise or enable the Board of Trade to authorise the breaking up of any road, railway, or tramway:

Provided that a Provisional Order authorising the breaking up of roads outside the area of supply of the local authority or company by whom the supply is to be given shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade, in any case in which the consent of any such local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the ground on which they have dispensed with the consent.

2. If the Board of Trade refuse to grant a Provisional Order under this section, on the ground that the matter ought to be dealt with by a private Bill, the notices published and served for the purposes of the proposed Order shall, subject to the Standing

Orders, be held to have been published and served for a private Bill applying for similar powers:

Provided that the applicants for the Order shall, by notice served in the prescribed manner and within the prescribed time, inform all opponents of their intention to proceed by way of private Bill, and, subject to Standing Orders, the application for a Provisional Order shall be deemed and taken to be a petition for leave to bring in a private Bill, and the applicants shall also give such additional notice (if any) as may be required by Standing Orders.

3. The Board of Trade may, if they think fit, by order permit any undertakers to supply electricity in bulk to any other undertakers upon such terms and subject to such conditions as may be specified in the order, if the supply can be given without breaking up any streets except such as the undertakers giving, or the undertakers receiving, the supply are authorised to break up; but the Board of Trade shall not in any case make such an order until notice of the intention to make the order has been given by advertisement or otherwise as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected, of stating any objections he may have thereto.

5.—(1) Any local authority, company, or person authorised to supply electricity in any area may, with the consent of the Board of Trade, supply at any point within that area electricity for the purposes of haulage or traction on any railway, tramway, or canal situate partly within and partly without that area, and for the purposes of lighting vehicles and vessels used on any such railway, tramway, or canal; but the Board of Trade shall not in any case give any such consent until notice of the application for the consent has been given by advertisement or otherwise in such manner as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected of stating any objections he may have thereto.

2. The Board of Trade may, by Provisional Order, authorise any such local authority, company, or person so to supply electricity to be used for purposes incidental to the working or lighting of the railway, tramway, or canal, other than the purposes aforesaid.

3. A company, local authority or body receiving a supply of electricity under this section shall not use the electricity in such manner as to cause, or to be likely to cause, any interference with Government observatories or laboratories, or observatories or laboratories now or hereafter erected, owned, or managed in pursuance of any present or future statutory enactment, but this sub-section shall not apply to any such company, local authority, or body who, by any Act of Parliament or Order confirmed by or having the effect of an Act of Parliament containing provisions for the protection of such observatories or laboratories, are authorised to use electricity for the purposes for which a supply is authorised to be given under this section.

6.—(1) Where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may if the local authority within whose district the premises are situate, and the undertakers (if any) authorised to supply electricity to such premises, consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit:

Provided that, if in the opinion of the Board of Trade any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given.

2. An order given by the Board of Trade under this section may, for the purpose of enabling a supply to be given thereunder, confer any such powers and impose any such duties on the undertakers as would have been conferred or imposed by the Electric Lighting Acts, and as might have been conferred or imposed by Provisional Order if the premises and the route along which lines are to be laid for the purpose of giving the supply were within the area of supply of the undertakers, anything in the special Act or Order relating to the undertaking to the contrary notwithstanding.

3. If the undertakers on whom powers are conferred by an order under this section are not a local authority, the works and lines erected and laid under the powers so conferred shall, so long as the order remains in force, be deemed, for the purposes of the provisions as to purchase applicable to the undertaking, to form part of the undertaking within the district of the local authority which comprises the area of supply of the undertakers, or, if that area is comprised within the districts of more than one local authority, within such of those districts as the Board of Trade may determine.

4. Nothing in this section shall enable the Board of Trade, without the consent of the undertakers within whose area of supply the premises are situate, to give such permission as aforesaid to any undertakers where the last-mentioned undertakers are by any Act of Parliament specifically prohibited from supplying electricity within the area of the first-mentioned undertakers.

7.—(1) Where any generating station, mains, or other works of a company used solely for supplying electricity within the district of a local authority are situated outside the district of that local authority, the generating station, mains, and other works so used shall for the purposes of the provisions of the Electric Lighting Acts, and any Provisional Order conferring on local authorities power to purchase undertakings, be deemed to be situated within the district of that local authority, and, where any generating station, mains, and other works are used solely for supplying electricity within the districts of two or more local authorities, but are not situated within any of those districts, the Board of Trade may, on the application of all or any of those authorities, by Provisional Order apply this provision subject to such adaptations as the circumstances of the case may require:

Provided that this sub-section shall not, except by agreement between the local authority and the company concerned, apply to any generating station, mains, or other works authorised by a special Act passed before the passing of this Act.

2. Any local authority having power under the Electric Lighting Acts or any Provisional Order to purchase so much of the undertaking of a company as is within the district of that local authority may, with the consent of and upon such terms and conditions as may be approved by the Board of Trade, and, in the case of an undertaking authorised before the commencement of this Act, with the consent of the company, transfer their rights of purchase to any other local authority having power to purchase so much of the same undertaking as is within the district of that last-mentioned local authority, and the deed of transfer may contain such consequential provisions as may be necessary for giving effect to the transfer.

8. The Board of Trade may, with the concurrence of the Local Government Board, by Provisional Order make such provisions as appear to them necessary or expedient, by the constitution of a joint committee or joint board or otherwise, for the joint exercise of all or any of the powers under the Electric Lighting Acts, or this Act, or any Provisional Order, by two or more local authorities as respects any area of supply consisting of the whole or parts of the districts of those authorities, in any case where it appears to them that the joint exercise of those powers would be expedient, and any such Provisional Order may contain such provisions as may appear necessary or proper for adapting any of the provisions of the Electric Lighting Acts, or this Act, or any such Provisional Order, to the case of any committee or board so constituted.

9. The Board of Trade may grant a Provisional Order notwithstanding that the notice required by section four of the Electric Lighting Act, 1882, to be given to a local authority on or before the first day of July, has not been given in the case of any local authority which waives its right to receive such a notice, and no such notice need be given to the local authority of a district in which it is not intended to take power to distribute electricity.

10.—(1) With a view to making five years the ordinary period of revision of maximum price and allowing representations as to revision to be made by consumers, Sub-sec. (2) of Sec. 32 of the schedule to the Electric Lighting (Clauses) Act, 1899, shall, for the purpose of incorporation with any Act or Order passed or confirmed after the passing of this Act, be read as if the words "five years" were substituted for the words "seven years," and the words "or such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply," were inserted after the words "either the local authority or the undertakers."

2. Where any Act or Provisional Order passed or confirmed before the commencement of this Act enables the Board of Trade to revise or vary any maximum prices to be charged for electricity, that Act or Order shall be construed—

(*a*) So as to enable the revision or variation to take place at an interval of five years after the commencement of the Act or Order, or the last revision, in cases where a longer interval is fixed by the Act or Order; and

(*b*) so as to enable the power of revision or variation to be exercised on the representation of such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply, in cases where under the Act or Order such a power either cannot be exercised on such a representation, or can be exercised only on the representation of a number of consumers greater than 20.

11.—(1) The sections set out in the Second Schedule to this Act shall be substituted for Secs. 49, 50, 51 and 53 of the schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any Act or Order passed or confirmed after the commencement of this Act.

2. The provisions contained in the sections so set out shall, subject to such adaptations (if any) as may be necessary, be substituted for any corresponding provisions as to the use, examination and certification of meters, and their connection and disconnection with electric lines, contained in or incorporated with any special Act or Provisional Order relating to the supply of electricity passed or confirmed before the commencement of this Act.

12. For the purposes of Sec. 9 of the Electric Lighting Act, 1882, the accounts of any undertakers being a local authority shall be made up to March 31st in each year, and accordingly as respects those accounts June 30th shall be substituted in that section for March 25th, and March 31st for December 31st: Provided that, if any such undertakers show to the Board of Trade that some other dates are, owing to special circumstances, more convenient in their case than March 31st and June 30th, the Board of Trade may substitute such other dates for March 31st and June 30th, and this section shall as respects those undertakers be construed with the substituted dates.

13. The Board of Trade shall from time to time make a return to Parliament giving such particulars as they may think proper with regard to the reports made by any auditors appointed by them to audit the accounts of any undertakers, and any action taken on such reports by the Board and by the undertakers.

14.—(1) A local authority, company, or person who have obtained a licence, order, or special Act for the supply of electricity shall not, by transfer or otherwise, divest themselves of any of the powers, rights, or obligations conferred or imposed upon them by the Electric Lighting Acts, or by any licence, order, or special Act, otherwise than under and in accordance with a provision contained in a licence, order, or special Act authorising such a divestiture.

2. Sec. 11 of the Electric Lighting Act, 1882, shall be repealed from "but no local authority" to the end of the section.

15. Notwithstanding anything in the Electric Lighting Acts or in any Act of Parliament or Provisional Order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises; the sum to be so paid shall be determined in default of agreement by arbitration.

16. All electric lines, fittings, apparatus, and appliances let by any undertakers on hire or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession, shall, whether they be or be not fixed or fastened to any part of any premises in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and be removable by the undertakers, and Secs. 24 and 25 of the Electric Lighting Act, 1882, shall extend and apply to all such electric lines, fittings, apparatus, and appliances: Provided that such electric lines, fittings, apparatus, or appliances have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon, sufficiently indicating the undertakers as the actual owners thereof.

For the purposes of this section, electric lines, fittings, apparatus, and appliances disposed of by the undertakers on terms of payment by instalments shall, until the whole of the instalments have been paid, be deemed to be electric lines, fittings, apparatus, and appliances let on hire by the undertakers.

Nothing in this section shall affect the amount of the assessment for rating of any premises upon which any electric lines, fittings, apparatus, or appliances are or shall be fixed.

17.—(1) Twenty-four hours' notice in writing shall be given to the undertakers by every consumer before he quits any premises supplied with electrical energy by the undertakers, and, in default of such notice, the consumer so quitting shall be liable to pay to the undertakers the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises may require the undertakers to supply electrical energy to such premises, whichever shall first occur.

2. Notice to the effect of this section shall be endorsed upon any demand note for charges for electrical energy.

18. The undertakers may refuse to supply electrical energy to any person whose payments for the supply of electrical energy are for the time being in arrear (not being the subject of a *bonâ fide* dispute), whether any such payments be due to the undertakers in respect of a supply to the premises in respect of which such supply is demanded or in respect of other premises.

19. Electrical energy shall be deemed to be goods, wares, or merchandise for the purposes of Sec. 59 of the Stamp Act, 1891 (which makes certain contracts chargeable with stamp duty as conveyances on sale), and also for the purposes of the exemption numbered three under the heading "Agreement or any memorandum of an agreement" contained in the First Schedule to that Act.

20. For removing doubts, it is hereby declared that so much of any Provisional Order or special Act, or of the Schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any such Order or Act, as prohibits undertakers from associating themselves with any company or person supplying energy under any licence, Provisional Order, or special Act unless the undertakers are authorised by Parliament to do so, shall not be construed as prohibiting the undertakers from taking a supply of electricity in bulk from any company or person authorised to give such a supply.

21. Money borrowed under the Electric Lighting Acts shall not be reckoned as part of the total debt of a local authority for the purpose of any limitation on borrowing under the enactments relating to borrowing by the local authority.

22.—(1) With a view to the protection of the royal palaces, parks, and gardens, museums, and other public buildings, and their contents (in this section referred to as "the protected premises"), the Commissioners of Works and their engineer, or other officer duly authorised in writing under the hand of their secretary, may from time to time enter upon and inspect any generating station of any undertakers, and, if on such inspection it should appear to the Commissioners that proper precautions are not being adopted for the due consumption of smoke, and for preventing as far as reasonably practicable the evolution of oxides of sulphur, and generally for the prevention of nuisance in relation to the protected premises, they may, without prejudice to any other remedy, require the undertakers forthwith to carry out such works and to do such things as are necessary in the circumstances.

2. The undertakers shall give all reasonable facilities for such inspection to the Commissioners and their engineer or other officer as aforesaid.

3. Any dispute arising between the Commissioners and the undertakers in relation to any of the provisions of this section shall be determined by arbitration.

This section shall not apply to the station of the Westminster Electric Supply Corporation, Ltd., at Horseferry Road, in the City of Westminster.

23. Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or Provisional Order granted in terms of the Electric Lighting Acts, provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic.

24. Nothing in this Act shall enable the Board of Trade by Provisional Order to authorise the compulsory acquisition of any land which, at the date of the first publication of the notice for the Order, belongs to any gas or water undertakers, and is used or authorised to be used by them for the purposes of their undertaking.

25. In this Act, unless the context otherwise requires—

The expression "Provisional Order" means a Provisional Order under the Electric Lighting Acts:

The expression "Electric Lighting Acts" means—

(*a*) As respects England and Ireland, the Electric Lighting Acts, 1882 and 1888; and

(*b*) As respects Scotland, the Electric Lighting Acts, 1882 and 1888, the Electric Lighting (Scotland) Act, 1890, and the Electric Lighting (Scotland) Act, 1902.

The expression "authorised" means authorised by Act of Parliament or Provisional Order.

The expression "area of supply" means any area within which any local authority, company or person is authorised to supply electricity.

The expression "undertakers" means any local authority, company or person authorised to supply electricity to whom the Electric Lighting Acts apply.

The expression "road" includes any street as defined by the Electric Lighting Act, 1882.

The expression "generating station" includes any station for generating, transforming, converting or distributing electricity.

The expression "to supply electricity in bulk" means to supply electricity—

(*a*) To any local authority, company or person authorised to distribute electricity to be used for the purposes of distribution; or

(*b*) To any local authority authorised by any general or special Act to undertake or contract for the lighting of streets, bridges or public places, to be used for the purposes of lighting streets, bridges and public places.

26.—(1) In the application of this Act to Scotland, the Secretary for Scotland shall be substituted for the Local Government Board as respects Provisional Orders relating to Scottish local authorities, and May 15th shall be substituted for March 31st, and the first day of August shall be substituted for June 30th. Sec. 99 of the Burgh Police (Scotland) Act, 1892, as applied by Sec. 44 of the Local Government (Scotland) Act, 1894, shall be read as if the words "subject to the provisions of the Electric Lighting Act, 1882, or any Act or Acts amending or superseding the same," were repealed.

2. In the application of this Act to Ireland, the Local Government Board for Ireland shall be substituted for the Local Government Board as respects Provisional Orders relating to Irish local authorities.

27.—(1) This Act may be cited as the Electric Lighting Act, 1909.

(2) This Act and the Electric Lighting Acts shall be construed together as one Act, and may be cited as the Electric Lighting Acts, 1882 to 1909.

(3) This Act shall come into operation on April 1st, 1910.

SCHEDULES.

First Schedule.—Modifications of the Lands Clauses Acts.

The following modifications shall have effect in the construction of the provisions of the Lands Clauses Acts incorporated by this Act for the purposes of the Electric Lighting Acts:—

(*a*) The expression "special Act" means the Electric Lighting Acts, inclusive of any Provisional Order authorising the compulsory acquisition of land, except that the period of three years mentioned in Sec. 123 Lands Clauses Consolidation Act, 1845, shall be calculated from the passing of the Act confirming the Provisional Order; and

(*b*) The expressions "the promoters" and "the undertaking" mean respectively the undertakers and the undertaking under the Electric Lighting Acts, and the expression "company" in the Railways Act (Ireland), 1851, the Railways Act (Ireland), 1860, and the Railways Act (Ireland), 1864, means the undertakers under the Electric Lighting Acts; and

(*c*) The expression "land" includes easements in or relating to land.

Second Schedule.—Sections to be Substituted for Secs. 49, 50, 51 and 53 of the Schedule to the Electric Lighting (Clauses) Act, 1899.

"49. The amount of energy supplied by the undertakers to any ordinary consumer under the Special Order, or the electrical quantity contained in the supply (according to the method by which the undertakers elect to charge), hereinafter referred to as 'the value of the supply,' shall, except as otherwise agreed between the consumer and the undertakers, be ascertained by means of an appropriate meter duly certified under the provisions of the Special Order, and fixed and connected with the service lines in some manner approved by the Board of Trade.

"50. A meter shall be considered to be duly certified under the provisions of the Special Order if it be certified by an electric inspector appointed under the Special Order to be a meter capable of ascertaining the value of the supply within such limits of error as may, as respects meters of the class to which the meter belongs, be allowed by the Board of Trade, and to be of some construction and pattern approved by the Board of Trade, and every such meter is hereinafter referred to as a 'certified meter': Provided that, where any alteration is made in any certified meter, that meter shall cease to be a certified meter unless and until it is again certified as a certified meter under the provisions of the Special Order.

"51. An electric inspector, on being required to do so by the undertakers or by any consumer, and on payment of the prescribed fee by the party so requiring him, shall examine any meter used or intended to be used for ascertaining the value of the supply, and shall certify it as a certified meter if he considers it entitled to be so certified, and the inspector shall, on the like requisition and payment, examine the manner in which any such meter has been fixed and connected with the service lines, and shall certify that it has been fixed and connected with the service lines in some manner approved by the Board of Trade, if he considers that it is entitled to be so certified.

"53. The undertakers shall not, nor shall any consumer, connect any meter used or to be used under the Special Order for ascertaining the value of the supply with any electric line through which energy is supplied by the undertakers, or disconnect any such meter from any such electric line, unless the one has given to the other not less than 48 hours' notice in writing of the intention to do so, and the undertakers, or any consumer acting in contravention of this section, shall be liable for each offence to a penalty not exceeding forty shillings."

THE CARE OF A COMMUTATOR.

[COMMUNICATED.]

John Pain Lumley had been designing direct-current machines for 23 years, and recollection of this circumstance never failed to awaken in his breast feelings of the liveliest gratification.

Events move quickly in the electrical world, and 23 years is a long time, viewed from the standard of progress made. Lumley well knew that there could be few men in the country who had been designing for that length of time; and he reckoned that he had succeeded in reaching the top rung of his ladder; that what he didn't know about his job wasn't fit to know.

From a primitive shunt-wound generator he had proceeded by sure stages to the latter-day refinements of the compound winding, the commutating pole, the ventilated spool, and the distributed field. Yes, he would think, as he leant back in his well-worn chair, he had not been idle.

He was wont sometimes to call to mind a machine he had designed with pride a couple of decades before. Big, ugly, wasteful, inefficient; bad in every respect! And then he would smile as he thought of his latest creature of the same output. Small, elegant, economical, efficient, good and sound all through. And all this the product of his brain. Then did he feel that the weary research, the restless nights, the crowded days, had not been spent in vain. He had evolved the finest D.C. machine which money could procure. Heating negligible. Commutation sparkless at heavy overloads.

Lumley, as a matter of fact, particularly prided himself on his knowledge of the subject of commutation. He had studied the question in all its bearings. He had published a work, running into three volumes, on "Reactance Volts, and How to Smother Them." A paper entitled "What's the Matter with Micanite?" stood to his credit in the annals of the local Society. Alternating-current men regarded him with envy, testers with awe. And the daily consolation of his hard-worked life was that he, John Pain Lumley, was the commutator king.

One day Lumley was called away to give expert advice on a job in the metropolitan district. In the station were a couple of his rotaries. He spent the morning clearing up the trouble, and was preparing to depart. As he was putting on his gloves he noticed how the marble panels gleamed; how the brass rails which hemmed in the machines sparkled in the sunlight. But the circumstance which most engrossed his attention was the sparkless, perfect operation of a couple of steam-driven generators. He called the attention of the switchboard man to it.

"They are not our machines," said Lumley, "but they're operating wonderfully well. Full load?"

"Yes. Bit of overload, if anything," replied the central station man. "They are excellent machines, but, in my opinion, care of the commutator while in service is even more important than good design."

"You think so?"

"I do, indeed!" said the switchboard man, impressively.

Now, the fact is, this man, Paynter by name, was something of a wag. He thought that with all his learning, Lumley looked a bit of a fool. There was nothing of the man of the world about him, and he might easily be deceived. Paynter resolved that he would have him on. He would start gently, and then if he found Lumley was taking the bait, he would give him as much as he could swallow.

"Yes," he resumed, "I feel it to be true that a closely-worked-out design may be entirely wasted and rendered worthless by careless running. While, on the other hand, a machine, theoretically poor and of doubtful operating powers, may be so tended and cared for, have its way so smoothed for it, so to speak, that it may perform wonders in service."

"I think there may be a great deal of truth in what you say," said Lumley, much impressed with Paynter's statement and heavy delivery.

"May be?" echoed Paynter, going on with increasing confidence, "there undoubtedly is. Look at those two machines. How are they operating?"

"Perfectly!"

"Yes. And how many commutating poles did the designer put in?"

"None!"

"Exactly! And do they look under-rated?"

"By no means. Over-rated, if anything, to judge simply by the size."

"Just so. Then the question is," cried Paynter exultingly, "how is it done?"

"Careful attention, eh?" queried Lumley, athirst for information.

Paynter nodded impressively, feeling that now he could tell his man any old lie he liked.

He took Lumley by the lapel of his coat, and prodded him gently, the while he regarded him with an air of much mystery.

"Do you know how I do it?"

"No!" murmured Lumley.

"Shall I tell you?"

"Tell me!"

"Mutton fat!" Paynter almost hissed.

"Mutton fat?" gasped his listener. A breathless pause, and then, "Oh, I see! You take the fat and rub it on the commutator instead of an oily rag."

"It must be mutton fat!"

"Why mutton? Wouldn't beef do, or bacon, or pork?"

"Good heavens, no! I've tried all the fats there are—vegetable and animal, and mutton is the only wear. And, of course, *any* mutton fat won't do, you know."

"Oh, won't it!" said Lumley.

"Not by any means; you have got to pick your sheep very carefully." By this time Paynter had fairly got into his stride, and was wondering how far he should go with it.

"You must pick a sheep which has never had any illness, preferably a two-year-old, without blemish."

"A two-year-old without blemish!" repeated Lumley with the eagerness of a child.

"Yes, and by far the most important point is this: *Cut the fat away near the kidney!*"

"Heavens!"

"One inch from the outside edge of the kidney!"

And Paynter drew back a few paces to watch the effect of his startling communication upon the face of the ingenuous Lumley.

As for that worthy, the thought that he was being grossly deceived never once crossed his mind. True, he was a little surprised to find that after worrying over commutation for

20 years, he should come to be instructed by a stripling like this young chap. But his mind was a receptive mind. He was open to conviction. He seized the attendant by the hand.

"A two-year-old without blemish," he cried joyfully, "and cut the fat one inch from the kidney."

"That's it," said Paynter. "Do that and your sparking troubles are over for ever."

Paynter moved away to put the water on the cooking stove; and Lumley, with many fervent expressions of thanks, took his leave.

He indulged in many fine speculations arising out of his new knowledge. He decided that to the instruction card which the firm sent out with every motor should be added a clause on "Care of the Commutator." He would at once have exhaustive tests made, and when he had found his ideal mutton fat he would have it prepared to his instructions on a large scale. He would read a paper before the Society, "Some Notes on Sheep as Applied to Electrical Engineering." What a stir it would create! What a boom for Lumley's reputation!

It happened that the very next day, when he got down to the office, he found a letter awaiting him from a man in charge of a gang on the outside staff. A 500-H.P. motor had been installed in a mill, and while the heating was well inside the guarantee, the commutation was simply shocking.

Wrote the outside man, "We have tried all possible adjustment of the brushes, checked up the pitch of the studs, adjusted all the springs, and, in short, done everything we can. Shall be obliged to you if you will write me at once, making any suggestions which occur to you as to next steps to take."

Lumley chuckled when he read this. This was where the mutton fat came in. He called for the stenographer.

"With reference to your letter of the 9th inst., and inquiry as to possible source of trouble in operation, I would advise the following procedure:—Apply to any vendor of British meat for some mutton fat, and note following particulars: The fat must be taken from a sheep at least two years of age, in perfectly sound condition at the time of slaughter, and this is most important—the fat must be cut away as near the kidney as possible—to be precise, one inch away. Raise the brushes, run machine round by placing men along the belt, and apply fat to the surface of commutator. This should clear up your trouble."

Serenely Lumley waited for the reply. It came the next day. The outside charge hand was a hard, cynical, common-sense man. "I have always known you to be a bally fool, but was not aware before that you were actually insane. Kindly note that I am not a blooming butcher!"

PROTECTION.

By R. M. M.

One sees and hears all kinds of woe-begone tales of unemployment, bad trade, bad prices, demand for Protection, or argument that Free Trade must be kept going for things to improve. Having had the pleasure of working for private companies in manufacturing business, in supply stations and in corporation undertakings, one conclusion the writer has come to is that protection is wanted, badly wanted—protection from ourselves.

All will grant that if the electrical business were better there would be a proportionately less amount of unemployment. Better trade means higher profits, more output, and, incidentally, higher salaries. Better business for supply companies, mark you, does not mean more units output, unless the extra units are sold at a decent margin of profit, immediate or in the near future. Better business for manufacturers does not mean larger output at a lower profit.

The station engineer recognises the first postulate, and quotes a five-year contract rate of supply to a large works with a decent margin for profits, or bases his tariff to bring in a margin—shall we say?—of over 15 per cent.

The manufacturer puts a price on his goods, and asks for something higher to be obtained to protect the trade; but then some of our station friends step in and say, "No, our consumers shall buy at your lowest price to us; we don't want to make any profit on the transaction." (What about the increased supply of juice with the margin for profit?) The station pats itself on the back and thinks the load is coming up nicely; other manufacturers hear the price quoted, and begin to worry how to cut their prices to the same or a lower figure. Wiring contractor A writes to the Review that some manufacturers sell to customers at a lower price or the same price as to himself, and the fat's in the fire.

No. 1 is selling, at practically no margin, through the supply station; Nos. 2 and 3 cut to this figure, and sell to the consumers. No. 1 has to drop, and so, *ad infinitum*, until the balance-sheets go wrong, and the cutting has induced cheap labour, and a consequent increase of unemployment.

There is a song which asks, "Little stranger, there's a danger. How's it all going to end?" (Who said Workhouse?)

The only one who as yet has not had any criticism is the contractor—his turn comes next. The contractor is no doubt well-meaning, but he also helps to upset things. A case has been heard of, where a contractor, who would ordinarily have his profit on wiring and a reserve on apparatus although the same was ordered direct, has actually cut the price quoted for the apparatus, thus giving away some of the reserve for nobody's benefit. Mixed motives, my masters!

We cannot find a grumble for the electrical Press, but certainly for the contributors. Some apparently desire that we should saddle ourselves with the horrors of Trade Unionism—to elevate the profession. "Ye gods!"

No, there is still a profitable lesson to be learned from America, which abbreviated is—Everyone electrical for everything electrical at all times, all working for electricity with eyes open to the benefit of the *whole* electrical profession.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

JAPAN.—The rates of duty given below are the lower rates which have been arranged by treaties with Japan. British goods are entitled to entry under these lower rates, but in order to gain this advantage they should be accompanied by a certificate of origin which is issued by the Japanese Consul in the place of origin. If no such officer exists, the certificates may be issued by the Custom House or other Government or public office, or by the Chamber of Commerce. The following is the form of invoice and certificate generally used:—

(Place and date.)

Invoice of ....

Marks.	Numbers.	Packages.	Quantity or weight.	Description of goods.

I (we) hereby declare that the above goods were produced in ...., and are to be shipped to Japan from the port of .... per (ship's name) on or about the .... day of ...., 19 .

(Signature.)

Certificate.

(Place and date.)

I hereby certify that ...., of ...., appeared before me and made the above declaration, and that I believe the same to be correct in every particular.

Signed and sealed this .... day of .... 19 .

(Signature.)

It is necessary that certificates of origin should be received by the consignee of the goods before the date of arrival of the vessel carrying the goods. Certificates from a Notary Public or an Honorary Japanese Consul will not be accepted. Certificates of origin can only be signed by a member of a firm or authorised agent, whose name must be registered at the Consulate.

Weight should be stated in kilograms to admit of conversion into Japanese weights; the net weight of the goods should be given on documents.

The dutiable value of an article subject to *ad valorem* duty is the actual cost of the article at the place of production or purchase with the addition of packing charges, cost of transportation, insurance and all other charges incurred up to the time of its arrival at the port of importation; however, in case of doubt, respecting the actual cost and the various charges, the balance after deducting the import duty from the price of the article at the place of importation is to be taken as the dutiable value thereof.

Yen = 2s. ½d. Kin = 1·32277 lb. Cattie = 1·32277 lb.

The following duties are payable:—

Asbestos, asbestos fibre or powder ...	10 % ad val.
Mica sheets	28·90 yen per 100 kin
Cloth or paper-backed mica, sheets of small size (about 2 × 2½ in.) ...	28·90 „ „
Mica, all other	10 % ad val.
Iron wire rod and small rod not exceeding ¼ in. in diameter: Of iron and mild steel	·503 yen per 100 catties
Of steel, other	1·819 „ „
Telegraph or galvanised wire: Of iron and mild steel	259 „ „
Of steel, other	5 % ad val.
Rails: Of iron or mild steel	·129 yen per 100 catties
Of steel, other	5 % ad val.
Fishplates for rails	1·20 yen per 100 kin
Copper wire and round trolley wire	11·20 „ „
Copper plates and sheets	11 „ „
Brass and yellow metal: wire, plates, &c.	7·40 „ „
Babbit's metal and other anti-friction metals	3·50 „ „
Brass bars for turbine blades, corrugated boiler furnace tubes, flanged iron boiler plates	20 % ad val.
Bolts for rails, flat and round tie bars for rails	10 % ad val.
Dog spikes, plain	·573 yen per 100 catties
„ galvanised	10 % ad val.
Posts for electric wires, points for railways, line materials for electric railways, materials for railway turntables, portable rails, chairs for rails, railway signal apparatus	25 % ad val.
Telegraph wire, other than telegraph or galvanised wire, of iron, mild steel, or steel	5 % ad val.
Other submarine and underground cables and other insulated electric wire or cables, includes lead-covered aerial cables for telephone; lead-covered underground cables for telephone, for electric light (three-phase dynamo); lead-covered aerial cables for electric light (three-phase dynamo); insulated copper wire for electric light; insulated twist copper wire for electric light or telephone; submarine telegraph cables; underground cables for transmitting electric power (excluding three-phase dynamo); insulated electric wire cord (twisted or not) ...	20 % ad val.
Electric radiators	30 % „
Metal manufactures not mentioned ...	30 % „
Porcelain insulators	40 % „
Electric locomotives	5 % „
Wheels and axles, tires, &c., for locomotives	5 % „

(*To be continued.*)

How German Firms obtain Contracts.—A financial transaction, which promises to be accompanied by the prospect of a large amount of work in the future, is now being brought to a conclusion by the ALLGEMEINE Co., of Berlin. It relates to the acquisition from a holding company of shares of £375,000 in the Silesian Secondary Railway Co., whilst the remainder of the shares in the latter, amounting to one-fourth, are to be purchased from the shareholders directly. The Silesian company is associated with two or three other light railways or tramways, and the possession of the whole of the capital by the A.E.G. will enable the latter to proceed with the conversion of the lines to electric traction where steam locomotion is still used. The three-fourths (£375,000) of the share capital will be exchanged for shares of £75,000 in the Berlin Electricity Works Co., in which the A.E.G. held shares of £315,000 at the end of the financial year 1908-9.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,429. "Electric switch with lever motion and instantaneous make and break." J. B. WYNNE. December 6th.

28,430. "Improvements in or relating to electric current leakage indicators." J. P. WINN. (Application for Patent of Addition to No. 4,666 of 1908.) December 6th.

28,462. "Improvements in inter-communication telephone instruments." J. A. ROMER. December 6th.

28,475. "Improvements in and relating to the driving axles of electrically-propelled vehicles." D. BALACHOWSKY and P. CLAIRE. (Date applied for under Sec. 91 of the Act, December 5th, 1908, being date of application in France.) December 6th. (Complete.)

28,532. "Improvements in electric detonators for explosives." J. H. ROBINSON and KYNOCH, LTD. December 7th. (Complete.)

28,545. "Commutator device for wireless telegraphic signalling stations." G. ERDMANN. (Application for Patent of Addition to No. 10,156, 1908.) December 7th. (Complete.)

28,555. "Electric arc lamp." L. M. McBRIDE. December 7th. (Complete.)

28,557. "Combined electric bell push and paper knife." H. HIRST and S. D. WHITE. December 7th.

28,579. "Improvements in or connected with secondary storage cells or other batteries containing liquids." S. L. PRICE and J. G. PATTERSON. December 7th.

28,617. "Improved process of making homogeneous mechanical junctures between metallic bodies." G. HARRISON. (Electric Railway Improvement Co., United States.) December 7th. (Complete.)

28,672. "New or improved terminal for electric cables." G. CHARLTON. December 8th.

28,692. "Improvements in the manufacture of metallic incandescent bodies for electric glow lamps." B. DUKES. (Ges. für Verwertungs Chemischer Produkte m.b.H., Germany.) December 8th. (Complete.)

28,699. "Improvements in and connected with spark coils." E. WILSON and W. H. WILSON. December 8th.

28,758. "Improvements in apparatus for automatically operating the track points on electric tramways and railways." H. DUDGEON and H. CROSS. December 9th.

28,759. "Improvements in dynamo or motor brushes." W. CHRISTIE. (Galvanische Metall-Papier Fabrik Akt.-Ges., Germany.) December 9th.

28,762. "Improvements in the method of observing the effects of minute electric signals in a telegraphic system." C. C. F. MONCKTON. December 9th.

28,804. "Improvements in the electrical propulsion of ships." SIEMENS BROS. DYNAMO WORKS, LTD., and E. A. HOLMES. December 9th.

28,813. "Improvements in and connected with electric furnaces." E. WASSMER. December 9th.

28,818. "Improvements in and relating to electric ignition devices for internal combustion engines." H. BATT. December 9th.

28,825. "Improvements in telephone exchanges." SIEMENS & HALSKE AKT.-GES. (Date applied for under Sec. 91 of the Act, December 12th, 1908, being date of application in Germany.) December 9th. (Complete.)

28,849. "Improvements in and relating to arc lamp casings." R. BINET and G. GUENNE. (Date applied for under Sec. 91 of the Act, December 11th, 1908, being date of application in France.) December 9th. (Complete.)

28,861. "Improvements in and connected with metallic conduit systems used in electric wiring." SAUNDERS & TAYLOR, LTD., and J. V. PYATT. December 10th.

28,907. "Improvements in electric arc lamps." E. E. PRESTWICH. December 10th.

28,941. "Improvements in and relating to systems of electric motor control." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 10th.

28,942. "Improvements in or relating to burglar alarms and switch devices." S. LICHTENFELD. December 10th. (Complete.)

28,947. Improvements in or connected with electric indicating and measuring instruments." E. R. MURRAY. December 10th.

28,951. "Improvements in and relating to internal communication telephone systems." G. BURNEY and STERLING TELEPHONE AND ELECTRIC CO., LTD. December 10th.

29,004. "Improvements in or relating to electric control gear." CLARKE, CHAPMAN & CO., LTD., and R. C. HARRIS. December 11th.

29,020. "Improvements in trolley wheels for electric trams and the like." W. G. T. GOODMAN and W. KEON. December 11th. (Complete.)

29,026. "Improvements relating to electrical ignition apparatus for internal combustion engines." H. W. VAN RADEN. December 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

SHADE CARRIER AS APPLIED TO ELECTRIC LAMP HOLDERS. W. Green. 3,250. February 10th.

ELECTRIC SWITCHES. W. H. Flood. 5,805. March 10th. (Cognate application, 15,211 of 1909.)

ELECTRIC SNAP SWITCHES. H. W. Lake. (Cutler Hammer Manufacturing Co.) 6,932. March 22nd.

STARTING AND REVERSING DEVICES SPECIALLY, THOUGH NOT EXCLUSIVELY, APPLICABLE TO ELECTRIC PULLEY BLOCKS. Electric Pulley Block Co. (Gese). 9,275. April 19th.

TELEPHONE SYSTEMS. M. S. Conner. 10,255. April 30th.

ALTERNATING-CURRENT DYNAMO-ELECTRIC APPARATUS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 10,497. May 14th. (Application for Patent of Addition to No. 23,288 of 1902.)

ARRANGEMENT FOR UNIFORM AND RAPID ELECTROPLATING OF ARTICLES OF THE FLAT SHEET OR ROD TYPE. Langbein Pfanhanserwerke Akt.-Ges. 14,091. June 16th. (Date applied for under International Convention, June 22nd, 1908.)

ACTUATION OF CONTROLLERS AND THE LIKE FOR ELECTRIC MACHINERY. H. P. van Daalen. 15,203. June 29th.

ELECTRIC MOTOR STARTING-SWITCHES. Siemens Bros. Dynamo Works and E. Schupp. 16,537. August 5th.

THE

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE RESPONSIBILITY OF COLLIERY MANAGERS.

AGAIN we have to draw attention to the extremely illogical attitude of the Home Office towards the responsibility of colliery managers in regard to the use of electricity in mines, as evidenced by the recent prosecutions of the Fife Coal Co.'s officials, already reported in our columns. The prosecutions also showed the very unsatisfactory way in which the special rules regulating the use of electricity in mines are being administered.

As will be remembered, Mr. Charles Augustus Carlow, general manager of the company; Mr. Henry Rowan, agent for the Western District collieries; and Mr. Henry Richardson, manager for three of the pits, were charged "That they (1) caused or permitted to be used two switches and two fuses which were not sufficient in size and power; (2) caused or permitted to be used in the switch-room, without being earthed, a metallic cover provided to prevent accidental contact with live parts; (3) caused or permitted to be used two gate-end or terminal boxes which were not in any way fixed, and of which one was not efficiently earthed, and the other was not earthed at all; (4) caused or permitted the unarmoured conductors or distribution cables in the main haulage road not to be efficiently covered and safeguarded; (5) caused or permitted the unarmoured conductors or distribution cables in the main haulage road and in two haulage roads leading to the coal face from the main haulage road to be fixed within reach of injury from passing tubs or trains, and not to be protected by a suitable covering," in the Foulford pit. Two days were occupied in hearing the evidence, and in the end Sheriff Shennan dismissed the case against Mr. Carlow and found Mr. Rowan and Mr. Richardson not guilty.

It may be interesting to examine the relationship of the above-named officials of the Fife Coal Co. to one another, as it was evidently the intention of the Home Office to make each of the defendants equally culpable. Mr. Carlow, then, as general manager of the company, is the head, and is almost, if not purely, directly responsible to the shareholders of the Fife Coal Co. for the commercial side of the undertaking. The position is open to anyone with or without mining experience, the requisite qualifications being managerial tact and commercial experience. Mr. Rowan, as mines agent, is directly responsible to Mr. Carlow for the working of the group of mines under his charge. The position is usually filled by a mining engineer with a first-class certificate of competency, though it is to be noted here that this is *not necessary*, and the owners may appoint anyone as agent with or without a certificate. Mr. Richardson, as the certificated colliery manager, is directly responsible to Mr. Rowan, as agent, for the working of the colliery, and to the law for any breach of the Coal Mines Regulation Act. The position can *only* be filled by a mining engineer having a first-class certificate of competency, who must have served for at least *five* years underground. Notification of the appointment of a colliery manager must be given to H.M. Inspector of Mines for the district; this is also usual in the case of the agent, and it was given in this instance. In addition, however, to these officials, the company employ an electrical engineer, who is in charge of the electrical plant at all their collieries, but has no responsibility except that implied by virtue of his position. He is not in the least recognised by the law, and it seems to us that a splendid opportunity for rendering a service to everyone connected with mining has been missed by Sheriff Shennan in his not making a point of this fact.

Turning next to the counts, it will be safe to assume that none of the defendants had any great electrical engineering experience or knowledge, and that they would be entirely dependent upon the advice of the electrical contractors who installed the plant, in which case the colliery manager would have to accept responsibility, or upon the firm's electrical engineer, who, in our opinion, ought to take full responsibility, and not the colliery manager. In either case, however, we can also assume that the manager, knowing his responsibility, would not rest until assured that the plant was satisfactory, and would convince himself of this fact so far as his knowledge, experience, or opportunity would allow him. What are the facts? Two switches are alleged to be faulty, yet the electrical experts—who ought to know—said, in their evidence, that they were quite satisfactory, and were in general use, and further that, to carry out the Home Office Rule (with reference to "earthing") would be *actually to increase* the danger. On the one hand, we have the Home Office electrical experts making a rule, and, on the other, electrical experts insisting that rigid compliance with such a rule will increase rather than lessen the danger. Yet the colliery manager is to be responsible! Surely he is between the devil and the deep sea!

On the third count we again have a diversity of opinion on the question of earthing, one witness stating "that he could point to cases where the earthing of the gate-end box would be a positive danger. The man who suggested a bell wire in connection with the earthing of a gate-end box had not a sense of his responsibility." With this we are in entire agreement. In a mine there can be only one way of obtaining an "absolute earth"; and that is to carry a separate copper "earth" wire. To depend upon the armouring of cables for an efficient earth would be futile, and it can be easily shown that more accidents have occurred with armoured cables than with unarmoured. With reference to count (4), which also applies to count (5), what is meant by "efficiently covered and safeguarded"? This is a rule which has never been satisfactorily interpreted. It would, however, be a hardship upon the coal mining industry if the Home Office were to insist upon all cables used underground being armoured.

As already mentioned, the prosecution failed, and it is difficult to see how they could ever have hoped to succeed; at any rate, it would have been a morally unjust conviction if they had. As Sheriff Shennan stated, "If the authorities regarded the question of switches and fuses as urgent they must frame special rules, fixing the type that was to be permitted, or at least the type that was forbidden." If, however, rules were to be drafted prescribing a particular type for all colliery electrical plant, there would be an end to progress, and a blow would be given to the extended introduction of electricity in mines, from which it would take a long time to recover, in spite of the fact that it has proved so beneficial in the past. As it is, these "rules" and prosecutions are already beginning to have their effect upon colliery managers, who are now hesitating about the introduction of electricity, and in some cases are seriously contemplating the removal of their existing plant. In the North of England a number of electrically-driven coal-cutting machines have already been taken out of the pits.

What, then, is the remedy for all this chaos? We repeat the suggestion we have made over and over again, and that is, to appoint qualified engineers, give them a proper status and make them responsible for all the machinery. This we venture to point out is the only logical and satisfactory solution, in spite of the *Colliery Guardian's* bogey of "dual responsibility." There can be no dual responsibility if there is an agent, as the mining engineer or colliery manager and the mechanical engineer would each be responsible to the agent for his department. And in cases where there is no separate agent, the owners can appoint *either* to act as agent. It will have to come in the end, and the sooner the better for everybody concerned, not the least being the working miner, who is now suffering from the fact that "the law is a hass."

LORD CHARLES BERESFORD AND THE ENGINEER OFFICERS OF THE NAVY.

We have consistently taken the view that in a highly technical service like that of the Navy—where every element of hulls, armament and auxiliary machinery involves engineering principles, and demands for its proper maintenance knowledge of engineering science—the engineer officer is at least as important as his brother officers who specialise for navigating, torpedo, or gunnery duties. Consistently, too, we have maintained that the rank and status of the engineer officer should be neither less nor more than that of his technical colleagues in the ward room, and that the profession of engineering is as worthy of honour in His Majesty's ships as is the profession of navigation or gunnery. Tradition, however, still regards the engineer officer as an interloper, and it gives the older technical branches of the service undue distinctions derived from the age of wind-propelled vessels. The public, who cannot be expected to follow minutely the details affecting the matter, are generally of opinion that all these disabilities of engineer officers were got rid of when Lord Selborne accepted a scheme based upon "common entry" for all cadets, and supported by engineering studies and engineering training right up to the period when, as lieutenants, the young officers proceed to specialise either for the gunnery, torpedo, marine, navigation, or engineer branches. But the truth is that while all the new-scheme officers are indeed to merge into the full enjoyment of the honours and dignities of the "military" branch of the Navy, the old-scheme engineer officers remain in degraded exclusion from the "military" branch. The explanation is that every service member of the Admiralty is himself of the "military" branch, and consequently entirely out of sympathy with, and blind to the meaning of, engineering. They thus stand in the way of progress, they fail to see the effect of their obstinacy upon discipline, they exhibit a remarkable lack of appreciation of what engineering has done for them and for the Navy, and they fail to realise the injury that results to the whole brotherhood of naval officers from their hesitancy.

Lord Charles Beresford, in 1903, summed up the position in words that at this moment may well be brought to remembrance. He was reported by the *Western Morning News* to have said: "The executive officer of to-day should possess an intimate knowledge of all that relates to his profession. Up to now he has been fairly educated in the different branches. The most important, however—in that we depend entirely upon it—that relating to steam and machinery, has been neglected. The duties of this branch have been delegated to, and well and loyally performed by, a body of officers existing for this special purpose, and there have been two results. The executive officer has remained ignorant of one of the most important parts of his profession; *the engineer officer has never received that recognition to which the importance of his duties and responsibilities so justly entitles him.*"

Six years have come and gone, and those words still stand as a rebuke to the Admiralty and to the Empire, and as a menace to the welfare of the Navy. Is it because the engineer officers of the present *régime* have failed in their duty? Is it because they have failed to master the technicalities of new vessels? Is it because they have failed to respond under conditions of war? Is it because in knowledge they are behind their brother technical officers? The answer is No—all the time, No! They have brought success out of failure in the change from cylindrical boilers to water-tube boilers. They have done equal service in the change from reciprocating engines to turbines, coal to oil fuel; *Powerfuls* to *Dreadnoughts*. At Ladysmith, Modder River and Pekin they fought, and they led. Who will say they were non-combatant? Then, as to their knowledge, the professional engineer officer educated through Keyham and Greenwich had the best education in the service; and in sports Keyham has a record that shows the stuff of which engineer officers are made. There is no reason for maintaining the inequality. None—but prejudice. It must be stamped out. Looking ahead, there are even more potent reasons for adjusting these disabilities, but as we do not wish in any way to hamper the progress of the new scheme, we refrain from enforcing arguments that would militate against its success. The case, moreover, is sufficiently strong on its own merits. Again, it would be unwise to use as a lever a scheme upon which the whole future of the Empire is balanced.

We are at a crisis in our history—a crisis heightened by the fact that at a moment of political tumult, the strongest naval administration of modern times is simultaneously giving place to what, in great measure, will be a new administration. The Board may review with pride the extent of their achievements. But if they fail to provide for continuity in their schemes, they fail altogether. So great an administration can scarcely be guilty of so great a blunder. It is satisfactory to observe that Engineer-Captain Bennington obtained from Lord Charles some answers that make for continuity. Lord Charles has expressed himself as being "strongly in favour of the new scheme of training as brought forward by Lord Selborne." He allows that "great trouble will occur" if adjustments between the old scheme officers and the new are not made, but he still hesitates to drive home these admissions to their logical conclusions by advocating positively that engineer officers should at once be given the "military" titles, uniforms and prerogatives, that alone can put an end to the discord and degradation that to-day is rankling, and that to-morrow may poison the service. We quote Lord Charles, not because we accept his statements in general as a guide to what is true concerning the Navy—far from it—but because he is an executive officer, and because he has frequently fought against the worst that remains of tradition. Rather would we quote Lord Nelson, who to Lord Howe wrote: "I had the happiness to command a band of brothers; *therefore night was to my advantage.*" Nelson thus recognised that unity is an element of strength in tactics and in strategy. It is towards this end that all efforts of naval officers, in all branches, and even at the Admiralty, should be directed—for the Nelson "touch" was the "touch" of brotherhood.

The Best Material for Brake-Blocks.

A DETERMINED campaign is being carried out by the Tramways and Light Railways Association through their Special Committee, to further the work already begun by themselves and by the Municipal Tramways Association, and they are employed chiefly at the present time in trying to settle once and for all the best material to use for brake-blocks. This has been the subject of considerable controversy since tramcar braking became a really serious matter, and we have little doubt but that many persons have made inquiries and researches into the question for their own satisfaction, and in some cases have come to definite conclusions, but the majority have had to be content to go on in relative darkness until some authoritative person or body should set to work to grind out the whole problem upon scientific principles guided by practical experience.

The October issue of the *Official Circular* contained an important contribution towards the solution of the problem. This consists of a paper by Prof. Ernest Wilson, recording tests made for the Brakes Committee upon Brake-block Coefficients of Friction.

We trust that all good tramway men, whether serving municipalities or companies, will help themselves and their colleagues so far as they can, and to this end we suggest that they should read Prof. Wilson's paper and send to the secretary of the T. & L.R.A. for a copy of the memorandum of procedure to be adopted by those who carry out tests. Prof. Wilson's tests were made upon a truck turned upside down in a laboratory, and are valuable so far as they go, and inasmuch as they have provided pointers for further tests of a more practical nature; but it is the results of the latter tests which will be used in any recommendations or report which may be issued in due season by the Committee. It is essential, therefore, that many tests should be made in many places, in order to obtain the highest diversity factor of conditions; and these tests would not be nearly so valuable if they were not carried out uniformly. Therefore, it is desirable that every engineer who undertakes to help the Brakes Committee should carry out his observations upon the fixed lines laid down by the Committee itself.

We can do no more here than give the merest outline of Prof. Wilson's test, as constant references are made in the paper to the tables which accompany it.

The materials tested were oak and poplar (with the grain horizontal); Frood's lining (two qualities); and soft grey cast-iron. The wheel tires were made of chilled steel. Velocities up to 22 miles per hour were dealt with, and specific loadings up to 120 lb. per sq. in. were employed. Two distinct series of tests were made—one under wet conditions, and one under dry conditions. Clean water only was used in the former tests.

The enormous superiority of cast-iron over non-metal linings, when water or other lubricant is present, is confirmed, the ratio of superiority being of the order of 10:1. In every case the coefficient falls with an increase of speed, and, with the exception of cast-iron, rises with an increased specific load.

When tested dry all the coefficients are brought to a higher level than under wet test conditions for the same speeds and loads, and in the case of non-metallic blocks, the differences are enormous, the coefficients being raised even beyond those for cast-iron. On the other hand, it is curious to observe that the coefficients of all the materials tested dry diminish with a rising specific load.

Prof. Wilson has misgivings as to the general reliability of non-metallic blocks for *tramway* purposes on account of the effect of water, and if it were not for the fact that road material mixed with water increases the coefficient of friction, he would find it difficult to believe that these substances could be trusted in wet weather for track-brake purposes.

Once or twice during the tests upon non-metallic blocks with water lubrication, combined with low temperature, the motors raced with a specific load of 120 lb. per sq. in., and it is possible that some of the worst runaway accidents have been due in part to this phenomenon, for "it is just when a car is about to descend an incline that the worst possible conditions may obtain. The blocks may be saturated with water, and the temperature of wheels and blocks may be low. The coefficient will not be sufficient at first to generate the heat required to evaporate the film of water between the blocks and wheels, with the result that racing may occur" (p. 1076).

It was noticed during these tests that the driving wheel on each axle furthest from the spur-wheel became corrugated, the number of corrugations corresponding with the number of teeth on the spur-wheel. This effect was attributed to the spring of the shaft combined with imperfect gearing, and may be connected with rail corrugation on tramways.

Copper. From Messrs. Merton's report for the 15th of this month, it would seem that visible supplies have at last reached their maximum at 107,185 tons, as the increase over the return for the end of last month is only 1,442 tons. The price has at present a tendency to harden, owing, probably, to the uneasy state of the market due to combination rumours. The re-shipments of standard to the States (indicating generally advance of consumption over local supply) are still maintained, at 50 tons for the fortnight. Australian and Chilian shipments are up to average, and the supplies from Spain and Portugal show considerably above (for the fortnight). The supplies from North America, as is to be expected, are down. The indications are in favour of heavy consumption, or accumulation, in the States.

A New Institution. Elsewhere in this issue we record the proceedings at the inaugural meeting of the new "Institution of Mining Electrical Engineers" at Manchester, and this we do with the greater pleasure seeing that we may claim a large share in the birth of this society; for it was in our leader of December 11th, 1908, that the suggestion was put forward that such a body should be formed, and correspondence was invited on the subject, which ultimately, thanks mainly to the energy and organising ability of one of our correspondents, Mr. J. G. Williams, led to the formation of a capable committee and to the establishment of the Institution on what we hope will prove to be a sound and enduring basis. The rapidity with which the idea was taken up and developed was remarkable; barely 12 months from the publication of the original suggestion the Institution was in existence, provided with a complete working organisation, and already it is the parent of several branches at the principal British mining centres, while the formation of Colonial branches has now begun, and thus the Institution bids fair to become one of world-wide influence and reputation. With the greatest cordiality and pleasure we offer our congratulations and good wishes to the youngest of our electrical engineering institutions, which, we trust, will thrive abundantly. We may be permitted, in the capacity of sponsors of the infant society, to utter a word of warning as to the supreme necessity for the exercise of care and discrimination in the enrolment of new members, though we do not doubt that the Council already appreciates the importance of this, upon which depend the future prestige and stability of the Institution. Recommendation of candidates by men of standing *from personal knowledge*, and, in addition, direct inquiry and verification of the qualifications alleged, should be regarded as indispensable preliminaries not only to first election, but also to promotion from one class to another. Founded thus on personal merit and technical ability, the Institution will be enabled to claim, and obtain, for its members due recognition as men who may be relied upon to know their work and to do their duty.

Electricity and Fire Risk. Compelled by the exigencies of time and the postal service to go to press before the resumption of the inquest upon the victims of the Clapham Junction fire, we are unable to record or comment upon the findings of the jury; and unfortunately such inquiries as we have been able to make have brought forth no new evidence as to the cause of that disastrous event. One fact, however, has come to our knowledge, which in the interests of safety ought to be made public property: and that is, that it is possible for the hot filaments falling from a broken incandescent lamp to ignite cotton wool situated several inches beneath the lamp. This, we believe, will surprise many of our readers, as it surprised ourselves; but if they doubt the truth of the statement, they can easily satisfy themselves of its accuracy by making the experiment.

The very fact that users of the electric light have acquired the habit of placing glow lamps in close proximity to materials of the most inflammable nature, such as cotton wool and celluloid, is in itself conclusive proof of the extraordinary freedom of electricity from fire risk, and of the confidence of the public in its safety: unfortunately their confidence has been carried too far. No one would dream of putting cotton wool in the neighbourhood of a gas burner of any description—the danger is too obvious; but with electric lamps the case is different. Properly installed, the electric light is by far the safest of all illuminants—witness its exclusive use in factories where explosives are manufactured—but that when unwisely used it still retains an element of danger is undeniable. We trust that the warning will be laid to heart, and we should be glad to see the use of lamps promiscuously slung about shop windows and similar places on flexibles prohibited entirely. There is not merely no need for this mode of lighting; it is altogether contrary to the accepted principles of scientific illumination, one of the first of which is that the source of light should not be within the range of vision. There are admirable and economical methods of obtaining any desired degree of illumination whatever, with fixed electric lamps, free from the slightest element of fire risk, and these are far preferable on every ground.

As for the burning of the Yarmouth Pier Pavilion, to which we referred in a hasty note last week, our information to the effect that there was not the least evidence that electricity had anything to do with the fire has been fully confirmed. A great deal of harm is done to the electrical industry by these reckless suggestions, against which we cannot protest too strongly.

Metallic-Filament Lamps. The paper by Mr. F. H. R. Lavender, an abstract of which is published elsewhere in this issue, contains many features of interest; the subject is one of very great importance, and well worthy of minute investigation. So far as the author's conclusions regarding the "smashing point" are concerned, he appears to have taken a narrow and unpractical view of this. We agree with some of the speakers in the discussion (reported last week) that he has really proved that there is no period in the life of a metallic-filament lamp of average quality when it would pay to smash it. As a matter of fact, the smashing-point question is one of purely academic interest, even in the case of carbon-filament lamps. Mr. Maurice Solomon put the case in a nutshell when he said that the smashing point was reached only when the light emitted was inadequate for the purpose for which it was required.

On the whole, the lamps passed triumphantly through the ordeal, and the claims made on their behalf of long life and small loss of candle-power, with high efficiency, were fully justified. It appears also that the common practice of under-running them is uncalled for; on the contrary, there would be some advantage in running them a few per cent. over normal, if a steady voltage could be depended upon, but on a commercial circuit it would be preferable to supply them at the voltage marked upon them.

The author, referring to the area of bulb exposed to blackening, apparently overlooks the fact that the distribution of the film of deposit follows approximately the same law as the distribution of light; there is no advantage whatever in this respect in using a large bulb, for the percentage loss of light is in both cases the same. True, the larger bulb may look cleaner to the eye, and the vacuum may be better maintained—but these are side issues.

The author's measurements of the temperature of the bulbs are of especial interest. It will be noticed that the bulb of an old tantalum lamp nearly reaches boiling point, and that of one old tungsten lamp 79°, so that in either case it would be very dangerous to place the lamp near inflammable material—especially celluloid.

FINANCIAL EQUATIONS FOR CENTRAL STATIONS.

By L. CROUCH.

Central station practice is now so far standardised as to enable certain average assumptions to be made concerning the fixed and running charges per KW.-hour. Basing the assumptions upon data collected during the last 10 years, M. Jean Mathieu (in *La Lumière Electrique*, October 9th, 1909) evolves certain mathematical relationships which enable a ready estimation to be made of the probable financial stability of any proposed installation. In the original article the coefficients of the various terms of the equations are chosen to suit the metric system, but converting these to enable the use of English measures, the following results are obtained, the whole information being finally compressed to the curves of fig. 1, and one simple equation.

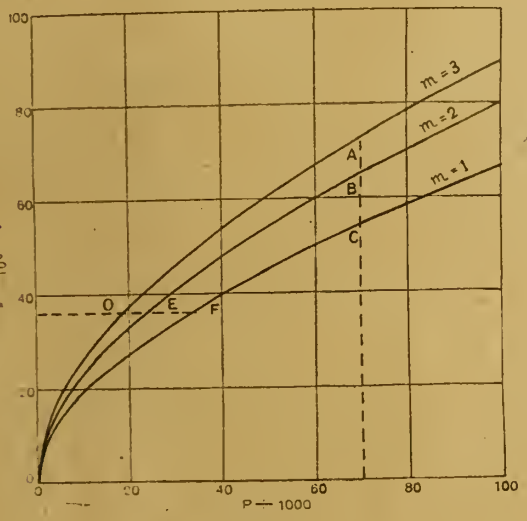

Fig. 1.

Assuming the case of an ordinary central station supplying energy for power and lighting within its own immediate neighbourhood (*i.e.*, with no long-distance transmissions), let—

A = share capital of such an enterprise,
O = capital obligations of same,
C = capital expended to equip the installation completely,
P = horse-power of machines installed,
K = critical number of KW.-hours to be sold per annum to ensure financial stability.

The financial equation to be deduced is that connecting the above quantities. The imperative condition is profitable working; the revenue obtained must pay all interest charges and a normal dividend, redeem the establishment capital, and cover all maintenance, operating and general charges. Such an equation defines the limits of financial equilibrium of the concern. If the station produces a greater number of KW.-hours than K, there will be a balance enabling the formation of a substantial reserve, or possibly of a supplementary dividend. If the annual output falls below K, the normal dividend cannot be declared, and the general and working costs may hardly be covered.

Apart from all current generation, the annual fixed charges of the enterprise are—

$$A\,d + O\,t + C\,a + F_g,$$

where
d = dividend (as fraction of capital),
t = rate of interest on loan,
a = coefficient of redemption,
F_g = general costs corresponding to the sum ($A\,d + O\,t + C\,a$).

The general costs may be taken to be 30 per cent. of the sum ($A\,d + O\,t + C\,a$), and 30 per cent. of the working costs, and may, therefore, be allowed for by multiplying all the costs, fixed and variable, by 1·3.

Variable costs.—These comprise the costs of coal, water, oil, salaries, repair of machines, &c., and may be respectively represented by—

$$c + e + h + s + E.$$

Then, denoting the mean selling price per KW.-hour by v, the financial equation becomes :—

$$(A\,d + O\,t + C\,a + c + e + h + s + E)\,1{\cdot}3 = K\,v \qquad (1)$$

which can be reduced to a much more concrete form.

Thus O and A can be expressed as a function of C, and c, h, s, E as functions of P. The only costs which are, in practice, variable with K are c and e (coal and water); these can be expressed as $f(K)$.

In general, $A = C = 2 \times O$,
$d = 0{\cdot}05$,
$t = 0{\cdot}04$,
$a = 0{\cdot}07$,

while M. Mathieu's analysis of central stations in operation during the last 10 years authorises the following formulæ :—

$$\left\{\begin{array}{l} C = 2{,}800\sqrt{P}, \\ s = 32\sqrt{P} \text{ (supposing all machines are used on peak load),} \\ h + E = 0{\cdot}16\ P \text{ (P = horse-power; C, } s, h, \text{ E = pounds sterling).} \end{array}\right.$$

As regards ($c + e$), the coal and water charges may be lumped together, since the water is generally obtained by electrically-driven pumps supplied by the station generators. A representative figure for the coal per KW.-hour delivered to the system appears to be 3·30 lb., and adopting a mean price of £0·000365 per lb. (·0872d. per lb.)—

$$c = {\cdot}000365 \times 3{\cdot}3 = £0{\cdot}0012 \text{ per KW.-hour.}$$

The mean price of sale v depends on the ratio of the power and lighting rates and on the KW.-hours sold at each rate. If K_f and K_l = KW.-hours sold for power and lighting respectively, and v_f, v_l = corresponding prices per unit—

then $$v = \frac{v_f\,K_f + v_l\,K_l}{K_f + K_l},$$

and $$K_f + K_l = K.$$

Now $$\left.\begin{array}{l} v_f = £0{\cdot}003 \\ v_l = £0{\cdot}006 \end{array}\right\}\text{on the average,}$$

and putting $K_f = m\,K_l$

$$v = \frac{£{\cdot}003m + {\cdot}006}{m + 1},$$

substituting which values in equation (1) we have—

$$(2{,}800\sqrt{P} \times {\cdot}05 + 1{,}400\sqrt{P} \times {\cdot}04 + 2{,}800\sqrt{P} \times {\cdot}07 + {\cdot}0012\,K + {\cdot}16\,P + 32\sqrt{P})\,1{\cdot}3 = \frac{{\cdot}003\,m + {\cdot}006}{m + 1}\,.\,K,$$

whence $$\frac{{\cdot}00144\,m + {\cdot}00444}{m + 1}\,.\,K = 551{\cdot}2\sqrt{P} + 0{\cdot}208\,P.$$

In any given district the value of m is known: usually it lies between 1 and 3; considering, therefore, the three typical cases in which m = 1, 2 and 3 (*i.e.*, power KW.-hours = 1, 2 or 3 × lighting KW.-hours),

$$\left.\begin{array}{l} \text{for } m = 1 : K = 187{,}500\sqrt{P} + 70{\cdot}75\,P \\ \phantom{\text{for }} m = 2 : K = 225{,}900\sqrt{P} + 85{\cdot}25\,P \\ \phantom{\text{for }} m = 3 : K = 251{,}700\sqrt{P} + 95{\cdot}00\,P \end{array}\right\} \quad \ldots \quad (2)$$

which three equations are represented by the curves of fig. 1.

The availability of these curves is of considerable service in the preliminary scheming of a central station. In particular, they enable the solution of the following two inverse problems :—

1. What is the minimum annual KW.-hours that a station of total horse-power P must sell to be financially stable?
2. What must be the horse-power of a station to produce K KW.-hours per year, and what should be the capital engaged in the scheme?

As illustrating these points and the use of the formulæ generally, the following numerical examples may be studied :—

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Numerical Examples :—I. Assume a 70,000-H.P. installation : for financial stability the yearly output of such a station should be :—

(*a*) With $m = 3 : 73 \times 10^6$ KW.-hours per annum (fig. 1) = 203,000 KW.-hours per diem., giving a daily return of—

$$\frac{\cdot009 + \cdot006}{4} \times 203{,}000 = \text{£}761\cdot25.$$

(*b*) With $m = 2 : 65 \times 10^6$ KW.-hours per annum (fig. 1) = 180,500 KW.-hours per diem, giving a daily return of

$$\frac{\cdot006 + \cdot006}{3} \times 180{,}500 = \text{£}722.$$

(*c*) With $m = 1 : 55{,}000{,}000$ KW.-hours (fig. 1), *i.e.*, 153,000 KW.-hours per day, giving a daily return of

$$\frac{\cdot003 + \cdot006}{2} \times 153{,}000 = \text{£}688\cdot5,$$

and, finally, the installation should cost—

$$\text{C} = 2{,}800 \sqrt{70{,}000} = \text{£}741{,}000.$$

II.—Suppose a station is required to yield 100,000 KW.-hours per day = 36×10^6 KW.-hours per year, the horse-power and capital should be as follows :

(*d*) With $m = 3 : \text{P} = 18{,}800$ (fig. 1),

$$\text{receipts per day} = \cdot00{,}375 \times 100{,}000 = \text{£}375,$$

$$\text{capital A} = 2{,}800 \sqrt{18{,}800} = \text{£}383{,}900 \text{ (net)},$$

$$\text{and liabilities} = \text{O} = \frac{\text{A}}{2} = \text{£}191{,}950.$$

(*e*) With $m = 2 : \text{P} = 23{,}000$ (fig. 1),

$$\text{receipts per day} = \cdot004 \times 100{,}000 = \text{£}400,$$

$$\text{capital A} = 2{,}800 \sqrt{23{,}000} = \text{£}424{,}650 \text{ (net)},$$

$$\text{and liabilities} = \text{£}212{,}330.$$

(*f*) With $m = 1 : \text{P} = 33{,}000$ (fig 1),

$$\text{receipts per day} = \cdot0045 \times 100{,}000 = \text{£}450,$$

$$\text{capital A} = 2{,}800 \sqrt{33{,}000} = \text{£}508{,}650 \text{ (net)},$$

$$\text{and liabilities} = \text{£}254{,}330.$$

OZONE : ITS ELECTRICAL PRODUCTION AND USE.

By A. MABILLE.

THE recent decision of the St. Petersburg Municipal Duma and City Authorities to install electrical ozonisers for sterilising the City drinking water supply, may serve to waken up our English municipal people and the electrical trade, to give attention to the possibilities of ozone in this connection. On the Continent there are a large number of cities having such ozone installations : for instance, Paris, treating 10 million gallons per day, Nice treating 5 million gallons, Dinard, St. Servain, Cosne Sulina, &c., while, strange to say, not one single British city or town appears to have given the matter any attention whatever. This is the more surprising as the cost of treatment is exceedingly low—viz., from 0·75 to 1 unit per 1,000 gallons, while as to the efficiency of the process there can be no doubt, seeing that the Pasteur and the Koch Institutes have fully investigated the matter, and shown that ozone can be relied on to completely destroy any bacteria in the water. A study of the subject is therefore of importance, as the electrical engineer can work hand-in-hand with the sanitary engineer in this branch of science, to the benefit of both parties ; indeed, the study of ionisation of air and radio-activity may in the near future yield most important results. Dr. Napier Shaw referred to the ionisation of air in his evidence before the Select Committee of the House of Commons, but was not able to give any definite data as to its practical application, while although we now know that rain water is strongly radio-active (while tap-water is quite inactive) we have but vague ideas at present as to the effect of the electrical and radio-active conditions of air on animal life. Ozone is strongly radio-active. Ozone, an allotrophic modification of oxygen, is produced by the passage of the silent electrical discharge across an air space ; if moisture is present, nitric acid and nitrous oxides are also produced, but by keeping the voltage low the production of nitric acid and nitrous oxides is reduced to a negligible quantity, so that the properly-designed modern ozoniser may be said to be quite free as far as nitric acid production is concerned. Air breaks down and allows a brush discharge to take place when the potential gradient exceeds about 18,000 volts per centimetre, ozone being freely produced ; nitric acid is not produced unless the voltage is considerably above that required to produce ozone, provided excessive moisture is not present. Most ozonisers work at from 2,500 to 5,000 volts, the two electrodes being about $\frac{3}{16}$ in. apart, with a glass plate in between $\frac{3}{32}$ in. thick, so that the air-space is about $\frac{3}{32}$ in. across. This glass plate between the electrodes (in small ozonisers it usually has an aluminium foil covering pasted on one side to form one electrode), prevents any arcing across, and incidentally also raises the potential drop across the air-gap by reason of the higher specific inductive capacity of the glass. The violet brush discharge passing over the air-gap converts the oxygen of the air, O_2, into ozone, O_3, provided the condenser plates are kept cool, the conversion ceasing if any considerable temperature rise takes place. In large apparatus the electrodes are usually water-cooled. In the case of a town supply, the air is generally sucked through the battery of ozonisers by means of an air pump, and then driven to a mixing tank or sterilising column, where the water entering at the top in a fine spray, meets the current of ozonised air, and is thoroughly commingled with the same, the water being thus completely sterilised, and ready to be delivered into the town supply reservoir.

A small domestic apparatus is now on the market, in which the air is sucked through the ozoniser by means of an emulser fixed on the outlet of the water tap, this emulser serving the double purpose of an air pump and ozone mixer. This apparatus will treat 60 gallons of water per hour, and takes approximately 50 watts ; the emulser has no moving parts, and cannot, therefore, get out of order. Using a small apparatus of this description, M. Neisser found that with water at a pressure of 30 lb. per sq. in., the number of germs was reduced from 43,000 to 2 per cubic centimetre, and that even microbes of the staphylococcus or coli bact. class were instantly killed.

In the ozone apparatus, the germs are actually killed, whereas in the ordinary mechanical type of filter they are merely held back by the filtering medium, which in time is liable to become very foul and act as an actual breeding place for the microbes. Carbon filters are particularly faulty in this respect, it being essential frequently to sterilise the carbon blocks by heating them—a process that is tedious and is generally neglected by the ordinary householder. Hence these filters are a positive danger in themselves. Ozone possesses both taste and smell, and is thus distinct from oxygen, which has neither. However, the flavour of water treated with ozone is not at all impaired ; indeed, the added oxygen appears to give the water a distinctly refreshing taste.

The sanitary engineer will be more concerned with the disinfecting properties of ozone, as likely to be of help to him in the prevention of "zymotic" diseases. The pathogenic or disease-producing bacteria consist principally of three groups :—*Micrococci* (more or less spherical in shape), *bacilli* (of rod-like shape), and *spirilla* (which derive their name from their spiral shape), none of which appear able to survive the poisoning action of ozone. This is important, for according to Dr. Koch's experiments, sporeless bacilli are only killed after five minutes' treatment by a 5 per cent. solution of carbolic acid, and are not even injured by a 1 per cent. solution, while the spore-bearing bacilli will resist a temperature of over 212° F.

Clearly, therefore, there should be a field for ozone for the flushing and disinfecting of sewers and house drains, especially in view of the fact that ozone destroys sulphuretted hydrogen, and would thus probably be far more effective in dealing with the gas from sewer ventilation pipes than the present method of burning the gas by the use of special gas lamps.

Air ozonisers have already been extensively used for hospital and sick-room disinfecting, but the use of any form or ozoniser for sewer work has up to the present not been tried. While sea air contains from 3 to 5 per cent. of ozone, the percentage of ozone in sick-room air is, as a rule, very minute indeed, hence the use of air ozonisers for hospitals is now finding considerable favour. The *Lancet*, in May last, advocated the use of the stem drinking glass, owing to the liability of the fingers to touch the brim of the ordinary tumbler; yet the same medical paper totally ignores the far greater risk of infectious disease being spread by reason of the absence of any attempt to sterilise the drinking glasses used in public bars, restaurants, &c. A glass after being used by a person, possibly in the last stages of consumption, is washed in lukewarm water, frequently none too clean, and then used for the next customer without any thought as to whether the glass is germ free or not.

Much consumption undoubtedly is spread in this way, and the matter is one which the manufacturers of ozone apparatus might find well worthy of close attention. Once the general public have their attention drawn to this point, they will insist on the hospital and restaurant managers using suitable precautions.

In dealing with tuberculosis the health authorities "strain at a gnat and swallow a camel"; spitting notices are hung everywhere, but little or no attempt is taken to enforce their observance, as is proved by the filthy state of railway carriages and tramcars. A consumptive tenant may live in a house for years, but unless he actually dies in the house, no steps are taken to disinfect the rooms before the house is re-let to a new tenant.

The oxidising and bleaching properties of ozone should ensure a wide use of this agent for manufacturing purposes.

In concentrated form its bleaching properties are superior to those of chlorine, vegetable colours, fats and oils being easily bleached by ozone. It may be noted that ozone transforms (owing to its being a powerful oxidiser), most of the lower oxides into peroxides, and nitrites into nitrates, and that iron, zinc, lead, silver and arsenic are oxidised by it; further, it is insoluble (or almost so) in acids and alkalis. In the manufacture of glue, grease, tallow, oil, &c., the bleaching action of ozone may prove of much value; as a matter of fact, it is already attracting considerable attention as a bleaching agent for flour, its germ-destroying effect on diseased grain being a valuable property in this connection. The flour is passed into a revolving tumbler drum, where it is thoroughly exposed to the action of the ozone. As the use of chlorine and nitrogen peroxide is now likely to be forbidden by the health and food authorities as being injurious, the use of ozone for flour bleaching will probably become very general. An article recently appeared in one of the weekly papers, strongly condemning this electrical bleaching of flour, but as the writer in question stated that the current was used to produce oxides of nitrogen, it can only be concluded that he had not studied the ozone process at all. One objection to any form of bleaching, is that inferior flour is made to have the appearance of a much superior grade, maize flour being thus passed off as wheat flour.

Apart from its bleaching effect, however, the action of ozone would be very beneficial on any portion of the flour that was derived from diseased grain, as already mentioned, and we know, from the experience of the Italians, how detrimental to health such diseased flour may be.

Prof. Lombroso traced the origin of the disease called the "pellagra," prevalent among the peasantry of Northern Italy, to the use as a food of diseased maize.

Taking air as being composed of 21 volumes of oxygen and 79 volumes of inert gases—chiefly nitrogen—it follows that, by the conversion of the oxygen into ozone (O_2 into O_3), approximately 14 per cent. of ozone should theoretically be produced. In practice, 10 to 12 per cent. is the maximum amount obtainable.

For many bleaching purposes (oils, for instance) a larger percentage of ozone is sometimes required, and in such instances a diluted mixture of oxygen must be passed through the ozonisers, the air being, as a rule, first passed through a scrubber containing strong caustic soda solution, which absorbs any carbon dioxide that may be present. The oil to be bleached should be heated to about 150° F., and in some cases 200° to 220° F.—siccative oils, for instance. Most of the vegetable oils are readily bleached by a 10 per cent. ozone treatment, while tallow and fat are readily freed from any rancidity and musty flavour. Turpentine has the property of absorbing ozone without being decomposed by it.

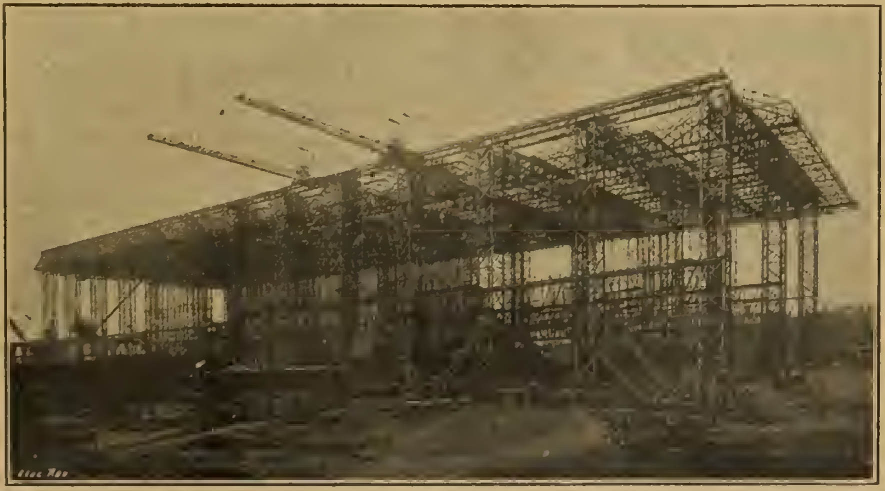
For bleaching textile material, wood, silk, &c., ozone has the great advantage of being quite as powerful as chlorine and not nearly so destructive to the fabric.

There does not seem to be any very satisfactory chemical test for ozone, the usual iodide of potassium (red litmus) test being unreliable, unless care is taken to check that the action is not due to ammonia. The sense of smell is very delicate, most minute quantities of ozone being readily detected; what is wanted, however, is a simple and accurate method of readily determining the percentage of ozone present.

From what has been said it will be seen that ozone has a wide field of usefulness, and the whole subject is one that ought to receive considerably more attention from the electrical trade than has been bestowed on it up to the present.

NEW CANTILEVER CRANES.

Our illustration gives a view of the immense glass-roofed shed covering two of the ship-building berths at the Wallsend Shipyard. The shed is 740 ft. long and about 150 ft. high, the clear inside width of the two berths being 100 ft. and 95 ft. respectively. These sheds are fully equipped with overhead travelling electric cranes. Our illustration, however, is given more particularly to show two cantilever cranes lately erected on the top of the sheds, so as to serve floating docks or ships which may be built beneath them. The cranes consist of a central truck with elevated tower, supporting large steel cables extending to the extreme end of the jib and also to the tail part which carries the machinery and ballast.



Electrical Cantilever Cranes at a Wallsend Shipyard.

Special care was exercised in the design of the cranes so as to make them as light and as strong as possible. The front cantilever is constructed of steel tubes supported at intervals by steel vertical lattice columns. The length of the cantilever jib is approximately 100 ft., while the tail part has a projection of 40 ft.

The cranes will lift 5 tons up to 34 ft., and $1\frac{3}{4}$ tons up to 100 ft. radius from the front rail. The work they will have to do is to deal with steel plates and sectional material for the construction of floating docks and ships. The cranes have three separate sets of electric motors for hoisting, racking, and travelling. Direct current at 240 volts is conveyed to the cranes by two trolley wires running the whole length of the berths.

Hoisting is done by a 25-H.P. motor, series wound, with powerful electrical and mechanical brakes, the rope being coiled on a very large drum. There is also an over-winding device to prevent the pulley block being lifted too far. The racking motion is driven by a 5-H.P. motor with electric brake. The travelling motion is worked by a 25-H.P. motor with both electrical and mechanical brakes. The hoisting speed for 5 tons is 60 ft. per min.; lighter weights are lifted more quickly up to a maximum of 150 ft. per min. The racking speed is 60 ft. per minute, loaded, and the travelling speed when the crane is loaded is 400 ft. per min.

An ingenious device has been fitted, by means of which, as soon as an excessive load is applied, an automatic switch in the driver's cabin comes into operation, and instantly prevents the load from being lifted or racked outwards, although permitting the load being lowered or racked inwards. Adequate means have also been provided to prevent any possible derailment.

These cranes were manufactured by Joseph Booth & Bros., Ltd., of Rodley, near Leeds, and the girder track on which they run was designed, constructed and erected by Swan, Hunter & Wigham Richardson, Ltd.

EMIGRATION.

By ERNEST T. WILLIAMS.

The overcrowded state of the electrical profession has caused more attention to be paid to the question of emigration than formerly.

Undoubtedly emigration offers opportunities and advantages which are too little understood or appreciated. This may be due to several causes, amongst which over-caution, inherent dislike of leaving the native land, and doubts of success, take an important place.

Another factor is the record of those who have emigrated and report unsatisfactorily. The writer recently crossed Canada from the Atlantic to the Pacific, and took advantage of the many opportunities which offered to inquire into the probability of success of qualified engineering immigrants.

The result of these inquiries confirmed the opinion previously held and published in an article in the Review, on September 13th, 1907, entitled, "The Electrical Engineering Profession: On Going Abroad," viz., that many young fellows would do well to emigrate.

The principal essential of success, in the Colonies even more than at home, is character; given this, the man who goes to Canada to-day is almost bound to succeed.

The possibilities appear to be endless, and the average man would have opportunities there, which he is very unlikely to get at home. Discussing the possibility of emigrating, a young engineer recently said he would require certain funds to keep him until he got something suitable to do. Here is the crux of the whole question. The right man will go and *do something* until he can get *something suitable* to do. Many cases could be cited of successful men whose start had been entirely different from what they intended when they emigrated. One man driven to an extreme took to washing windows, and found it most profitable, whilst another chopped up firewood and hawked it round. Both are now owners of their own businesses, whilst the men who went out with them, though possibly equally worthy, returned home and announced emigration to Canada a failure. In England probably more is heard of the failures than of the successes, the latter being too busy developing their new country to make much noise.

In travelling through Canada, one feels instinctively that the faith Canadians have in the future greatness of their country is not misplaced. Only by travelling through it, day after day, can its extent be dimly realised, and when one considers how comparatively little has been done, and yet how rapidly the country is opening up, a conviction is formed that the right men who go there to-day are the ones who will reap success to-morrow.

The writer was repeatedly assured that any man who was not afraid of work would do well there, and not only this, but that he would be welcomed and made at home.

It is important to remember that work means more to the Canadian than to the Englishman at home. This is easily accounted for; in the one case wages are high and labour is scarce, in the other, wages are low and labour is abundant. It follows that in Canada work is more strenuous, hours are longer, and specialisation is not so general.

Many a likely young fellow has spoiled his chances in Canada by obstinate adherence to methods of work which the Colonial condemns, and one of the first things necessary is to adopt the views of the Colony.

The importance of adaptability was insisted on in the previous article, and recent experience has shown that this can hardly be over-estimated. Owing to advertisements appearing in Canadian papers with the appendage that "no Englishman need apply," it is often considered that Canadians are opposed to English immigration. This is correct only to a small degree, and is due to their bitter experience of "remittance men," and to their deeply ingrained objection to the superior airs, often consciously or unconsciously, adopted when the English travel abroad. This is deeply to be regretted, for nothing is more likely to raise the Colonial ire than any indication, whether it is justified or not, that one is socially superior.

It cannot be too clearly emphasised that the sooner and the more thoroughly an emigrant adapts himself to the land and people, the greater will be his chances of success, and the sooner he will make friends and form those connections which go so far to make up for what he left at home.

In Western Canada and British Columbia, which places are at present advancing the most rapidly, an immigrant may consider he is well established when he has what is called "made good," and not before. This making good is equivalent to saying that a man has proved himself to be what he claims. Before a man has "made good," he may have a hard time, but once this is done he can be assured of much sympathy and help. But making good indicates more than that a man can do what he claims as regards his trade or profession, it indicates that he has a certain strength of character that will not be upset by trifles. For example, the men referred to who cleaned windows and sold firewood, would be considered to have made good, *i.e.*, shown grit, and triumphed over difficulties, whilst their less resourceful, and more despairing fellow emigrants had returned disappointed to England. It should be remembered that to take on any class of work whatever in Canada, where all men are socially equal, is in no sense degrading, nor is one likely to lose caste. In fact, men will often accept a post at a small salary in order to "make good" with a view to doubling, or even trebling, their salary in the first year. A case of this kind came under the writer's notice. Another point is that every man tries to save enough capital to start in business for himself, as this is considered an important point there.

This short article has been written mainly with a view to assisting those young fellows who have character, ability, and courage to emigrate if they think there are reasonable hopes of succeeding. There are others in the profession who may have done comparatively well, and the question arises as to whether emigration would be an advantage in their cases. There are certainly greater opportunities in Canada for using and investing capital than in England, and given that a man and family, who have become accustomed to the comforts of home life in England, are prepared to largely sacrifice these, there is no reason why they should not emigrate. Intelligent Canadians, with whom this question was discussed, considered that on the whole, if a man was doing well in England, the Dominion offered him personally no advantages, but that, if he was willing to sacrifice his personal conveniences for the sake of the greater scope that would accrue to his offspring, he would do well to consider the question.

Finally, the writer would earnestly put forward a plea for the greater recognition of the importance of emigration.

The overcrowded state of the electrical profession calls for serious attention, and the possibilities of emigration in this respect have barely been realised or taken advantage of.

Even more important than this is the increasing necessity of English manufacturers to extend their business abroad if the electrical trade of England is to hold its own. Every home-trained electrical engineer who emigrates carries with him a knowledge and interest in home concerns, so that he becomes a factor for the good of British trade. Remembering the almost unlimited scope for electrical engineering in many parts of the world, and especially those countries which are only now being developed, it is to the interests of the electrical manufacturers in particular, and of the electrical profession in general, to encourage the emigration of the maximum number of suitable well-trained engineers.

So important, hopeful, and full of possibilities does the writer consider emigration to be, that he would strongly advocate the formation of a permanent sub-committee of the Institution of Electrical Engineers to deal with the subject in all its branches.

Such a committee, if formed, could count upon the support of the manufacturing interests, and that of all Colonial and many foreign Governments.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Batteries as Load Equalisers.

By a coincidence your issue of November 5th, 1909, drew reference to a circular recently issued by the Chloride Electrical Storage Co., Ltd., dealing with descriptions of their boosters and Chloride batteries in industrial works, while in another part of the same issue in an article on the design and operation of rolling mill motors, by Mr. Manktelow, several statements were made to the effect that batteries as load equalisers were very unsatisfactory.

It is evident that the author of the article is labouring under a misunderstanding as to the suitability of a storage battery for high-rate momentary discharges. Plates that are carefully designed for this class of service could readily handle discharges up to twice or even three times their one hour rating. In fact, it is not the danger of injury to the battery that limits the rate of discharge, but the drop in voltage, and the consequent cost of the boosting apparatus. By permitting the voltage to drop, and thus reducing the capacity of the boosting apparatus, the battery may be utilised up to three times its one hour rating with good practical results. This drop in bus voltage will produce no greater drop in speed than that required to utilise the energy of the fly-wheel, and need not be resorted to until the discharge rate exceeds a certain amount, whereas with a fly-wheel the speed must fall off for every unit of energy delivered.

It is not suggested that for all installations the battery booster would be superior to the fly-wheel, as the first cost of the fly-wheel is less than that of the battery, but it almost invariably is found that conditions arise in actual service which cannot be definitely predetermined, and which call for an output in KW.-hours far beyond the practical limits of the fly-wheel scheme, and the same battery which will meet the momentary peak conditions will have sufficient capacity to handle these exceptional loads, whereas the fly-wheel will be wholly inadequate. Reference to actual practice will be perhaps more convincing than mere general statements.

In the Gary plant of the Indiana Steel Co., the one 2,000-H.P. and six 1,000-H.P. motors which have been installed for operating the rolling mills, are provided with very heavy fly-wheels, and notwithstanding this fact a storage battery is required to handle the fluctuations in load, which would otherwise fall upon the generating machinery. In actual practice it is found that the operation of the mills is very much impaired, and the output in tons per hour is seriously reduced at the Gary plant when the battery is out of service.

Again, the results obtained from the operation of the first "Chloride" battery which was installed at the Carnegie Steel Co.'s, at Youngstown, Ohio, were so satisfactory that other batteries were installed in the different mills of the Carnegie Steel Co., in Pittsburg, in the Illinois Steel Co., in Chicago, and in the Lukens Iron and Steel Co., Coatesville, Pa.

We again repeat that we do not claim superiority of electrochemical storage over electromechanical storage *for all conditions*, but experience shows that electrochemical storage, with its admitted high efficiency, can be applied successfully beyond the limitations of electromechanical storage, and with sufficiently satisfactory results to warrant the somewhat higher initial first cost.

The Chloride Electrical Storage Co., Ltd.,
W. S. Naylor, *General Manager.*

Pendlebury, *December 22nd*, 1909.

The Industry and the Institution.

I received last week an invitation to be present at the Institution meeting, where the paper of Messrs. Lepine and Stelling was discussed. I declined that invitation on the ground that I did not think I could possibly discuss such a paper without contravening the rules of the Institution, which, I believe, preclude political opinions. A perusal of the reports available shows me that I need have had no such fear, and as I do not find my point of view exactly expressed in the discussion as reported, I should esteem it a favour if you would grant me the space necessary for such expression in your paper.

Messrs. Lepine and Stelling's paper sets up a comparison between Germany and this country, apparently to the disadvantage of this country, and offers as a reason the lack of enterprise of the English financiers and commercial leaders, saying: "If they were as enterprising and as successful as their German rivals English manufacturers supported as they are by the superiority of their products would not have to fear German competition in the open market." That, in my opinion, is entirely true. The question is: "Why are they not?" If it is admitted that our work technically is better than the German, how is it that the English financiers and commercial leaders fall so far behind their technical advisers? That Germany is ahead of us no one who is content to judge by results can deny. A country supporting four or five electrical companies, to say nothing of numerous smaller ones, aggregating in capital some £20,000,000 sterling and paying from 8 to 18 per cent. on such capital, is far ahead of us. That we are unable to even mildly imitate this is due to our fiscal policy, which began to act to our detriment at the very moment it was introduced.

As Mr. Rich very truly remarked in the discussion, "A financial artillery duel precedes all technical arrangements." If the electrical industry is to advance in this country, the very first essential is that profit should be made in order that more money may be found.

The reason why money is so very readily forthcoming for industrials in the leading protected countries is that they start off with a certain market. Another reason—the essential difference between Germany and this country—is that the vast wealth of England has been made. It is consequently in the hands of the most conservative class—the people who are looking for safe investments and not industrial speculations. Wealth under these conditions can go on increasing, and possibly does increase, as claimed by our Free Trade friends. In the younger countries, however, the wealth is in the process of making, is consequently being handled by those who are making it, which means the younger generation, which means industrial speculation. The term "industrial speculation" contains within it all the experimental work and commercial pioneer work which are so necessary to keep the engineering science and the engineering trade of the country in the forefront.

To come back to my point, if England—a country importing 250 millions annually more than its exports—were making money instead of living to a very large extent upon its income, income which is spent abroad, while our unemployed, to our lasting shame, are increasing every day, we should be doing all that the Germans are doing, all that the Americans are doing, and in my humble, but convinced, opinion, a little more. All that we want is a fair chance, and I am satisfied that we shall maintain the position which we have not yet lost, although it is being rapidly undermined.

A. B. Anderson.

I have read the leading article in your issue of the 24th inst. with the interest which is always aroused by clever polemic writings, and with the pleasure afforded by politely-veiled sarcasm, even when intended for oneself.

My object, however, is not to join in a controversy for the enjoyment of it, but to obtain amelioration of the conditions under which we are working in the electrical industry. I feel, in common with other performers, that we have work to do and duties to perform while the critics in the industry who have not the responsibility of performances are free to indulge in *Schadenfreude.*

Those who insist on regarding economic and legislative matters as political questions to be excluded from discussion of the electrical conditions, or to be discussed only superficially, do serious harm to the industry. These questions are at the root of our industrial problems, and their elimination or partial treatment precludes an exhaustive inquiry into the conditions. Moreover, those who take up this attitude are apparently forced into making contradictory statements—such as that the disabilities referred to are non-existent, and that they are due to lack of sound business principles, that they are due to absence of enterprise and to the greed of capitalists in fostering excessive competition. No good purpose whatever is served by general imputations of this kind, for although they may be intended to apply only to particular members, they amount to alternative indictments, incapable of proof, of entire industries and of all who are engaged therein.

The position I have taken up in regard to this matter is, I think, unequivocally expressed in the statement I recently made at the Institution, and in the letter I have written to the secretary of the Institution. I ask for a representative and authoritative organisation for the discussion of our troubles with a view to an agreement being arrived at as to the remedial measures to be adopted. One of the reasons why there is no such organisation is that many of us entertain the belief that the Institution is there to promote and defend our industrial interests, although I affirm (without the use of any invective) that the Institution has not adequately safeguarded our legislative and industrial interests in the past, and I have asked the Council to make a definite pronouncement on the question of whether these matters are within the recognised province of the Institution, so that we may know where we are. The reply of the secretary is that the question is receiving consideration. I, therefore, await the decision of the Council. For my own part I hope the Council will not take your view that "the ability of the Institution to confer the maximum benefit upon its members," is shown by its aloofness from questions which are deprecatingly called political, but which, as I have already shown, cause not only the material prosperity or adversity of the industry, but even the fructification or otherwise of scientific research.

E. Garcke.

Ditton House, Maidenhead,
December 26th, 1909.

Russian Development.—Russia is welcoming British enterprise in gold mining, railway building and other industrial undertakings. An interesting interview with M. Kokovtseff, the Russian Minister of Finance, appeared in the *Standard* on December 24th, in which the general question of British capital for Russia was discussed.

RESTRICTIVE COVENANTS.

All men of business who have occasion to employ clerks or assistants, are well aware of the necessity of inserting a restrictive clause in the agreement of service. Keen competition makes it difficult to make and keep a connection; and steps must be taken to prevent a discharged clerk or assistant drawing off the custom of his late master, or entering into direct competition with him. A case which was heard in the Chancery Division some months ago involved the discussion of an interesting point in relation to what are termed "covenants in restraint of trade." The decision was as follows:—The defendant covenanted not to practise as an architect or surveyor within a defined area for a certain number of years. It was held that he committed a breach of that covenant by acting as manager in a fixed area to another architect. He who is not a lawyer may wonder why there should be any doubt about a question of this kind. He may also fail to understand the meaning of the phrase "covenant in restraint of trade." It is necessary, therefore, to point out that, as a general rule, a covenant which binds a man not to practise his calling at all, is looked upon with suspicion. The reason is that if a man deliberately sells the right which all men have in a free country to the exercise of their calling, he deprives the public of the benefit of his skill and experience, while he abandons what may be his means of livelihood. A principle of law has, therefore, been evolved, having its origin in the famous case of Mitchell *v.* Reynolds, which was decided in 1712, that contracts in restraint of trade are void, and must not be enforced by the Courts. If an electrical engineer at the present day were to enter into a bond which prevented him from carrying on his business anywhere for the rest of his natural life, no Court of Justice would enforce its due performance.

But while contracts in total restraint of trade are void, it has become a well settled rule that if restriction is limited as to area, and there is "consideration" for the bargain, the goodwill of a business may be made the proper subject matter of a contract. And so the well-known "bond" into which the vendor of a business enters is recognised in, and will always be enforced and respected by, a Court of Justice. Were it otherwise, the sale of a connection would be rendered impossible, as nothing could operate to prevent the vendor from interfering with the practice which he himself had disposed of for a substantial sum of money. Similarly, unless an assistant or servant could be put under restriction, employment anywhere would be dangerous on any terms.

Such is the bare outline of a branch of law which is surrounded with many technicalities. Into these it is not our purpose to inquire at any length, but there are a few points which demand a further elucidation. It has been pointed out that the restriction must be limited as to space. It would be wholly unreasonable, for instance, to prevent an assistant from exercising his calling anywhere in the British Isles. Many cases have arisen in the Courts as to what is a reasonable limit. In Horner *v.* Graves (7 Bing. 735) it was held to be unreasonable to restrict a dentist from practising anywhere within 200 miles from York. On the other hand, to borrow an instance from the legal profession, a covenant preventing a solicitor from practising as such anywhere in England for 20 years has been held to be reasonable and capable of enforcement (Whittaker *v.* Howe, 3 Bras. 383). It follows, therefore, that in marking the border line, the Court will be influenced in a large measure by the nature of the business. The available means of communication are also important. By means of railways, telephones, &c., a practice can be extended over a much wider area at the present day than would have been possible at the close of the last century. That the Court is willing to enlarge the boundary in certain cases, even to the confines of the habitable globe, was clearly demonstrated in 1896, when world-wide restriction was placed upon the manufacture of a particular class of guns and armament. Although this case could never have any direct application to the electrical profession, yet it serves to show the elastic nature of rules by which the Court is governed in these matters.

With regard to time, there does not appear to be any restriction. Nevertheless, if a man binds himself not to practise for a limited period, the area of restriction may receive a slight extension. The rule by which the boundary should be determined was thus expressed in the case of Horner *v.* Graves, to which allusion has already been made:—

"The restraint must be only such as to afford a fair protection to the interests of the party in favour of whom it is given, and not so large as to interfere with the interests of the public."

The consideration—another essential feature of these contracts—is the next matter which deserves attention. And upon this point, so long as the Court is satisfied that there is a consideration which is not merely colourable, the contract will be enforced. The adequacy of the consideration is left entirely to the parties themselves. Instances could be cited without number to show what has been held as a reasonable consideration. In the case of Sainter *v.* Fergusson (7 C.B. 716) the engagement of the defendant as assistant was held to be sufficient consideration for an undertaking on his part not to practise within a radius of seven miles after the termination of his employment.

Having made an attempt to indicate the features which are essential to contracts in restraint of trade, we now propose to consider what constitutes a breach of such contract. In most contracts the covenant is in the following form: The vendor undertakes that he "will not at any time hereafter, directly or indirectly, and either alone or in partnership with or as assistant to any other person or persons, carry on the profession or business of, &c., within a certain area." A further clause prohibiting practice "in open competition" sometimes finds its way into the deed.

The question naturally arises, What constitutes practising? Most men—or their consciences—will be able to answer this question without difficulty, but doubtful points arise from time to time. In the case of Palmer *v.* Mallett (36 Ch. D. 411) it was decided that a person acting only as a salaried assistant was carrying on the profession of a surgeon, and that to do so was a breach of the covenant. In that case Lord Justice Cotton said: "Carrying on a trade implies to, my mind, that the person engaged in it is engaged in it *qua* trade—that is to say, as a trade producing profit or loss which is to be shared by him; and that is not the case if he is merely a salaried assistant. . . . I cannot come to the conclusion that a man is less carrying on the profession of a surgeon because he is doing so as assistant to someone else. 'Profession' is different from trade, and it is much more emphatic to my mind than if 'business' alone were here. When, as here, the words 'carrying on the business or profession of a surgeon' are merely used to denote what is done by a man acting as a surgeon, a man, in my opinion, acts as surgeon none the less because he is not the principal or engaged in the business as a partner, but is merely carrying it on as assistant to somebody else." It was the very case of Palmer *v* Mallett that was followed in the case under review, where Mr. Justice Warrington said: "Applying that to the present case, surely someone who was assisting as architect another, who was himself carrying on the profession of an architect, was himself carrying on the profession of architect as much as if he was acting as architect for a lay client."

Waste Electricity.—The *Daily Mirror* of December 18th published some ridiculous statements to the effect that, owing to the introduction of the metallic-filament lamp, the electricity supply companies are "producing very nearly twice as much current as is being used. Much of this surplus current must go to waste!" Further, "an experienced electrical engineer" is said to have told the *Mirror* "that the companies are turning out current that they cannot sell."

The appearance of arrant nonsense in the columns of the daily Press in connection with electrical matters is not uncommon; but to make an electrical engineer responsible for such stuff is really going too far.

PROCEEDINGS OF INSTITUTIONS.

Research on Metallic-Filament Lamps.

By F. H. Reakes Lavender, M.Sc., Student.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, December* 1st, 1909.)

This research was undertaken in order to investigate the conditions of working as regards voltage, and efficiency and percentage drop in candle-power, giving the most economical life in the case of metallic-filament glow lamps, and to determine as far as possible the cost of illumination with this source of light.

It was considered desirable that the results should apply to metallic-filament lamps generally, and not to a special make. For this reason a number of lamps were obtained from six firms which were considered fairly representative of that industry in this country. The lamps were obtained direct from the makers, of 100 volts and 25 c.p. They had clear bulbs, and in most cases were marked to burn in any position. Six lamps of each kind were taken and run at six different voltages, namely, 95, 97·5, 100, 102·5, 105, and 107·5 volts. Thus there was one lamp of each make at each voltage, making 36 lamps in all.

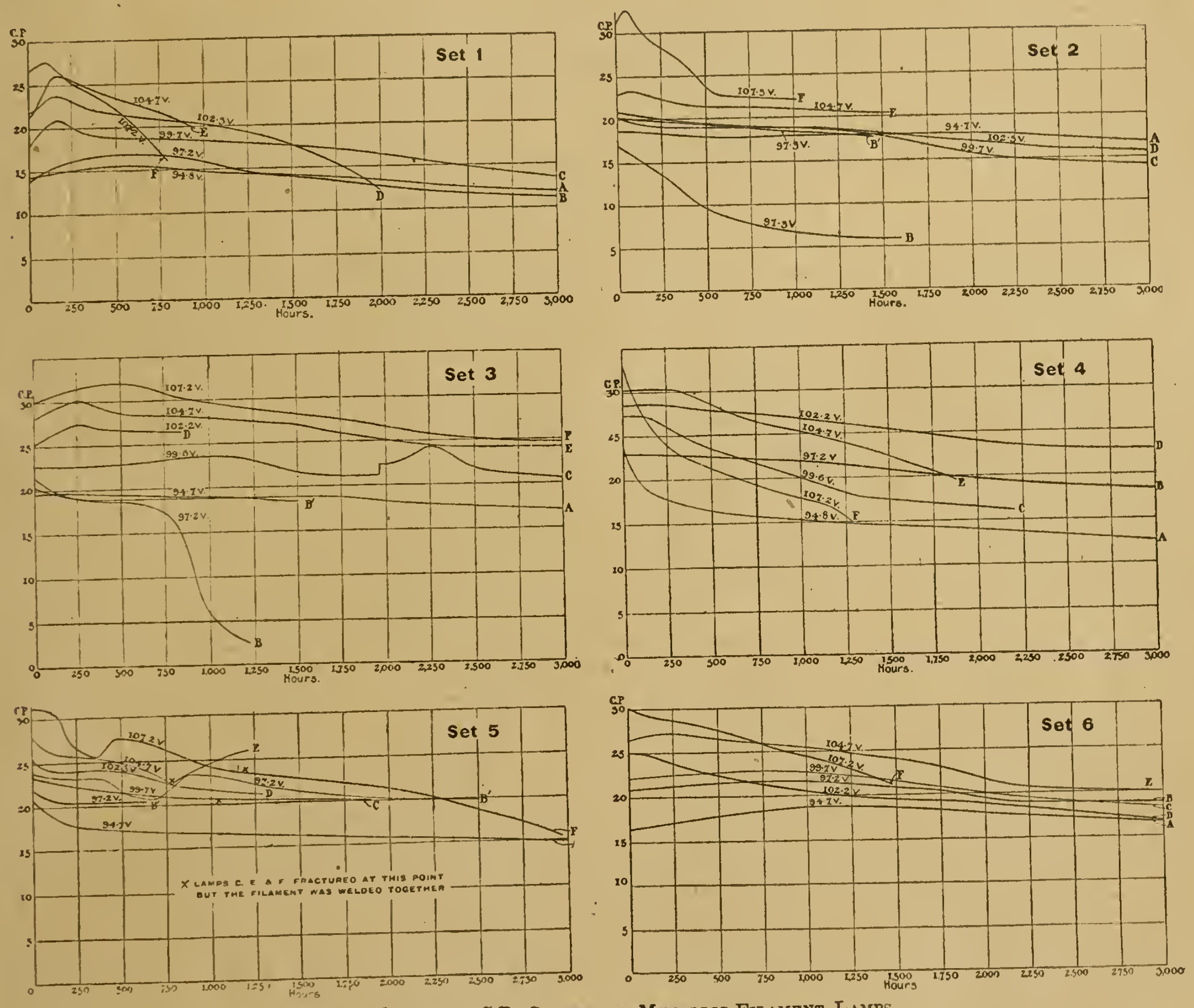


Fig. 1.—Life and C.P. Curves of Metallic-Filament Lamps

For the life tests the lamps were run continuously night and day, week ends included. In the daytime (about seven hours) power was obtained from the University power station, off the 110-volt lighting mains. At other times the load was switched over on to the 220-volt battery. The lamps were run as far as possible under the usual commercial conditions. No special automatic voltage regulation was used. The drop across the battery during the night was very small, and easily allowed for by slightly increasing the potential difference at the lamp terminals at the start. In the daytime the voltage had a limit of variation of 2 per cent. up and down for the most part. The lamps were taken out of their holders and into an adjoining room to be photometered twice a week.

For convenience a number has been assigned to each make of lamp, the voltage being indicated by a letter, as follows :—

Makes 1, 2, 3, 4, 5, 6.

Voltage A means 95 volts   Voltage D means 102·5 volts
" B " 97·5 "   " E " 105·0 "
" C " 100·0 "   " F " 107·5 "

Thus lamp No. 1 A is the one of make 1, run at 95 volts. Those of Set 1 are tantalum; the other sets are tungsten.

The candle-powers of all six lamps of a set are plotted on one sheet against the life in hours as abscissa. The curves shown (fig. 1) are the mean lines drawn through the points. The candle-hour curves (fig. 2) give the number of candle-hours obtained from the lamp for a given life. From the price of the lamp the "pence per candle-hour for lamp" curve is constructed. This shows the proportion of the total cost which is due to the outlay on the lamp. These curves have been worked out on the latest list prices at the time of writing, which are as follows: Make No. 1, 2s. 6d.; the other makes, 3s. 6d. On the same sheets the consumption curves corresponding to the lamps are plotted; from these the watt-hour curves are obtained. The watt-hour curve, together with the candle-hour curve, gives the curve of watt-hours/candle-hours. This gives the average efficiency, and therefore, with a certain price of energy, the cost per candle-hour for any predermined length of life. From this curve, together with that of lamp cost, the "total pence per candle-hour" curves are plotted. This has been done for energy at 2d., 4d., 6d. and 8d. per unit. It was found best to plot them at four different scales, otherwise those at cheaper current would be unduly flat. The scales have been marked on the sheets. When the lamp has been burning a sufficiently long time, the ordinates to these curves reach a minimum value; this gives the most economical life for the lamp. It happens in some cases that the lamp breaks before this point is reached. However, its absolute life may often be prolonged by welding the filament together, by shaking the lamp until the loose end comes in contact with another part, so closing the circuit. This means that it will be overrun to an extent depending on the length of the filament cut out. This is an advantage, since, even if the lamp does not last very long, yet for that period we are obtaining light at a higher efficiency and without any cost for the lamp, because it is a scrapped one we are using.

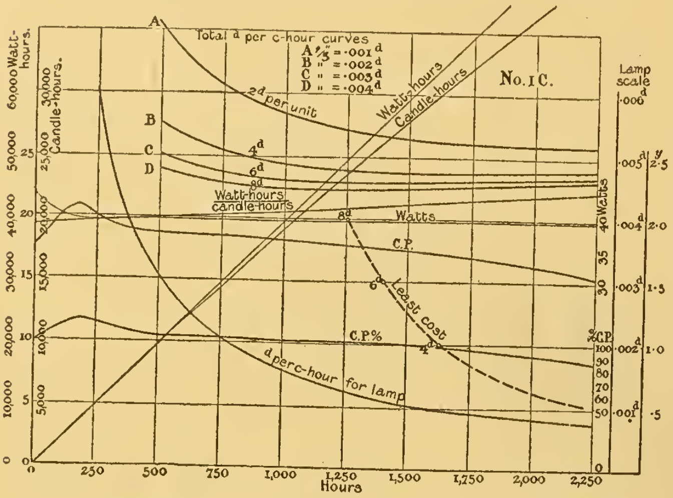


FIG. 2.—RESULTS OF TESTS ON A TANTALUM LAMP AT NORMAL VOLTAGE.

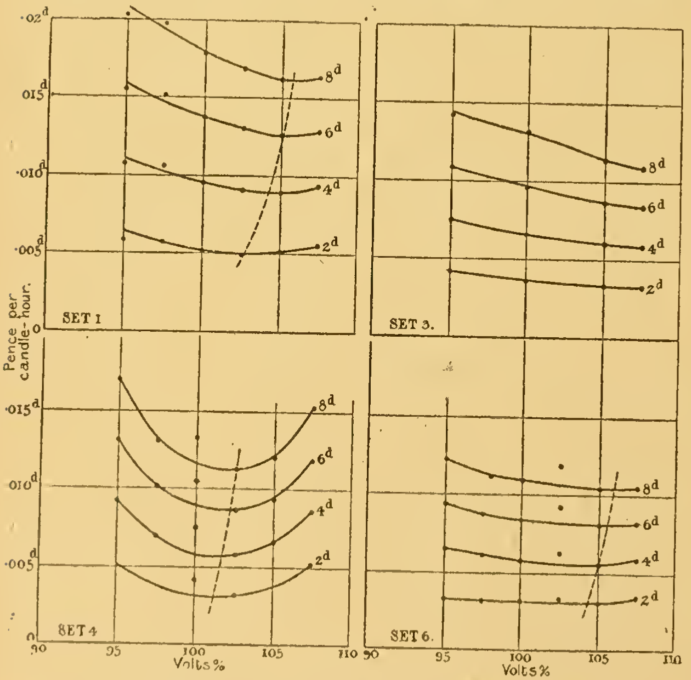


FIG. 3.—TOTAL COST OF LIGHT AT DIFFERENT PRICES OF ENERGY FOR VARIOUS MAKES OF LAMPS.

For example, lamps Nos. 5 C, 5 E and 5 F fractured at 600, 800 and 1,200 hours respectively, and after being joined again, burnt to 1,800, 1,200 and 2,900 hours respectively. In other cases the increase in life was not so great. Naturally much greater care has to be taken in handling such lamps, as the joint is very liable to become broken again. This, however, shows that the fragility of metallic-filament lamps is to some extent balanced by the possibility of mending broken ones. This does not apply to tantalum filaments, which, I understand, speedily fracture again after welding. Perhaps this is partly due to the shortness of the loops and consequent greater mechanical strain on the joint, and partly to the fact that their temperature is considerably lower than that of tungsten filaments.

The broken-line curves give the relation between the cost of energy in pence per unit and the useful life. They are obtained from the total cost curves. In fig. 3 are curves giving the relation between the least total cost of light (for lamp and energy) and the voltage for four typical cases. These have been constructed by taking the minimum points of the total-cost curves mentioned above. The broken lines on these sheets are drawn through the minimum points.

Considering the tantalum lamps, *i.e.*, Set 1 first, all the candle-power curves show a distinct rising at first and then a gradual fall, the slope of which depends on and increases with the voltage at which the lamp is run. In nearly all cases the actual life curves are very wavy, with alternate rising and falling of candle-power.

Two of the lamps, namely, 1A and 1B, were still burning when these results were collected. The useful life of a lamp, and the drop in candle-power which it is advisable to allow for a given voltage, depend on the cost of energy and the price of the lamp. The cheaper the energy, of course, the longer the life, and the greater the admissible drop.

Taking energy at 5d. per unit as an average price, and the lamp run at rated voltage, then it pays to throw the lamp away as soon as the candle-power has fallen to 3 per cent. below its original value. This result appears startling at first, considering the large initial cost of the lamp. However, by the time this point is reached the lamp has been burning for 1,500 hours at the best possible efficiency for the given potential difference at its terminals, so that the cost of the lamp per candle-hour has become small. In most cases the "total cost" curves are very flat near their minimum value, so that the exact time to scrap the lamp is not very clearly marked. When the lamps are run at a low voltage the efficiency curve rises very slowly, and the smashing point is not reached until the "lamp cost" curve has become fairly flat, which means a long economical life, for the candle-power is low but varies slowly. On the other hand, when run at a higher voltage the changes in the lamp take place more rapidly, the efficiency curve rises quicker, and consequently the economical life is shorter.

From the curves, fig. 3, it appears, as would be expected, that the dearer the energy the higher the potential difference at lamp terminals, and therefore the efficiency at which it pays to burn it:—

Price of energy.	Per cent. voltage.	Hours.
8d.	106·0	700
6d.	105 0	950
4d.	104 0	1,050
2d.	102 5	1,300

It appears that it would be good practice to overrun the lamps from 2 to 6 per cent., and for a life of 1,300 to 700 hours according to the price of energy. With energy at 4d. per unit the drop in candle-power from the initial giving the most economical life appears to be about 5 per cent. This is very much less than that commonly allowed in the case of carbon lamps.

Tungsten lamps are included in Sets 2, 3, 4, 5 and 6. Many of the remarks made on tantalum lamps apply equally well to these. The initial rise in candle-power mentioned in connection with tantalum lamps is in most cases not apparent. It occurs most markedly in Set 6. The candle-power curves, generally speaking, show a continual drop from the start. In many cases the drop is very rapid at first, and then becomes less and less so until they become almost horizontal. When this is so there is found to be very little blackening of the bulbs. The total-cost curves reproduced in fig. 3 all show the same characteristics as those for tantalum lamps.

These curves in the case of Set 3 show a continual drop without a minimum point. This is due to a very great improvement in the efficiency of the lamps at higher voltages without a corresponding shortness of absolute life or greater steepness of the life curves. The following lamps were still burning when these results were collected:—

Set 1.	Set 2.	Set 3.	Set 4.	Set 5.	Set 6.
A B	A B′ C D	A C E F	A B D	A B	A B C D E

Collecting these together we get:—

Voltage	95·0 A	97·5 B	100 0 C	102 5 D	105·0 E	107·5 F
Number of lamps still burning.	6	5	3	3	2	1

From this it would seem that the increased potential difference has an effect on the absolute besides the useful life. The useful life of tungsten lamps is much longer than that of tantalums. If carelessly handled the absolute life would probably be shorter owing to the greater fragility of the filament. It may be noted that the area of bulb exposed to blackening is greater in the case of all the tungsten lamps tested than in the case of the tantalums. This would help to prolong the efficient life. Practically all the blackening takes place in a belt opposite the filament, the pip end keeping clear.

The following table gives a comparison of the different makes. Below it are given for comparison some figures for carbon lamps taken from Mr. Hirst's paper, read before this Institution, and reduced to English candle-power, and 9d. per lamp. The cost of energy has been taken at 4d. per unit:—

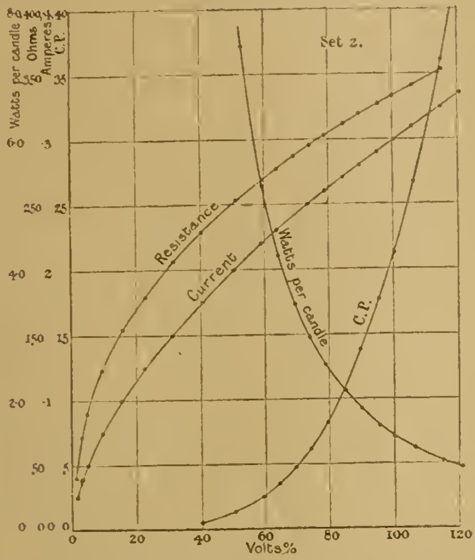


FIG. 4.—VARIATION OF CANDLE-POWER AND EFFICIENCY WITH VOLTAGE.

Lamp.	Initial candle-power.	Volts per cent.	Useful life. Hours.	Mean efficiency	Candle-hours.	Cost per 1,000 candle-hours.		
						Re-newals.	Current.	Total.
Set 1 ...	21·50	105 0	970	1 87	22,200	1·35d.	7·50d.	8 85d.
2 ...	24 20	105·0	1,500	1·45	32,400	1·30d.	5·80d.	7·10d.
3 ...	30 00	107 5	2,300	1·24	67,464	0·64d.	5·16d.	5·80d.
4 ...	28 50	102 5	2,000	1 32	53,138	0·79d.	5·28d.	6·07d.
5 ...	31·20	107 5	1,900	1·34	47,500	0·88d.	5·36d.	6 24d.
6 ...	26·50	105 0	2,350	1·22	55,770	0 75d.	4 88d.	5 63d.
No. 1*...	15·10	100 0	1,000	4 94	14,560	0·619d.	19 75d.	20 369d.
2*...	14·95	100·0	1,000	4·06	14,400	0·628d.	16·25d.	16·878d.

* No. 1, 110-volt; No 2, 200-volt, carbon lamp.

The duration of life is that giving the best economy. The actual life in some cases was much greater. The life curves show that many lamps were burning well at 3,000 hours. Unfortunately, I was not able to continue the tests further, or an even greater duration of life would probably have been obtained. The voltage is that which, according to the curve, gives the best economy.

From these tests it appears that the cost of lighting with tungsten lamps amounts to about 6 2d. per 1,000 candle-hours. If tantalum lamps are used the cost is about 8·8d., or 42 per cent. more. When carbon lamps are used, according to the figures above quoted, the cost is about three times as much as for tungsten. In the case of metallic-filament lamps 85 per cent. of the cost is paid for the energy consumed, and 15 per cent. for the lamp itself, while with carbon lamps this latter item only amounts to 5 per cent. of the whole.

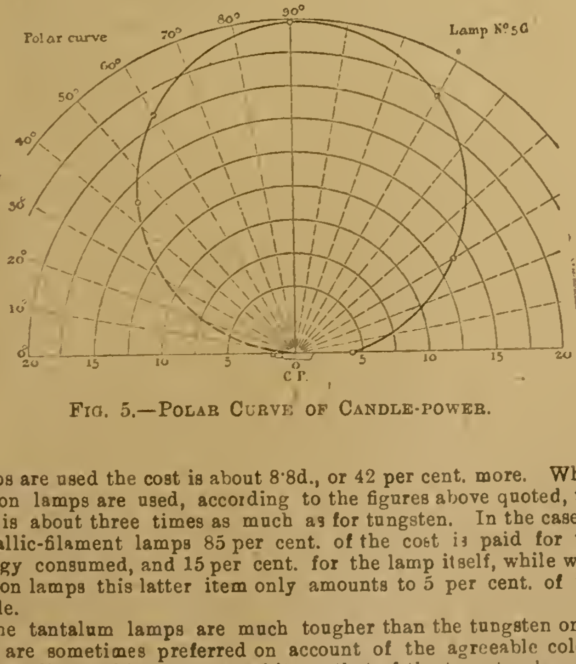


FIG. 5.—POLAR CURVE OF CANDLE-POWER.

The tantalum lamps are much tougher than the tungsten ones, and are sometimes preferred on account of the agreeable colour of their light, which is not so white as that of the tungsten lamps.

In shop window lighting, &c., the lamps are often placed in close proximity to perishable goods. The outside temperature of the bulbs was therefore measured. The maximum temperatures, after 1,400 hours, were 95° C. for tantalum and 79° C. for tungsten (No. 4), 48° C. (No. 6).

Some tests were made in order to determine the dependence of the candle-power and efficiency on the voltage. A typical set of curves is given in fig. 4.

For a 3 per cent. variation of volts above and below the normal the average variation for metallic-filament lamps works out at 22 per cent.; the variation with carbon lamps is 50 per cent. more.

Some tests were also carried out in order to obtain the mean spherical candle-power. The lamps were run at rated voltage. When being photometered they were fixed in a stand which enabled them to be turned through a complete circle in planes perpendicular to and parallel with the filament. The following table gives the average figures obtained:—

A.	B.	C.	D.	$\frac{A.}{C}$	$\frac{D.}{C}$
Mean spherical C P.	Mean hemispherical C.P.	Mean horizontal C.P.	Perpendicular C P.		
17 6	18·6	22·7	4 0	0·78	0·18

The mean spherical candle-power is thus about 22 per cent. less than the mean horizontal candle-power, and the vertical candle-power is only 18 per cent. of the horizontal.

I have reproduced a representative polar curve in fig. 5.

Marine Propulsion by Electric Motors.

By H. A. MAVOR, M.Inst.C.E.

(*Abstract of paper read before the* INSTITUTION OF CIVIL ENGINEERS, *December 7th*, 1909.)

So long as reciprocating steam engines were the best attainable power generators, it was possible to correlate the speeds of generator and propeller so as to gain the best efficiency of each; but the steam turbine and the non-reversible internal-combustion engine introduced a new set of conditions.

Before the introduction of electric transmission the marine engineer had the more complete scientific data, and consequently the marine engine held the blue ribbon of economy which now belongs to the turbo-electric generator. Among the reasons for the higher efficiency of the land turbines are:—That the engineer on land is freer than is the marine engineer to adopt a suitable speed of revolution; that the land turbine runs at approximately constant speed for all loads, and can therefore be run on the governor, rendering easier the application of superheat and augmented vacuum; that on land it is possible to sub-divide the power-units to meet the conditions of varying load, and thus maintain at the smaller loads an efficiency not materially different from the efficiency at the full load of the system; that at sea, change of power is directly associated with change of speed, and the whole of the power units must always be in motion while the ship is in motion. The same engine has to run the ship at 10 knots and at 20 knots, although the power varies very widely between those limits. Also the high economy of power production on land associated with electric transmission is largely due to the possibility of exact measurement of power under all conditions of load, giving a complete knowledge of the effect of all changes in the apparatus or in the methods of working it.

The proposition here made is to provide an electric equipment intermediate between the prime mover and the propeller, extending the limits of practical economy in each by modifying the restrictions which the prime mover and propeller impose upon one another, and providing that the prime mover may operate at or near the constant speed required for the attainment of maximum efficiency and full power, and that the power expended in driving machinery not required for work is reduced to a minimum or entirely eliminated. At full power all the elements of the generating plant are in full operation and the whole power resources can be concentrated on driving the ship. When full power is not required the generating plant may be shut down in sections.

To accomplish these ends special motors have been designed which give the necessary changes of speed and direction and permit of the advantageous combination or elimination of the power generators. These motors involve no new electrical principle, but simply mechanical adaptation of well-known electrical designs. Alternating current alone is available for the purpose in question, and normal motors have, therefore, a fixed speed of rotation which is a simple multiple of the generator speed.

Two methods of speed change are proposed, each associated with a new form of motor.

The principle of operation of the "spinner" motor is that an ordinary normal motor driving the propeller at a fixed speed, with the shaft and propeller directly connected, is so arranged as to be rotatable as a whole about the propeller-shaft axis. This rotation is accomplished by a second motor concentrically arranged outside the first, so that the main motor system may be rotated in either direction—again at a fixed speed which is a simple multiple of the generator speed—and the speed of rotation of the propeller shaft and of the propeller in the water is the algebraic sum of the rotation of the main motor and of the rotation impressed upon it by the auxiliary motor.

As both motors are reversible it will be seen that in each direction there are three speeds:—

1. The speed of the main motor system; the middle speed.
2. The speed of the main motor system minus the speed of the auxiliary motor system; the low speed.
3. The speed of the main motor system plus the speed of the auxiliary motor system; the full speed.

The combination may be designed for any three-speed ratios, such as 1, 2, 3; 2, 3, 4, &c. Any intermediate speeds required are attainable by adjustment of the turbine or engine-governor, which can be operated economically through a range down to about 75 per cent. of full speed. The same method is applicable to non-reversible internal combustion engines.

The "Multiple" motor is an ordinary squirrel-cage induction motor in all respects, except that its stator is wound with two or more independent electric circuits, each associated with a separate source of supply of energy.

For example, the motor may be fed from two sources of supply at 25 and 50 periods respectively, the motor windings being for 46 and 92 poles. At full power and speed, both windings are in operation under their most advantageous conditions; each of these windings results in a synchronous speed of 66 revolutions per minute. When the 25-period current is supplied to the 92-pole winding, the speed is 33 revolutions per minute.

Each of these motors permits of one or more generators being used together in the same mechanical system without electrical connections or synchronising devices.

The author then goes on to discuss the application of electric propulsion to certain definite types of ship, and also gives diagrams illustrating the saving in space obtained. The examples worked out are as follows:—

1. In a cargo vessel of 840 shaft-H.P., the normal reciprocating engine equipment with a single screw would weigh 570 tons for engines, boiler and fuel. The electrical equipment, consisting of three oil engines, three motors and three propellers, would weigh only 270 tons, including fuel. Further, with coal at 20s. per ton, and oil at 40s. per ton, the saving in fuel cost on a total of £17 would be £5 6s. per day at full power.

2. In a similar cargo vessel gas engines might be used. Taking an equipment of 770 shaft-H.P., and using three gas engines and one multiple motor, the respective weights of the normal and proposed equipments would be 446 tons and 229 tons. The consumption of fuel shows an equally favourable comparison.

3. A third cargo vessel, but of 1,030 shaft-H.P., is worked out for the purpose of illustrating the application of steam turbines to the multiple motor. One plant drives the ship under normal conditions: extra power is supplied by a small turbo-generator, and is used to keep up the ship's speed in heavy or contrary weather.

4. On a passenger vessel of, say, 16,200 shaft-H.P., the electrical equipment permits of a sub-division of the plant, so that at ship speeds lower than the maximum only part may be run, and that at full power. This advantage is gained without loss in full power economy, and without additional complication.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. Lepine and A. R. Stelling, Dipl.Ing., Students.

(*Discussion at the* Institution of Electrical Engineers, *Manchester, December 14th*, 1909.)

Mr. J. S. Peck thought the most valuable part of the paper was that dealing with the financial relations between the manufacturers and the banks. Many opportunities had been lost by British firms to Germany, simply because the Germans made money to put into the company to help finances. The same arrangement existed, to a lesser degree, in America. He noticed in a paper a paragraph regarding a certain railway about to be completed: "Part of the road has been financed by German interests, and the equipment will, of course, be manufactured in Germany. The other part of the road was financed by a British financier, and it is hoped that a considerable portion of the equipment will be manufactured in Great Britain." There appeared to be more co-operation in Germany among the manufacturers than there was in this country; in fact, there was very little here, and he would like to see a little forced co-operation in the shape of a protective tariff. He understood that at the A.E.G. works, part of the time they had three eight-hour shifts per day. As regarded the statement as to the finish of the German machines being slovenly, he thought it was true in general, but he had seen some German machines that were beautifully finished. They could teach us nothing with regard to high-voltage windings. The special form of field-winding for turbo-generators with "butt" joints had been tried elsewhere, but without success; in fact, it gave a great deal of trouble.

Mr. Gregory considered that the rule of forbidding the draughtsman to enter the shops was peculiar. A draughtsman should be acquainted with the general design of the machinery he was connected with, and it did not seem conducive to the firm's interest to keep him away from the process of manufacture.

Mr. T. L. Miller said that the methods by which the German firms were financed and the mode of dealing with the staff in countries outside Europe, had a great influence on the manner in which Continental firms obtained large contracts outside their own country, and in competition with British manufacturers. Most of the Continental firms had good technical staffs at their branches, who were able to go into the whole matter on the spot, and close the bargain there and then. With most of the British firms it was necessary to write home before anything could be done. Then, again, the financial system enabled the Continental firms to take greater risks than was possible in the case of the British manufacturer. It was not superior technical education and design, so much as the financial backing, and the type of agents they had abroad, by which success was attained. The closer the connection between the drawing office and the shop, the better. A draughtsman ought not only to be kept in touch with the carrying-out of the work, he should also be allowed to get out the cost of the work, and the value of the material and labour upon it, and to check his estimates with the actual results which had been obtained in the works. The more the men in the drawing office know about costing, the better for the employers. With regard to works management, a firm of high-speed engine builders had four Committees dealing with the whole of the production, viz.:—Designs, Estimating, Works, and Sales Committees, and there were certain men who were on the whole of the Committees. Supposing a new design was got out, it was first submitted to the Designs Committee, who criticised it. On that Committee they had some of the foremen, and also representatives of the Estimates, Works, and Sales Committees. From there it went to the Works Committee, who considered the question from the works point of view; from there to the Estimating Committee, who drew up the cost, and then the Sales Committee considered whether the thing would sell. An arrangement like that was to his mind one of the best methods that could be adopted. Where there was a large variety of different classes of work, it was well for the heads of various departments to collaborate from time to time with those in the office, and pass the designs before they went into the works.

Mr. J. Frith said that draughtsmen should be forbidden to stay in the office rather than that they should be forbidden to go into the shops. He would like to know whether in the curves comparing English and German machines, allowance had been made for the lower temperature rise and larger overload capacity of the English machines, also if the commutator copper was included in the weight of the active copper. In the D^2L formula the "n" seemed out of place, and the 10^{-4} seemed to indicate mm. not cm.

Mr. Faye Hansen said he had worked in both countries, and agreed that the reason of the German success was not to be sought in better design and workmanship, or in tariff conditions. There were quite a number of smaller firms having capitals of from £100,000 to £500,000, which were doing important work in generators and motors as well as in specialities. He thought the continued existence of these firms was one of the reasons why trusts in Germany had not been detrimental to the German electrical trade, as competition in all classes of work had prevented stagnation. Regarding draughtmen not being allowed in the shops, it was not true of the shops he was acquainted with, which included two of those mentioned in the paper. The hours in the A.E.G. works four years ago were six to two, and two to ten; but when busy, a night shift from ten to six was worked. He had noticed in this country that if rush jobs were going through the shops, the cost of labour usually came out less than normally, notwithstanding overtime rates, which proved that ordinarily workmen were not working up to their full capacity. He had not noticed the same in Germany, and believed that the Trade Union policy of restricting the output of each man was very injurious to the industry. Wages in Germany four years ago were higher than the figures mentioned in the paper. Most of the work was done on piecework, or on a bonus system, and the wages of skilled workmen were more like 50s. than 30s. German firms were quite willing to alter their designs if an important order could thereby be obtained. There were very few consulting engineers in Germany, and it was, therefore, very seldom that firms were pressed to deviate from their standard design. The different wishes of consulting engineers were increasing the cost of English electrical machinery all through by at least 5 per cent., as a larger technical and correspondence staff was required for the same output. It would certainly give a big impetus to the industry if the consulting practice could be restricted to really eminent and broad-minded engineers.

Mr. R. B. Slacke stated that the average price paid per head in Germany for skilled and unskilled labour was about 6d. per hour. That was about the same average price as in this country. The skilled erectors got about 15s. per day, which was about the same as English erectors got when working on the Continent. There was no doubt that branch offices should be more efficient than agents, and principals were generally more willing to keep their branch offices fully posted as to progress than their agents. It was for this reason that it was not always the agent's fault if he was not as efficient as he might be.

Mr. H. W. Wilson, when in Germany, was struck with the good discipline which prevailed, and also the comparatively small amount of work turned out per man. Men worked steadily but not very hard. The hours of work were more, about 60 hours per week, and the wages about 35s., which was practically the same price as paid in England. Female labour in Germany was generally more highly paid than here. In the winding department the operatives got about 15 marks per week. In the A.E.G. works they reckoned to have one skilled man to every 10 workmen. The technical men were paid very badly considering their qualifications. He came to the conclusion that German manufacturers could not be producing much more cheaply than ourselves, but owing to the increased output the establishment charges were reduced. The great advantage of the German industry lay in its financial backing. There was no doubt that if the English electrical industry could obtain similar financial support, the outside markets would be a very much less serious matter than at the present time. Electrical manufacturers would never make money either with or without Tariff Reform unless the number of firms were reduced. If a combination of firms in this country were to adopt the policy of generally sending out thoroughly qualified technical men who knew the conditions of the country, there would be a chance of obtaining some of the large orders.

Dr. F. H. Bowman thought the superiority in German trade arose from three things—viz, their sales departments abroad were better than our own, they had greater financial facilities, and they worked longer hours. He had been through German workshops, and the thing that struck him was the superior organisation, and that the works were kept cleaner; but a great deal of their work would not pass in England.

Mr. W. Cramp said the authors pointing to the dividend "earned" said that the state of the industry in Germany was satisfactory. From whose point of view was it satisfactory? Although it might be reasonable for an ordinary manufacturing firm to pay a dividend upon its capital, he did not think 12 per cent. or 18 per cent. was reasonable from a purchaser's point of view, unless there was some very special reason why such a dividend should be paid. It seemed to him that those dividends pointed to the existence of a sort of combination which we in this country should try to avoid, especially when, as in this case, they did not go hand in hand with relatively higher wages. With respect to the curves, the ratios of total active iron divided by total active copper, and of armature iron divided by armature copper, which were given for English and for German practice respectively, were not such as would, in his opinion, lead to curves shaped as these curves were; for if the above ratios were plotted against KW., it would be found that the curves of English and German practice crossed in some cases twice. It was said that it was difficult for us to export to Germany on account of the tariff against machinery and finished articles in general. Some few weeks ago he visited the Morganite Co.'s works in London, which made carbon brushes, and the manager told him that, if it had not been for the foreign demand for these brushes, they would have been compelled to give up making them. He mentioned that, of the brushes turned out, 1 million were going to Germany annually, to the very firms mentioned in the paper. On inquiring the reason, he was told that it was because the full technical data supplied for every quality of brush were much appreciated, and uniform results could be relied on. The English manufacturer was too slow to take advantage of this, and so continued to buy his brushes abroad. He had come across the "Kollonnen" system of labour in the textile trades. Although it looked satisfactory from the manager's point of view, it was, in his opinion, a most insidious and dangerous practice, which led very quickly to sweating.

Mr. Thomas said the system mentioned by Mr. Cramp was not in use in Germany. It was only applied to machine shops, and not to the erection of installations. It had been stated that wages were slightly less than in this country, but the cost of living had also to be considered. It was the organisation of these works which put them on the good basis they were on. The finish of German machines was generally reckoned to be quite equal to any. There were a great many small German firms who specialised in small things, such as arc lamps, switches, &c.

Mr. Adamson said that one of the American Societies of Electrical Engineers had a publicity department, which laid interesting facts concerning their industry before the general public. He thought it would be to the advantage of electrical engineers if their Institution took some steps to inspire the confidence of English financiers in the particular work its members were interested in. It was difficult to get money from the bank, but some trades were more favoured in this respect than others, and he thought it was because bankers were better informed. There was no difficulty in raising money for building Lancashire cotton mills.

Mr. T. H. M. Swinburne said that, apart from all questions of financial backing and tariff, much of the success seemed to be due to the fact that whenever a German firm wished to compete in this country, it invariably employed English engineers to exploit its interests in the first instance; then, when a connection was established, the Englishmen were replaced by Germans, with the usual results. Taking the case of other countries in the South of Europe, where English and German machinery were placed on the same basis as regards tariff, instances had arisen in which the preference had been given to English machinery, even when it cost 10 per cent. more than German, particularly in the case of textile work. There was no doubt as to the Germans being willing to send in tenders; but any departure from the standard specification invariably entailed additional expense, and it was quite another matter as to whether the requirements were actually met. If the tariff were reformed in this country the results would doubtless be very different.

The Chairman (Mr. S. J. Watson) said the very intimate relationship between commercial undertakings and the banks undoubtedly tended to help forward the carrying out of large schemes as the opportunity offered, but during times of trade depression trouble might occur. If a firm was paying 18 per cent., it was an easy matter to set aside a portion of the profits for scientific investigation, but unfortunately in this country there was not enough profit to allow for this.

Mr. A. E. Stelling, in reply, said he thought that the key-note of the whole system of trade abroad was organisation and the question of having proper staffs and competent agents. There was no doubt that combinations like those of the large German firms were more successful than the English firms, because they represented so many branches of the industry. That was particularly noticeable in the case of China, where one German firm had very large showrooms, showing all their manufactures and had a staff of 14 Europeans. He thought the good work which the German agents were doing could only be obtained on our part by a combination of English firms to set up a large show-room abroad, with competent agents to show the things they manufactured. The firms should be thoroughly organised and in touch with branch offices, which should be organised so that they would be capable of attending to anything that might come forward. With regard to impregnation, this was always done in vacuo, in some cases with varnish and in others with bituminous compound. He quite agreed that draughtsmen should be allowed to go into the shops, but he could not agree with Mr. Miller that so much latitude should be allowed the draughtsman. With regard to the organisation of works, in some firms the letters were signed by two men—one a technical man and the other a commercial man. The "active copper" was, of course, armature copper. The small letter "n" was in its right place, it represented the most efficient average speed in R.P.M. of the respective sizes of machines given in the tables; $D^2 l n/\text{KW}$. was a formula used by Profs. Arnold and Kapp for purposes of comparison, but the authors had given it what they considered to be a commercial value by altering it to $D^2 l n/\text{KW}$. at 1,000 R.P.M.; KW. at 1,000 R.P.M. limited the "standard size" of machines which would be offered. There were a good many small firms in Germany mostly manufacturing switches and instruments; a good many of these for a long time had not paid any dividends, and they were practically absorbed by the large firms. The standard rate of wages was lower than in England, except for certain classes of female labour. Erectors abroad were all paid the same wages, whether they were German, American or English. All the reports of the large companies and of the banks stated that adverse legislation had caused a diminishing business in certain branches, but, at the same time, the four large firms mentioned in the paper paid a dividend 1 per cent. higher this year than they paid last year. If the trade was decreasing at home, it must be increasing abroad. These German firms did insist on their specifications. If trade was so good as to warrant double shifts, he thought England ought to have a look in too. As to the financing of small municipal undertakings, the Council could borrow money on the plant to be erected, and with this money and the money the manufacturing firm put in, the plant was set up. The great advantage of that was that the manufacturing firm would supply the machinery and superintend the running, and the bank would take care of the financial side and of the accounts. As time went on, the town had power to repay the loan from the banks.

Institution of Mining Electrical Engineers.

The inaugural meeting of the Institution of Mining Electrical Engineers was held at the Midland Hotel, Manchester, on Friday, the 17th inst. The list of officers elected for the coming session is as follows:—

President, Mr. Wm. Maurice; Vice-Presidents, Mr. W. C. Mountain and Prof. W. Robinson; Hon. Treasurer and President of Finance Committee, Mr. A. M. C. Field, Newcastle; Hon. Editor of *Transactions*, Mr. J. H. C. Brooking; Hon. Secretaries, Messrs. Saunders, Derby. Two hon. members had been elected by the Council, viz.:—Mr. J. Glynn Williams, Whitehaven, the founder of the Institution; and Mr. Robt. Nelson, H.M. Electrical Inspector of Mines. The meeting elected Messrs. E. J. Dryhurst and Mr. J. Kirkby as auditors. Mr. Wm. Maurice then read his presidential address.

He first gave a brief account of the origin and development of the new Institution, which took its rise in a leading article in the Electrical Review on December 11th, 1908, followed by letters from various correspondents; in February last Mr. J. Glynn Williams, of Whitehaven, drew up a set of rules, and on April 24th a meeting was held at which it was decided to form a society, commencing with 50 members—a number which was quickly trebled. Mr. Williams was elected the first honorary member. The new institution was neither an offshoot nor a rival of any existing corporate body; it was new in conception, for its memorandum of association contained features never previously embodied in the design of any technical society, and new in title, for the electrical engineer possessed of special experience in the uses of electricity in mines was only just coming into existence.

Twenty years ago there were only three or four electric power installations in the mines of this country, and only 42 mines provided with the electric light, while to-day practically every colliery in the country had its own electric generating plant, and all classes of colliery workmen derived incalculable benefits from the use of electrical methods, which tended to increase their wages, while relieving them of physical labour. The exchange of manual for mechanical labour always increased the total volume of employment, and from a sociological point of view the change was always in the upward direction.

A very much higher standard of attainment was now demanded of the colliery manager by the changed conditions of the times, and it was expected that the next Mines Act would make a clean sweep of the existing system of appointing managers. Attention was drawn to the provisions of the Coal Mines Regulation Act, whereby every person found guilty of offences against the Act was made liable to punishment. The manager and under-manager were primarily responsible before the law for enforcing the regulations, and the engineer, electrician and other officials were responsible to them. The extended application of machinery and the adoption of scientific methods of working demanded technical qualifications for the under-manager, which a few years ago were thought good enough for a manager. The engineer and electrician were accounted of little importance when the 1887 Act was drafted, being referred to only under the vague title of "competent persons." Both were undoubtedly destined to become mining electrical engineers, and they should seek to understand each other at this new starting point. The colliery engineer must necessarily possess an intimate knowledge of his plant, but electrical work in many cases came too late in life for him to acquire familiarity with it, and the position called for the exercise of tact and judgment on the part of both the engineer and the electrician, for there must inevitably be occasional slight collisions of authority, overlapping of responsibility, and so on. Generally speaking, the colliery engineer of to-day was not an electrician, and the colliery electrician was not an engineer; but the new conditions demanded that each should have a competent knowledge of both mechanical and electrical engineering. The same goal would then be open to both. Measures should be taken to improve the position of the engineer, and the colliery electrician should be made responsible for the constant maintenance of all parts of the electrical installation in such condition as would normally suffice for the prevention of accidents. Colliery engineers were eligible for membership, and the colliery manager would be a valued member of the Institution, which also profited by the support of many well-known electrical experts. The constitution had been framed on a broad and generous basis, which provided that no class of official or member of a colliery staff should be inadmissible; but there would be a distinct class of diploma members, who were, or had been, actively engaged in the care or management of mining electrical installations, and had passed the Institution's examination in that subject, and who would eventually form the premier class of the Institution. The first object of the Institution, then, was to establish a professional class of mining electrical engineers, by considering means to minimise the risk in the application of electricity to mining, promoting the adoption of approved methods, and extending the experience and elevating the status of the members. It had been arranged that the papers and proceedings should be published in a weekly technical journal of high standing and circulated to all the members, instead of publishing "Transactions." A technical newspaper was, in the widest sense, a living library, and if one had any claim whatever to be a technical man, one must read the principal journal or journals relating to his business. A purely electrical journal had not been chosen, because the Institution had to deal only with the mining applications of electricity, from the mining point of view.

A disastrous explosion which recently occurred had been by some attributed to an electrical origin, and the main business of the Institution during its first session would be to inquire into the causes of, and means of preventing, accidents arising from the use of electricity in mines. The safety with which electricity could be used depended primarily on character; out of 48 accidents from shock between 1903 and 1909, only two were unavoidable, and of 19 ignitions of fire damp, only 1 was classed as an "accident," unsuitable apparatus and neglect being in most cases responsible. Accidents happened solely from want of order, cleanliness and common care; a little elementary technical knowledge, associated with intelligent application, would work wonders in the prevention of accidents. The true function of the engineer was to prevent rather than to repair breakdowns, and to lessen waste due to inefficiency. "The central passion of all men of true ability was to do their work well," and the problem of raising the efficiency of themselves and their surroundings was the most important object of their membership. That object was explicitly indicated, for the first time on record, in the memorandum of association. The future of the Institution must inevitably depend upon the collective character and ability of its members; if they wished it to grow and flourish, they must give loyal support to their leader, and, by raising the Institution, elevate their own status.

Proposing a vote of thanks to the President, Mr. W. C. Mountain said that as far as the mining industry was concerned, electrical machinery had suffered from inattention due to want of knowledge, and accidents with electrical machinery had frightened some of the proprietors, but in his opinion electricity was the safest thing to be used in mining operations, if properly looked after and given proper attention.

The title of the Institution had been criticised by some people, and after some discussion, it was resolved to defer the question.

A dinner was afterwards held, at which the President presided. After the loyal toast, Prof. Thornton proposed "The Institution of Mining Electrical Engineers," and said that in his opinion electricity when properly used, and properly attended to, was the best and safest thing that could be used in mines. The object of the Institution was to go into the question of mining electrical machinery, and make the risks as light as possible. The President, in reply, referred to the question of the title, and said that they were willing as far as possible to meet the wishes of other Institutions without detracting from their own position. There was no other society likely to injure them unless it were the National Association of Colliery Managers, and he thought they would have the support of that Association.

Mr. G. H. Winstanley proposed the toast of "The Mining Industry," to which Mr. Ritson and Mr. Halliday replied.

Mr. J. H. C. Brooking proposed "The President of the Institution," and Mr. Maurice, in replying, said that they were not endeavouring to make their Institution a highly technical organisation, but an educative one which would work for the managers and owners of collieries, and would be of great service to the mining industry generally.

Pig-Iron.—The output of pig-iron in Great Britain for the first half of 1909 was 4,715,679 tons, an increase of 61,690 over the previous half year.

LEGAL.

The Electrical Co., Ltd., v. Oliver H. Thomas, Son and Co., Ltd.

(*Continued from page* 1015.)

Further cross-examined, Mr. Stottner said that the reason why plaintiffs entered into the agreement to unwater the mine after the flooding in June was, first, to avoid litigation, and secondly, because they had no desire that it should be spread about broadcast that the Electrical Co. had supplied a plant which was not satisfactory.

Mr. Williams, K.C., for the defence: Defendants were threatening you, were they not, and declaring that they had heavy claims against you?—Yes.

And your idea was that if you got in the first blow by issuing your writ, it might have the effect of stopping litigation?—Witness denied that this was so. Plaintiffs issued their writ simply to enforce payment for the plant. It was an automatic method. If a customer did not pay he was threatened from the counting house. If that did not bring about the desired result, then a writ was issued. Witness admitted that the plaintiffs supplied defendants with a plant which did not, to a certain extent, do the work required of it.

You contracted in 1905 to supply machinery capable of unwatering this mine, and yet in November, 1907—two years afterwards—the mine was still unwatered?—I could not say how long it was.

On Thursday, December 21st, Mr. Stottner was cross-examined by Mr. Williams for the defence, and, in answer to Counsel, said that about March, 1908, a Mr. Flood came on the scene as directing engineer, and he wrote several letters pointing out defects. Witness wrote and said that unless they received certain pipe columns which defendants had undertaken to supply, they would take no responsibility for anything which might occur. At that time the delivery pipes for the pumps, which were part of defendants' old plant, were in a very defective condition. Witness admitted that one of his people had suggested that a Worthington pump, which had been used in the mine, could be passed off as nearly new if it had a coat of varnish and some repairs. Witness added, however, that no one would buy such a pump without first properly examining it.

The Official Referee: I suppose this is a sample of what you would call "commercial diplomacy"?—Witness explained that the pump was one which had been taken to the mine when the plaintiffs were engaged in unwatering it.

Referring to a certain part of the work which plaintiffs were seeking to charge defendants with, Counsel asked witness if he really thought plaintiffs were entitled to make such a charge?—When the water was got out and they came to discuss terms it was thought that Mr. Thomas would meet them.

Examined as to certain charges, amounting to about £280, for work done in November for unwatering the mine, Witness said the labour which was charged for between July and November was incurred in unwatering the mine.

Counsel: Your letter of June 21st was to the effect that you would supply labour for unwatering the mine?—Witness agreed, and said that the mine was unwatered several times, but unfortunately it got filled up again.

Do you suggest that you should be paid for your unsuccessful attempts?—I think we should be paid in accordance with the agreement.

The Official Referee: The agreement does not say that you are to be paid if you fail to unwater the mine, and you admit you had not done this in November?—Witness eventually admitted that the unwatering was not carried out, and that defendants ought not to have been charged for it.

Mr. Williams: I thought you would agree with me in time.

Questioned as to the difficulty experienced at one time to get labour in the Lyuvi Valley, Witness declared that plaintiffs' men were "in a frenzy to get away from the mine." "They declared," said Witness, "that if the work did not stop soon they would run away, commit suicide, or something."

Mr. Williams: Why was that?—Because they were sick and tired of the whole job, and the work was very strenuous.

The Official Referee adjourned the hearing until after the Christmas vacation.

Shaw v. Stoke-on-Trent Pure Ice and Cold Storage Co., Ltd.

At the Hanley County Court, the week before last, plaintiff, John Shaw, owner of a dwelling house, 3, Ashford Street, Shelton, sought an injunction to restrain defendants from using or working in their premises any electric motor or other engine or machinery in such a manner as to interfere, by reason of the vibration and noise, with the plaintiff's enjoyment of the premises, or in any way to create a nuisance to plaintiff or injury to his premises. The company, it was stated, had a 40 h.p. electric motor, driving an ammonia compressor, and there were smaller motors driving fans. Plaintiff complained of the noise, and added that the whole house was in a tremble. Defendants said that there was no nuisance, but that, if there were, it was so intermittent that it might be disregarded. After hearing a certain amount of evidence, his Honour said that he would visit the house and the works before giving judgment (on January 12th), but he asked if it were not possible for some arrangement to be arrived at.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Automatic Tumbler Switch.

An automatic tumbler switch, which is claimed to be the smallest circuit-breaker extant, has been designed and patented by Mr. C. W. Denny, of 2, Pembroke Cottages, Edwardes Square, Kensington, W. We illustrate in the accompanying figure this automatic switch and wall-box combined, suitable for use on a conduit system.

The object of the switch is to eliminate as far as possible the use of fuses for small power and lighting circuits, and, consequently, to get rid of the trouble and inconvenience caused in replacing blown fuses. The switch is admirably adapted for controlling lights, either from a distribution board or from separate points. In the former case the distribution board is fitted either with d.p. automatic tumbler switches or with s.p. automatic tumbler switches and s.p. fuses, the fuses being, of course, rated about 50 per cent. above the load at which the switches are set to operate. In either case the size, and consequently the cost, of the distribution board is considerably reduced, and greater efficiency results. If the switches are used at different points of a building, a small distribution board is used, containing s.p. automatic switches or fuses, as the case may be. If fuses are used, they are rated above the capacity of the switches, as mentioned above; in fact, with s.p. fuses one fuse can be used for several switches, and it should be preferably of the magazine type, thereby greatly hastening the restoration of current to a circuit.

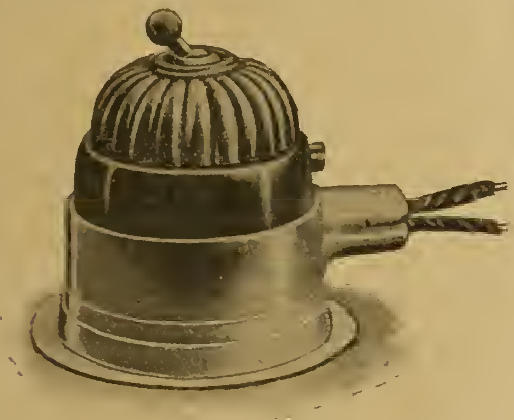


Fig. 1.—"Denny" Automatic Tumbler Switch.

Cooking Demonstrations.

An interesting series of demonstrations of electric cooking recently took place at the Le Radiant, Ltd., 83, Mortimer Street, London, W., their new patent electric ovens being used; among those present were engineers and representatives from many electrical companies and corporations. Special watt and watt-hour meters were installed for the purpose.

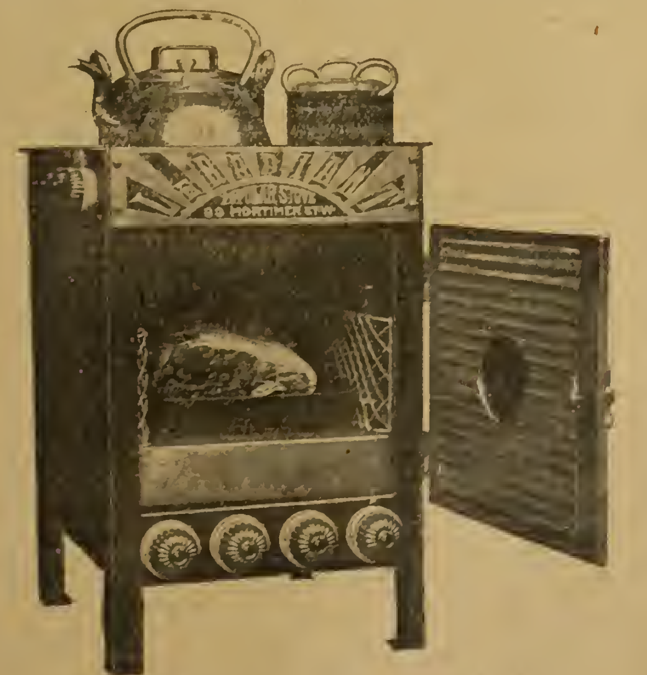


Fig. 2.—"Le Radiant" Oven, 1910 Model, No. 2.

On the 15th inst. the following were cooked:—6 lb. of beef and Yorkshire pudding; a large fowl; potatoes and cauliflower; a 3-lb. apple pie; cheese cakes and wine biscuits. The time occupied was one hour and a quarter, and the amount of energy consumed was 4½ units.

On the 16th inst. the following menu was cooked:—Leg of mutton, 7 lb.; large fowl; apple pie; French pastries; fried sole, and boiled potatoes. The time taken was one and a half hours and the energy consumed was 5 units.

The chefs and others present agreed that the results were excellent, and far superior to those obtained from either gas stoves or coal ranges, the dishes being very tender and of excellent flavour.

We described the "Popular" Le Radiant stove in our issue of July 9th, p. 75; since then the design has been improved, and we illustrate the 1910 model, No. 2, herewith. The total height of this stove is 2 ft. 3 in., and the maximum consumption 2,800 watts; six regulating switches are provided. The inside measurements are 18×15×12 in. high. There are ten heating tubes, and in the top of the oven are two openings for boiling and stewing.

Model No. 1 is a larger size, 3 ft. 6 in. high, and takes a maximum of 4,000 watts.

Lamp-Holder Suspension Clip.

This clip has been designed by Mr. C. W. Denny for the purpose of attaching to any ordinary lamp-holder, to suspend the lamp from a wall, bracket or shelf, and, in fact, any place where a vertical cord hang is not permissible. The device is suitable for shop-window lighting, bazaars, and other places where lamp-holders have to be suspended in awkward or difficult positions. The use of the clip prevents nails, hooks, or other metallic appliances coming in contact with the flexible connections, which are apt to become frayed and the insulation weakened when used as a means of support for the lamp-holder. A further advantage is that the weight of the lamp-holder or pendant is removed from the flexible connections. The clip shown in the accompanying illustration is made from spring steel and brass wire, and is being placed upon the market by the Clarence Engineering Co., Ltd., 3, Cherry Tree Court, Aldersgate Street, E.C.

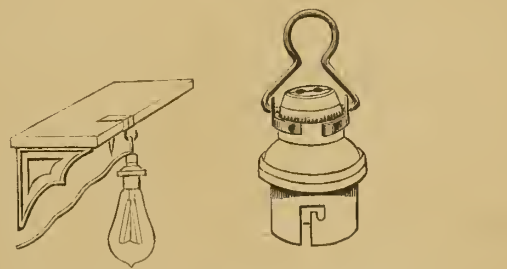


Fig. 3.—"Denny" Lamp-holder Suspension Clip.

ELECTRICAL FIRMS AND THE COPPER COMBINATION.

The reported formation of a combination to restrict the production of copper in the United States aims at bringing about an increase in prices, and there seems reason for believing that quotations will advance in the near future. If consumers were to exhibit anxiety on this point, the question would specially affect the electrical industry in the manufacture of cables. In discussing this subject a German newspaper points out that from the profit standpoint the electrical firms in that country are independent of the price of copper prevailing at any time, seeing that the contracts contain a clause making provision for fluctuations, and in the case of contracts for bare or insulated cables, it is arranged that the prices are to remain open and be fixed according to the market price. If the companies have to bind themselves to the prices of insulated conductors, as in the case of public competitions, a clause somewhat as follows is provided:—"The prices for insulated conductors are founded upon a basis price for electrolytic copper of £   to £   , and are increased by ·2 mark (2½d.) per 1 square millimetre cross-section and 1 kilometre long for each £ begun, or are reduced by the same amount for each complete £, by which the London quotation for electrolytic copper is higher than £   or lower than £   on the day of the receipt of the order." A similar clause is usually inserted in contracts for the delivery of lead-covered cables.

The result of the insertion of provisions of this character in contracts is that the electrical companies are not directly interested in the rise or fall in the price of copper. Of course the orders for cables in a period of extraordinarily high prices for copper are less numerous than when normal or low prices prevail, as it may be assumed that about one-half of the value of cables is represented by the cost of copper, and the remainder by other materials, labour, profits, &c. The proportion of copper used in the construction of electrical machinery is insignificant as compared with cables, amounting to from 6 to 10 per cent. of the total consumption of a large firm. It is therefore necessary for the works, apart from cables protected by a clause of the kind above mentioned, to keep stocks of copper for use in the making of machinery and for other purposes, as such a clause is not usual in these cases, but these stocks in general are not so considerable as is sometimes assumed. The firms will naturally cover their requirements on a large scale when they conclude from the situation of the copper market that an advance is probable. The stocks in the case of the large German companies that are not appropriated for orders should not exceed 1,000 tons; stocks of several thousands of tons are regarded as very considerable.

The total copper consumption of the Allgemeine Elektricitäts Gesellschaft, the Siemens-Schuckert Works and the Felten & Guilleaume-Lahmeyer Works is estimated at from 60,000 to 65,000 tons per annum, and is approximately divided among them uniformly. As a consequence of the protection clause in contracts, it follows that neither large profits nor large losses can result to makers in respect of the cable department, in which by far the greatest amount of the copper is used, and the prevailing price of copper therefore cannot have a determining influence upon the remunerativeness of the undertakings, although it still forms a factor which directly or indirectly cannot be left out of consideration. Suggestions have repeatedly been made to the large companies to render themselves free from the purchase of copper in the market by the acquisition of copper mines, or by taking a financial interest in them, but the proposals have not met with sympathetic reception, as the consumption of even the largest undertaking is not large enough to justify such an association with a single mine. The reports of a copper trust have not caused the companies to depart from their usual rates of supply, thus showing the opinion entertained in electrical circles as to the probable development of the market.

The tone in the brass trade in Germany seems to be similar to that prevailing in the electrical industry. Brass contains from 60 to 70 per cent. of copper, and makers have not found any occasion for providing themselves with specially large stocks owing to the reports of a copper trust and its possible consequences. In case the trust or combination should attempt to force up prices very high, the brass trade would look out for various substitutes, such as brass-plated iron, whilst the electrical industry would devote more attention to the use of aluminium wherever possible. Indeed, the producers of aluminium, of which large stocks are believed to be held, and which is now suffering from a productive capacity that is considerably in excess of the demand, would find a favourable opportunity for stepping into any gap that might be caused by inflations in the price of copper.

BUSINESS NOTES.

Brussels Exposition, 1910.—At the forthcoming Exhibition at Brussels the boiler room will be an attraction. It is to form a part of the International Machinery Hall, and there are to be ten large water-tube boilers of Continental make, to provide the steam for power, light and heating purposes, and the latest and most approved boiler accessories of almost every description are to be included. It is interesting to note that English-made stokers have been selected for these boilers, the Underfeed Stoker Co., Ltd., having received the order for the equipment of the boilers with their system of mechanical stoking and mechanical draught. These stokers will be of the self-cleaning mechanical underfeed pattern, and the fans for the forced draught are to be direct connected to electric motors. The Underfeed Stoker Co., Ltd., will have a stand in the British Section of the International Machinery Hall, where they will exhibit stokers for various classes of boilers, as well as their patent air heater, &c.

The Future of Turkey.—Reuter's Constantinople representative, in a dispatch appearing in the *Financial Times*, makes the following interesting observations on the subject of Turkish concessions and the precautions that are being taken by the new Government. He writes as follows:—

"Ever since the new *régime* came into force in Turkey, the Ministry of Public Works has been literally besieged with applications for all kinds of concessions. So numerous have been these demands that the Ministry has been seriously embarrassed by the claims on its attention, and has finally devised a plan with a view to eliminating such as were not serious or did not enjoy proper backing. It was announced that no applications would be entertained which were not supported by a certificate of financial and technical aptitude, and a delay of one month was granted for this guarantee to be furnished. This measure has been entirely successful. Out of nearly 400 applications which had already been submitted to the Minister of Public Works only four were able to establish their soundness and good faith; the rest, for the most part, were speculative demands by concession-hunters who would afterwards attempt to sell their concession to the highest bidder."

Mr. Fairbanks, late Vice-President of the United States, who is at present making a tour round the world, will arrive in Constantinople from Egypt about the middle of next month.

Private Meetings.—Mackey's Electric Lamp Co., Ltd., Tulip Place, New Church Street, Bermondsey, S.E.—In compliance with Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors of the above was held on December 24th, at the Manchester Hotel, Aldersgate Street, E.C. The liquidator (Mr. Walter Bean, of 174, Aldersgate Street, E.C.) submitted a statement of affairs as at December 9th last, and this showed liabilities amounting to £7,294. The claims of trade creditors were only £315 13s., and there were sundry creditors for £1,433. The balance of £5,545 represented an amount due to Mr. J. A. D. Mackey, in respect of rent and money lent to the company. After allowing £100 10s. for preference claims, the assets were expected to produce £639, being made up as follows:—Cash at bank, £10; good book debts, £283; estimated to realise, £276; stock-in-trade valued at £64; machinery expected to produce £371; and fixtures and fittings, £17. In addition to the liabilities shown on the statement, there were debentures to the extent of £2,500, on which no interest had been paid by the company. The debenture-holder was Mr. J. A. D. Mackey. The liquidator reported that the company was formed some nine or ten years ago by Mr. Mackey, the present debenture-holder. The debentures had been issued for cash advanced by the vendor; and no part of the purchase price was paid by the company by the issue of debentures. Mr. Mackey's solicitor stated that if the creditors agreed to the voluntary liquidation of the company, he would make no claim in respect of the debentures he held, and he would also withdraw his claim on the company for £5,500 in respect of money lent. Two of the sundry creditors also informed the meeting that they would reduce their claims on the company by 50 per cent. The liquidator said that under those circumstances there was every prospect of the creditors getting something near 20s. in the £, which Mr. Mackey desired. The creditors passed a resolution confirming the appointment of Mr. Walter Bean as voluntary liquidator. An informal committee was also appointed, consisting of Mr. S. R. Mullard, and the representatives of Messrs. Schmidt & Co., and the Bryant Trading Syndicate Co., Ltd. The following are creditors:—

Bryant Trading Syndicate Co., Ltd.	£66	Mullard, S. R.	£141
Ceramic Co., The	57	Smith, Norman	617
Safety Paper and Box Mnfg. Co.	19	Cash creditors: Mackey, J. A. D.	5,545
Siemens Bros., Ltd.	23	Debenture-holder: Mackey, J. A. D.	2,500
Schmidt & Co.	70	Preferential creditors:—	
Vaotite Wire Co.	35	Mullard, R. (salary)	44
Creditors under £10	49	Mullard, S. R. ,,	19
Bean, Walter	13	Rent	37
Mullard, R.	660		

Dissolutions and Liquidations.—The following letter has been addressed to us regarding a report on the affairs of the Bradford Electrical Engineering Co., Ltd., which appeared under this heading in our last issue:—

"In your issue of the 24th inst. you publish a report of the creditors' meeting of the above company, and as the same contains false, if not libellous, statements, I must ask your permission to place before your readers and those concerned, the true facts of the case.

"The business originally belonged to me, and not to me and my son. The balance-sheet and trading account were drawn up for me by a firm of chartered accountants, who had access to all books and documents kept by me, and were correct to the best of my belief, the results arrived at being similar to those drawn up by me in my own way. Mr. J. H. Haley had the same opportunity, as his account rendered to me shows, 'to perusing the accounts of your firm' are the words used in his account, a document now in the possession of my solicitors. It was on his own proposition that we adopted the trading account already in my possession as the basis of the company formed by him. If Mr. Haley had been a cute man of business, he would have investigated before, and not after, the event. It was in January, 1908, that Mr. Haley discovered, as he said, a deficiency of £341, but how this had arisen was always a mystery to me. At the subsequent shareholders' meeting, I pressed those present to allow me to return the 341 shares which it was alleged I had got more than I ought to have, but was persuaded to retain same as a loan at 5 per cent., to be repaid as I was able. Some time afterwards I was persuaded to sign a promissory note for the £341, something being said as to its being given to the bank if we needed an overdraft. I pointed out to the other directors at the time that it could only be a formal document, as there was no possibility of my being possessed of this sum, as all that I had was the remuneration from the company, and that not a large amount, but out of which both I and my son repaid to the company as much as we were able. This is the 'amount owing by the vendors under their contract' mentioned in your report. Had I consulted my present solicitors at the outset I should not have been allowed to have taken these steps—signing a document which was subsequently used to oust me from my position.

"Mr. Haley told the creditors that 'ever since the company was formed the trading had not been profitable.' This is false, as the company paid a dividend of 7½ per cent., carrying forward more than enough to have paid a 15 per cent. dividend, besides having paid the flotation expenses out of profits as the result of its first year's trading. Two large bad debts prevented any profits being made in the second year, and for these bad debts, of course, the management was blamed. The question might be asked why Mr. Haley drew a salary of 60 guineas a year for keeping the books and managing the finances, when he says that the company's trading was not profitable.

"It is false to say that the two directors 'resigned their positions on November 18th last.' The facts are that early in October, when it was discovered that we had made a serious loss on a contract through the failure of the principal contractor, we being sub-contractors, the directors asked one of us to resign and seek a fresh post in order to save the expense of a salary. My son, Mr. H. H. Cassé, had the offer of a post, and we reported to the directors this fact, and that he would resign as requested. But the chairman would not agree, saying to me, 'It is you who must go; we are not going to let him (my son) go.' I would not agree, and the meeting was adjourned. At the next meeting my promissory note was produced, and I was told that I must resign or meet the promissory note, which they knew I could not; and under threat of the issue of a writ, I had no alternative but to hand in my resignation, to take place on October 30th, and my son was asked if he was willing to manage the business, to which he agreed. On October 23rd the directors brought in another man to act as manager, and he indignantly refused to work with him, pointing out that he had been appointed to manage, and that I had retired to save the expenses at the directors' wish, and not to make way for another. As the directors insisted on installing 'the new manager,' my son tendered his resignation, which was accepted, and we both left the concern on October 30th last.

"For the bungling and blunders made after this date we own no responsibility—I certainly am of the opinion that the business could have been saved, and ought to have been saved, if all parties had been agreeable, and for the shareholders' and creditors' sakes I am sorry that it has not been saved.

"I must apologise for the length of my communication and for so much of the personal element, but I thought it due to myself, and the creditors especially (by whom I have always been well treated), that I should give something of the other side of the picture.

"C. J. Cassé, Bradford."

Superheaters, Ltd.—This company is winding up voluntarily, with Mr. G. W. F. Dawes, 56, Ludgate Hill, E.C., as liquidator.

Eldon Electric Co., Ltd.—A meeting is to be held at 46, Grainger Street West, Newcastle-on-Tyne, on January 31st, to hear an account of the winding up from the liquidator, Mr. A. G. Robson.

Heele & Co., dealers in scientific and other apparatus, Ealing.—Messrs. P. Heele and G. H. Ironmonger have dissolved partnership.

R. E. Walker, electrical engineer and cycle agent, Eign Road, Hereford.—First meeting of creditors, January 5th; public examination, January 18th—both at Hereford.

Shipley Fan Co., Well Croft Works, Shipley (electrical and ventilating engineers).—Messrs. W. Walsh and J. Whitfield have dissolved partnership. Mr. Walsh will attend to debts and continue the business under the same name. Mr. Whitfield will carry on a similar business, also at Shipley.

"Metalik" Lamps.—In connection with Mr. Lavender's research on metallic-filament lamps, of which an abstract appears elsewhere in this issue, we are informed that the lamps tested in Set No. 3 were Messrs. G. M. Boddy & Co.'s "Metalik" lamps.

Franco-German Co-operation.—It is stated that the Felten & Guilleaume-Lahmeyer Works have concluded an agreement with the French firm of Schneider & Co., of Creusot, for the working under licence of a number of electrical manufactures. As a first result of the arrangement the latter has received from the Southern of France Railway Co. an order for the construction of an electric locomotive for main line service of 1,400 H.P., whilst the former firm will provide the electrical equipment. The locomotive is to be of the single-phase type, and it is assumed that further orders will follow the completion of the engine. In addition, both firms have jointly obtained an order for an electric rolling mill equipment for the Italian Terni Steel Works.

Book Notices.—*The "Practical Engineer" Pocket Book, and the "Practical Engineer" Electrical Pocket Book for* 1910. London: The Technical Publishing Co. Price 1s. each, net.—Concerning the former, such an old friend needs no more than kindly mention, for its merits are too well known to call for emphasis. The amount of information embodied in it is astonishing—and it grows fatter every year.

Its electrical younger brother has not been before the public so long, but is growing in size and popularity, and a variety of new sections has been incorporated with the new edition. One of these (candle, International) is indexed page 355, instead of 335, and the new ratio should be adopted in such tables as that on page 342. We are interested to learn (page 343) that Osram lamps are now made of 16 C.P. at 200-220 volts; perhaps this is an "intelligent anticipation." On page 403 silicon is repeatedly spelt silicum; an error such as this, which can hardly be due to the printer, greatly depreciates the value of the section in which it occurs, by shaking the faith of the reader in the qualifications of the author. However, we have found but a few of these, and the matter generally is kept well up to date. Some of the blocks need renewal—for instance, on pages 102, 125, 173, &c., and historical matter, such as the description of the old Brush and Thomson-Houston lamps, is out of place in a pocket-book. The diary is printed on sectional paper.

Directory of the Royal Society of Arts.—Edited by Sir H. T. Wood. London: George Bell & Sons. Price 2s.—This pamphlet contains a short sketch of the Society's history, an account of the Trust and Prize Funds which it administers, a history of the Examinations which it has carried on for the past 50 years, the Charter and By-Laws, and other general information, including a list of the Proceedings of the past session, and a financial statement for the past year.

"Science Examinations, 1909."—Reports on the science examinations and summaries of the results, &c. London: Wyman and Sons. Price 6d.

"Practical Electrician's Pocket Book and Diary, 1910." London: S. Rentell & Co. Price 1s. net.

Trade Announcements.—Messrs. Watson & Whyte, of 19, Waterloo Street, Glasgow, have taken over the agency for Glasgow and district, for the portable electric circular saws of Messrs. Feld Bros. & Co., Ltd., of London.

The works of the Electric and Ordnance Accessories Co., Ltd., of Aston, will reopen on Monday morning next, after stocktaking.

Mr. Harry Moss, late manager for Mr. Chas. Pullan, of Bradford, will commence in business as an electrical engineer and contractor, on January 1st, 1910, at 116, Horton Grange Road, Bradford. He desires to receive manufacturers' price lists and catalogues.

Messrs. J. & H. Grevener announce that their branch in Manchester having now been thoroughly organised there, Mr. H. J. Booker is returning to London again to take charge of their motor department.

Closed for the Holidays.—Messrs. Hurst, Nelson and Co., Ltd., of Motherwell, announce that their works are closed for the New Year Holidays until the morning of Thursday next, January 6th.

Unfair Overloading.—As showing the heavy strain to which electrical apparatus is often unfairly subjected, the Foster Arc Lamp and Engineering Co., Ltd., inform us that some 15 months ago they supplied a "Foster" auto-transformer, 110/50 v., output 500 watts, which was installed and loaded to 1,250 watts, a load which it had to carry some six hours continuously day after day. After over a year's service it, of course, broke down. If proper precautions were taken to ascertain the correct size and capacity of apparatus before ordering, fewer complaints would be lodged against manufacturers, and one would hear less about the uncertainty of electric light and the fire hazard attaching to it. The fact that the transformer stood the strain so long speaks well for its design and construction.

Carbide of Calcium.—The Usines Electriques de la Lonza, of Yampel, in the Swiss canton of Vallais, which are principally engaged in the production of carbide of calcium and iron alloys, report a very unfavourable period in 1908-9. The accounts show a loss of £18,900, which is mainly attributed to the depreciation of securities in the company's portfolio, this result comparing with a profit of £28,900 and a dividend of 5 per cent. in 1907-8 on a share capital of £480,000. Although the undertaking is passing through a critical time, which may still influence the year 1909-10, the report states that as the company's products have gained a market better results may be expected at a later period.

Calendars and Catalogues.—Messrs. John Spencer, Ltd., Globe Tube and Engineering Works, Wednesbury.—Trade price list of wrought-iron tubes and fittings, also another of their aluminium date-calculating pocket disks.

Messrs. Wm. Geipel & Co. have sent out to their friends, ourselves among the number, one of their vest-pocket diaries for the new year. It differs from diaries so far received this year, for it contains a £1,000 accident coupon. Some pages in the front of the book contain particulars of the firm's specialities and useful engineering tables.

Messrs. W. Leonard & Co., 4, Soho Street, Oxford Street, W.—Priced leaflet of electric reflector signs.

The Electrical Co., Ltd., 122-124, Charing Cross Road, W.C.—Eight-page illustrated and descriptive price list of their arc lamps for indirect lighting.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, London, S.W.—Eight-page pamphlet (Reprint No. 506B), in which are given reprints of two papers on "Roentgen-Therapy in Gynæcology" (with illustrations), by Prof. Dr. Albers-Schönberg, from the *Archives of the Roentgen Ray.*

Mr. John Whitelaw, electrical and mechanical engineer, 15A, Duncan Street, Edinburgh.—Wall calendar for 1910, with monthly tear-off slips placed beneath a capital colour print of a child-life picture, "The Greatest Show on Earth," by an Austrian-American artist, Karl Witkowski.

The Mirrlees Watson Co., Ltd., Scotland Street, Glasgow.—Pamphlet C25, in which is contained an illustrated description of an exhaust steam turbine installation at Messrs. Nobel's Explosive Co.'s Ardeer Works.

Mr. G Braulik, 8, Lambeth Hill, E.C.—New price lists of "Eclipse" semi-enclosed long-burning arc lamps, and of the "Eclipse" automatic transformer switch.

Messrs. W. F. Dennis & Co., 49, Queen Victoria Street, E C.—The "Useful Tables and Data," issued last year on a card have been revised and issued in pocket form, in a neat little leather case, provided with pockets for stamps, &c., making a very neat and handy souvenir. The tables relate to wire gauges, iron wire, copper conductors. conversion tables, &c.

Mr. John Gregory, Nelson, Lancs.—Leaflet describing the "Eureka" electric motor-driven surfacing machine for levelling down new or cleaning existing floors.

Messrs. Alfred Herbert, Ltd., Coventry.—We have received this firm's calendar for 1910. The date figuring on each monthly sheet is, as usual, boldly printed, making it useful for the office wall. Each sheet gives an excellent half-tone print of one or other of the firm's machine-tool manufactures. Copies of the calendar can be obtained on application by firms interested.

LIGHTING and POWER NOTES.

Barking.—The electrical engineer has been directed to report upon a letter from the general manager of the British Coalite Co., stating the terms upon which the company would supply the Council with electricity in bulk. The electrical engineer, together with the surveyor, are to report upon a proposal to sink a well for the purpose of supplying water to the generating station; experiments by the Barking Gas Co. in the same direction have been very satisfactory.

Bedford.—The T.C. on Wednesday decided to rescind terms for differential rates for lighting current now in force, and to replace them with terms making it optional for any consumer whose annual consumption of electricity for lighting purposes reaches or exceeds 3,120 units, to pay either at the existing rate of 5½d., or 6½d. per unit from sunset until 8 p.m., and 4½d. per unit during the remainder of the day, the above charges subject to a discount of ½d. per unit, when accounts are settled within a month of delivery.

Belfast.—The scheme for the public lighting by electricity of a large number of the streets is to be gone on with at an early date it is understood. The lighting will be by arc lamps.

The Board of Guardians has commissioned its architects, Messrs. Young & Mackenzie, to prepare the plans and specifications for the electric lighting of the Abbey Sanatorium. The scheme will involve an outlay of £4,405, and an annual upkeep of close on £900.

Bexhill.—On December 21st a L.G.B. inquiry was made into the application of the T.C. for a loan of £3,058 for electricity purposes. The Inspector (Mr. H. R. Hooper) suggested that a further loan of £1,500 should be asked for, as the total amount would then meet prospective expenditure for about 2½ years. There was no opposition.

Bridgend.—It is reported that a gross profit of £1,116 has been made on the electrical undertaking up to November 18th, since the works were taken over by the Council; the net profit is £175.

Broadstairs.—The U.D.C. has consented to the Isle of Thanet Electric Tramways and Lighting Co. submitting a scheme for electrically lighting Dumpton Park Drive. The lamps could be attached to the tramway poles at little cost.

Camberley.—A recent meeting of the ratepayers decided that the U.D.O. ought not to take up an electric lighting order unless sufficient support were assured to make the venture profitable. There is a strong feeling, however, in favour of the scheme, which was prepared by Messrs. Medhurst & Brewer.

Canada.—According to the *Canadian Engineer*, some 40 water wheels near Ottawa are now equipped with heating devices to prevent "frazil" from clogging and stopping the wheels and gate mechanism. The Ottawa and Hull Co., which supplies the Ottawa distribution system, has added a 100 H.P. boiler to its "frazil combatting" plant, and expects to keep up its output of 10,000 H.P. without trouble. The latest 3,000-H.P. unit is provided with cored chutes and gate chambers with pipe connections, so that steam or hot water may be circulated. The power houses of the Ottawa Electric Railway and Ottawa Electric Co. are also equipped with water wheel heating systems. At all these plants the works have, so far, been kept free of ice by electric motor-driven rakes, and no heat has been utilised.

The B.C. Electric Railway has just installed a new 10,500-H.P. wheel and generator at Lake Buntzen, bringing the number of power units up to five, operating on four transmission lines. The new unit consists of a Doble wheel supplied through a 7-ft. diameter pipe, and coupled to a Dick-Kerr generator.

Castleford.—The U.D.C. has decided that, in view of the possibility of its dealing with the application of electricity for public lighting under the order of the Yorkshire Electric Power Co., the present time is inopportune for extensive alterations in gas lighting.

Continental Notes.—France.—The T.C. of Bourg, in the department of the Ain, has received proposals from the Lyons Gas Co. for the lighting of the town by electricity, but before coming to a decision, has decided to await the proposals which may come from any other societies.

The T.C. of Mâçon has passed a resolution advocating the undertaking of works on the upper Rhone in order to make it navigable and to facilitate the construction of a hydro-electric station at Genissiat.

For once in a way, the efforts of M. Pataud, the electrical agitator, to inconvenience Parisian electrical users have failed. It appears that Pataud had engineered a scheme to deprive the city of electric light on Friday or Saturday last, and lodged a sort of ultimatum with the Minister of the Interior at the last moment. Owing, however, to the authorities having got wind of the affair, and to the linking up of the various generating stations, suitable arrangements could be made to frustrate any complete strike.

Russia.—The municipal authorities of Jersk, Caucasia, are considering the question of establishing a central electric lighting station in the town.

Holland.—Work is about to be commenced on the establishment of a central electric lighting station in the town of Gouda.

Germany.—An electric scheme to serve Fürstenberg and 15 other townships in the Bernese Oberland has been launched, a company being formed for this purpose. It is proposed to build an electric station and supply energy at 10,000 volts, which will be transformed down to 110 and 120 volts, the price charged to the consumer being 20 pfennige for power and 30 pfennige for light. The construction contract has been secured by the Frankfurt Lahmeyerwerke.

Sweden.—According to the *Affärsvärlden*, the first Swedish factory for the manufacture of calcium cyanamide is expected to be in working order in the winter of 1911. The Stockholm Superphosphate Co., Ltd., has bought three waterfalls in Ljungan, Norrland, near Sundsvall, for the purpose, and the plant will have a capacity of 15,000 H.P.

Dublin.—The South Dublin Union Guardians have decided to ask the L G.B. to hold an inquiry into the relative merits of gas and electric lighting for the workhouse, &c., and to advertise for tenders for both gas and electric lighting at the conclusion of the inquiry. Gas lighting now costs the Guardians £1,500 per annum, and a recent quotation is £1,142. The Corporation has offered to fit up and light the building by electricity for £1,295, £750 being for the lighting itself and an alternative quotation was £293. An outside company has offered to supply electricity for £750 per annum on a 10 years' contract.

Gillingham (Kent).—As the result of the investigation into the working of the electricity undertaking, the T.C. has decided to forthwith install a Diesel engine at a cost of £3,112. A loan is to be applied for, and, if refused, the money will be raised from current revenue.

Haslingden.—In order to retain its powers under the E.L. order, which has several times been extended, Haslingden T.C. has by the end of February next to show the B. of T. that it is definitely prepared to exercise the powers. Hitherto it has hesitated because of fears that the scheme might not prove commercially successful. It has, however, just ascertained that 75 per cent. of the tradesmen in the borough are willing to adopt electricity for lighting, and there are also fair prospects of a good demand for power purposes.

Hull.—The T.C. is negotiating for the supply of electricity to the new pier of the Hull and Barnsley Railway Co.

Kingston-on-Thames.—The work of converting gas lamps to electric glow lamps in six roads is to be put in hand.

Littleboro'.—At a recent meeting of the District Council an agreement between the Council and Messrs. Hawtayne & Zeden, having reference to their terms for acting as consulting engineers in carrying out the work in connection with the supply of electricity from the Rochdale Corporation, was approved and the seal of the Council attached. The clerk was instructed to make application to the L.G.B. for the borrowing of £3,500, to be repaid in 25 years, to carry out and complete the laying of cables, transformer station, &c. The clerk was also instructed to obtain terms for land for the erection of a transformer station near Hare Hill Road corner.

Lancaster.—The new municipal buildings which Lord Ashton has given to Lancaster at a cost of £155,000, are lighted by electricity. The installation is fed from two points with special feeder mains from the electricity station of the Corporation, which is in close proximity to the buildings. At each point the current is brought in on the three-wire system, and divided into eight circuits, four on each side. The circuits are carried in solid drawn steel conduits with junction boxes, and are controlled by a triple-pole ironclad switch. The fittings in the main apartments, which are very large, are all suspended with a special clutch gear, which is actuated by a steel wire-rope winch, this enabling the fittings to be lowered for cleaning and relamping. As far as practicable, the whole of the lighting is by metallic-filament lamps, numbering upwards of 1,000; there are 150 lamps in the public hall with a total of 7,500 C.P. The electroliers are of wrought-iron and hand gilded. The whole of the fittings, with the exception of those in the public hall, which seats 2,500 people, are made in coinage bronze. The portico at the main entrance is lighted by means of five large lanterns, each containing four 56-c.p. lamps. Mr. F. Dare Clapham, F.R.I.B.A., designed the fittings, which were made by Messrs. Veritys, of Manchester. The contractors were Messrs. Calvert & Heald of Market Street, Lancaster, whose representative, Mr. A. Davies, has personally superintended the work.

London.—Hampstead.—The B.C. has introduced the "telephone rate" system of charging where both heating or power and lighting are required—the charge to be £8 5s. per kw. of maximum demand for lighting, and 1d. per unit for all energy supplied for all purposes. The system is only applicable to private houses, &c., where the whole of the premises are lighted by electricity.

Maidstone.—The T.C. has sent a circular letter to the various local authorities throughout the country owning electricity undertakings, asking them to contribute towards the promotion of a Bill in Parliament to enable local authorities to undertake the wiring of consumers' premises and the sale of fittings.

Oldham.—The T.C. has received from the Royton U.D.C. permission to supply electricity in the district upon the same terms as exist at Oldham.

Perth.—The Corporation Gas Works Committee is considering a proposal to introduce an electrical stoking plant at the gas works.

Rochdale.—This week the Electricity Committee had before it a report of Mr. C. C. Atchison, electrical engineer, on the proposed extensions at the electricity works to meet the great development of the business, and the largely increased demand for supply, which will have to be met when the cars run to Whitworth, Bacup and Milnrow. There is also the supply in bulk to Littleboro' to be provided for. A battery is to be provided at a cost of £7,500, which, however, is only part of a larger scheme which it is expected will ultimately involve an expenditure of £40,000, or thereabouts. The Committee proposes to ask for borrowing powers for £4,000 (in addition to the £7,500) for cables, and £600 to cover the cost of treating water taken from the river. The loan now to be applied for thus totals over £12,000.

Southend-on-Sea.—The T.C. has decided, as a tentative measure, to charge 1½d. per unit for energy for radiators until the end of May next.

A loan of £3,000 for meters has been applied for.

For all-night public lamps the following charges have been fixed:—One 50-c.p. Osram lamp, £4 per annum; two 32-c.p. Osram lamps, £5 per annum.

Swinford (Ireland).—The R.D.C. of this place has decided to proceed with the electric lighting scheme which was projected some months ago.

Walthamstow.—The electrical engineer has been authorised to lay cables to supply current to a factory in Macdonald Road, and the street lamps along the route of this extension are to be converted from gas to electricity. After January 1st the charge for power to consumers of 30,000 units and over per annum is to be reduced to 1d. per unit.

TRAMWAY and RAILWAY NOTES.

Aston.—Travellers on the Perry Barr tramway route from Birmingham, or *vice versa*, have long grumbled at the necessity of having to change cars at the Six Ways, Aston, and have wished for a through service of cars to Perry Barr. This has now come into operation. At the time the new service started, however, one matter had not been adjusted. The fares in force were from Newtown Row to Perry Barr 1½d., and the through fare was 2½d. The Aston authorities were prepared, provided Birmingham would consent, to make the Six Ways at Aston the penny stage from town, instead of the city boundary, Newtown Row, as at present. This would make the through fare 2d., which the public who use the line—and it passes through a populous district—would naturally prefer. It remains to be seen whether the public will appreciate the change. It appears to be slight, for all that the new arrangement does is to ensure that the Birmingham cars continue their journey to Perry Barr.

Continental Notes.—France.—A trial run was recently made over the first electric railway constructed on the great railway system of the Midi. The line runs from Villefranche-Verneh-les-Bains to Mont Louis, and is said by *La Revue Pratique de l'Electricité* to be of an exceptionally bold design, being built on the side of a very steep range of mountains. It has a length of 28 km., and rises from a height of 427 metres to 1,510 metres by means of gradients varying from 25 to 60 mm. per metre. A feature is the Gisclar Bridge, hung by metallic cables 80 metres above the bed of the Tet, and certainly noteworthy among the most daring constructions of the kind in Europe. The line was opened to traffic on the 25th ult.

Germany.—During the last few years the question has often been raised as to the desirability of the purchase by the Berlin Municipality of the undertaking of the Berlin Tramways Co., but without definite result. At the present time the municipality and the company have suspended large construction schemes which had been decided upon. The company has had in contemplation the building of an underground railway system, but shows no sign of carrying the proposal into effect. It is said that both parties are ready to adopt the principle of repurchase, provided a scheme satisfactory to both can be discovered. The most important point, of course, is the purchase price, concerning which there are varied estimates. In some quarters it is asserted that the price will probably work out in the neighbourhood of 200,000,000 marks.

Italy.—Work has recently been completed on the construction of an electric tramway, about 5½ km. long, between Birano and S. Lucia Portorosi, Istria.

Exeter.—The Tramway Committee has received a letter from the Chamber of Commerce asking consideration of the question of issuing books of tramway tickets as adopted at Bournemouth and other towns. The Chamber has been informed that the Committee sees no reason for altering its previous decision not to adopt this system in Exeter.

Kirkcaldy.—In the Provisional Order promoted by the Corporation, power is asked to construct and work additional tramways in and adjacent to the burgh, to confirm an agreement with the burgh of Dysart as to the working of tramways, to extend the area of supply of electricity, and to confer further powers on the Corporation in relation to its electricity undertaking.

Nottingham.—Though it entailed a loss of £500, the City Council gave all the tramway employés a holiday on Christmas Day, and not a single car was run. This caused a good deal of inconvenience to those attending the Notts and Chelsea football match at Trent Bridge.

Perth.—Mr. Peter Fisher, tramway manager, Dundee, has visited Perth with the object of preparing a report on the working of the Corporation tramways and making suggestions as to how the system can be improved.

Rhondda.—The U.D.C. has decided to seek powers to construct additional tramways, which are to be leased to the Rhondda Tramways Co., Ltd.

West Fife.—The portions of the Dunfermline and District Tramways between the West End and Cowdenbeath and the terminus at Lochgelly have been inspected by Colonel Von Donop, and the service has been commenced.

York.—The tramway track is now completed from the terminus at Fulford to Railway Street, and from the city boundary to Dringhouses, about a quarter of a mile still requiring a small section of the permanent way to be laid and the widening of Queen Street Bridge. The committee recommends that the section between Fulford and Nessgate be opened for traffic as soon as the necessary arrangements can be made for the purpose, subject to the lines being passed by the B. of T. The amount authorised to be borrowed in respect of the Light Railways Order is £130,170. The amount of the contracts already entered into for the purchase of properties, construction of tramways, strengthening of Lendal Bridge, &c., and the purchase of the old tramway undertaking is £115,412, of which £42,397 had been expended up to December 21st.

TELEGRAPH and TELEPHONE NOTES.

Cable Co.'s Jubilee.—The Commercial Cable Co. has just attained its 25th anniversary, having been founded in December, 1884, and in celebration of this event Mr. Clarence H. Mackay, president of the company, entertained the staff at dinner at the Great Eastern Hotel, London, on Monday last. The officers and employés were also invited to dine at various provincial centres, the centre for the North of England being the Angel Hotel, Liverpool, where representatives were present from Liverpool, Manchester, Bradford and Newcastle-on-Tyne, under the chairmanship of Mr. Joseph Furze, Liverpool superintendent of the company. The Scottish staff dined at the St. Enoch Station Hotel, Glasgow, Mr. H. J. Tracey, the Glasgow manager, presiding.

Cables Interrupted.—Obok-Djibouti, December 20th; Tourane-Amoy, December 27th.

Wireless Telegraphy.—On the resumption of the case in which R. S. Knowden was charged with stealing a wireless receiver from H.M.S. *Vernon* torpedo school, serious additional charges were preferred, it being stated that at his house were found other instruments and over 80 drawings of wireless telegraph apparatus, embodying the whole of the secret improvements effected in wireless telegraphy for the British Navy, and including information of a very confidential character. Commander Maurice, of the *Vernon*, gave evidence to the effect that the prisoner had been warned that no copies should be made without authority, and that the plans and apparatus were found at his house. Other evidence was given, and the prisoner was committed for trial, bail being allowed.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—January 15th. An electric generating station is about to be established in connection with the State Tobacco factory in Vienna, and tenders are being invited by the authorities for the supply of a dynamo, 16 electric motors, and four electric lifts, in connection with the same.

Australia.—Melbourne.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

Sydney.—January 11th. A power station generating equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" December 10th.

Sydney.—Two junction-line sections of common-battery switchboard for the P.M.G. See "Official Notices" December 24th.

South Australia.—Telegraph and telephone material for the P.M.G. See "Official Notices" December 24th.

Belgium.—February 26th. The municipal authorities of Bree (Province of Limburg) are inviting tenders for the establishment of a central electric lighting station in the town.

Belfast.—January 10th. One 1,500-kw. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" December 10th.

Bridlington.—January 1st. 300-kw. steam dynamo for the Corporation. See "Official Notices" December 10th.

Brighton.—January 10th. One 3,000-kw. three-phase turbo-alternator, with condensing plant, &c.; one 1,300-h.p. 8,000-volt three-phase induction motor; one 300-kw. induction motor-driven balancing set; high-tension switchgear, &c., for the Council's North Road sub-station. See "Official Notices" December 24th.

Birmingham.—February 1st. Stores for the Tramways Department. See "Official Notices" to-day.

Dublin.—January 14th. Electric lighting scheme for the new Crooksling Sanatorium of the Dublin Joint Hospital Board. Patrick Nally, Clerk to the Board, Municipal Buildings, Cork Hill, Dublin.

Eccles.—January 15th. 150-kw. steam engine and d.c. dynamo for the Corporation electricity undertaking. See "Official Notices" December 24th.

Erith.—January 10th. High-tension three-phase alternating-current switchboard for the U.D.C. See "Official Notices" December 24th.

Italy.—January 11th. The Ministry of Marine invites tenders for the supply of electric lamps and lampholders. The upset price is put at 150,000 lire (£6,000), and 10 per cent. of this sum will be required as a deposit to qualify any tender. Tenders to the "Ministerio della Marina," Rome.

London.—I.E.E.—January 10th. The Council of the Institution of Electrical Engineers is inviting tenders for the interior wiring and fittings for lighting and power at its new premises. See "Official Notices" December 24th.

Woolwich.—The Electricity Committee is about to invite tenders for a year's cable supplies, based on the variations in the copper and lead market.

CLOSED.

Cleckheaton.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for cable.

Kingston-on-Thames.—The Council has placed an order with Messrs. Haydn Harrison & Co. for 30 Croydon type fittings for street lighting, at £1 10s. each.

London.—Southwark.—The B.C. has placed an order with Messrs. Sanders, Rehders & Co., Ltd., to supply a "Sarço" combustion recorder for use at the electric light station, at £34 10s. The tender of Messrs. Alfred Blackmore & Co., for the supply of 6,000 tons of Griff or Kingsbury peas, at 11s. 4d. per ton delivered at the Electricity Works, Penrose Street, was accepted.

Messrs. A. W. Penrose & Co., Ltd., have received the contract from Messrs. Wallis-Jones & Dent for the lighting installation at the Holborn Hall and Book Room, which was till recently the Holborn Town Hall.

Maidstone.—The Electricity Committee has accepted the tender of Messrs. Cory & Son, Ltd., for Scotch screened washed peas coal up to August 31st, 1910, at 10s. 11d. per ton.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

The British Thomson-Houston Co., Ltd., London.—Eight traction motors, with gear and gear cases, £582.

Messrs. Sidney Stone & Co., Ltd., London.—Steel tires for tramcar wheels, £1 3s. each.

Wallasey.—The U.D.C. has given an order for 10 electric tramcars, of the patent Brush long-base truck type, to the Brush Electrical Engineering Co., Ltd.

Swansea.—The T.C. has accepted the tender of Glasbrook Bros. for the annual supply of Garngoch coal to the electricity works, at 9s. per ton.

FORTHCOMING EVENTS.

Royal Institution.—Lectures on "Modern Electricity," by Mr. W. Duddell. Saturday, January 1st, "Röntgen Rays"; Tuesday, January 4th, "Generation of Electricity"; Thursday, January 6th, "Electric Oscillations"; Saturday, January 8th, "Electric Lighting." Lectures at 3 p.m.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, January 5th. Meeting at 7.30 p.m. At the University, Birmingham.

Rontgen Society.—Thursday, January 6th. At 8.15 p.m. At 20, Hanover Square, W. Paper by Dr. W. S. Lazarus-Barlow.

Institution of Mechanical Engineers.—Friday, January 7th. At 8 p.m. Papers on "The Application of the Pitot Tube to the Testing of Impulse Water Wheels," by Mr. W. R. Eckart; and "An Account of a Visit to the Power Plant of the Ontario Power Co. at Niagara Falls," by Mr. C. W. Jordan.

Electro-Harmonic Society.—Friday, January 7th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Association of Engineers-in-Charge.—Saturday, January 8th. Social. Dance.

NOTES.

"A Little Nonsense."—One of our contemporaries either credits the trade and its readers with remarkable ignorance regarding the position of electrical affairs in this country, or it has on its staff one of the most inexperienced greenhorns that ever set foot in Fleet Street. Anybody not entirely new to our industry knows that, compared with what was happening a few years ago, the number of new electrical undertakings on the Parliamentary papers for consideration next Session is very small indeed. We gave a list of them in our issue of December 10th, page 927, and a reference thereto will have shown that they consist chiefly of unimportant alterations in powers already granted, extensions of supply areas, extension of time, transfers of provisional orders, financial re-organisations, while only here and there new schemes—trackless trolley proposals, an electric railway and a few lighting provisional orders—are named. Really, the writer in our exchange must have been overwhelmed with his first glance through the legal phraseology of the *London Gazette*, for he sees big contracts indicated in every line. Mark what he says:—

"Parliamentary notices have already been given of a larger number of Important Electrical Undertakings than have ever before been simultaneously projected, and the general outlook is universally declared to be indicative of exceptional activity in all branches of work.

"Competent authorities calculate that even if only a comparatively small proportion of the enterprises already planned are carried into fruition, a sum of upwards of £50,000,000 sterling would be expended during the year in the electrical trade alone."

For sheer unadulterated nonsense we think this beats anything we have seen in an electrical paper for a long time. That the electrical position is improving we believe, as we have already said, but to represent the state of things as given above is no better than the method of some others who are always shedding tears and cannot even at Christmas time throw off their miserable attack of melancholia. Either attitude can only do more harm than good. The merest tyro in electrical matters should know that the Parliamentary applications nowadays are no indication to the probable business of a coming year. If they were, then next year would be quite different from what our greenhorn deduces. When the electrical industry of this country was existing chiefly on public electric lighting and tramway and tube railway enterprises, the applications to Parliament meant far more than they do now, when all sorts of big work is proceeding for which Parliamentary permission is no more necessary than is the consent of the man in the moon—colliery and ironworks electrification, textile mill and other industrial works conversion to electrical operation, installation work and manufactures of all kinds for export, not forgetting plant and mains additions to authorised and existing electric light and power undertakings at home, of which there are more examples advertised for tender lately. The centre of interest for electrical industry is no longer found in the House of Commons Committee rooms, and if we mistake not, it is unlikely to become so again until some other and more or less important change or advance takes place in a new electrical direction. Even when Parliamentary electrical schemes filled *London Gazettes* to bursting their wrappers years ago, one, of course, had no assurance as to the effect thereof on the incoming year. How many of them fell through, unable to survive the preliminary stages, how many dozens of them were choked by investigation, how many more were financially sickly, or were of a wild-cat character! Even those which did go through in the first six months of the year after filing, could bring but small benefit to the industry in that particular year. And if this was so then, how much more unreliable is it as a guide to-day, when the number of public schemes is very small, and their value a quite indefinite thing. To talk of 1910 being a record year on such evidence as appeared in the *Gazette* really is nothing short of sheer clap-trap, and it would be amusing were it not so utterly ridiculous, that any man pretending to write even an advertisement about the electrical industry, could produce such a statement. But perhaps he was indulging in a little bit of Christmas fooling at the expense of the electrical trade?

Turkish Concessions: A Warning.—When discussing the probable openings for business in Turkey, in our "Notes on Trade Abroad," we dwelt upon the necessity for treading warily in this field. We now observe in the *Times* that the Board of Trade has issued a warning which is of interest to those who may propose to visit Constantinople with a view to transacting business with, or obtaining concessions from, the Turkish Government. "An intimation has been received through the Foreign Office from that Government conveying a warning against unscrupulous persons who, under pretext of acting as intermediaries between them and the Government Departments, merely seek to take advantage of their ignorance of the country and its conditions. As these persons enjoy no credit with the Turkish Government, their services are valueless. The Turkish Government accordingly advise all foreigners wishing to transact business with them to communicate direct with the competent departments, which are always ready to supply any information required and to accord all necessary facilities."

Institution and Lecture Notes.—Electrical Contractors' Association (London).—On Thursday, December 9th, Mr. S. H. Webb read a paper before the Association, on "Registration and Authorisation," in which he pointed out the difficulty of obtaining thoroughly satisfactory all-round workmen, and advocated a return to the apprenticeship system; he laid stress on the importance of retaining control over the apprentice until he attained the age of 21, in order to secure to him the advantage of subjection to discipline. His own firm required apprentices to attend evening classes during their period of service, and claimed that the result was an efficient workman; such men should be registered by the Association. Good workmen had to be made, and employers must be prepared to make some sacrifice to secure the best results. Casual employment had disastrous effects on the character of a youth. Mr. Webb also urged the need of "authorisation" of employers by a recognised authority, with the sanction of the Board of Trade, with a view to maintaining a certain amount of control over them, and preventing untrained persons from entering the trade. Such a system would also secure to the electrical contractor freedom from illegitimate competition, and would ensure his obtaining the trade discount on materials, as in the case of the "Authorised Plumbers."

Leeds University Engineering Society.—Mr. M. Sykes recently read a paper on "Economic Setting of Steam Boilers," in which he remarked upon the small amount of attention paid to the matter by those who were willing to pay the highest price for boilers and accessories, but trusted the setting of them to any bricklayer. The correct setting of boilers contributed largely towards their economy and efficiency, and also to their longevity, and was, therefore, a matter of importance. He gave detailed particulars of the proper method of boiler setting.

University College, London.—An advanced course of lectures on "The Theory of the Propagation of Electric Currents in Telephone Cables and in Electric Conductors" will be delivered by Prof. J. A. Fleming, F.R.S., on Wednesday afternoons at 5 p.m., beginning January 19th, 1910.

Birmingham and District Electric Club.—At the annual meeting of this club the report of the committee stated that the membership was standing at a steady figure, although, owing to the fluctuations in the electrical trade, they were constantly losing useful members who migrated to other centres of industry. A good year's work had been done, and visits had been paid to the steel works of Messrs. Alfred Hickman, Ltd., Bilston, and the Daimler Motor Co., Ltd., Motor Works, Coventry. The club was in a flourishing financial condition. Mr. G. V. Donovan, M.I.E.E., was elected president, and Mr. W. G. L. Riddle and Mr. E. A. Morgan were re-elected hon. sec. and treasurer respectively.

Mr. C. J. Stonier, Corporation Electricity Department, lectured to a large audience in Dundee on "Electricity and its Uses in the Home." The lecture is the first of a series to be delivered by officials of the department.

The Constantinople Telephone Concession.—Since our "Correspondence" columns were closed the following important letter has reached us from Mr. Herbert Laws Webb:—

"The note in your issue of December 17th, page 982, translated from a German newspaper, gives a very garbled account of the method by which the decision with respect to the Constantinople telephone concession was arrived at.

"The system followed by the Committee appointed by the Minister of Finance to examine the various tenders was correct and fair in every respect. The Committee's method was to value each proposal in the light of each article of the original conditions (of which there were 47), and in this way a valuation of each tender was obtained which represented the combined effect of the various factors concerned. Had the Committee made the competition turn upon one or two only of the 47 conditions, then a purely speculative proposal, with nothing serious behind it, might have been accepted.

"The critics of the Turkish Government on this matter seem to take the ground that the idea of providing Constantinople with a telephone service was got up with the object of making a business for some group of bankers and manufacturers, whereas the Turkish Government not unnaturally wish to ensure the best telephone equipment possible and the best telephone service possible for the capital. Consequently, the proposal which offered the greatest guarantees of efficient equipment and efficient service naturally appealed most forcibly to the Government and was bound to be rated first in any fair and equitable system of valuation.

"The facts are all incorrectly stated by the correspondent of the German newspaper from which your note is quoted. The proposal of the East European Telegraph Co. (a small company operating a 200-mile cable between Constantinople and Constanza, and having no telephone experience at all) was not rated superior to mine in any respect, and in its rating by the Committee it received more than double the number of bad marks allotted to the tender of the Anglo-Franco-American group.

"After the classification of the various tenders by the technical Committee—a work which occupied five weeks and was most carefully and systematically done—the only changes proposed by the Committee were modifications of my proposal, not, as suggested by the German correspondent, of the original conditions. These modifications have been discussed in the course of the preparation of the final agreement, which contains various new articles favourable to the Turkish Government.

"It is unfortunate that the unsuccessful bidders for the concession should have inspired the reports sent to the German Press from Constantinople, for the result is to mislead honest public opinion in Germany. But disappointment over a business failure, however keen, hardly justifies bringing charges of irregular methods against a Government department.

"According to my experience, the methods of the Turkish Ministry of Finance are above reproach, and the result of the telephone competition has been the choice of the tender which was the best from every point of view—technical, financial, and administrative.

"Herbert Laws Webb."

The Extinction of a Spark.—

The strings of my mystical lyre
Are riven with sorrow and mute:
So I've thrown the old thing in the fire,
And my "Swan" must be mourner depute.

'Twill tell you the terrible tale
Of Septimus W. Bragg;
A man, who, apparently hale,
Was, alas, an incurable wag.

As the reader has probably guessed,
This gentleman lived in the States;
Where practical joking's the test
Of a citizen's humorous "traits."

One evening he'd supped and he'd sipped
Not wisely and rather too well,
And sine-waving homewards he tripped
On the beams of an arc lamp and fell.

An arm round the standard, he sat
Determined no further to roam,
Till the pavement developed a "flat"
Whereon he could short-circuit "ohm."

A cigar was soon stuck in his "phase,"
But lights for it "lagging," he "surged"
In vain; till his rotary gaze
Synchronised with the arc lamp and urged

Him to foolishly lower the gear
And light his cigar at the arc.
Which he did! . . . The verdict was clear:
"A series lamp earthed by a Spark!"—H. R. T.

Foreign Markets and their Problems.—We have received the following communication from a writer interested in the commercial side of the industry. Those who have followed the various points that we have endeavoured to bring out in "Notes on Trade Abroad," will observe that the writer confirms a good deal that we have already said:—

"Of late there has been much discussion, in view of increased foreign competition, as to whether the methods of the British manufacturer are as up to date as they might be. To electrical manufacturers this especially applies, since the natural trend of affairs is such that the foreign and colonial work should be of even more value to them than the home business itself. Nor is there any reason, we submit, why this should not be so, if the proper ways and means of securing it are adopted. We are quite aware that there are many firms which cannot be reproached with laxity in this line, yet it may be well again to mention one or two of the said ways and means for the benefit for those which are not yet in line with the times.

"Both the lay Press and the technical papers constantly bear testimony that we fail largely because of the other man being on the spot. It was stated the other day that foreign merchants abroad, in our Colonies, would often order British goods because of their superiority, and so the agents of our rivals who work those markets were obliged to quote for British goods. We are sure, however, that it would be more easy to obtain such orders if the travellers were British. Co-operation might, if properly arranged, provide a solution to the first question—that of cost. Several firms in different lines of the electrical industry might put their heads together and secure a suitable man for a certain ground, as yet outside the scope of their respective businesses. Some preliminary training in the language might be necessary, but that should not be insurmountable, and it is only reasonable to suppose that he would soon repay them for the outlay, and that new business would accrue.

"Another difficulty which often exists is the custom of demanding long credit, and this is in itself no small obstacle to international business relations. If it is considered, however, that many firms in the home business regularly take three or four months to pay their monthly accounts, and, further, that in the case of distant markets like Australia, from 4½ to 6 months' credit is inevitable, the chances are that it will be found better to allow the required term rather than forego the business altogether. A compromise might also be effected by stipulating part payment on dispatch against documents, the balance to follow at a stated date some months later. Where deposits are required with tenders, these are sometimes retained for some time, and tenders should provide for interest on such deposit, which often amounts to a consideration. In some cases the deposit is not returned in full, owing to heavy charges for exchange fees.

"The home correspondence department is another item which should not be omitted. In the cotton trade foreign correspondents are largely used, with the result that business is much facilitated. The general practice on the Continent, outside Germany, seems to indicate that French is most used in business circles for foreign correspondence. German predominates in Scandinavia, in the same way as Spanish does in South America. A home firm receives a letter from Russia, written in French. The reply is written in English, and the chances are ten to one that if the negotiations break down this is due to the fact that the other man does not understand English. It is just as easy to send him a letter in his language, and further to convert for him our standards of coinage, weight and measurements, as to send the whole thing in English, and the result is eminently more satisfactory to both parties. If it is possible for the cotton people to find foreign correspondents, who need not necessarily be other than Britishers, then electrical manufacturers can do it, but we do not recommend the methods now used by some firms in the cotton industry, who employ what are called 'volunteers' as correspondents. Such men will work for six or 12 months for nothing merely to get experience in the business prior to setting up for themselves."

Tramway Club Meeting.—Sunderland district tramwaymen held a meeting in their club room on Sunday, December 19th (Chief Inspector Craggs presiding), at which recreation club matters were first dealt with. The hon. secretary (Mr. J. Richardson) in his annual report showed receipts amounting to £83 16s. and expenditure of £80 12s., leaving a balance of £3 4s. at bank. Mr. Richardson was again appointed secretary.

A meeting of the sick club members then took place, at which Hon. Secretary C. Watson presented his report for the past year, showing an income of £63 17s. and sick relief pay £29 17s., leaving a balance of £34. It was decided to carry forward £6 15s., and to declare a dividend of 13s. per member. The president stated that all the men in the traffic department were now members of the sick club, and more men from other departments were joining. A Committee was then elected. Mr. Craggs was elected president and Mr. Watson secretary.

Conciliation.—According to an announcement made by the Metropolitan Railway Co. to the daily Press, as a result of meetings of the Sectional Conciliation Boards, formed a short time ago under the scheme agreed to with the Board of Trade, satisfactory settlements have been arrived at with the whole of the company's employés in the traffic department and also in the permanent way department. The altered conditions of service, &c., come into effect this month, and the settlement covers the period up to the end of 1913.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The marriage took place on December 23rd of Mr. J. R. Parkinson, engineer to the Newcastle-Emlyn and District Electric Supply Co., Ltd., to Miss S. A. Jenkins, of Waunmarlog, Newcastle-Emlyn.

Tramway Officials.—Mr. J. Graham, of Brisbane, has been appointed, from among 21 applicants, general manager of the Rockhampton Corporation Tramways, Queensland. He went out from Leicester in October, 1908, since when he had been in the service of the Brisbane Electric Light Co., and the Brisbane Tramway Co., and of the Toowoomba Electrical Co., drawing up for the last-named a report for a Toowoomba tramway system. Prior to going out to Australia Mr. Graham had had 12 years' experience in connection with the Sheffield and Leicester Corporation tramways.

Mr. Frank Hinchcliffe, an inspector of the Salford Corporation tramways, was, on the 24th inst., presented with a gold watch and a sum of money for the services he rendered to the Prestwich police in the arrest of two men. The presentation was made by Supt. Keys on behalf of the members of the Manchester Division of the Lancs. County Constabulary. Mr. Hinchcliffe had a severe struggle with the prisoner on a car, and but for him, said Supt. Keys, no arrest would have been made.

General.—From the 25th inst. the title of the firm of Lacey, Sillar & Leigh will be Lacey & Sillar, the junior partner of the firm, Mr. F. A. C. Leigh, having accepted the appointment of chief electrical engineer to the London and North-Western Railway Co.

Obituary.—Dr. Shelford Bidwell, F.R.S.—The death occurred on December 18th of Dr. Shelford Bidwell, in his 62nd year. Some 35 years ago he was called to the Bar, but his bent was scientific research, and he became an F.R.S. in 1886, an M.I.E.E., and was twice president of the Physical Society. In reviewing his career the *Times* writes as follows:—"One of the first questions that engaged his attention was that of the change caused in the electrical resistance of selenium by light. This phenomenon had been noticed by Willoughby Smith in 1873 and had been studied by various other investigators, but Bidwell was the first, in 1881, to utilise this curious property of the substance for a purpose to which others have subsequently applied it with more or less success—the electrical transmission of pictures to a distance. A few years later he was working at various questions connected with magnetic action, such as the changes produced by magnetisation on the dimensions of rods and rings of iron and other metals, and later still at problems of physiological optics."

Mr. A. A. Whitlock.—We regret to learn of the death, on the 26th inst., at 4, Rossdale Road, Putney, of Mr. A. A. Whitlock, who was for 11 years resident engineer at the County of London Electric Supply Co.'s Wandsworth station, and previously resident engineer of the Dover electric supply undertaking.

Mr. W. H. Whitworth.—The death has occurred of Mr. Wm. Henry Whitworth, manager of the Liverpool branch of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown.

NEW COMPANIES REGISTERED.

Aluminium Corporation, Ltd. (106,421).—This company was registered on December 14th, with a capital of £450,000 in 5,000 participating shares of 1s. each and 149,750 preferred and 300,000 ordinary shares of £1 each, to acquire certain freehold lands, water rights and properties referred to in an agreement with the Aluminium Corporation, Ltd. (incorporated in 1907) and R. Lawson and A. H. Gibson, the liquidator thereof, and to carry on the business of manufacturers of and dealers in aluminium, electricians, engineers, machinists, fitters, &c. The subscribers (with one share each) are:—A. H. Elliott, 6, Winterbrook Street, Herne Hill, S.E., accountant; A. Harbert, 48, Selby Road, Anerley, S.E., accountant; G. Wilson, 214, Victoria Road, Alexandra Park, N., clerk; W. L. Waite, 28, Wallingford Avenue, North Kensington, W., clerk; W. Newbert, 123, First Avenue, Manor Park, cashier; W. Moir, 60, Broomwood Road, Clapham, S.W., clerk; G. C. Pullman, St. Helens, Hampton Wick, articled clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than four or more than seven; the first are S. G. Bibby, Dashwood House, New Broad Street, E.C.; K. M. Clark, Sudbourne Hall, Orford, Suffolk; E. Manville, St. Stephen's House, Victoria Embankment, S.W.; W. C. Stennett, 116, Victoria Street, S.W.; and W. Williamson-Wylie, Vulcan Works, Johnstone, N.B. No qualification necessary for first directors; of other directors, £500; remuneration, £100 each per annum (chairman, £150) and a share in the profits. Registered office, 34, Old Broad Street, E.C.

Compagnie Generale Electrique de la Champagne, Ltd. (106,408).—This company was registered on December 13th, with a capital of £80,000 in £4 shares, to install and exploit works for the distribution of electric power in the Valley of Guippe, Rheims, and in Aisne, Ardennes, Marne, all in France, and elsewhere, to build works and lines of transport in the department of Marne and the bordering departments, for the production, transportation and distribution of electric power. The subscribers (with one share each) are:—J. C. Bomine, 1, Broad Street Place, E.C., financial agent; M. W. Prentis, 11, Broadhurst Gardens, Hampstead, N.W., gentleman; R. B. M. Wilkins, 21, Therapia Road, East Dulwich, S.E., gentleman; A. O. Warren, 2, Broad Street Place, E.C., gentleman; F. C. Sanders, 1, Broad Street Place, E.C., clerk; H. Bowden, 1, Broad Street Place, E.C., secretary; R. Pilkington, 47, Fetter Lane, E.C., gentleman. Minimum cash subscription seven shares. The number of directors is not to be less than two or more than five; the first are J. Bouchet and H. Lamort (managing director), and others (if any), to be appointed by the subscribers; remuneration of managing director, £240 per annum; of chairman, £150; of others, £100 each per annum. Registered office, 1, Broad Street Place, E.C.

Electro-Metallurgical Syndicate, Ltd. (106,503).—This company was registered on December 17th with a capital of £1,250 in 2s. 6d. shares, to acquire certain options to work and exploit patents, to acquire land and call for electrical power, to adopt an agreement with C. J. Head and W. D. Rock, and to carry on either in connection with the above options or otherwise the business of manufacturers of ferro-chrome or other alloys, &c. The subscribers (with one share each) are:—W. D. Rock, 62, Leadenhall Street, E.C., engineer; H. S. Gain, 42, Lowth Road, Camberwell, S.E., clerk; H. J. Rayment, 42, Chaucer Road, Herne Hill, S.E., clerk; A. E. Davis, 19, Park Road, Spencer Road, New Wandsworth, S.W., shorthand writer; W. R. Chambers, 262, Albany Road, Camberwell, S.E., hosier; F. H. Chamberlain, 69, Prince George's Avenue, Raynes Park, S.W., accountant; Elizabeth A. M. Pratt, 19, Officers' Quarters, The Avenue, Brixton Hill, S.W., typist. Minimum cash subscription, £10. The first directors are not named. Registered office, 25, Victoria Street, Westminster.

Electro-Scrip Sign Co., Ltd. (106,453).—This company was registered on December 15th, with a capital of £1,000 in £1 shares, to acquire the exclusive right to manufacture and deal with a patent luminous sign to be called the "Electro-Scrip" in the United Kingdom and British Dominions. The subscribers (with one share each) are:—A. S. Newmark, 52, Albemarle Road, Beckenham, gentleman; A. Rapoport, 84, Hatton Garden, E.C., diamond merchant. Private company. The number of directors is not to be less than two or more than three; the first are A. S. Newmark, A. Rapoport and E. Klaber; qualification, £50. Registered office, 16, Holborn Viaduct, E.C.

Luminator Water Co., Ltd. (106,460).—This company was registered on December 15th, with a capital of £25,000 in £1 shares, to carry on the business of electricians, engineers, machinists, fitters, machinery manufacturers, &c. The subscribers (with one share each) are:—H. L. Usborne, 22, Austin Friars, E.C., stockbroker; W. F. Sheridan, 22, Austin Friars, E.C., stockbroker. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Mayo, Elder & Co., 10, Draper's Gardens, E.C.

Hilo Ignition, Ltd. (106,508).—This company was registered on December 17th, with a capital of £50,000 in £1 shares, to acquire certain inventions relating to a system of ignition for internal combustion engines known as the "Hilo" ignition, and to carry on the business of manufacturers of, and dealers in, ignition devices, magnetos, electrical appliances, motors, cars, aeroplanes, accessories, &c. The subscribers (with one share each) are:—C. Leachman, Caversham Lodge, Barnes, S.W., paper maker; A. J. Postans, Sym Park Cottage, Brentford, engineer. Private company. The number of directors is not to be less than two or more than seven; the first are C. Leachman, J. M. Postans and W. Frost; qualification, £1; remuneration, £450 per annum, divisible. Registered office, 17, Fenchurch Street, E.C.

Broughton Machinery Co., Ltd. (106,481).—This company was registered on December 16th, with a capital of £1,000 in £1 shares, to take over the business of a dealer in electrical and mechanical machinery carried on by Martha E. Mercier, at 291, Bury New Road, Broughton, as the Electrical and Engineering Stores. The subscribers (with one share each) are:—A. O. Walker, Trevelyan Buildings, Corporation Street, Manchester, electrical engineer; C. L. Turner, 49, Deansgate, Manchester, consulting engineer. Private company; the number of directors is not to be less than two or more than five; the first are C. L. Turner and S. W. Robinson; qualification, £5; remuneration, £50 per annum, divisible. Table "A" mainly applies. Directors' borrowing powers restricted to the amount of the subscribed share capital. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Suter's Patents, Ltd. (106,441).—This company was registered on December 14th, with a capital of £1,000 in £1 shares (500 preferred ordinary and 500 ordinary), to carry on the business of electrical engineers, electricians, water, gas and consulting engineers, aeroplane, flying machine, engine and motor manufacturers, tube makers, wire drawers, motor-car, cycle and carriage builders, workers in rubber and other materials, &c. The subscribers (with one share each) are:—F. Suter, 16, Percy Street, W., electrical engineer; J. W. Stephens, 16, Percy Street, W., electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are F. Suter and J. W. Stephens; remuneration of managing director not to exceed £1,000 per annum. Registered by H. A. Scott, 53-4, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bryant Trading Syndicate, Ltd. (67,051).—Memorandum of deposit of title deeds, dated November 15th, 1909, to secure £5,000 and a bonus of £500, charged on certain freehold hereditaments in State of Missouri, U.S.A., comprised in Cedar Gap Title Deed. Holder:—W. Jaggard, Cornhill, Bury St. Edmunds, and H. S. Golding, Newmarket.

Small Power Dynamo and Motor Co., Ltd. (103,094).—Charge dated November 22nd, 1909, to secure all moneys, not exceeding £300, for which the mortgagee as guarantor may become liable. Property charged: The company's undertaking and property, present and future. Holder: W. T. Wood, Clarence Buildings, 2, Booth Street, Manchester.

Church Stretton Electric Supply Co., Ltd. (80,857).—Charge dated December 1st, 1909, to secure £235. Property charged: Certain lands, hereditaments and premises. Holder: E. Bond, 43, Thurloe Square, S.W.

Edison and Swan United Electric Light Co., Ltd.—(18,904).—Trust deed dated November 25th, 1909 (supplemental to trust deed dated June 19th, 1900), to secure £100,000 ranking, *pari passu*, with outstanding stock secured by principal deed. Property charged: Certain assets. Trustees: London Trust Co., Ltd., 37, Lombard Street, E.C.

Hindhead and District Electric Light Co., Ltd. (75,361)—Particulars of debentures to secure not more than one-third of the share capital, created October 6th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Consolidated Electric Works and Appliances, Ltd. (101,022).—Issue on December 6th of £300 debentures, part of series created January 12th, 1909, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,200.

Amazon Telegraph Co., Ltd. (44,532).—Particulars of £300,000 debentures created November 16th, and secured by trust-deed dated December 7th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding an annual subvention of £17,125 from the Brazilian Government, except so far as the company can, under the terms of its concessions, charge the same. Trustees: Sir. Wm. Cuthbert Quilter, Bart., 11, Great Swan Alley, E.C., and Capt. C. S. Schreiber, Marlesford Hall, Wickham Market.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—A memorandum of satisfaction to the extent of £500 on December 1st, 1909, of mortgage dated September 30th, 1908, securing £1,465 15s., has been filed.

Paignton Electric Light and Power Co., Ltd. (98,437).—Particulars of £5,000 debentures created October 15th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £900. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Charing Cross, West End and City Electricity Supply Co., Ltd. (29,122).—Trust deed dated December 9th, 1909 (supplemental to trust deed of March 31st, 1908), to secure £50,000 debenture stock (ranking *pari passu* with the £600,000 covered by the principal deed). Property charged: As per principal deed. Holders: Union of London and Smiths' Bank.

Hove and Worthing Electric Tramways Co., Ltd. (80,239).—This company's annual return was filed on November 26th, when 9 shares had been taken up out of a nominal capital of £100,000 in £5 shares. £45 has been paid. Mortgages and charges: Nil.

Nalder Bros. & Thompson, Ltd. (62,214).—This company's annual return, made up to November 12th, shows 8,256 preference and 11,125 ordinary shares taken up out of a nominal capital of £22,500 in £1 shares (10,000 preference and 12,500 ordinary). £9,381 has been paid, and £10,000 is considered as paid. Mortgages and charges: Nil.

Mansfield and District Tramways, Ltd. (91,130).—This company's annual return was filed on November 30th, when 60,000 preference and 27,836 ordinary shares had been taken up out of a nominal capital of £ 80,000 in £1 shares (80,000 preference and 50,000 ordinary). £43,611 has been paid, and £44,225 is considered as paid. Mortgages and charges: £70,000.

McKenzie, Holland & Westinghouse Power Signal Co., Ltd. (94,747).—This company's annual return was filed on November 19th, when the entire capital of £20,000 in £1 shares had been taken up. 4s. per share has been called up, and £4,000 has been paid. Mortgages and charges: Nil.

CITY NOTES.

The Schuckert Gesellschaft.

The directors of the Elektrizitäts Gesellschaft vorm. Schuckert and Co. have decided, in connection with the accounts for 1908-9, to dissolve the guarantee fund of £392,000 which was formed in 1902 by an appropriation from the legal reserve fund for the purpose of obviating subsequent losses through depreciation. This has been accomplished by re-transferring £181,600 to the reserve fund by applying the balance of £210,400 to the depreciation of investments; and the former in this way, together with an allocation of £10,780 from the past year's trading, becomes increased to £250,000, or the equivalent of 10 per cent. of the share capital. The undernoted table indicates the principal points in the accounts:—

	1908-9.	1907-8.
Share capital	£2,500,000	£2,500,000
Bond "	1,995,000	2,065,000
Gross profits	310,190	295,910
Administrative expenses ...	11,915	13,238
Depreciation (general) provision	2,102	1,173
Depreciation on securities ...	16,564	—
Net profits	226,790	193,320
Dividend...	150,000	125,000
" per cent.	6	5

The gross profits have been derived from investments, lighting and tramway undertakings in the company's possession or control, and from securities. During the year the electricity works and tramway at Regensburg were sold to the local authorities at a profit, as compared with the book value, and the transaction will be brought into the accounts for the new financial year.

Siemens-Schuckertwerke.

The report of the directors for 1908-9 states that the year stood under the influences of the depression which burdened trade and industry. It was only due to the progressive extension in the use of electrical energy that the company was able to report an increase in the value of the orders, a circumstance which was all the more noteworthy seeing that the sale prices of the majority of the products further declined. The falling off of profits, owing to the depression in prices, was only in part recouped by the simultaneous cheapening of raw materials and the improvement in the working equipment. Apart from slight decreases at the beginning of the financial year, the employment in the individual branches of heavy electrical engineering was uniformly good. The accounts show the following figures, those for 1907-8 being added for the purpose of comparison:—

	1908-9.	1907-8.
Share capital	£4,500,000	£4,500,000
Bond capital	980,000	990,500
Gross profits	663,970	750,900
Administrative expenses ...	67,740	64,720
Depreciation provision ...	40,780	133,140
Net profits	513,390	509,740
Dividend	450,000	450,000
" per cent.	10	10

The share capital is held to the extent of £2,252,500 by the Siemens & Halske Co., and £2,247,500 by the Schuckert Co. It will be observed from the table that although the gross profits diminished, the net profits were greater. This is due to the reduction in the amount provided for depreciation, as the period has expired during which it was necessary to set aside a minimum of £100,000 per annum for this purpose, whilst at the same time the machine tools, machinery and heating and lighting installations, apart from additions during the year, had previously been written down to 1s.

The report states that the deliveries of the German and ex-German works in 1908-9 comprised 52,038 machines, motors and transformers of 1,201,170 KW. as compared with 51,857 and 1,014,225 KW. respectively in 1907-8. It is proposed to transfer manufacturing gradually from Charlottenburg to the Nonnendamm, and the existing machine shop is being enlarged for this purpose. The company developed mathematical methods and apparatus for the protection of high-tension installations against excess pressures, and work was successfully carried out in the improvement of compensated machines for heavy and sudden overloading in the case of rolling mills and ironworks, winding engines, shaft ventilators and pumps, and fire-damp-proof motors and apparatus, together with driving for the textile, paper and crane industries. The large units already constructed had been surpassed during the year. The output of the automobile works found a ready sale. As the proposed taxation of electricity had been abandoned, the company received important orders from the mining and iron and steel industry, particularly for main winding engines and heavy reversing rolling mill trains. The erection of "overland" central stations both at home and abroad had assumed a noteworthy extent, and was a source of abundant employment. Orders had not been lacking for the execution of new railways and the extension of existing lines, whilst electrical working for mine and similar railways was gaining more ground and afforded good employment. Large orders were received for the Berlin and Schöneberg elevated and underground railway. As the results of the main line Hamburg-Altona-Blankenese bad been favourable, the Prussian State Railway Administration had selected as a long-distance railway the Magdeburg-Bitterfeld-Leipsig-Halle line, and, as a beginning, intended to introduce electric traction on the Dessau-Bitterfeld section, a substantial portion of the orders for which had been placed with the company. The latter was also participating in the conversion of the Spiez-Frutigen line, which represented the first portion of the great Alpine line through the Lötschberg tunnel that was in course of construction. The report remarks, in conclusion, that orders in the new financial year have hitherto come to hand to a satisfactory extent, although prices have not advanced, notwithstanding the apparent improvement in the economic situation.

Siemens & Halske.

The directors state in their report for 1908-9 that the general situation of business was not very favourable, and some of the departments were not unaffected by it, as they had to suffer from keen competition and the reserve manifested by important customers, especially local authorities. On the other hand, the more favourable working of other departments had the effect of causing the total results to be considerably better than in the preceding year, the turnover being 15 per cent. greater. The sales of the glow lamp factory, which was enlarged in 1907-8, largely increased during the year, and were also progressing in a satisfactory manner in the new financial year. At the close of the year three automatic telephone exchanges were in course of construction, and the building of benzine motors had been taken up on a large scale. The branch of ozone water installations had experienced a fresh revival by various installations which had been partly carried out and were partly in progress. The Electro-Steel Installation Co. had made a further advance, and the Wireless Telegraph Co. had obtained a considerable success by the development of its new system of sounding sparks. The works for the continuation of the Elevated and Underground Electric Railway in Berlin, from the Spittelmarkt *via* the Alexanderplatz to the Schonbauser Allee, were in preparation, whilst the execution of this railway company's new power station on the Lower Spree had been commenced. It was assumed that as the works in connection with the Schoneberg undergound railway had made considerable progress, the line would be set in operation about the end of 1910, before the expiration of the contract period. The construction of the city and suburban railways in Hamburg was proceeding according to the programme. The following items are extracted from the accounts:—

	1908-9.	1907-8.
Share capital	£3,150,000	£2,725 000
Bond capital	1,328,500	1,348 000
Gross profits	639,870	553,880
Administrative expenses ...	42,250	42,870
Depreciation provision ...	24.050	23,610
Net profits	571,450	484,410
Dividend	378,000	299,750
,, per cent.	12	11

The report states further that the Austrian Siemens-Schuckert Works Co. had increased its dividend for the past year to 5 per cent., whilst the Russian Siemens & Halske Co. and Siemens Bros. and Co. had again distributed 4 per cent. It is added that a further expansion in orders has taken place in the new financial year.

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

January 6th.—New York Telephone Co.—Scrip, fully paid, for £2,000,000 4½ per cent. first and general mortgage 30-year bonds (London issue).

And ordered the above and the following to be quoted in the Official List:—

Charing Cross, West End and City Electricity Supply Co.—Further issue of £182,570 4½ per cent. debenture stock.

Direct West India Cable Co., Ltd.—The directors have declared an interim dividend of 6 per cent. per annum (1s. 6d. per share) free of income-tax, on the ordinary shares for the past half-year.

Halifax and Bermudas Cable Co.—The directors have declared an interim dividend of 5 per cent. per annum (2s. 6d. per share), free of income-tax, on the ordinary shares for the past half-year.

The Paris Compressed-Air Co.—It was recently mentioned that a syndicate of French banks had concluded negotiations for the repurchase of a considerable number of shares held by German financial institutions in the Compagnie Parisienne de l'Air Comprimé or the Popp Company, there only remaining outside the transaction a block of shares possessed mainly by the firm of Sal. Oppenheim & Co., of Cologne. The operation was completed at the beginning of November, when the shares changed hands, but the satisfaction at this apparent nationalisation of the Popp Compressed Air and Electricity Co. has been somewhat tempered by the knowledge that has now become public that the shares still in Teutonic hands number about 6,400, and are founders' shares. As such the shares are entitled to 41 per cent of the net profits after a dividend at the rate of 6 per cent. has been paid, and they also carry the right of subscription at par for one-third of any new issue of shares by the Paris company. The French interests now propose to acquire these particular shares; negotiations on the subject are proceeding, and are expected to be completed by the end of this month between the company itself, instead of the banking syndicate, as in the case of the ordinary shares, and the German holders.

Electrical Securities Trust, Ltd.—The accounts for the year ended November 14th show a loss, after providing for debenture interest, of £5,442, increasing the debit to profit and loss brought forward to £10,485. During the year the South-Western Traction Co., of Canada, in the first mortgage debentures of which this company is interested to a large extent, was placed in the hands of a receiver, and the property was sold in October last. The amount which the company is entitled to in respect of its holding is, approximately, £50,000, and, as soon as this money has been received, says a financial daily, meetings of the debenture-holders and the shareholders will be called to consider its distribution and the future of the company.

Houghton-le-Spring and District Electric Lighting Co., Ltd.—Mr. A. W. Tait presided at Basildon House, E.C., on Wednesday last week, over the annual meeting of the above company. In the absence of any shareholders, the following report was adopted, on the motion of the Chairman, seconded by Sir Douglas Fox:—The loss on the working of the year ended December 31st, 1908, is £133, after charging interest amounting to £394. To this loss has been added the cost of the investment in the S.M.H. Tramway Syndicate, Ltd., written off, amounting to £1,000, making the loss carried to the balance-sheet £1,133. The sales of energy during the year show considerable increase over those of the previous year, and still further progress has been made during the year 1909. In accordance with arrangements made in conjunction with the Durham Collieries Electric Power Co., Ltd., Mr. H. R. Hogg and Captain Osborne resigned from the board, and Messrs. L. D. Cunliffe and T. O Callender were appointed. Mr. H. van Brienen Collet was elected as an additional director.

Howard & Bullough, Ltd.—An interim dividend of 10 per cent. per annum (6d. per share), free of income-tax, has been declared on the ordinary shares for the past quarter.

Sunderland District Electric Tramways, Ltd.—The accounts for the 12 months ended October 31st, 1909, show the company to be in a better position than in any previous year. After providing for interest on the prior lien bonds and first and second mortgage debentures and loans, viz., £9,730, there is a loss of £780, bringing the loss to date up to £14 604. During the year the traffic receipts fell off by £1,319, but against this a saving was effected in working expenses of £2,108. The decrease in traffics is attributable to the exceedingly unsatisfactory state of trade in the district served by the company during the past year, following on the long shipbuilding strike of the previous year. In addition, the unfortunate weather of the past summer contributed to the decrease. Signs of improving trade are now discernible in the district, and the directors are hopeful that the coming year will show a very considerable improvement in the company's position.

Calcutta Electric Supply Corporation, Ltd.—The *Financial Times* says that the negotiations for the placing privately of £100,000 of the cumulative 5 per cent. £5 preference shares of the Calcutta Electric Supply Corporation, which were reported to have fallen through, are still proceeding, and will, it is believed, prove successful. It appears that the technical legal difficulty which has occurred is being surmounted by mutual concessions between the company and its friends.

Electric Conversion Syndicate, Ltd.—The report states that during the year to September 30th the liabilities have been reduced by £2,815, and the annual expenditure has been brought down so as to be covered by the incomings. A scheme for the continuation and rehabilitation of the company has been prepared, and will be laid before the members at an early date, as soon as the necessary guarantees now under negotiation can be completed. A contemporary adds that the directors have before them several propositions by which, if carried through, a satisfactory amount in commissions can be earned, and that without requiring any serious amount of capital to finance them.

France.—The balance-sheet of La Compagnie d'Energie Electrique du Centre, of Paris, for the last financial year shows a net profit of £12,405, compared with only £8,246 in the preceding 12 months.

Manx Electric Railway Co., Ltd.

The report of directors to September 30th, 1909, shows that the gross receipts amounted to £32,745, and the gross expenditure to £16,509, leaving £16,237, plus £1,050 brought forward, = £17,287. Deduct debenture interest £9,000, interim dividend of 2½ per cent. on preference shares paid September 30th, 1909, £3,580, leaving £4,707. Deduct, balance of preference share dividend due in respect of the year ended September 30th, 1909, £3,580, leaving a balance of £1,126, which the directors propose carrying forward to next year. During the year the capital expenditure had been £20. The net result of the year's working has been injuriously affected by the bad weather, as is the case with all undertakings in the island, and the passengers carried during the 12 months totalled only 518,655, at compared with 527,986 during the previous 12 months, a decrease of 9,331. The receipts were £32,745, as compared with £33,735 in the prèvious year, whilst the working expenses amounted to £16,509, comparing with £16,734 in the previous year. The ratio of working expenses to receipts has been 50·3 per cent. in 1909, as compared with 49·6 per cent. in 1908.

Mr. A. G. Boscawen (chairman) presided on Tuesday, December 21st, at the offices, 3, Finch Lane, E.C., over the seventh annual general meeting of the above company.

The Chairman, in moving the adoption of the report (as above), pointed out that in the past it had been usual to receive the accounts at an extraordinary meeting, but under the new Companies' Act they were enabled to hold that meeting there, and it would be unnecessary to hold a meeting in Douglas in the spring. It was perfectly obvious that the accounts were a disappointment to the board and shareholders alike. The receipts during the year showed a total decrease of £989 4s. 4d. The decrease in the revenue from passengers was £1,293 19s., but there was an increase in goods and sundry receipts of £304 14s. 8d. On the other hand, the working expenses were £224 19s. 8d. lower. Owing to the decrease in the receipts there was a slight increase in the ratio of working expenses to receipts, viz., 50·3, against 49·6. The mileage had considerably decreased, both as regarded passengers and goods. There was a decrease in passenger mileage of 14,671¼ miles and in goods of 922½ miles, which showed that the board and the officers had taken every step to decrease the mileage in view of the falling receipts. The decrease in the number of passengers carried was 9,331. They were showing practically the same receipts per train-mile as last year, although the number of passengers was considerably smaller, and this was due to the judicious reduction in the mileage run, or, in other words, to careful and economical working. Of course, the principal cause for the falling off was the bad weather experienced in the island, for they had had 35 completely wet days during the season against an average of 26 in the last four years. Unfortunately for them the two wettest months were July and August, the two months in which they expected to make money; June was comparatively fine, and in September there was a great improvement. But for this improvement things would have been much worse than they were. He could only say that every step was taken by the officers and the board to secure as much traffic as possible, and it was a fair comparison to make to show that similar undertakings in the island suffered quite as much, if not more than they did. The Douglas Southern Electric Tramway Co.'s receipts were £222 down compared with last year, notwithstanding an increase of mileage of 2,521 miles, whilst the receipts of the Isle of Man Railway Co. were down by £1,213. It was quite true that the returns of the Isle of Man Steam Packet Co. showed that there were more visitors to Douglas, but these returns were somewhat illusory, because the increase was due to day trippers and week end visitors, and, of course, such visitors were not nearly so much use to them as those who came and resided some weeks in the island. At the same time, they took every step to obtain as much advantage as was possible from trippers, and in nearly every case through bookings were arranged from this side. Another cause which operated against them was the decreased spending capacity of the people who came, as compared with previous years, which was attributable to the long-continued bad trade, especially in Lancashire and Yorkshire. The receipts from each passenger over the line averaged 13·5d., against 13·8d., which was a decrease of ·3d. during the year. The net result during the past year enabled them to pay the debenture interest and the preference dividend, and to carry forward £1,126; but they were unable to place anything to the reserve fund for special renewals. That account, however, stood at £5,316, and he wanted to assure the shareholders that during the year the line had been well kept up in every respect. Sir W. Vaudrey and himself visited the whole line during the month of August, and they were convinced that everything had been done to maintain it and make it attractive in every way. It was well advertised, and the care which had been exercised showed that their officers were doing everything they possibly could to make a trip along the line attractive. It was a great matter for regret that nothing further had been done towards the electrification of the front, and the better lighting of the town of Douglas, and he was bound to say that in the opinion of the board, one reason why the residential visitors to the island had not increased was because Douglas and the island, to some extent, was falling behind in the competition with such places as Blackpool. He was convinced that the Corporation of Douglas would be taking a wise step if they improved the lighting of the town and replaced the antiquated system of horse tramways along the front with electric trams.

Mr. B. E. Greenwell seconded the motion.

Mr. Holford asked whether there was a prospect of the ordinary shareholders ever receiving a dividend.

The Chairman said he certainly thought so, and, in fact, they received one two years ago.

Mr. Holford: It was very small.

The Chairman said that was true, but had it not been for the two disappointing years that dividend would have been maintained and increased. Their first duty was to maintain the line in an efficient state, but he hoped that with better trade they would do a good deal better next year.

The motion was then carried, and the retiring directors and auditors were re-elected.

Mr. Tiarks proposed a vote of thanks to the board, and Mr. Holford, in seconding, expressed the hope that the board would be able to induce the Douglas Corporation to have the tramways on the front electrified.

The Chairman said they had been doing all they could to come to some arrangement with the Corporation, but their negotiations had broken down through no fault of the board's.

Durham Collieries Electric Power Co., Ltd.

Mr. A. W. Tait (chairman) presided at the ordinary general meeting of the above company at the offices, Basildon House, Moorgate Street, E.C., on Wednesday last week, when the following report was submitted:—The directors submit accounts made up to September 30th, 1909, covering a period of 18 months from March 31st, 1908, which was the date of the previous balance sheet. The trading account shows a profit of £5,266, but after charging head office expenses, rent and royalty to the Sunderland District Tramways, Ltd., and writing off a bad debt of £7,363, there is a debit of £8,787, to which has to be added the prior lien debenture interest and first mortgage debenture interest, bringing the total loss for the period up to £21,714. The sales of current during the period show considerable improvement, and, owing to contracts which have been made with further consumers and to the extension of the demand of existing consumers, further progress in this respect is to be expected. The arrangements suggested in the previous report for an issue of second mortgage debentures could not be carried out, and, owing to the financial position of the company, it was necessary to convene meetings of debenture-holders, which were held on December 14th, 1908, and powers were taken for the creation of £50,000 prior lien bonds, the proceeds of such issue to be applied in the improvement of and for extensions to the company's distribution system. The debenture-holders also agreed to waive their foreclosure rights in respect of interest on the first mortgage debentures for a period of five years to December 31st, 1913, on the condition that any net profits earned by the company during that period, after meeting the prior lien interest, should be distributed among the debenture-holders. Arrangements were also made at the same time with the outstanding creditors of the company, under which they accepted first mortgage debentures at par in satisfaction of their claims against the company. An agreement was also entered into, with the consent of the debenture-holders, with the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the County of Durham Electric Power Supply Co., under which the former company agreed to operate the company's generating station at Philadelphia, and to supply any current which may be required by its consumers at fixed prices, and also to manage the company's distribution system on a sliding scale according to the output; these arrangements to last for a period of 42 years from January 1st, 1909. In respect of this agreement, the County of Durham Co. has given certain rights and privileges to this company with regard to the supply of power to consumers within specified areas. In connection with these arrangements, Messrs. J. S. Bergheim, H. R. Hogg and C. A. Osborne retired from the board, and Messrs. H van Brienen Collet, L. D. Cunliffe and T. O. Callender were appointed by the debenture-holders, the Newcastle Co., and the creditors respectively, to fill the vacancies. The appointment of these gentlemen will be submitted for confirmation to the meeting. Mr. A. W. Tait and Sir Douglas Fox offer themselves for re-election.

STOCKS AND SHARES.

Tuesday Afternoon.

To the year 1909 belongs the honour of being better than its predecessors for half a decade, from the Stock Exchange point of view. The honour may be a little equivocal, seeing how barren the recent years have turned out, but nevertheless the fact remains. Amongst electricity stocks and shares the 12 months have produced much activity in foreign power, traction and lighting issues, but in domestic securities they have proved a period of much quietude. Home Rails in particular have been neglected, and how slender are most alterations on balance, this table shows:—

Stock.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
Central London Ord.	65	64	— 1
,, Pref.	85	86	+ 1
,, Def.	51	46	— 5
City & South London	27	$32\frac{1}{2}$	+ $5\frac{1}{2}$
Great Northern & City	$\frac{1}{2}$	$\frac{3}{4}$	+ $\frac{1}{4}$
Metropolitan	37	40	+ 3
Metropolitan District	14	$18\frac{1}{2}$	+ $4\frac{1}{2}$
,, ,, 6 per cent. Deb.	$123\frac{1}{2}$*	144	+ $20\frac{1}{2}$
Baker Street & Waterloo Deb. ..	95	98	+ 3
Charing Cross and Euston Deb. ..	85*	96	+11
Gt. Northern, Picc. & B. Deb. ..	92*	96	+ 4

Quiet as business has been in Home Railway stocks, in Electricity Supply shares the year brought greater quietude still, and the comparative quotations of leading shares are as follows:—

Ordinary shares.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
Brompton and Kensington	$8\frac{1}{4}$	$7\frac{1}{4}$	— 1
Charing Cross and Strand	$4\frac{5}{8}$	$4\frac{1}{8}$	— $\frac{1}{2}$
Chelsea	4	$3\frac{5}{8}$	— $\frac{3}{8}$
City of London	$10\frac{1}{8}$	$10\frac{1}{8}$	—
County of London	$10\frac{7}{8}$	$10\frac{7}{8}$	—
Edmundson's Pref.	$\frac{3}{4}$	$\frac{5}{8}$	— $\frac{1}{8}$
Kensington and Knightsbridge ..	8	$7\frac{1}{4}$	— $\frac{3}{4}$
London Electric	$1\frac{9}{16}$	$1\frac{15}{16}$	+ $\frac{3}{8}$
Metropolitan	$5\frac{1}{4}$	$4\frac{1}{4}$	— 1
Notting Hill	$12\frac{1}{4}$	$12\frac{3}{4}$	+ $\frac{1}{2}$
St. James' and Pall Mall	$8\frac{7}{8}$	$8\frac{3}{4}$	— $\frac{1}{8}$
Smithfield	$\frac{1}{2}$	$1\frac{3}{4}$	+ $1\frac{1}{4}$
South London	$2\frac{13}{16}$	$2\frac{15}{16}$	+ $\frac{1}{8}$
Urban Pref.	$1\frac{13}{16}$	$1\frac{1}{2}$	— $\frac{5}{16}$
Westminster	$8\frac{1}{2}$	$8\frac{5}{8}$	+ $\frac{1}{8}$

The development of metal-filament lamps has made serious inroads upon profits in a certain number of cases, but the falling off is simply a matter of recoiling in order to prepare for a bigger leap forward, and the new year should bring its reward—or a first instalment of reward—to the supply companies in consequence of the increased demand for an electric illuminant demonstrably cheaper than gas.

The telegraph market has experienced its usual amount of more or less harmless shocks, and the result of the year's working is, on the whole, satisfactory to proprietors. The heavy rise in Mackay Companies' Common is due, of course, to operations from the other side of the Atlantic.

Stock or share.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
Amazon	$2\frac{5}{8}$	$3\frac{5}{8}$	+ 1
Anglo-American Deferred	$15\frac{3}{8}$	22	+ $6\frac{5}{8}$
Cuba	8	$8\frac{3}{4}$	+ $\frac{3}{4}$
Direct Spanish	$3\frac{1}{4}$	$3\frac{1}{4}$	—
Direct U.S.A.	$13\frac{1}{8}$	$13\frac{1}{4}$	+ $\frac{1}{8}$
Eastern	$130\frac{1}{2}$	$135\frac{1}{2}$	+ 5
Eastern Extension	$11\frac{7}{8}$	12	+ $\frac{1}{8}$
Great Northern	31	30	— 1
Globe Telegraph and Trust	$10\frac{1}{4}$*	$10\frac{1}{2}$	+ $\frac{1}{4}$
Indo-European	$53\frac{1}{2}$	52	— $1\frac{1}{2}$
Mackay Common	76	94	+18
do. Pref.	$72\frac{1}{2}$	79	+ $6\frac{1}{2}$
Marconi	$\frac{9}{16}$	$\frac{9}{16}$	—
Western	$12\frac{3}{4}$*	$13\frac{3}{4}$	+ 1
West Indian and Panama	$\frac{9}{16}$	$\frac{11}{16}$	+ $\frac{1}{8}$
do. First Pref.	$7\frac{7}{8}$	9	+ $1\frac{1}{8}$
do. Second Pref.	8	$8\frac{1}{2}$	+ $\frac{1}{2}$

Putting a few telephone issues by themselves, the annexed comparisons appear:—

Stock or share.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
American Telegraph and Telephone ..	$130\frac{1}{2}$	145	+ $14\frac{1}{2}$
Chile	$8\frac{1}{4}$	$7\frac{15}{16}$	— $\frac{5}{16}$
Monte Video	$\frac{15}{16}$	$\frac{13}{16}$	— $\frac{1}{8}$
National Preferred	$109\frac{1}{2}$	$107\frac{1}{4}$	— $2\frac{1}{4}$
,, Deferred	$117\frac{1}{2}$	124	+ $6\frac{1}{2}$
Oriental	$1\frac{3}{8}$	$1\frac{7}{16}$	+ $\frac{1}{16}$
United River Plate	$6\frac{1}{2}$	$7\frac{1}{8}$	+ $\frac{5}{8}$

The activity in tramway, traction and power descriptions has already been mentioned, and, for convenience sake, the accompanying catalogue embraces a number of the best known issues in the several sections:—

Stock or share.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
British Columbia Electric Rly. Def...	$136\frac{1}{2}$	143	+ $6\frac{1}{2}$
,, ,, ,, Pref. ..	118	123	+ 5
British Electric Traction	$1\frac{1}{16}$	$\frac{13}{16}$	— $\frac{1}{4}$
,, ,, ,, Pref. ..	$3\frac{3}{4}$	$2\frac{13}{16}$	— $\frac{15}{16}$
Canadian General	107*	$114\frac{1}{2}$	+ $7\frac{1}{2}$
Calcutta Trams	$4\frac{3}{4}$	$4\frac{3}{4}$	—
Cape Trams	$\frac{1}{4}$	$\frac{5}{16}$	+ $\frac{1}{16}$
London United Pref.	$4\frac{3}{8}$*	$2\frac{1}{4}$	— $2\frac{1}{8}$
,, ,, Deb.	68*	$61\frac{1}{2}$	— $6\frac{1}{2}$
Mexico Trams	$136\frac{1}{2}$	124	—$12\frac{1}{2}$
Mexican Light and Power	76	69	— 7
Rio Trams	$84\frac{1}{4}$	92	+ $7\frac{3}{4}$
Sao Paulo	159*	154	— $4\frac{1}{2}$
Shawinigan Water	$82\frac{1}{2}$	104	+$21\frac{1}{2}$

The final list must comprise some of the most important manufacturing and "miscellaneous" companies. In their shares the changes during the year have been decidedly varied, as these statistics illustrate:—

Stock or share.	Dec. 31, 1908.	Dec. 28, 1909.	Rise or fall.
Babcock & Wilcox	$3\frac{15}{16}$	$4\frac{5}{8}$	+ $\frac{11}{16}$
British Aluminium Ordinary	$2\frac{1}{16}$	$\frac{3}{4}$	— $1\frac{5}{16}$
Do. "A" Preference ..	4	$3\frac{1}{2}$	— $\frac{1}{2}$
British Insulated	$6\frac{3}{4}$	$6\frac{7}{16}$	— $\frac{5}{16}$
British Westinghouse Preference ..	$\frac{1}{2}$	$\frac{9}{16}$	+ $\frac{1}{16}$
Do. do. 4 per cent. Deb.	$43\frac{1}{2}$	50	+ $6\frac{1}{2}$
Brush 4½ per cent. Debentures ..	$67\frac{1}{2}$	$43\frac{1}{2}$	—24
Callender's Ordinary	$9\frac{3}{8}$	$10\frac{1}{8}$	+ $\frac{3}{4}$
Castner Kellner	$1\frac{9}{16}$	$2\frac{5}{16}$	+ $\frac{3}{4}$
Dick, Kerr	$1\frac{5}{16}$	$1\frac{1}{16}$	— $\frac{1}{4}$
Edison & Swan "A" fully	2	$1\frac{1}{4}$	— $\frac{3}{4}$
General Electric Preference	$7\frac{1}{4}$*	$8\frac{1}{4}$	+ 1
Henley's Ordinary	12	$12\frac{3}{8}$	+ $\frac{3}{8}$
India Rubber	$16\frac{5}{8}$	$16\frac{1}{4}$	— $\frac{3}{8}$
Telegraph Construction	$31\frac{1}{2}$	$35\frac{1}{4}$	+ $3\frac{3}{4}$
Willans & Robinson	$\frac{3}{4}$	$\frac{3}{8}$	— $\frac{3}{8}$
Do. Preference ..	$2\frac{9}{16}$	2	— $\frac{9}{16}$

* *Ex* dividend.

The Old Year might have been worse: the New Year holds prospects for investment securities that are admittedly bright. It is in the hope that the prices for all stocks and shares which they may hold, or buy, may advance in value during 1910 that the readers of these notes are tendered good wishes for a prosperous and successful New Year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Dec. 22	2,865	— 178	29	41,159	— 1,087	..	..
Ayr	,, 25	851	— 9	82	10,308	— 156	8	..
Bath	,, 22	1,290	— 52	51	38,934	— 1,285	..	..
Belfast	,, 24	8,025	+ 19	37	147,251	+ 5,810	37	..
Birkenhead.. ..	,, 26	2,193	+ 61	38	41,421	— 380	18·68	..
Birmingham Corp.	,, 18	13,806	+ 565	38	248,922	+ 7,299	..	..
Blackburn	,, 22	1,762	— 199	39	42,628	— 1,392	14·62	..
Blackpool Corp. ..	,, 23	622	— 61	..	49,947	+ 4,083	..	..
Blackpool-Fleetw'd	,, 11	450	— 4	23	22,315	+ 1,367	..	..
Bolton	,, 19	4,286	— 16	38	88,279	+ 238	26	..
Bournemouth ..	,, 22	2,624	— 84	38	64.524	+ 283	21·96	..
Bradford	,, 18	8,956	+ 236	37	183,370	+ 6,153	54·81	..
Brighton	,, 26	1,539	— 30	39	38,400	+ 1,619	9·5	..
Bristol	,, 24	11,430	+ 737	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 17	409	— 9	50	10,940	— 139	3·65	..
Barnsley	,, 17	320	— 9	,,	8,432	— 381	..	..
Barrow	,, 17	413	— 3	,,	11,553	— 596	5·37	..
Cavehill	,, 17	99	— 6	,,	4,197	— 110	..	..
Devonport ..	,, 17	688	— 262	,,	18,363	— 4,952	8·85	..
Gateshead ..	,, 17	1,967	+ 9	,,	49,856	— 522	11·25	..
Gravesend ..	,, 17	383	+ 28	,,	10,521	+ 54	6·5	..
Greenock	,, 17	955	+ 64	,,	27,655	+ 1,592	7·25	..
Hartlepool ..	,, 17	422	+ 25	,,	11,766	— 50	6·72	..
Kidderminster ..	,, 17	173	+ 8	,,	5,352	— 136	..	..
Leamington ..	,, 17	265	— 4	,,	8,792	+ 208	..	..
Merthyr	,, 17	371	— 57	,,	10,454	— 239	2·9	..
Metropolitan ..	,, 17	11,916	+1,153	,,	311,726	+24,011	22	..
Middleton ..	,, 17	528	— 55	,,	16,555	— 1,038	8·5	..
Mid. Joint Com'tee	,, 17	11,180	+ 108	,,	286,342	— 624	..	..
Oldham—Ashton	,, 17	1,004	— 40	,,	27,971	— 1,236	9·13	..
Peterborough ..	,, 17	191	— 4	,,	5,885	— 435	5·31	..
Potteries	,, 17	8,670	— 55	,,	90,408	— 358	29	..
Rothesay	,, 17	73	+ 2	,,	9,915	+ 118	2·75	..
Southport.. ..	,, 17	422	— 18	,,	14,195	— 464	8·17	..
S. Metropolitan ..	,, 17	1,866	+ 7	,,	39,732	— 583	..	..
Swansea	,, 17	1,877	+ 132	,,	48,931	+ 1,737	12·5	..
Tynemouth ..	,, 17	266	+ 3	,,	11,936	+ 851	3·75	..
Weston-s Mare ..	,, 17	46	— 6	,,	7,165	+ 393	3	..
‡Worcester ..	,, 17	480	— 8	,,	13,893	— 147	5·75	..
Wrexham ..	,, 17	167	— 14	,,	4,895	— 218	..	..
Yorks. Wool. Dist.	,, 17	1,749	+ 100	,,	46,167	+ 603	17	..
Miscellaneous ..	,, 17	377	+ 12	,,	10,438	— 786	..	..
Burnley	,, 25	2,238	— 231	..	..	..	..	..
Burton-on-Trent ..	,, 26	516	— 6	39	10,335	— 214	6·63	..
Bury	,, 19	1,891	— 65	$37\frac{4}{7}$	43,870	— 418	22·5	..
Cardiff	,, 18	4,071	— 98	37	83,565	+ 1,126	..	..
†Carlisle	,, 18	136	— 21	..	8,211	— 464	..	..
†Chatham and Dist.	,, 16	724	— 35	50	40,981	+ 1,563	14·98	..
Cork	,, 23	895	— 75	51	22,924	— 718	9·89	..
Croydon	,, 10	3,025	+ 556	..	57,674	+ 5,235	11·25	4·75
†Darlington.. ..	,, 18	172	— 12	38	7,010	— 501	..	..
Darwen	,, 17	442	— 5	37	9,334	— 108	4·86	..
Dover..	,, 18	314	— 4	58	8,078	— 410	4·75	..
Dublin	,, 24	10,719	— 20	..	139,756	+ 1,864	54·25	..
Dundee	,, 22	2,210	— 83	$31\frac{4}{7}$	37,583	— 821	15·5	..
†East Ham	,, 18	942	+ 34	$37\frac{1}{2}$	37,863	+ 4,561	8·52	·77
Exeter	,, 24	566	— 18	39	13,009	+ 557	..	..
Glasgow	,, 25	33,049	— 505	..	501,190	— 9,811	$94\frac{1}{2}$	5
†Hastings	,, 16	640	— 71	..	..	..	..	..
†Huddersfield ..	,, 18	1,604	+ 94	37	62,755	+ 2,848	28·5	·5
Hull	,, 25	5,507	+ 163	38	100,261	+ 4,088	14·5	1·5
Ilkeston	,, 22	232	— 15	38	5,160	— 263	..	..
†Ipswich	,, 18	340	— 29	38	15,312	+ 161	10·5	..
Kilmarnock ..	,, 18	258	— 31	31	4,539	— 199	4·25	..
Lancashire United	,, 22	2,098	— 190	51	66,417	— 934	..	..
Leeds	,, 18	12,908	+ 333	37	255,651	+ 7,399	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	,, 25	1,014	+ 44	32	19,432	+ 2,235	9	3
Liverpool	,, 18	21,521	+ 125	50	539,642	— 1,356	..	..
‡L.C.C.	,, 11	38,298	—8,064	..	1,355,055	+64,980	..	..
London United ..	,, 25	10,776	— 468		306,718	—29,334	..	..
†Lowestoft	,, 18	161	+ 10	12	1,931	+ 20	3·5	..
Manchester ..	,, 25	28,633	—1,302	39	578,334	— 9,247	..	..
†Newcastle	,, 18	3,885	— 8	..	146,617	— 1,212	14·5	..
Newport	,, 18	1,215	+ 9	38	24,844	— 1,293	14·5	..
Oldham	,, 26	3,059	— 880	39	71,671	— 5,699	23·75	..
†Pontypridd.. ..	,, 18	372	— 11	$37\frac{1}{2}$	15,509	+ 1,066	5·5	..
Portsmouth ..	,, 18	3,146	— 110	38	79,814	— 2,232	14·5	..
Preston	,, 22	1,276	— 134		..	..	..	..
†Rotherham ..	,, 16	571	+ 1	37	21,952	— 1,026	12	2
Salford	,, 20	8,464	— 283	$37\frac{5}{7}$	172,379	— 4,675	..	..
†Sheffield	,, 19	5,594	+ 84	$38\frac{3}{7}$	216,901	+ 2,328	..	..
Southampton ..	,, 22	2,008	— 83	38	41,100	— 856	..	..
†Southend-on-Sea ..	,, 15	342	+ 47	37	20,332	+ 2,662	..	..
South Shields ..	,, 25	1,080	— 48	$38\frac{3}{7}$	21 827	— 18	..	..
†Swindon	,, 8	126	+ 12	$37\frac{1}{7}$	211,307	+ 2,244	..	..
Tyneside	,, 22	714	— 70	25	10,705	+ 248	..	..
Wallasey	,, 25	1,603	— 52	$28\frac{1}{2}$	85,676	+ 639	..	·22
Walthamstow ..	,, 25	1,210	+ 42	39	25,623	+ 605	9	..
West Ham	,, 16	4,549	+ 223	37	87,470	+ 5,141	15·25	·48
†Wolverhampton ..	,, 15	880	+ 100	37	31,264	+ 290	14·25	1·75
Baker St.-Waterloo	,, 25	7,135	+ 735	25	79 610	+ 3,000	4·25	..
Cen. London Rly...	,, 25	11,818	+1,099	25	133,792	—41,840	6·82	·55
Char. +, Eus. Hamp.	,, 25	7,735	+ 475	25	94,030	— 9,250	7·75	..
City & S. Lon. Rly.	,, 26	6.882	+ 387	25	79,626	+ 3,179	7·3	..
Dublin-Lucan Rly.	,, 24	228	— 34	25	3,557	+ 6	7	..
G.N. and City Rly.	,, 25	3 095	+ 205	25	34,185	+ 449	3.5	..
G.N., P'y. & Brmtn.	,, 25	12,210	+1,210	25	136,535	+ 6,770	9·25	..
†L'pool Overh'd Rly.	,, 19	1 247	— 83	24	34,579	— 163	6·8	4·3
†Llandudno-Col. Bay	,, 17	94	— 3	$2\frac{1}{2}$	251	— 4	..	..
†Mersey Railway ..	,, 18	2,099	+ 78	24	47,007	+ 1,719	4·5	..
Metropolitan Rly...	,, 26	86,5 0	+2,154	..	410,382	+ 49	24·5	..
Met. District Rly...	,, 25	21,825	+2,615	25	260,419	+15,430	24	..
Anglo-Argentine ..	,, 23	87,259	+6,555	..	2,028,310	+123,946	..	..
§Auckland	,, 3	14,816	+1,292	48	164,769	+14.899	22·3	1·38
Bombay (B.E.T.) ..	Nov. 25	11,146	+ 919	47	119,870	+ 6,259	..	..
§Brisbane	,,	16,170	+1,666	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
†Calcutta	Dec. 18	3,468	+ 157	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	..	3,399	..	..	41,472	..	20·5	..
Madras	Dec. 15	1,405	+ 221	..	29,729	+ 1,511	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	Dec. 24	3,498	+ 184	..	72,283	+ 1,059	28	2·4

* Compared with the corresponding period of 1908. † One week only. ‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations Dec. 21st.	Closing Quotations Dec. 28th.	Business done week ended Dec. 28th, 1909.		Rise + or Fall —	Present Yield per cent.
			1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ – 3⅞	3⅜ – 3⅞	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 –103	100 –103	..	..	..	4 17 1
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 –146	144 –146	..	..	–1	5 9 0
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 – 98	96 – 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3⅞%	3½%	£3 4s.	60 – 62	60 – 62	..	..	..	5 8 4
8,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 –101	100 –101	100¾	100	..	5 18 0
8,220,770	Do. do. do. Deferred	Stock	½%	1⅞%	1 %	8/-	21¾ – 22	22 – 22¼	22	21¾	+ ⅛	1 14 8
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 –103	101 –103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7¾ – 8¼	7¾ – 8¼	..	..	..	4 18 6
2,481,850	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86½ – 88½	86 – 88	87¾	86⅝	– ½	4 18 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝ – 9⅛	8⅝ – 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 – 18	17 – 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 – 3½	3 – 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 – 8½	8 – 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ –102½	100½ –102½	..	..	..	4 7 10
60,710l	Direct United States Cable	20	4⅛%	4⅝%	4⅛%	4⅛%	13 – 13½	13 – 13½	..	..	..	6 4 7
39,500l	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 –102	100 –102	..	..	..	4 7 10
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	133 –136	134 –137	136½	135	+1	5 2 2
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 – 87	85 – 87	..	..	+ ½	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock, Red. ..	Stock	4 %	4 %	4 %	4 %	102 –104	102 –104	..	..	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾ – 12¼	11¾ – 12¼	..	..	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 –104	102 –104	..	..	..	3 16 11
300,000l	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 –102	100 –102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5¾%	10¼ – 10¾	10¼ – 10¾	10⅜	..	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¼ – 14	13¼ – 13¾	13⅜	..	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	29½ – 30½	29½ – 30½	..	..	– ½	5 18 0
5,000l	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 –102	100 –102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	51 – 53	51 – 53	..	..	..	7 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93 – 95	93 – 95	..	..	–2	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 – 80	78 – 80	..	..	+2	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	½ – ⅝	½ – ⅝	10/7½	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾ – ⅞	¾ – ⅞	16/-	..	..	6 8 0
36,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾ – ⅞	¾ – ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ –108	106½ 108	..	..	..	5 11 1
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123 –125	123 –125	124¼	123¼	+1	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¼ – 11	10¼ – 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10⅛ – 10⅞	10⅛ – 10⅞	..	..	+ ⅛	5 12 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 – 5 11/16	5 7/16 – 5 11/16	..	..	..	4 8 7
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98½ – 100½	98½ –100½	..	..	+ ½	3 9 8
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100½ –102½	100½ –102½	..	..	+ ½	3 18 1
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ – 1½	1⅜ – 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16 – 1 5/16	1 3/16 – 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87½ – 89½	87½ – 89½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 –102	100 –102	..	..	..	3 18 5
11,839l	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ – 8⅛	7⅝ – 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	101 –103	101 –103	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 –132	129 –132	130	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 – 7½	7 – 7½	7 3/16	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5½ – 5¾	5½ – 5¾	..	..	..	4 6 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	2½%	1⅜ – 1⅝	1⅜ – 1⅝	27/6	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 –102	100 –102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½ – 14	13⅝ – 14⅛	14	13 13/16	+ ⅛	4 19 1
300,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 –105	103 –105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝ – ¾	⅝ – ¾	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¾ – 9¼	8¾ – 9¼	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 – 9	8 – 9	..	..	..	6 13 4
80,000l	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 –104	102 –104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅝ – 4⅞	4⅝ – 4⅞	95/-	93/1½	..	5 2 7
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4⅜ – 4⅝	4⅜ – 4⅝	..	..	..	5 8 1
978,230	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	92 – 93½	92 –93½	93½	92⅝	..	4 5 7
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 –107	104 –107	..	..	..	4 13 6
530,000	Babcock & Wilcox, 1 to 530,000..	1	20 %	20 %	20 %	20 %	4⅝ – 4⅞	4⅝ – 4⅞	92/6	..	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 – 1 9/16	1 7/16 – 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	Nil	½ – 1	½ – 1	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	3½%	1⅝ – 2⅛	1⅝ – 2⅛	..	..	..	7 15 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¼ – 3¾	3¼ – 3¾	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	2 %	2½ – 3½	2½ – 3½	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	97 –100	97 – 100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	139 –143	141 –145	142½	140	+2	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 –125	121 –125	123⅛	123	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 –111	110 –113	112	110⅞	+2	4 8 6
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 –104	102 –104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 –105	102 –105	103⅜	..	..	4 6 2
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅝ – 1	⅝ – 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2⅝ – 3	2⅝ – 3	..	..	..	5 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 – 87	84 – 87	84⅝	..	..	5 14 11
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 – 65	60 – 65	..	..	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 – 7½	7 – 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6½ – 6⅞	6½ – 6⅞	..	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 –106	103 –106	..	..	..	4 4 11
304,940l	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 – 94	89 – 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	⅜ – ⅝	7/16 – 11/16	..	..	+ 1/16	Nil
1,816,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 – 52	48 – 52	50½	49¾	..	7 13 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16 – 11/16	7/16 – 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 – ⅛	0 – ⅛	..	..	..	Nil
125,000l	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 – 46	41 – 46	..	..	..	9 15 8
125,000l	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 – 31	27 – 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ – 5	4½ – 5	..	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4½ – 5	4½ – 5	96/8	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 –104	101 –104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 – 10¾	10 – 10¾	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½ – 5⅞	5½ – 5⅞	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 –107	105 –107	..	..	..	4 4 3
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	3/16 – 7/16	3/16 – 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 5/16 – 2 7/16	2¼ – 2⅜	46/	..	– 1/16	5 5 3
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	–108	105 – 108	..	..	..	3 14 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3¼%	63 – 65	64 – 66	65	64	..	4 18 6
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 – 87	85 – 87	..	..	+1	4 12 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	45 – 47	46 – 48	47	46½	+1	5 4 2
1,480,000	City and South London Railway	Stock	1⅞%	2⅛%	2⅛%	1⅛%	32 – 33	32 – 33	33	32⅝	..	4 10 0
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	5 %	5 %	Nil	½ – 1	½ – 1	..	..	..	Nil
100,000l	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 – 93	90 – 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Dec. 21st.	Closing Quotations Dec. 28th.	Business done week ended Dec. 28th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 1/32 — 1 5/32	1 1/32 — 1 5/32	..	..	..	5 4 4
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12¾ — 13¾	12¾ — 13¾	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4⅛%	4⅛%	2½%	Nil	3/32 — 7/32	3/32 — 7/32	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139 ..	5	4⅛%	4⅛%	2½%	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	5/16 — 9/16	5/16 — 9/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390..	2	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	10 4 0
35,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
2 0,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	⅝ — ⅞	⅝ — ⅞	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10¾	10¼ — 10¾	..	..	..	6 10 9
90,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	+ ⅛	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12¾	12 — 12¾	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15¾ — 16½	15¾ — 16½	16 3/16	16 1/16	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾ — ⅞	¾ — ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
999,930	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3¾%	2 — 2½	1¾ — 2¼	40/-	..	— ¼	16 13 4
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	%	4 %	61 — 64	59 — 64	59⅛	..	—1	6 5 0
5,732,062	Metropolitan Consolidated	100	2⅝%	1 %	½%	½%	39½ — 40	39¾ — 40¼	40	39⅞	+ ¼	1 4 4
2,640,914	Do. Surplus Lands	100	2⅝%	2¾%	2¾%	2¾%	66 — 68	66 — 68	67½	..	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	17¾ — 18¼	18¼ — 18¾	18½	18⅛	+ ½	Nil
991,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	19/32 — 11/16	19/32 — 11/16	..	..	..	6 10 11
914,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/32 — 5/32	1/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
$10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	123 —125	123 —125	124	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91½ — 93½	91½ — 93½	92¾	..	..	5 6 11
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
97,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35⅝	35¼	..	5 3 0
140,000*l*	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100½ —101½	100 —101	101⅜	100½	—1	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 89	88 — 90	..	..	+ ½	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	34 — 36	34 — 36	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	10 %	5 %	¼ — ½	¼ — ½	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	6 %	1¾ — 2¼	1¾ — 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4½ — 4¾	4¼ — 4¾	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	.	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7 — 7½	7 — 7½	7 3/16	7 1/32	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	98 —101	..	..	—1	3 19 3
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3¾ — 4¼	3⅞ — 4⅜	..	..	+ ⅛	5 14 3
90,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	4 17 4
60,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3½ — 4	3½ — 4	..	..	..	5 0 0
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 9
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅛ — 3⅝	3⅛ — 3⅝	..	..	..	6 4 2
175,000*l*	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10¼ — 10¾	10¼ — 10¾	..	..	..	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¾ — 12¾	11¾ — 12¾	..	..	..	4 12 4
400,000*l*	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	..	..	..	5 7 10
400,000*l*	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
10,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	½ — ¾	⅝ — ⅞	..	..	+ ⅛	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$3,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞ — 5⅜	4⅞ — 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6¾ — 7¼	6¾ — 7¼	7⅛	..	..	5 13 4
$1,976,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	..	5 %	101½ —103½	101½ —103½	..	..	..	4 16 7
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝ — 2	1¾ — 2⅛	35/7½	..	+ ⅛	4 4 3
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4¾ — 5⅛	4¾ — 5⅛	..	..	..	5 17 1
382,955	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	..	..	..	4 4 3
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3⅞ — 4⅜	4 — 4½	85/-	..	+ ⅛	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
295,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000*l*	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$3,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	81 — 83	81 — 83	82¼	..	..	6 0 6
$3,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	68 — 70	68 — 70	69½	68½	..	5 0 0
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	101 —105	100 —104	100	.	—1	6 14 7
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	..	5 %	85 — 87	85½ — 87½	86⅛	85½	+ ½	5 14 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 197,500	5	8 %	8 %	8 %	2½%	3¾ — 4¼	3¾ — 4¼	..	..	..	2 16 9
197,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	3¾ — 4¼	3¾ — 4¼	..	..	..	5 17 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	93 —100	93 — 100	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12¼ — 13¼	12¼ — 13¼	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,910	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1½ — 1⅝	1½ — 1⅝	..	..	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 7/32	1 3/32 — 1 7/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	8 13/16	8¾	..	6 7 0
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
150,000*l*	Do. do. 8½ % Deb. Stock Red. ..	100	9 %	8½%	9½%	8½%	84 — 88	84 — 88	..	..	..	9 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2¾ — 3⅛	..	..	+ ⅛	6 9 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 9/16	5/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜ — ⅞	⅜ — ⅞	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¼ — 1¾	1¼ — 1¾	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	..	5 %	⅞ — 15/16	⅞ — 15/16	..	..	..	5 6 8
100,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8½ — 9	8⅝ — 9⅛	..	..	+ ⅛	5 9 7
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	4 0 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent., December 9th, 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1909.

The November returns of electrical business were considerably ahead, in all three sections, of those of the previous months—the imports especially, their total having only once been exceeded during the past five years.

The exports for the month were valued at £309,607, this figure including £49,170 of telegraphic material, and being comparable with a total of £265,523 recorded in October.

A year ago, however, the November total reached £336,100, due to an abnormal export of telegraphic plant.

The imports total of £191,504 compares with £164,246 in October and £144,163 in November, 1908, while the re-exports were valued at £16,336, or somewhat above the average.

The improved export total can be attributed mainly to better business in the electrical machinery, telephone and telegraph sections, for it will be noted that the cable exports were some £18,000 less than in the previous month.

The individual items of the import table, with one exception, show an increase over the previous month's figures; the exception, however, electric lamps, amounted to over £50,000 in value, and is actually the most prominent section in the returns.

The Argentine, Japan, India and Canada were our best customers, while Germany, as usual, was the most prominent importer into this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	89	1,891	48	186	282	4,064	38	80	...	3	161	6,842
Germany	97	514	24	57	51	2,141	...	8	...	41	46	2,979
Netherlands and Java	238	879	20	159	14	502	...	...	...	...	53	1,865
Belgium	82	488	33	17	922	933	30	50	...	536	118	3,209
France and Switzerland	22	28	134	478	171	2,053	...	...	...	34	70	2,990
Portugal, Madeira and Portuguese Africa ...	90	151	94	172	48	1,739	14	233	...	179	59	2 779
Spain and Canary Isles	106	...	113	210	...	2,152	...	39	...	1,061	...	3,681
Italy and Austria-Hungary	92	...	13	...	801	3,841	...	...	...	112	598	5,457
Greece, Bulgaria, Roumania and Turkey ...	401	...	92	184	...	180	...	81	...	10	103	1,051
Channel Isles, Gibraltar and Malta	40	...	...	23	12	240	1,300	48	...	...	29	1,692
U.S.A. and Cuba	59	...	...	29	180	665	...	...	468	13	4,713	6,127
Canada and Newfoundland	328	1,165	1,416	350	1,981	1,415	...	101	...	...	17,991	24,747
Bahamas, British West Indies and British Guiana	16	11	30	114	...	79	...	5	...	32	6	293
Mexico, Colombia, Bolivia and Panama ..	...	148	...	472	...	752	...	25	...	127	1,172	2,696
Peru and Uruguay	87	61	42	63	25	6,067	...	...	38	...	...	6,383
Chile	223	341	38	544	15	1,525	2,315	63	12	88	10	5,174
Brazil	404	237	322	223	62	6,731	6,147	874	...	...	1,436	16,436
Argentine	1,422	6,452	105	856	409	20,517	352	2,743	99	16,211	4,061	53,227
Egypt	166	12	221	16	3	99	3	298	...	536	57	1,411
British West Africa, Ascension and St. Helena...	180	177	19	70	43	158	1,239	5	12	57	29	1,989
Cape of Good Hope	1,222	401	374	839	67	457	...	1,067	42	73	332	4,874
Natal	1,440	8 876	238	389	205	2,839	25	277	11	321	...	14 621
Rhodesia, O.R.C. and Transvaal	1,740	9,361	63	891	2	6,742	316	266	16	130	15	19,542
Zanzibar, Brit. East Africa, Mauritius & Aden	134	185	52	98	29	232	3	10	...	170	72	985
China and Siam	851	608	1,458	252	...	2,449	20	30	...	2 021	89	7,778
Japan	85	1,470	330	102	1,391	14,104	590	2,827	...	1,213	15,053	37,165
India	770	8,154	2,254	1,524	1,093	11,804	3,907	5,035	45	423	749	35,758
Ceylon	60	87	29	223	654	65	64	17	...	305	46	1,550
Straits Settlements, Fed. Malay States, British North Borneo and Sarawak ..	260	1,280	87	111	38	172	23	51	...	17	51	2,090
Hong Kong	220	338	53	305	...	891	24	29	21	11	...	1,892
West Australia	271	346	6	838	...	656	283	27	...	37	845	3,309
South Australia...	320	926	27	253	19	883	7	...	29	5	...	2,469
Victoria	1,100	2,572	25	474	11	1,041	...	166	...	4,864	44	10,297
New South Wales	2,819	1,015	289	505	486	2,664	1,667	275	...	224	190	10,134
Queensland	15	263	...	101	21	83	196	17	...	...	...	696
Tasmania	...	...	...	85	28	21	...	...	...	52	39	225
New Zealand	471	1,261	137	798	112	405	983	52	13	29	933	5,194
Total, £	15,920	49,698	8,186	12,011	9,175	101,361	19,546	14,799	806	28,935	49,170	309,607

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		£
Norway, Sweden and Denmark	20	6	...	208	26	1,476	..	678	...	3,458		5,872
Germany	315	11,465	1,694	41,358	1,800	29,405	206	1,661	11,976	19,560		122,440
Holland	48	...	...	2,636	10	...	19	...	44	...		2,757
Belgium	665	592	362	76	232	4,335	45	283	373	2,769		9,732
France	473	40	1,265	2,539	993	25	...	1,500	2,967	3,421		13,223
Switzerland	5,911	...	29	10	98	...	...	8	20	194		6,270
Italy	52	1,230	...	...	...	23	...	...	...	1,606		2,911
Austria-Hungary	...	734	...	541	4	168	...	...	1,477	269		3,193
United States	2,457	1,213	1,148	2,791	...	13,078	3,469	137	54	769		25,106
Total, £	9,941	18,280	4,498	50,159	3,163	48,510	3,739	4,267	16,911	32,036		191,504

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Country	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	2,903	572	...	2,668	...	2,633	...	262	854	6,444		...

Total Exports : £309,607. Total Re-Exports : £16,336. Total Imports : £191,504.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

(*Continued from page* 995.)

PART II.

In this section of the paper, it is proposed to deal with the application of the formulæ for α and β to practical cases, and the simplification of the expressions where possible. It will be convenient to divide telephone circuits, so far as the lines themselves are concerned, into two classes: first, those in which the inductance is merely that between the ordinary wires forming the loop, which circuits are said to be *unloaded*, and, second, those in which the inductance has been increased by distributing iron along the whole length of the conductors, or in which inductance coils have been inserted at regular intervals. Circuits of this second class are said to be *loaded*; and coils used to increase the inductance are known as *loading coils.*

Before proceeding further, it is necessary to emphasise that any sound made in normal speech is complex; inasmuch as it may be composed of a number of superposed vibrations or waves, some having periodicities as low, or lower, than 100 per second, and others as high, or higher, than 2,000 per second. These vibrations or waves should be reproduced in their proper order or proportion in a telephone circuit if good speech transmission is to be obtained. Supposing all the sound waves at the sending end to have been properly converted into periodic currents of electricity, then, if all the variations of current strength reached the receiving end of the circuit in their proper order and proportion, the reproduction of the quality of the original speech—or articulation, as it is called—would be perfect. An inspection of the formulæ for both α and β will show that they each become greater with the frequency, which means that waves of different frequencies are not transmitted with the same velocity, nor are they subject to the same attenuation. If, however, $\mathrm{K\,R}$ be made equal to $\mathrm{S\,L}$, then the expression for α reduces to—

$$\alpha = p\sqrt{\mathrm{K\,L}} = 2\pi f\sqrt{\mathrm{K\,L}}.$$

$$\text{Now the velocity, } \mathrm{V}, = \frac{2\pi f}{\alpha}$$

$$= \frac{2\pi f}{2\pi f\sqrt{\mathrm{K\,L}}} = \frac{1}{\sqrt{\mathrm{K\,L}}},$$

so that, if K and L were independent of frequency, all waves would travel with the same velocity. Again, on the same assumption, namely, that $\mathrm{K\,R} = \mathrm{S\,L}$, the equation for β reduces to—

$$\beta = \sqrt{\mathrm{R\,S}},$$

which is apparently independent of the frequency; and, if this be the case, all waves are proportionately attenuated. When these conditions obtain, the circuit is said to be *distortionless.* In the first place, no ordinary substance used as a dielectric, other perhaps than air, is known to remain fairly constant in specific inductive capacity and leakance for all telephonic frequencies; while, if there be any iron in the neighbourhood of the conductor, it is improbable—if not impossible—that R and L will remain constant for all frequencies; so that the distortionless circuit, so far as the telephone engineer is concerned, is a thing at present impossible of attainment. Even supposing it were easy to attain, say, by increasing L or reducing S and taking into consideration the absolutely lowest present known values for K and R, in any case of practical telephony, it would be found that the resulting attenuation would be so great, although the articulation might be perfect, that the volume or loudness of speech obtained would be too small on a lengthy line to be of any commercial use whatever.

As the attenuation is different for different frequencies, it is necessary to state in every case what periodicity has been assumed. It is usual to take an average frequency for telephonic currents, and to regard all the elementary waves making up a complex wave as being attenuated in the same way as the average. What this mean value is, is a matter of some debate. Generally, in this country, it is taken as 750 periods per second; but some place it as high as 800. For attenuation calculations the former will be assumed unless otherwise stated. Later on, it is explained why, when velocity is being considered, 2,000 is taken as the periodicity.

Unloaded Lines.—Although underground circuits, and the like, are primarily being considered, it may be mentioned in passing that in calculating the attenuation of an ordinary overhead line the full formula for β should be used, as none of the factors are negligible. In underground or submarine cable circuits, however, the insulation resistance between wire and wire is of a high order; rarely being as low as 5 megohms per mile, and often as high as 2,000. Generally, then, S, the leakance, is not greater than 0·0000002 mhos; so that, without producing any appreciable error in the results, S may be neglected. If this be done—

$$\alpha = \sqrt{\tfrac{1}{2}\,p\,\mathrm{K}\left(\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} + p\,\mathrm{L}\right)},$$

$$\beta = \sqrt{\tfrac{1}{2}\,p\,\mathrm{K}\left(\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} - p\,\mathrm{L}\right)}.$$

These formulæ in cases where S is negligible are applicable to all unloaded subterranean and submarine telephone circuits possessing normal resistance, inductance and electrostatic capacity. A further simplification is possible in special cases, such as when the resistance of the circuit is high compared with the product $p\,\mathrm{L}$. The inductance of any loop in an underground paper cable, unloaded, may be taken as 0·001 henry per mile; consequently, if $p = 2\pi \times 750$, $p\,\mathrm{L} = 4{\cdot}7$ approximately. In the case of 10 or 20 lb. per mile copper conductor loops, where the resistance per mile of loop is 176 and 88 ohms respectively, it may be taken that $\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} = \mathrm{R}$ nearly, and that $\sqrt{\mathrm{R} - p\,\mathrm{L}} = \sqrt{\mathrm{R}}$ nearly, with the result that—

$$\beta = \sqrt{\tfrac{1}{2}\,p\,\mathrm{K\,R}}.$$

It should, however, be understood that the result is only approximately correct, say, to within 5 per cent.

Loaded Lines.—In the case of circuits in which the inductance per mile of loop has been greatly increased *by the insertion of loading coils*, a considerable simplification of the formulæ for α and β is possible. It should be noted that the following consideration does not apply, at present, to cases where the inductance is increased by winding iron wire over the conductors. The reasons for making this reservation are given in Part III.

In a properly loaded circuit the product $p\,\mathrm{L}$ is much greater than R; and in any normal underground or submarine circuit the product $p\,\mathrm{K}$ is much greater than S.

Take, first, the expression—

$$\alpha = \sqrt{\tfrac{1}{2}\left[\sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)(\mathrm{S}^2 + p^2\,\mathrm{K}^2)} - (\mathrm{R\,S} - p^2\,\mathrm{L\,K})\right]}$$

and extract from it $\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2}$.

$$\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} = p\,\mathrm{L}\left(1 + \frac{\mathrm{R}^2}{p^2\,\mathrm{L}^2}\right)^{\frac{1}{2}},$$

and expanding this by the binomial theorem—

$$\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} = p\,\mathrm{L}\left(1 + \frac{\mathrm{R}^2}{2\,p^2\,\mathrm{L}^2} - \frac{\mathrm{R}^4}{8\,p^4\,\mathrm{L}^4}\ \ldots\ \&c.\right);$$

all terms involving higher powers than the square may be ignored as being too small to make any practical difference in the result, so that—

$$\sqrt{\mathrm{R}^2 + p^2\,\mathrm{L}^2} = p\,\mathrm{L}\left(1 + \frac{\mathrm{R}^2}{2\,p^2\,\mathrm{L}^2}\right) \text{ nearly.}$$

Similarly, it may be shown that—

$$\sqrt{\mathrm{S}^2 + p^2\,\mathrm{K}^2} = p\,\mathrm{K}\left(1 + \frac{\mathrm{S}^2}{2\,p^2\,\mathrm{K}^2}\right) \text{ nearly.}$$

The term $\sqrt{(\mathrm{R}^2 + p^2\,\mathrm{L}^2)(\mathrm{S}^2 + p^2\,\mathrm{K}^2)}$

then becomes $\left[p\,\mathrm{L}\left(1 + \frac{\mathrm{R}^2}{2\,p^2\,\mathrm{L}^2}\right) \cdot p\,\mathrm{K}\left(1 + \frac{\mathrm{S}^2}{2\,p^2\,\mathrm{K}^2}\right)\right]$

$$\text{or}\quad p^2\,\mathrm{K\,L}\left(1 + \frac{\mathrm{R}^2}{2\,p^2\,\mathrm{L}^2} + \frac{\mathrm{S}^2}{2\,p^2\,\mathrm{K}^2} + \frac{\mathrm{S}^2\,\mathrm{R}^2}{4\,p^4\,\mathrm{L}^2\,\mathrm{K}^2}\right).$$

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* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

The last term within the bracket is so small a quantity as to be negligible, and by multiplying out the expression becomes—

$$p^2 KL + \frac{p^2 R^2 KL}{2p^2 L^2} + \frac{p^2 S^2 KL}{2p^2 K^2}$$

$$= p^2 KL + \frac{R^2 K}{2L} + \frac{S^2 L}{2K}.$$

The complete expression for α then becomes—

$$\alpha = \sqrt{\tfrac{1}{2}\left[p^2 KL + \frac{R^2 K}{2L} + \frac{S^2 L}{2K} - RS + p^2 LK\right]}, \quad (13)$$

$$= \sqrt{p^2 KL + \frac{R^2 K}{4L} + \frac{S^2 L}{4K} - \frac{RS}{2}}$$

$$= p\sqrt{KL\left(1 + \frac{R^2}{4p^2 L^2} + \frac{S^2}{4p^2 K^2} - \frac{RS}{2p^2 KL}\right)}$$

$$= p\sqrt{KL\left[1 + \left(\frac{R}{2pL} - \frac{S}{2pK}\right)^2\right]}.$$

If, as stated, pL be great compared with R, and pK be great compared with S, then—

$$\frac{R}{2pL} - \frac{S}{2pK} \text{ is negligible,}$$

and

$$\alpha = p\sqrt{KL},$$

which result is *not* to be compared with the one of similar form given previously, because in this case it is *not* assumed that $KR = SL$.

Take next the expression for β, and notice that it only differs from that for α in that the last term under the principal root sign is positive. Making the same assumption as before in connection with the magnitudes of pL and pK, the complete expression for β is (from equation 13)—

$$\beta = \sqrt{\tfrac{1}{2}\left[p^2 KL + \frac{R^2 K}{2L} + \frac{S^2 L}{2K} + RS - p^2 LK\right]}, \quad (14)$$

$$= \sqrt{\frac{R^2 K}{4L} + \frac{S^2 L}{4K} + \frac{RS}{2}}$$

$$= \sqrt{\frac{R^2 K}{4L}\left(1 + \frac{S^2 L^2}{K^2 R^2} + \frac{2SL}{KR}\right)}$$

$$= \sqrt{\frac{R^2 K}{4L}\left(1 + \frac{SL}{KR}\right)^2}$$

$$= \frac{R}{2}\sqrt{\frac{K}{L}}\left(1 + \frac{SL}{KR}\right)$$

$$= \left(\frac{R}{2} + \frac{SL}{2K}\right)\sqrt{\frac{K}{L}}$$

$$= \frac{R + \frac{S}{K}L}{2}\sqrt{\frac{K}{L}}.$$

This formula gives the attenuation constant for any loaded circuit provided pL be great compared with R, and pK be great with respect to S, as is usually the case.

Methods of determining the values of R and L at different frequencies are fairly well known, and for the particular periodicity considered, we may, therefore, insert the measured values in the above formula. This, however, is not the case with S and K. Very little information is available respecting the variation of electrostatic capacity and insulation resistance with frequency. Further experimental investigation appears to be necessary on the following points :—

(*a*) What is the periodicity which may be taken as the mean of a speech wave ?

(*b*) Is this mean frequency the same for all types of circuit, and if not, how does it vary ?

(*c*) How do electrostatic capacity and leakance vary with frequency in paper and gutta-percha-covered conductors such as are commonly used in practice ?

In this paper it is not intended to discuss these matters, owing to lack of information of a definite character. There is, however, one assumption which may be made with some degree of safety : namely, that at any particular frequency the ratio of S to K will be constant.

Let

$$\frac{S}{K} = n,$$

then

$$\beta = \frac{R + nL}{2}\sqrt{\frac{K}{L}}.$$

In the present incomplete state of knowledge as to the variation of K with frequency and of what the mean frequency in any particular circuit is, the only thing to be done is to take K as being the same at all periodicities, and by associating a large number of practical results to fix a value to the constant n, which most nearly fits the observed results. This, as will be seen later on, has been done, with the results that when the loading coils used have non-magnetic cores, and have no magnetic material near them, $n = 50$; and, when the loading coils have cores of magnetic material in the form of a closed magnetic circuit, then, $n = 80$, give results sufficiently near the truth for present practice in the matter of estimating what improvement will be effected by loading a particular circuit. It must, however, be noted that these figures are based upon the observations made with the coils described in Part III ; where it is mentioned that the effective resistance of so-called "iron-core coils" is much less than that of the "air-core coils" for a given inductance. The difference in effective resistance of the two types of coil for the same inductance may explain the reason for the different value of the constant n required to make the observed and calculated results agree. These matters require further thought and investigation, but until such investigation has been made, it may be accepted with confidence that—

(*a*) Where loading coils *without* magnetic coils are used,

$$\beta = \frac{R + 50L}{2}\sqrt{\frac{K}{L}}.$$

(*b*) Where loading coils with magnetic cores (such as are mentioned hereafter) are employed,

$$\beta = \frac{R + 80L}{2}\sqrt{\frac{K}{L}}.$$

Anyone who studies these formulæ, or, indeed, who scans the practical results given in Part III, will at once appreciate the necessity for keeping the resistance R as low as possible for any given increase in the value of the inductance L.

It is very lamentable that little attention appears to have been paid to Mr. Oliver Heaviside's repeated indications that inductance would be beneficial in a telephone loop. Some eminent scientists appear to have recognised the importance of the matter, amongst them being Prof. S. P. Thompson, but no definite information as to the manner in which the inductance might be efficiently inserted appears to have been given until the subject was investigated mathematically and experimentally in America by Prof. M. I. Pupin, whose papers are worthy of the most serious consideration ; they are "Transactions of the American Institute of Electrical Engineers," (*a*) March 22nd, 1899 ; "Propagation of Long Electrical Waves," (*b*) May 19th, 1900 ; "Wave Transmission over Non-Uniform Cables and Long-Distance Air Lines."

Other valuable work has also been done by Dr. G. A. Campbell, see *Phil. Mag.*, 1903, Vol. 5, page 313, "On Loaded Lines in Telephonic Transmission."

Lagrange in his "Mecanique Analytique," Sec. partie, Sec. VI, Lord Rayleigh in his "Theory of Sound," Vol. I, pages 233 and 234, Prof. Routh in his "Advanced Rigid Dynamics," page 260, and many others have investigated the propagation of waves along uniformly loaded strings. They show, in effect, that if a long, thin stretched string be taken and loaded by small weights at equal distances along its length, it will vibrate practically as though uniformly loaded if there be not less than π loads per wave length ; or, that the string will transmit waves when the length of each wave is such as to include π loads. Of course, the closer the loads, the shorter will be the wave length which the string will be able to transmit.

Prof. Pupin and Dr. Campbell each seem to have recognised an analogy between the behaviour of a loaded string under tension, fig. 6, and that of an electric circuit, fig. 7, where the inductance coils inserted at regular intervals take the place of the loads on the string. The papers of the able investigators referred to will throw all necessary light upon this matter. Because the inductances inserted in an electric circuit limit the wave length which can be transmitted, in the same way as the loads upon a string limit the wave lengths which it will transmit, they are regarded as loads and the coils are called *loading coils.*

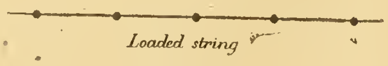

Fig. 6.

Working upon this analogy between the transmission of waves along a loaded string under tension, and a loaded electric circuit respectively, it will be accepted that there must be at least π coils per wave length in the circuit. To obtain sufficiently clear speech for practical purposes, it is essential that waves having a periodicity of 2,000 per second should be transmitted; there must, therefore, be π coils per wave length at this high frequency. This fact may be made use of in establishing a simple rule for the minimum distance apart for the loading coils selected to serve any circuit. Thus—

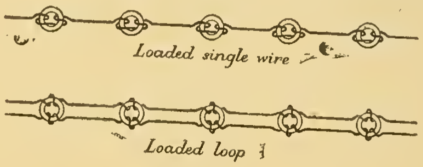

Fig. 7.

$$\text{Wave length} = \lambda = \frac{2\,\pi}{a}.$$

If D be the distance in miles between the coils, then—

$$D = \frac{\lambda}{\pi} = \frac{2}{a}.$$

But in a loaded circuit it has been shown that—

$$a = p\,\sqrt{K\,L} = 2\,\pi\,f\,\sqrt{K\,L}$$

where f is the periodicity per second.

$$\therefore\ D = \frac{2}{2\,\pi f\,\sqrt{K\,L}}$$

$$= \frac{1}{\pi\,f\,\sqrt{K\,L}}.$$

and $$D^2 = \frac{1}{\pi^2 f^2\,K\,L}$$

Now let K_1 and L_1 be the electrostatic capacity in *microfarads* and the inductance in *millihenrys* respectively per mile of loop. Then—

$$D^2 = \frac{10^9}{\pi^2 f^2\,K_1\,L_1}.$$

But the inductance between the actual wires of any telephone loop in practice is so small as to be negligible compared with that added in loading the circuit; so that L_1 may be taken as the inductance per mile due to the coils. If, therefore, L_2 be the inductance in *millihenrys* of each coil used—

$$L_1 = \frac{L_2}{D},$$

and by substituting this in the above equation for D^2—

$$D = \frac{10^9}{\pi^2 f^2\,K_1\,L_2},$$

or $$D\,K_1\,L_2 = \frac{10^9}{\pi^2\,f^2}.$$

Taking $f = 2{,}000$ periods per second—

$$D\,K_1\,L_2 = 25{\cdot}3.$$

This result represents the worst permissible condition—namely, that in which there are just π coils per wave at 2,000 periodicity. It is better in practice to allow some margin, so that commonly $\pi\,f$ is taken as equalling 7,000, which, according to the view taken, allows more than π coils per wave at 2,000 periods, or allows shorter waves to be transmitted at π coils per wave-length. If $\pi\,f = 7{,}000$, then—

$$D\,K_1\,L_2 = 20{\cdot}4.$$

The general rule is, therefore, that the product of the distance apart of the coils in miles, the electrostatic capacity per mile in microfarads, and the inductance per coil in millihenrys should not be greater than 25·3, and need not be less than 20·4.

(*To be continued.*)

CONCILIATION.

There has been so much friction between employers and employés upon municipal tramways, that we welcome any scheme which has for its aim the nipping in the bud of labour disputes. The way has been made clear by many earlier workers, and the production of a mutually acceptable set of general principles and rules to govern procedure has been simplified by the existence of precedents. Nevertheless, the formulation of the "scheme for conciliation and arbitration, as agreed between the Board of Trade, the L.C.C., and the employés of the Council in the Tramways Department, for the settlement of questions affecting the employés in the Tramway Department," must have involved a great deal of hard work which, often enough, no doubt, became tedious and unpleasant as well. The three bodies concerned are to be congratulated upon the technical results of their labours, and it is to be hoped that the conciliation boards will sweeten continually the relations between master and man, and will prevent effectually the recurrence of those unseemly disputes, which, from time to time, have disturbed the public peace.

We, like all who wish earnestly to see the nation prosperous, have viewed with growing apprehension the creation and prolific growth of an army of municipal employés, whose "power for selfishness" increases just twice as fast as its numbers. To such a politically powerful body a strike is a tempting weapon, and "pressure" would develop from the spasmodic to the usual.

We do not suppose that the erection of any number of Conciliation Boards will put an end to the illegitimate use of political pressure for narrow domestic purposes; but these Boards should do something at least to suppress that type of man whom we may call, in imitation of some of our correspondents, the super-growler, or, in better known terms, the professional agitator and the rank Socialist.

We are especially relieved and pleased to see that questions relating to discipline and management are exempted from the jurisdiction of the board. Object lessons have been given to the country during the last few years sufficient to show the more than folly of buying a dog and doing the barking oneself, and the general ridicule of this principle when it is displayed should prevent its introduction into any conciliation scheme which may be drawn up in the future.

The L.C.C. scheme is so important, in that it is the first of its kind applied to tramways, that we have reprinted it below as it appeared in the Agenda of the Council on November 2nd, 1909. Its clauses will repay careful study, and may give rise to considerable criticism, but that will not be surprising under the circumstances. For ourselves, we are not inclined to subject the scheme to any detailed criticism, but we cannot refrain from saying that a second and a third perusal have not sufficed to remove our first impression that the keynote of confidence which we ought to hear is missing. The very first clause under "Procedure" emphasises this :—Each side of a Conciliation Board to select its own chairman. Then in Clause 3 there is provision for appointing two secretaries in case the two sides of the Board cannot agree to any one member of either side. Clause 4 provides that each side of a Board is to vote separately.

These and other clauses indicate rather that the Board is to be formed out of two sets of irreconcilables than from one general body of men whose sole object is to take evidence upon all aspects of a proposition, and to arrive at their decision upon a basis of moral and commercial justice and equity.

It seems to us, too, that the Board is to be put into an invidious position by the reference of any resolutions involving a reduction of wages to the general body of employés, and we should like to know by what logical process it was determined that a representative board could be trusted to make equitable decisions upon all but one subject.

Upon the whole the scheme has our heartiest approval, and we trust that in due course all the larger towns will adopt something similar.

The L.C.C. scheme is to be given a fair trial for three years as a minimum, unless both sides find it unworkable before the end of that time, and we predict that the general public will feel the benefit of the arrangement indirectly in many ways, because the recent state of uncertainty must have been reflected to some extent in the work of the whole staff, and of the Highways Committee.

General Principles.

1. Conciliation boards to be formed to deal with questions referred to them either by the Council or its employés, affecting any class of employés to which the scheme applies, which cannot be be mutually settled through the usual channels. The questions that may be thus dealt with are:—
   (1) Differences as to rates of wages;
   (2) Differences as to hours of labour;
   (3) Differences relating to general conditions of labour (not being questions of discipline or management).

2. The various grades of the employés of the Council who are covered by the scheme, to be grouped for this purpose in a suitable number of sections, and the area served by the Council to be divided, if necessary, into a number of suitable districts.

3. The employés belonging to each section so grouped, to choose from among themselves one or more representatives, these representatives to form the employés' side of a sectional board to meet representatives of the Council to deal with questions of the nature defined in Clause 1 affecting grades of employés within that section.

4. The term of office of a conciliation board to be three years. Casual vacancies through death, resignation, or loss of qualification to be filled by a special election.

5. Elections, subsequent to the one which has been conducted by the Board of Trade, to be regulated by the central conciliation board.

6. Employés under 21 years of age will not be eligible as representatives on any board, nor entitled to nominate candidates, nor to vote in any election.

7. All questions referred to the conciliation boards to be first submitted to the appropriate sectional board. Where a sectional board fails to arrive at a settlement, the question to be referred on the motion of either side to the central conciliation board.

8. The Council may appoint representatives equal in number to the representatives of the employés on any board, but not more than two representatives on any sectional board shall be officials.

The central board shall consist of six representatives of the Council and six representatives of the employés. Not more than two of the representatives of the Council on the central board shall be officials of the Council.

9. In the event of the central conciliation board being unable to arrive at an agreement, the subject of difference to be referred to arbitration. The reference shall be to a single arbitrator appointed by agreement between the two sides of the board, or, in default of agreement, to be appointed by the Board of Trade. The decision of the arbitratar shall be binding on all parties.

10. No change involving a reduction in wages or an increase in hours of labour, affecting any class of employés to which this scheme applies, shall be brought into operation until it has been considered and decided upon in accordance with this scheme.

Procedure.

1. Each side of a conciliation board to select its own chairman, and each side may from time to time vary such chairman.

2. Every board to meet for business as required at the request of either side, and all business ripe for discussion shall be disposed of at such meeting or an adjournment thereof. A fortnight's notice to be given of all meetings. Any meeting may be adjourned, but no board to be required to meet for new business oftener than once in two months, except that in the case of the central board, where this would involve an interval of more than one month after the failure of a sectional board to agree upon any matter submitted thereto, the central board shall meet to deal with such business as soon as convenient. No meetings shall be called during the Easter, Whitsun, Summer or Christmas recesses of the Council.

3. A secretary shall be appointed by agreement between the two sides of the central board. Failing agreement, each side to appoint a secretary from among the salaried or wages employés of the Council. The secretary or secretaries so appointed shall act for the sectional as well as for the central boards. All meetings of the sectional or central boards to be convened by the secretary or secretaries. The agenda to be circulated with the notices calling the meetings, and no question not on the agenda to be brought up except with the consent of both sides.

4. Each side of a board to vote separately by a majority of the members constituting the side, and all decisions to be arrived at by agreement between the two sides. Two-thirds of each side of a board to form a quorum.

5. Before a conciliation board can entertain any proposal from the employés for a change regarding any question of the nature defined in Clause 1, affecting any class of employés, an application for such change must previously have been made through the chief officer of tramways to the Highways Committee in the usual course.

Where the Council proposes to make a change involving a reduction in wages or an increase in hours of labour affecting any class of employés, not being a change for which application has been made by the employés as aforesaid, reasonable notice of such proposed change shall be given to the employés by circular, posted notices or any other usual method, through the officers of the department concerned.

6. After any such application has been made by the employés they shall be informed, as soon as practicable, and in any case within two months, of the Council's decision with regard to the request or of its desire to refer it to a conciliation board; and similarly in the case of a notice by the Council of a proposed change, the employés shall intimate within the period allowed by the notice whether they agree to the proposal or desire that it shall be referred to a conciliation board. In the event of the decision not being accepted or of no reply being received within the specified time, the men or the Council, as the case may be, may require the matter to be referred to a conciliation board, which shall be convened to consider the matter so referred, or a change proposed by the Council, if uncontested by the employés, may be brought into operation. For the purpose of this clause, the periods during which the Council is in recess shall not count.

7. Any proposal agreed to by a sectional board, or by the central board, involving increased expenditure shall be placed before the Highways Committee and the Council for their acceptance within 28 days of the proposal, except during the recess periods of the Council, and failing its acceptance by the Council shall be referred as follows; that is to say—

(1) A proposal agreed to by a sectional board and not accepted by the Council shall be referred to the central board; and

(2) A proposal agreed to by the central board and not accepted by the Council shall be referred to arbitration.

Any proposal agreed to by a sectional board, or a central board, involving a reduction of rates of wages shall be communicated to the employés, and if rejected by them within a month shall be referred as follows; that is to say—

(1) A proposal agreed to by a sectional board and rejected by the employés shall be referred to the central board; and

(2) A proposal agreed to by the central board and rejected by the employés shall be referred to arbitration.

Except as otherwise herein provided the decision of the sectional board, or of the central board, shall be final and binding on the parties, and no decision shall be reopened within 12 months.

8. In cases in which the central conciliation board fail to agree, the meeting of that board shall be adjourned, and, if the two sides of the board fail to agree upon an arbitrator, either of them may make application to have an arbitrator appointed in terms of Sec. 9 of the General Principles. After such arbitrator has been appointed, he shall fix a date for the adjourned meeting, at which he shall preside as chairman. After hearing the matter in dispute in such manner as he may think fit, he shall within one month give his decision, which shall be final and binding on both parties for such period as the arbitrator shall determine. For the purpose of this clause the periods during which the Council is in recess shall not count.

9. In cases in which the central conciliation board have agreed, but in which their decision is not accepted by the Council or by the employés, as provided in Clause 7 hereof, if the two sides of the central conciliation board fail to agree upon an arbitrator, either of them may make application to have an arbitrator appointed in terms of Sec. 9 of the General Principles. After such arbitrator has been appointed, he shall fix a date for a meeting, at which he shall preside as chairman. After hearing the matter in dispute in such manner as he may think fit, he shall within one month give his decision, which shall be final and binding on both parties for such period as the arbitrator shall determine. For the purpose of this clause the periods during which the Council is in recess shall not count.

10. Where any question is referred to an arbitrator, all procedure in connection with the hearing of the case shall be settled by the arbitrator. Each side of the central conciliation board may select such person or persons as may be considered desirable for the purpose of representing the Council or the employés, as the case may be, at the arbitration proceedings. Counsel or other legal persons shall not be entitled to appear before the arbitrator, except with the consent of the arbitrator and at the joint request of both parties. When an arbitration takes place, the expenses of the arbitration shall be borne by the Council and its employés in such proportions as the arbitrator shall decide.

11. The question of the payment of wages and travelling expenses of employés when engaged in the business of the conciliation boards and the other expenses of the said boards shall be determined by the sectional or central boards in conformity with the procedure under which other questions are dealt with by those boards.

Duration of Scheme.

The present scheme to be in force until six months after notice has been given by one side to the other to terminate it. No such notice to be given before October 31st, 1912, except by mutual consent.

Interpretation.

1. If any question should arise as to the interpretation of this scheme, it shall be decided by the Board of Trade.

2. If any question should arise as to the interpretation of an arbitrator's award, it shall be referred for decision to the central board, or a committee appointed by the central board, and, failing agreement, to the arbitrator.

A. Shirley Benn, *Chairman.*

TRADE STATISTICS OF CANADA.

The following figures showing the imports into, and exports from, Canada of electrical and similar materials during the year ended March 31st, 1909, are taken from the recently issued trade statistics; figures for the year 1907-8 are given for purposes of comparison and notes of any increases or decreases have been added:—

	1907-8. Dollars.	1908-9. Dollars.	Increase or decrease. Dollars.
Brass ware, plain.—			
From Great Britain ...	7,000	44,000	+ 37,000
" Germany	—	3,000	+ 3,000
" United States ...	26,000	5,000	— 21,000
" Other countries ...	—	1,000	+ 1,000
Total ...	33,000	53,000	+ 20,000
Railway passenger cars.—			
From United States ...	227,000	227,000	—
Tram or horse cars.—			
From United States ...	9,000	21,000	+ 12,000
Celluloid manufactures.—			
From Great Britain ...	15,000	8,000	— 7,000
" Germany	4,000	3,000	— 1,000
" United States ...	21,000	35,000	+ 14,000
" Other countries ...	9,000	3,000	— 6,000
Total ...	49,000	49,000	—
Coal bituminous.—			
From Great Britain ...	11,000	140,000	+ 129,000
" United States ...	14,788,000	13,011,000	— 1,777,000
" Japan	44,000	—	— 44,000
Total ...	14,843,000	13,151,000	— 1,692,000
Copper wire, plain, tinned or painted.—			
From Great Britain ...	1,000	1,000	—
" United States ...	38,000	36,000	— 2,000
Total ...	39,000	37,000	— 2,000
Electric light carbons and carbon points.—			
From Great Britain ...	2,000	3,000	+ 1,000
" Austria	1,000	3,000	+ 2,000
" Germany	12,000	15,000	+ 3,000
" United States ...	29,000	24,000	— 5,000
" Other countries ...	1,000	1,000	—
Total ...	45,000	46,000	+ 1,000
Electric apparatus not mentioned—insulators, electric and galvanic batteries, telegraph and telephone instruments.—			
From Great Britain ...	49,000	66,000	+ 17,000
" Austria	1,000	2,000	+ 1,000
" France	5,000	5,000	—
" Germany	6,000	5,000	— 1,000
" Sweden	4,000	1,000	— 3,000
" United States ...	2,236,000	1,550,000	— 686,000
" Other countries ...	5,000	1,000	— 4,000
Total ...	2,306,000	1,630,000	— 676,000
Incandescent lamp bulbs, &c.—			
From Great Britain ...	15,000	1,000	— 14,000
" Austria	4,000	7,000	+ 3,000
" United States ...	40,000	42,000	+ 2,000
" Other countries ...	1,000	1,000	—
Total ...	60,000	51,000	— 9,000
Electric motors, generators, dynamos and sockets.—			
From Great Britain ...	10,000	18,000	+ 8,000
" France	1,000	4,000	+ 3,000
" Norway	—	4,000	+ 4 000
" Sweden	—	1,000	+ 1,000
" United States ...	578,000	294,000	— 284,000
" Other countries ...	4,000	—	— 4,000
Total ...	593,000	321,000	— 272,000

	1907-8. Dollars.	1908-9. Dollars.	Increase or decrease. Dollars.
Lamp chimneys, glass shades and globes.—			
From Great Britain ...	4,000	4,000	—
" Austria	20,000	17,000	— 3,000
" Germany	15,000	16,000	+ 1,000
" United States ...	118,000	104,000	— 14,000
" Other countries ...	1,000	1,000	—
Total ...	158,000	142,000	— 16,000
Rubber belting.—			
From Great Britain ...	1,000	2,000	+ 1,000
" United States ...	35,000	31,000	— 4,000
Total ...	36,000	33,000	— 3,000
Manufactures of india-rubber and gutta-percha.—			
From Great Britain ...	100,000	80,000	— 20,000
" Austria	16,000	7,000	— 9,000
" France	5,000	4,000	— 1,000
" Germany	26,000	21,000	— 5,000
" United States ...	353,000	333,000	— 20,000
" Other countries ...	—	1,000	+ 1,000
Total ...	500,000	446,000	— 54,000
Locomotives for railways.—			
From Great Britain ...	—	6,000	+ 6,000
" United States ...	1,238,000	378,000	— 860,000
Total ...	1,238,000	384,000	— 854,000
Gasoline engines.—			
From Great Britain ...	74,000	17,000	— 57,000
" United States ...	619,000	698,000	+ 79,000
Total ...	693,000	715,000	+ 22,000
Steam engines.—			
From Great Britain ...	76,000	38,000	— 38,000
" United States ...	347,000	196,000	— 151,000
Total ...	423,000	234,000	— 189,000
Boilers.—			
From Great Britain ...	187,000	31,000	— 156,000
" United States ...	510,000	123,000	— 387,000
Total ...	697,000	154,000	— 543,000
All machinery not mentioned except sewing machines, textile machinery, printing machinery, &c.—			
From Great Britain ...	677,000	503,000	— 174,000
" France	16,000	41,000	+ 25,000
" Germany	138,000	37,000	— 101,000
" United States ...	7,167,000	4,925,000	— 2,242,000
" Other countries ...	7,000	11,000	+ 4,000
Total ...	8,005,000	5,517,000	— 2,488,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber or other material, including cable so covered.—			
From Great Britain ...	173,000	162,000	— 11,000
" United States ...	264,000	110,000	— 154,000
" Other countries ...	5,000	6,000	+ 1,000
Total ...	442,000	278,000	— 164,000
Iron and steel wire, not mentioned (except fencing wire).—			
From Great Britain ...	52,000	16,000	— 36,000
" Germany	63,000	23,000	— 40,000
" United States ...	194,000	93,000	— 101,000
" Other countries ...	1,000	5,000	+ 4,000
Total ...	310,000	137,000	— 173,000
Belting.—			
From Great Britain ...	182,000	136,000	— 46,000
" U.S.A.	4,000	3,000	— 1,000
Total ...	186,000	139,000	— 47,000
Lighting fixtures of metal, including electric light fixtures of metal.—			
From Great Britain ...	12,000	21,000	+ 9,000
" Austria	4,000	26,000	+ 22,000
" U.S.A.	372,000	295,000	— 77,000
" Other countries ...	11,000	11,000	—
Total ...	399,000	353,000	— 46,000
Asbestos Manufactures.—			
From Great Britain ...	22,000	18,000	— 4,000
" U.S.A.	166,000	160,000	— 6,000
" Other countries ...	3,000	3,000	—
Total ...	191,000	181,000	— 10,000

	1907-8. Dollars.	1908-9. Dollars.		Increase or decrease. Dollars.
Plumbago, ground and manufactures.—				
From Great Britain ...	4,000	2,000	—	2,000
U.S.A.	27,000	26,000	—	1,000
Total ...	31,000	28,000	—	3,000
Exports				
Mica.—				
To Great Britain ...	61,000	69,000	+	8,000
„ U.S.A	271,000	137,000	—	134,000
„ Other countries ...	6,000	3,000	—	3,000
Total ...	338,000	209,000	—	129,000
Electrical apparatus.—				
To Great Britain ...	3,000	4,000	+	1,000
„ Newfoundland ...	3,000	11,000	+	8,000
„ France...	2,000	3,000	+	1,000
„ U.S.A....	83,000	63,000	—	20,000
„ Other countries ...	5,000	2,000	—	3,000
Total ...	96,000	83,000	—	13,000
India-rubber manufactures.—				
To Great Britain ...	11,000	8,000	—	3,000
„ Newfoundland ...	3,000	3,000	—	—
„ New Zealand ...	6,000	5,000	—	1,000
„ U.S.A.	31,000	86,000	+	55,000
„ Japan	15,000	—	—	15,000
„ Other countries ...	4,000	2,000	—	2,000
Total ...	70,000	104,000	+	34,000
Machinery.—				
To Great Britain	69,000	40,000	—	29,000
„ Newfoundland... ...	29,000	29,000		—
„ New Zealand	28,000	21,000	—	7,000
„ Argentine	26,000	15,000	—	11,000
„ France	23,000	10,000	—	13,000
„ United States	584,000	441,000	—	143,000
„ Other countries ...	145,000	33,000	—	112,000
Total ...	904,000	589,000	—	315,000

N.B.—Dollars = 4s. 2d.

THE PHYSICAL SOCIETY'S EXHIBITION.

(Continued from page 1014.)

R. W. Paul.

Mr. Paul showed several novelties. One was the Sumpner reflecting electrodynamometer (fig. 11), invented by Dr. W. E. Sumpner for accurately measuring a large range of small alternating voltages, and for use in connection with various bridge methods for induction measurements and similar purposes. The indications of the instrument are independent of wave-form and frequency, and are unaffected by external fields, these results being obtained by the use of an iron magnetic circuit of special form. The great range and high sensitivity possible with this form of dynamometer open up a new sphere of electrical measurements.

The magnetic circuit is constructed of thin laminations of iron, of high resistance and low hysteresis. The instrument is designed so that the field flux is accurately proportional to, and in quadrature with, the voltage applied to the magnet coil. The moving coil has few turns, and therefore low self-inductance; it is freely suspended by a phosphor-bronze strip, which acts as a control, and is fitted with a vane working in a closed chamber, which gives effective air-damping.

The magnet is wound with three coils, to enable high sensibility to be obtained for various applications of the instrument.

To use the instrument for the measurement of small voltages, one of the magnet coils is connected across the voltage to be measured, while the moving coil, in series with a condenser, is connected across the same or another of the magnet windings. The deflection is proportional to the square of the applied voltage, and directly proportional to the capacity used in the moving-coil circuit. The range of the instrument is enormous, and can be varied by altering the connections of the coils and also by varying the capacity.

The sensibility of the instrument can be further increased by using it heterostatically, *i.e.*, exciting the magnet with a high voltage from the same source as the voltage to be measured. It then becomes possible to detect voltages smaller than one microvolt. A pressure of 200 volts at 50 cycles may be applied to the fine-wire coils in series without injuring them.

By applying a known alternating voltage to the magnet winding and also to the moving coil in series with the condenser under test, the instrument may be used for the measurement of capacities, the deflection being proportional to the capacity tested. The instrument can also be used for the investigation of the magnitude of "skin effect" in a conductor, and for the measurement of very small amounts of power, with the aid of a suitably-designed quadrature transformer.

A new model of the Campbell vibration galvanometer was shown in action; compared with the original pattern, its coil is very much smaller and lighter, having only 30 turns of wire and a total resistance, including suspensions, of about 3 ohms. Nevertheless, it can be tuned to any frequency from 50 to 1,000 periods, and at 100 periods its sensitivity is such that $\frac{1}{10}$th of a micro-ampere can be detected. The suspensions are of bronze wire, and form connections to the coil, thus eliminating the damping effect of the flexible connections previously employed. The effective length of the upper, or bifilar, suspension can be varied at will, and a separate adjustment of the tension on the suspension is provided.

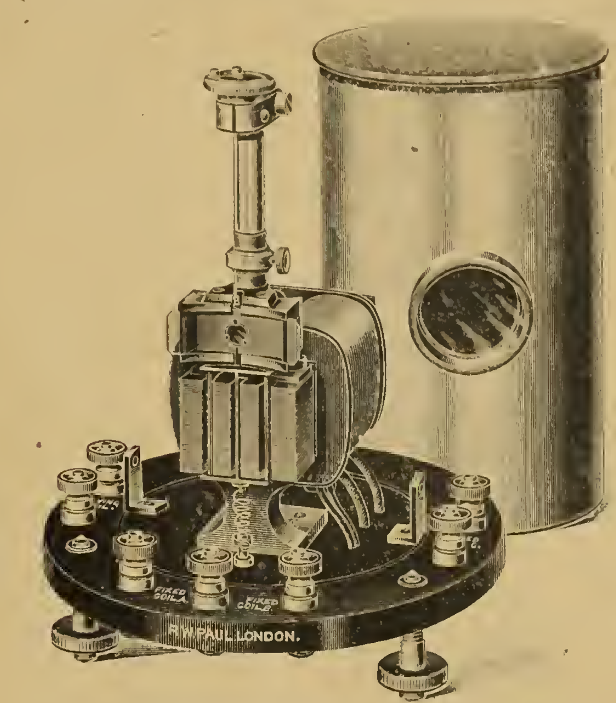

Fig. 11.—Sumpner Reflecting Electrodynamometer.

The Campbell inductance standards and bridge were shown in use for measuring inductances and capacities for wave telegraphy. Their range of usefulness has been greatly extended by the development of a system of unequal ratio arms, so that inductances and capacities of any value may now be measured by direct-reading methods with almost as much simplicity as the measurement of resistance by the Wheatstone bridge.

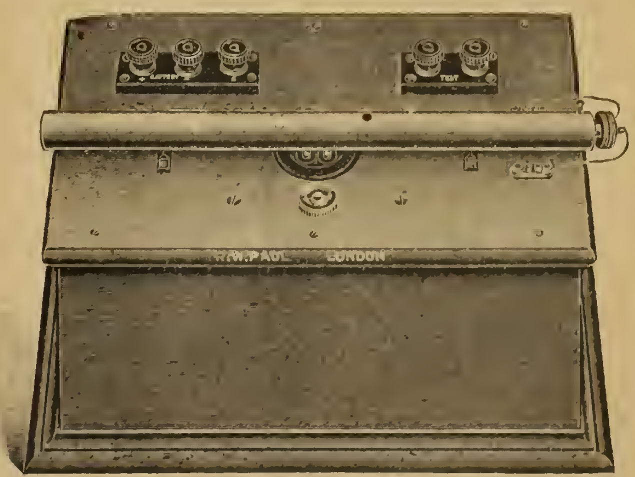

Fig. 12.—Microphone Hummer.

As a source of small alternating current of known high frequency for testing purposes, the microphone hummer (fig. 12) was exhibited. It consists of a bar of steel resting on nodal points near its extremities, and carrying a microphone button shunted by a condenser. A transformer is connected in circuit, the secondary current passing through a coil on a polarised magnet under the bar. On striking the bar, an alternating current passes round the magnet and maintains the vibration. The testing current is taken from another secondary winding; its frequency depends on the length of the bar selected, and may be 1,000, 2,000 or upwards. The instrument is self-contained, and needs only to be connected to a 6-volt battery to be ready for use. A special telephone receiver for use with the selected frequency is supplied, the diaphragm being arranged to resonate to it, thereby increasing the sensitivity and the sharpness with which a null point may be detected when testing; this is also aided by the comparative freedom from higher harmonics of the current from the hummer, and its unvarying frequency.

Some new models of the single-pivot moving-coil instruments invented a few years ago by Mr. Paul were exhibited; these have been simplified and fitted into teak cases, so as to render them more suitable for rough use and for elementary students (fig. 13). An interesting extension of the single-pivot principle to A.C. measurements has been made; the circular coil with its central pivot moves in a spherical space between two fixed coils, thus forming a sensitive dynamometer. One of the new instruments, giving a full scale deflection for 8 milliamperes, was exhibited, and other forms are made as ammeters, voltmeters, and wattmeters with various ranges. As there is practically no metal used in the construction, except in the coils, this dynamometer is particularly suitable for the accurate measurement of small powers.

The Optiphone, an attachment by means of which the vibrations of a telephone diaphragm are magnified and made visible to the eye, with the aid of the device invented by Mr. Irwin for his oscillograph, was shown at work; we hope to describe this more fully later.

A potentiometer, designed by Mr. Melsom, of the National Physical Laboratory, was exhibited. It has 150 coils, and is operated by six dials with switches, so arranged as to give direct reading in conjunction with a short slide wire. The balance to standard cells can be checked at any moment by simply pressing a key, without disturbing the test in hand, and compensation for the varying temperature of the standard cell is provided. The rheostat is of new design, giving great steadiness of adjustment, and in order to render the slide wire easily replaceable, it is adjusted by shunting.

A potentiometer for extra-high pressures, fitted with Duddell-Mather non-inductive anti-capacity resistance gauze, was exhibited, forming one section of a set for use at the National Physical Laboratory; it had a resistance of 100,000 ohms, sub-divided into four divisions of 20,000 ohms, and 10 of 2,000, connected to highly-insulated sockets for travelling plugs. The gauze, which had a length of 30 ft., and a width of 7 in., was mounted on long porcelain bobbins enclosed in a framework, and protected by wire-work panels; each division was accurately adjusted to within one part in 10,000. This particular section was capable of independent use on a 10,000-volt circuit, or of being coupled up to others for higher pressures.

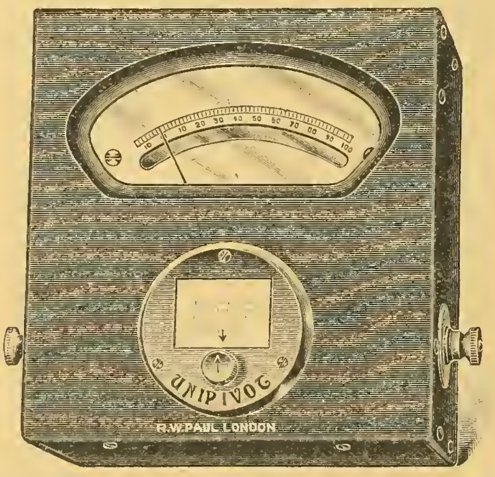

Fig. 13.—"Unipivot" Moving-Coil Galvanometer.

A number of other instruments and accessories was also exhibited.

Siemens Bros. & Co., Ltd.

Messrs. Siemens Bros.' exhibits would form a lengthy list, including various types of ammeter and voltmeter, the Universal galvanometer, portable current transformer, collapsible photometer, and other measuring apparatus. Amongst the items of especial interest was the Saladin double-mirror galvanometer, which we mentioned last year, and now illustrate (fig. 14). This instrument is ingeniously arranged for the purpose of reproducing a curve on a stationary photographic plate. It consists of two galvanometers, the mirrors of which are optically connected by means of a prism. The horizontal movement of the beam of light from the mirror of the first instrument is converted by the prism into a vertical movement, and the light is then thrown on to the mirror of the second instrument, where its vertical movement is combined with the horizontal movement of the mirror of the latter. The resultant of the horizontal and vertical movements gives the required curve. The apparatus can be worked for any speed of the ray of light up to 2·5 mm. per second, and with photographic plates of ordinary sensitiveness.

A typical example of the application of the instrument is to the determination of the recalescence points in metals. One galvanometer is connected directly to a pyrometer giving the temperature of a metal which is known to have no recalescence points; the other is connected across both this and another pyrometer, recording the temperature of the metal under test, so that the latter galvanometer measures the difference in temperature at any moment between the two metals. Thus a curve between actual temperature and difference of temperature is described by the spot of light, showing clearly the recalescence points, and recording the curve on a photographic plate.

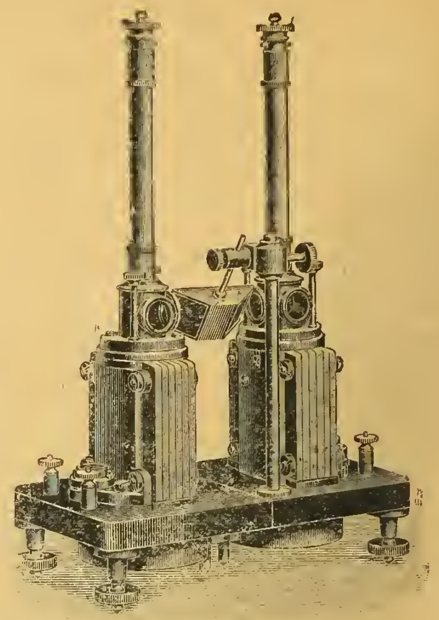

Fig. 14.—Saladin Double-Mirror Galvanometer.

Another interesting exhibit was a high-frequency generator, for a normal frequency of 3,500 cycles per second (fig. 15). This was provided with a loading generator, instead of the eddy-current brake, as shown last year, and was driven by a motor. On a 220-volt circuit, a maximum frequency of 6,000 cycles per second could be attained.

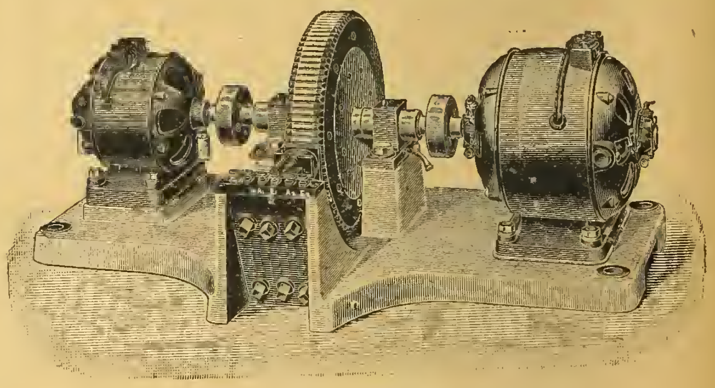

Fig. 15.—High-frequency Generator.

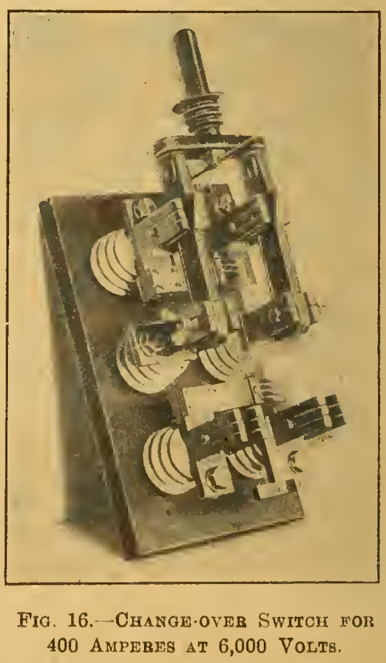

Fig. 16.—Change-over Switch for 400 Amperes at 6,000 Volts.

A large change-over switch was exhibited, which was specially designed for measuring the power in a three-phase unbalanced circuit with a single-phase wattmeter (fig. 16). The capacity of the switch was 400 amperes at 6,000 volts. By an ingenious arrangement the contacts are short-circuited until the blades of the switch connected with the wattmeter are practically home, so that the main circuit is never interrupted for a moment, and the change-over can be effected instantly.

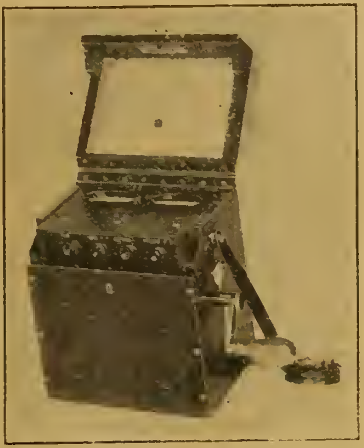

Fig. 17.—Siemens Ohm-meter, with Generator.

Other noteworthy exhibits were the Frahm speed and frequency indicators, of the vibrating reed type, which Messrs. Siemens Bros. now supply; and an ohm-meter, operated either with a generator, fig. 17 (up to 1,000 volts), or direct from the supply mains at 220 or 440 volts.

Nalder Bros. & Thompson, Ltd.

At this stand there was a variety of electrical measuring apparatus. The Telethermometer, the Ohmer, portable D.C. testing sets, the limit indicator (described in our issue of November 26th, page 865), and a number of switchboard instruments, were shown. A recording wattmeter was exhibited, suitable for use on three-phase unbalanced circuits, being fitted with two movements on the same spindle, arranged to avoid mutual effects. We illustrate a lamp-testing wattmeter of the moving-coil type, designed for a very low power consumption, and to read accurately on both A.C. and D.C. circuits.

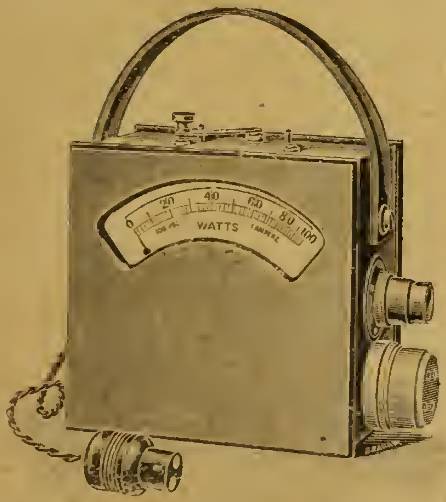

Fig. 18.—Lamp-testing Wattmeter.

F. Harrison Glew.

Mr. Glew showed an interesting application of the properties of radium to the collection of atmospheric electricity. A metallic spiral, coated with a radium salt, was suspended from an insulator on the top of the building, and connected with an electroscope; the radium ionised the surrounding air, and allowed the aerial conductor to acquire the potential of the air at that point, thus charging the electroscope. The latter automatically discharged itself to earth every few seconds through a coherer, causing a bell to ring. Another exhibit was an arrangement for recording the number of sparks passed during a short interval of time by an induction coil, as in instantaneous X-ray photography. For this purpose a steel ball was allowed to roll down inclined rails on to a horizontal track consisting of two graduated straight-edges, one of which was covered with a strip of paper. The sparks passed from the rolling ball to the rail through the paper, perforating the latter and thus recording the number and frequency of the sparks.

Electrical Regulators and Economisers, Ltd.

A number of the Martin rheostats was exhibited at this stand including, besides the standard type which we have illustrated, patterns suitable for shunt-field regulation, elementary laboratory use, and a stage-lighting dimmer to carry 40 amperes, consisting of nine columns of 12 cells each. One of the regulators was fitted up in series with a wattmeter and a lamp, to show the extremely wide range over which the instrument was effective.

(*To be continued.*)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

JAPAN—(*concluded*).

Electric, horse and other tramway cars, and parts, regulators and motors for electric cars, trolley wheels and poles, electric motor trucks, Ganz's patent motor cars, inspection cars	20 % ad. val.
Instruments: physical, chemical, surgical, surveying, and other scientific instruments	20 % „
Amperemeters, voltmeters, galvanometers, wattmeters, ohmmeters, &c.	20 % „
Telegraphic and telephonic instruments and parts thereof, including transmitters, perforators, relays, citophones, logphones, field telephones, telautographs, speaking tubes, receivers	20 % „
Boilers and arranged boiler tubes for water-tube boilers...	15 % „
Steam engines, gas engines, petroleum engines. electric motors and other motive power machines, hydraulic engines, water turbines, steam turbines, Pelton wheels, air engines, electric dynamos, pistons, piston rings, governors, condensers, armatures, carbon and copper brushes for electric dynamos, oil furnace for petroleum engines and parts thereof	15 % „
Carbon rods for electric light, including coppered carbon rods... ...	6 86 yen per 100 kin
India-rubber or caoutchouc: crude ...	Free
Plates and sheets, soft, not exceeding 1 mm. thickness	87·80 yen per 100 kin
Others	35·90 „ „
Hard	37·80 „ „
Rods	10 % ad val.
Other, unmanufactured	10 % „
Gutta-percha: crude	Free
Plates and sheets	39·40 yen per 100 kin
Other, unmanufactured	40 % ad val.
Gutta-percha manufactures	40 % „
Caoutchouc manufactures	10 % „
Celluloid bars, rods, plates, &c. ...	25 60 yen per 100 kin
„ manufactures	40 % ad val.
Packings for engines	7·51 yen per 100 kin
Incandescent electric lamps:	
Not exceeding 32 C.P.	5·80 yen per hundred
Others	10·20 „ „
Arc light lamps, sockets and filaments for electric lamps, shades, globes, reflectors, detached parts of incandescent electric lamp sockets ...	30 % ad val.
Electric blasting fuses	25 % „
Articles not separately mentioned in the Tariff:	
Raw or unmanufactured	10 % ad val.
Partly manufactured	20 % „
Wholly manufactured:	
Coarse	30 % „
Fine	40 % „

The following articles are admitted free of duty:—Articles imported for Imperial use, samples of merchandise which are only fit for use as such, tools and instruments of professional necessity to settlers.

Electric Smelting of Iron Ore.—Dr. Haanel, Director of Mines, has been advised from Norway of the early erection in that country of a second works for the reduction of iron ore by the electric furnace. Dr. Haanel has also been requested by Director H. Boholm, of the Copper Mine and Smelting Co., of Trondhjem, to recommend an electro-metallurgist capable of taking charge of the erection and management of the proposed works. The recurring erection of works in Norway and Sweden for the purpose of electric smelting proves the correctness of the reports issued from time to time by the Canadian Department of Mines upon the subject.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

29,064. "Improvements in electric sparking plugs for internal-combustion engines and the like." A. Taylor and F. Stebbing. December 13th.

29,068. "Improvements in electric arc lamps." H. Hirst and A. E. Angold. Deeember 13th.

29,069. "Improvements in electric arc lamps." H. Hirst and A. E. Angold. December 13th.

29,087. "Improvements in and relating to electric cartridge fuses." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) December 13th. (Complete.)

29,088. "Improvements in and relating to rotary converter dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) December 13th. (Complete.)

29,090. "Improvements in or relating to the working of single-phase commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., (Siemens Schuckertwerke G.m.b.H., Germany.) December 13th. (Complete.)

29,091. "Improvements in electric switches." H. E. Donnithorne. December 13th.

29,136. "Improvements in electromagnetic clutches for transmission of power, speed regulation and acceleration." W. P. Durtnall. December 13th.

29,200. "Improvement in controllers for electric motors." Electric Construction Co., Ltd., and F. W. Close. December 14th.

29,206. "Totally-insulated electric lamp-holder." G. D. Adam. December 14th.

29,214. "Improvements in the electro-deposition of iron." S. O. Cowper-Coles. December 14th.

29,236. "Improvements relating to electric clocks and like instruments." H. Creese. (Application for Patent of Addition to No. 3,851/09.) December 14th.

29,240. "Improvements in storsge batteries." H. C. Hubbell. December 14th. (Complete.)

29,255. "Improvements in and relating to ignition systems for internal combustion engines." E. L. Weiss. (Date applied for under Sec. 91 of the Act, December 17th, 1908, being date of application in France.) December 14th. (Complete.)

29,267. "Improvements in and connected with electric motors." J. D. Roots. December 14th.

29,284. "Improvements in and relating to electric welding." E. B. Koopman. December 14th. (Complete.)

29,312. "Improvements in dynamo-electric machinery." Bruce Peebles and Co., Ltd., and P. Dornonville de la Cour. December 15th.

29,329. "Improvements in the use of magnetic generators." M. A. Codd. December 15th.

29,339. "Improvements in or relating to switches for use in electric circuits." F. Broadbent. December 15th.

29,350. "Improvements relating to conduits or casings for electric conductors." Key Engineering Co., Ltd., and L. Nagel. December 15th.

29,376. "Improvements relating to dynamo-electric machines." M. Walker. (Date applied for under Rule 13, January 11th, 1909; an invention comprised in Application No. 693, dated January 11th, 1909.) December 15th.

29,383. "Improvements in automatic electrically driven pumps for domestic water supply." M. Brandenburg. December 15th. (Complete.)

29,411. "Improvements in electrical heating apparatus." S. L. R. Price. December 16th.

29,437. "Improved electrically illuminated advertising sign." C. Gates, jun. December 18th.

29,448. "Improvements in or relating to electrical ship-log apparatus." T. Walker & Son, Ltd., T. F. Walker and T. S. Walker. December 16th.

29,481. "Improvements in wireless electric signalling particularly applicable to free aerial vessels." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, February 11th, 1909, being date of application in United States.) December 16th. (Complete.)

29,496. "Improvements in and relating to the prevention of over-charge or over-discharge or of both over-charge and over-discharge of secondary batteries." R. S. Dobbie. December 16th.

29,506. "Improvements in wall and like plugs for electrical connections." A. Bonnella and G. J. Bonnella. December 16th.

29,511. "Improvements in separators of electrodes." H. F. Joel. December 16th.

29,521. "Improvements in and relating to the distribution of electrical energy." J. T. Morris. December 16th.

29,582. "Improvements connected with plug and socket connections used in electric lighting and power installations." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. December 17th. (Complete.)

29,583. "Improved speed governing device for electric motors." R. A. Smith. December 17th.

29,584. "Improvements in tractive electro-magnets." R. A. Smith. December 17th.

29,629. "Improvements in X-ray vacuum tubes." W. M. Martin. December 18th.

29,637. "Improvements in or connected with electric call or signalling apparatus, or an instrument for calling separately by means of an electric bell several stations connected by a single wire." L. E. Belcourt and L. S. Lebret. December 18th.

29,671. "Improvements in electric furnaces." O. Vogel. December 18th. (Complete.)

29,677. "Improvements in telephone installations." Siemens Bros. & Co. and H. W. F. Ireland. December 18th. (Complete.)

29,699. "Improvements in and relating to electric motor controllers." British Thomson-Houston Co., Ltd. (General Electric Co., United States. December 18th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Apparatus for Producing Rapid Electric Oscillations. E. Von Lepel. 17,349. August 18th. (Date applied for under International Convention, August 20th, 1907.)

Manufacture of Refractory Electric Conductors. C. T. Fuller. 17,619. August 24th. (Date applied for under International Convention, August 21th, 1907.)

Magneto Ignition. J. L. Milton. 22,271. October 20th.

Regulation of Continuous-Current Motors. P. Scharf. 24,794. November 18th.

Wireless Signalling. R. A. Fessenden. 25,305. November 24th. (Date applied for under International Convention, December 23rd, 1907.)

Electric Lamps for Vehicles. E. Aron. 25,389. November 25th.

1909.

Dynamo-Electric Machines. J. Taylor. 16. January 1st.

Means for Supporting Electric Lamps. J. H. McLean. 875. January 13th.

Electric Traction Systems. E. M. Munro and Railless Electric Traction Co. 1,067. January 15th.

Trolley Heads for Electrically-Propelled Vehicles. E. M. Munro and Railless Electric Traction Co. 1,077. January 15th.

Electric Control of Lifts. J. G. Childs and T. S. Hill. 1,086. January 15th.

Electric Indicators. Julius Sax & Co. and H. C. Wheat. 1,985. January 27th.

Electric Protective Devices of the Type Suitable for Use as Lightning Arresters. British Thomson-Houston Co. (General Electric Co., United States.) 2,529. February 2nd.

Treating Wood to Render it Suitable for Use in Secondary or Storage Batteries. P. Marino. 2,641. February 3rd.

Secondary or Storage Batteries, P. Marino. 2,683. February 4th.

Apparatus for Producing but very slightly Damped Electrical Oscillations. W. P. Thompson. (Ges. für Drahtlose Telegraphie.) 6,424. March 17th.

Process for Manufacturing Electric Incandescent Lamps. R. Hopfelt. 8,146. April 5th.

Galvanic Dry Batteries. G. L. Patterson and G. H. Hopper. 11,155. May 11th.

Electric Time Alarm Apparatus. W. Rausch. 12,195. May 24th.

Electric Arc Lamps. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 14,505. June 21st.

Electric Locking and Unlocking Device for Locks. G. Sahmer. 15,991. July 8th.

Static Induction Generators or Influence Machines. C. Harrison. (C. E. Baker.) 21,529. September 21st.

Manufacture of Arc Light Electrodes. Geb. Siemens & Co. 23,171. October 11th. (Date applied for under International Convention, November 19th, 1908.)

Circuit Closers for Automatic Electric Burglar Alarms. H. B. Collier. 24,453. October 25th. (Date applied for under Rule 13, November 26th, 1908.)

Electricity in Swedish Industry.—According to a lecture by Dr. Sahlin, published in the *Jernkontorefs Annaler*, electricity has now been introduced at about 50 iron mines and deposits for various purposes. The energy is in some cases transmitted over considerable distances, as, for instance, 50 km. to the well-known Grängesberg mine, which was one of the pioneers in the adoption of electrical energy in Swedish mines, and the first to use the three-phase system.

At these mines there are now 94 motors in work with a total capacity of 5,280 h.p., in addition to which 585 h.p. are used for lighting purposes, including 175 h.p. in the pits. The average consumption of power amounts to 4,050 h.p.

The total number of electrical motors installed in Swedish iron mines is 427, having a total capacity of 10,086 h.p.

Electricity has now been introduced at 44 iron and steel works, of which 18 are using motors for driving rolling mills. The following table is based on the official statistics of the Electrical Inspection:—

Number of motors installed	1,246
Of which are used for steel-rolling purposes	61
Total capacity of the motors	34,339 h.p.
Of which are used for steel-rolling purposes (maximum)	13,260 "
Electrical power for electrometallurgical purposes (maximum)	11,095 "
Electrical power for lighting purposes...	2,657 "
Total of the present installation	48,191 "

The last-named figures will be largely increased within a short time, when two very large transmission undertakings have been completed. The experimental works at the Trollhättan waterfalls for the electric smelting of iron ore are designed to have a capacity of 7,500 h.p.

The Buenos Ayres Exhibition.—We recently commented upon the enterprise which was being displayed by British electrical and other engineering manufacturers in booking space for the great Buenos Ayres Exhibition of next year. It appears that there is not a similar enterprise evident on the part of the United States firms, indeed, owing to the apathy shown, in spite of the efforts of the Government administration departments, the United States applications for space do not reach the minimum of 5,000 square metres, and according to the *Times* New York correspondent, the States may have no building at all at the Exhibition. Against this, put the statement that both Great Britain and Germany have already engaged 100,000 square metres, and cannot then accommodate all their representatives, and we see more plainly than ever that the fight for South American business is an Anglo-German one. By way of explanation of the American attitude, the *Times* correspondent adds:—"The reason for this situation lies in the fact that nearly all the American firms who carry on business in the Southern Continent employ foreign agents, who naturally include the exhibits of the American concerns which they represent in the buildings assigned to their own countries. It would seem obvious that if manufacturers here were really anxious to extend their business in South America they would send out their own agents. However, for various reasons it has always proved a difficult task to get the right men to go there and to retain them when they have gone." A few weeks ago in our "Notes on Trade Abroad," we alluded to a remarkable series of blunders in dealing with the South American market for which United States firms suffered a severe Consular castigation.

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„ D., and R. Ziegler (26,967), 320
Tirrill, A. A. (28,190), 680
Trenzen, C., and F. R. Pope (14,852), (14,853), 280
Trier, W. A. (16,597), 80; (21,813), 400
Tudor Accumulator Co. and P. L. R. Fraser (25,709), 860
Tyer, E., and J. R. Dobson (17,143), 200

ULLRICH, R. (14,082), 400

VAN RADEN & Co. and M. Metz (15,388), 280; (25,478), 320
Vandervell, G. A., and A. H. Midgley (21,936), (21,938), 200
Varley, R. (19,850), 680
Veevers, E., and G. H. Butterworth (23,546), 920
Venner, R. F., R. C. Griesbach and P. K. Morris (13,327), 200
Veritys, Ltd., and W. G. Pipkin (20,646), 400; (28,029), (25,322), 920
Verney, R. B., and F. G. Bazell (27,729), 920
Vetter, W., and C. Mürer (19,151), 640
Vickers, Sons & Maxim, Ltd., and A. D. Williamson (23,908), 200
Vogel, C. (14,814), 40
Vollert, H. (27,034), 960

WAGNER, F. (21,490), 720
Warn, W. H. (8,210), 280
Wartmann, H. (27.512), 40
Wattles, R. (28,343), 480
Weatherill, F. (23,622), 820
Webb, J. H., H. F. Bigge and F. R. Butt (19,885), 720
Wedmore, E. B., and British Thomson-Houston Co. (17,890), (20,598), 440
Weissmann, G. (18,283), 40
West, A. (14,695) 120; (25,721), 840
Whatson, H., and M. Lawton (27,816), 720
White, W. (17,170), 40
Wilderspin, E. A., and E. S. Hough (15,053), 320
Wilkinson, G. (21,779), 840
Williamson, A. D., and Vickers, Sons and Maxim, Ltd. (23,908), 200
Wilson, H. C., and C. R. B. Claflin (17,858), 520
Winkler, K. (24,597), 960
Winterbottam, T. E. (25,132), 370
Wolfram Lampen Akt.-Ges. (10,891), 40
Woodhall, A. T., and A. Emery (19,150), 600
Woods, R. S. (19,183), 480

ZIEGLER, R., and D. Timar (26,967), 820
Zimmerl, F., J. Bock and J. Purthner (16,772), 40
Zumsteg, A. H., and R. E. (23,800), 120
Zweigbergk, T. von (25,954), 600; (25,955), 800

1909.

ACCUMULATOR-FABRIK Akt.-Ges. (6,248), 660
Adams Manufacturing Co., A. H. Curtis and A. H. Mackley (4,111), 960
Aktiebolaget Elektrimetall (6,088), 320; (4,553), 720
Allgemeine Elektriatäts Ges. (5,318), 200; (13,231), 280; (4,856), 360; (4,705), 560; (5,717), (17,199), 720; (17,758), 960
Audibert, A. (1,706), 840

BACKMAN, C. A. (14,062), 960
Baker, J. E., J. B. Young and R. F. Hellyer (9,692), 480
Bayliss, F. W. (20,877), 280
Beaver and Claremont (2,076), 40
„ C. J., J. Stratton, W. Shaw and E. A. Claremont (10,539), 840
Beck, C., and C. Wirth (5,811), 720
Bell, J. O. (195), 840
Bellini, E., and A. Tosi (4,801), 360
Bergmann Elektricitätswerke Akt.-Ges. (9,265), 80
Bilton, C. E. (9,999), 280
Bimeler, J. (16,529), 280
Birchall, T. (1,678), 489; (1,675), 840
Blackall, A., and T. Jacobs (27,436), 280
Bleckley, H. P., and R. Brown (9,516), 240
Bleeck, W. A. F. (15,194), 689
Boeckel, A., O. Grunberg, J. K. Krukovski and E. Luxembourg (72), 720
Bohm, E. (3,897), 320
Bosch, R. (3,511), 280
Boult, A. J. (1,548), 840
Bourke, A. M. (18,690), 840
Brand, H. (11,267), 560
British Aluminium Co. and F. Horn (2,611), 800
„ Thomson-Houston Co. (1,345), (5,119), 240; (16,298), 280; (6,209), 400; (4,882), 440; (6,985), 560; (17,370), 880; (10,497), 1040; (2,529), 1080
„ Thomson-Houston Co. and Garton (14,700), 280
Broadhead & Hawkins and Siemens Bros. Dynamo Works (4,425), 560
„ F. R., T. F. Wall and Siemens Bros. Dynamo Works (5,544), 400
Brown, R., and H. P. Bleckley (9,516), 240
Bryan, S. (747), 40

CARBONE, T. L. (17,448), 880
Chambers, F. J. (2,330), 920
Childs, J. G., and T. S. Hill (1,086), 1080
Claremont, E. A., C. J. Beaver, J. Stratton and W. Shaw (10,539), 840
Clark, T. (6,525), 920
Coan, W. C. S. (256), 960
Collier, H. B. (24,453), 1080
Collins, N., and Electric and Ordnance Accessories Co. (7,276), 960
Connor, M. S. (4,899), 560; (5,145), 840; (4,270), 880; (4,630), 920; (4,271), 960; (1,025), 1040; (10,255), 1040
Cooper, M. I. (241), 560
„ G., F. C. Sharp and T. A. Stevens (12,662), 720
Couade, M. (2,374), 200
Cowderoy, W., and Reason Manufacturing Co. (2,379), 200
Cubitt, A. S. (7,113), 920
Cumberland, P. E. G. (8,068), 40
Curtis, A. H., A. H. Mackley and Adams Manufacturing Co. (4,111), 960
Cutler, W. F., and T. Barnett (3,028), 200

DAALEN, H. P. van (15,203), 1040
Daimler Motor Co. and F. M. Green (695), 920
Davey, A. C. (22,345), 280
Davies, A. E., Rapid Magnetting Machine Co. and H. H. Thompson (335), 240
Day, H. E. (78), 200
Degener-Böning, R. (2,845), 480
Delon, R. (13,450), 820
Demuth, R. (1,125), 400
Denieport, E. (18,812), 280
Derain, R. (4,887), 900
Dey, H. E. (759), 440
Dixon, W. T., and G. P. Fairless (4,863), 240
Drault, L. J. B. (9,502), 920
Dreger, C. von, and D. Timar (14,518), 280
Duschnitz, B. (11,578), (11,579). 880

EGNER, C. E., and J. G. Holstrom (12,918), 600
Eisenstein, S (5,578), 860; (17,217), 270
Electric and Ordnance Accessories Co. and N. Collins (7,276), 960
„ Pulley Block Co. (9,275), 1040

FAIRLESS, G. P., and W. T. Dixon (4,863), 240
Fairweather, W. (4,911), 40
Farber, F. (7,913), 880
Felten & Guilleaume Lahmeyerwerke Akt.-Ges. (8,191), 820
Fery (687), 320
Fisher, H. F. (6,818), 680
Flood, W. H. (3,628), 560; (5,805), 1040

GARTON and British Thomson-Houston Co. (14,700), 280
Garty, J. H. (14,391), 960
Geppert, H. (4,853), 680
Giles, G. (4,997), 40
Girard, H. (425), 820

Gould, C. C. (7,610), 440
Graham, E. A. (21,002), 880
Grant, W. (14,117), 720
Green, W. (3,250), 1040
„ F. M., and Daimler Motor Co. (695), 920
Gröndal Kjellin Co. and J. Härden (8,194), 360
Grunwald, C. (3,599), (7,396), 200

HALL, E. (12,869), 320
„ R. F. (11,223), 680
Hansell, H. F. (7,081), 80
Härden, J., and Gröndal Kjellin Co. (8,194), 360
Hardingham, G. G. M. (2,016), 360
Harris, R. (225), 920
Harrison, C. (21.529), 1080
Hatry, C. C. (2,358), 40
Hay, J. G. (6,105), 240
Heinrich, W. (7,092), 880
Hellyer, R. E., R. J. E. Baker and J. B. Young (9,692), 480
Hill, T. S., and J. G. Childs (1,086), 1080
Holstrom, J. G., and C. E. Egner (12,918), 600
Hookham, G., and S. H. Holdem (3,217), 880
Hopfelt, R. (8,146), 1080
Hopper, G. H., and G. L. Patterson (11,155), 1080
Horn, F., and British Aluminium Co. (2,611), 800
Horst, L. (4,576), 200
Hoyt, G. P. B., and E. L. Linsabaugh (5,893), 200

ISAAC, C. (7,298), 40

JACOBS, T., and A. Blackall (27,436), 280
Johannsen, F. F. V. (3,539), 360
Justice, P. M. (6,850), 360

KALLMANN, M. (6,957), 680
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Korting, M. (4,122), 240
Krause, G. (9,987), 200
Krebs, G., and G. Krebs & Co., Ges. (15,895), 920
Kruger, E. A. (8,283), 560
Kunkel, F. R. (19,594), 840
Kuzel, H. (1,332), 40

LAGYE, B., and R. Vandatte (5,859), 800
Lake, H. E. (3,517), 280
„ H. W. (5,595), (5,909), 8[illegible]0; (6,932), 1040
„ W. E. (14,126), 680
Lamme, B. G. (14,579), 920; (19,392), 960
Langbein Pfanhauserwerke Akt.-Ges. (14,091), 1040
Law, A. H., and C. A. Parsons (11,822), 400
Leder, W. (7,635), 40
Lord, A. P., and J. C. Russell (11,210), 880
Lowden, W. A. (12,985), 200
Lundberg, A. P., G. C. and P. A. (7,993), (8,429), 560; (11,605), 960
Lux, H. (21,586), 280

McLEAN, J. H. (875), 1080
McLelland, T. (299), 960
McCurdy, O. S., and J. N. Mahony (8,521), 40
Mackintosh, J. (7,048), 560
Mackley, A. H., A. H. Curtis and Adams Mannfacturing Co. (4,111), 960
Mahony, J. N., and O. S. McCurdy (8,521), 40
Mallinson, A. S. (4,928), 880
Marchal, P. (590), 200
Marconi and Marconi's Wireless Telegraph Co. (4,125), 960
Marconi's Wireless Telegraph Co. and H. J. Round (185), 360
Marietti, S. (14,483), 280
Marino, P. (2,641), (2,683), 1080
Marks, E. C. R. (318), 480
Mattonet, H. H. (3,403), 360
Meszaros, J. (667), 960
Middleton, V. G., W. E. Townsend and H. W. Ravenshaw (14,530), 280
Miller, T. (5,903), 960
Moschini, A. (522), 800
Moser, R. (6,103), 440
Munro & Rogers, Ltd., and A. J. Rogers and Brecknell (319), 200
„ E. H., and Railless Electric Traction Co. (1,078), 840; (1,067), (1,077), 1080
Murray, T. E. (4,228), 200

NEALE, J., and E. Powell (3,437), 920
Newstetter, M. A. (10,198), 840
Nicholson, A. H. (6,523), 40

O'HAGAN, F. F., and Siemens Bros. Dynamo Works (10,067), 200
Otto, W. (1,922), 800
Owen, H. L. (7,531), 720

PARKES, T. (6,258), 960
Parsons, C. A., and A. H. Law (11,822), 400
Patterson, G. L., and G. H. Hopper (11,155), 1080
Pauling, H. (6,429), 320
Payne, B. G., and Siemens Bros. Dynamo Works (4,317), 440
Peck, J. S. (13,762), (13,763), 280
Philips, R. E. (5,087), 40
Pictet, A. (10.450), 320
Pickard, G. W. (10,772), 920
Pinson, W. C., and R. Walker (12,482), 840
Plato, R. (6,646), 240
Polkey, J. (4,117), 200
Ponzini (15,786), 960
Powell, E., and J. Neale (3,437), 920
Price H. W. (6,289), 880

RAILLESS Electric Traction Co. and E. H. Munro (1,078), 840; (1,067), (1,077), 1080
Rapid Magnetting Machine Co., H. H. Thompson and A. E. Davies (335), 240
Rausch, W. (12,195), 1080
Ravenshaw, H. W., V. G. Middleton and W. E. Townsend (14,530), 280
Reason Manufacturing Co. and W. Cowderoy (2,379), 200
Regnart, C. C. (5,567), 80
Richter, W. E. (2,605), 920
Robinson, W. (9,623), 880
Rogers, G. D. (16,943), 840
„ A. I., and Brecknell, Munro and Rogers, Ltd. (319), 200
Round, H. J., and Marconi's Wireless Telegraph Co. (185), 360
Russell, J. C., and A. P. Lord (11,210), 880
Ruthenburg, F. M. (4,175), 960

SAHMER, G. (15,991), 1080
Salpetersaure Industrie Ges. (8,443) 40,
Sand, E. (16,912), 840
Sax, Julius, & Co., and H. C. Wheat (1,985), 1080
Schiessler, R. (4,028), 40
Schneider, J. A. (17,436), 920
Schweiger, A. (13,661), 720
Sharman, A. W. (6,962), 200
Sharp, F. C., T. A. Stevens and G. Cooper (12,562), 720
Shaw, W., E. A. Claremont, C. J. Beaver and J. Stratton (10,539), 840
Sheehy, R. (10,796), 960
Siemens & Halske Akt. Ges. (16,928), 840; (14,213), 840; (16,985), (18,456), 880
„ Bros. & Co. (5,904), 40; (103), 280; (4,594), 320; (13,750), (13,919), 400; (14,240), 480; (10,203), (17,104), 600; (605), 680; (6,281), (14,239), 880; (13,135), 960; (14,605), 1080
„ Bros. Dynamo Works (8,263), 40; (1,509), 440; (16,538), 480; (22,789), (19,012), (19,599), 960
„ Bros. Dynamo Works, Ltd., Broadhead & Hawkins (4,425), 560
„ Bros. Dynamo Works, F. R. Broadhead and T. F. Wall (5,544), 400
„ Bros. Dynamo Works and F. P. O'Hagan (10,067), 200
„ Bros. Dynamo Works and B. G. Payne (4,317), 440
„ Bros. Dynamo Works and E. Schupp (16,537), 1040
„ Schuckertwerke Ges. (580), 80; (11,904), 280; (9,048), 840; (18,328), 880; (14,622), 960
Simms, F. R., and Simms Manufacturing Co. (1,641), 960
Sinsabaugh, E. L., and G. P. B. Hoyt (5,893), 200
Smith, E. W. (2,151), 720
„ F. W. (2,150), 960
„ T. B. (3,469), 960
Soc. Ch. Legrand et Cie. (8,168), 880
„ Française d'Incandescence par le Gaz (11,149), 200
Stearn, C. H., and C. E. Topham (4,691), 960
Stevens, T. A., G. Cooper and F. C. Sharp (12,562), 720
Storer, N. W. (3,831), 240
Stratton, J., W. Shaw, E. A. Claremont and C. J. Beaver (10,539), 840
Suter, F. W. (432), 800; (430), 920

TABLER, F. C. (1,493), 40
Taylor, J. D. (1,788), 560; (15,978), 960; (16), 1080
Thompson, W. P. (6,424), 1080
Thompson, H. H., A. E. Davies and Rapid Magnetting Machine Co. (335), 240
Thursfield, C. J. (25,279), 280
Timar, D., and C. von Dreger (14,513), 280
„ D., and R. Ziegler (8,570), 320
Topham, C. E., and C. H. Stearn (4,691), 960
Tosi, A., and E. Bellini (4,801), 360
Townsend, W. E., H. W. Ravenshaw and V. G. Middleton (14,530), 280
Traun, H. D. (11,116), 960
Trier, W. A. (7,299), 840

VANDATTE, R., and B. Lagye (5,859), 800
Venning, F. J. (7,795), 320
Vernier, C. (15,413), 840
Vyle, C. C. (8,533), 360

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Wall, F. F., Siemens Bros. Dynamo Works and F. R. Broadhead (5,544), 400
Walters, J. F. (15,532), 880
Webb, W. R. (15,657), 960
Wechmar, E. (9,803), 720
Whalley, A. (5,040), 920
Wheat, H. C., and Julius Sax & Co. (1,985), 1080
White, H. E. (6,567), 560
„ W. D. (3,252), 280
Williams, W. V. (2,984), 880
Williamson, W. A. (3,836), 880
Willis, P. R. J. (868), 40
Wirth, C., and C. Beck (5,811), 720
Witzenmann (3,257), 920
Wolters, G. O. (10,312), 600
Wright, E. B. (3,637), 680
Wustet, C., Cie (4,561), 720
Wysocki, B. von (11,230), 440

YOUNG, J. B., R. E. Hellyer and R. J. E. Baker (9,692), 480

ZIEGLER, R., and D. Timar (8,570), 320
Zucker Fabrik Frankenthal (12,258), 720

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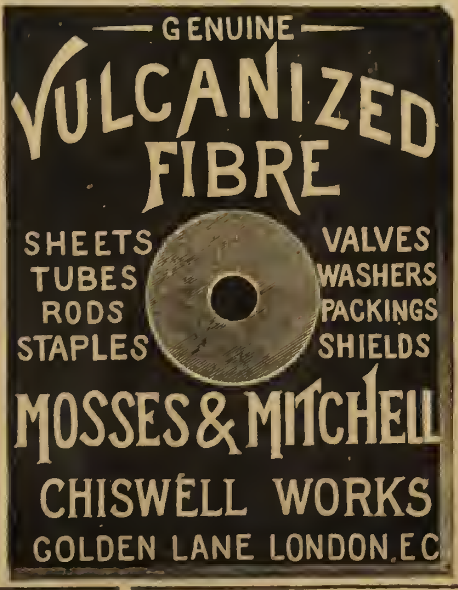

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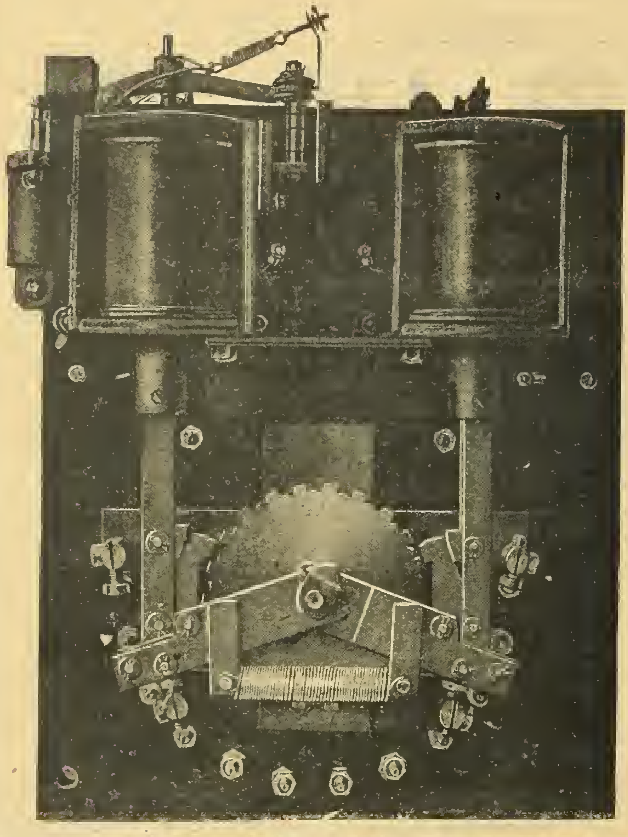

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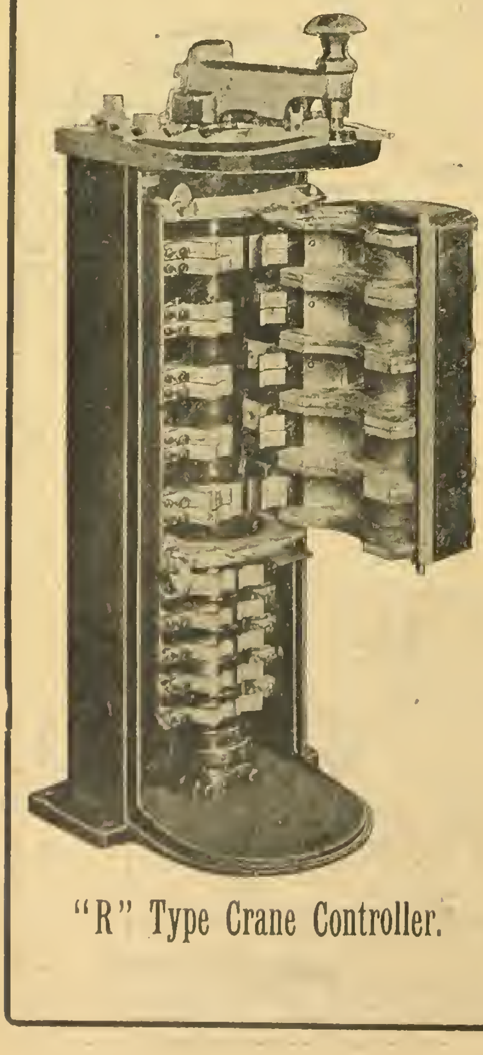

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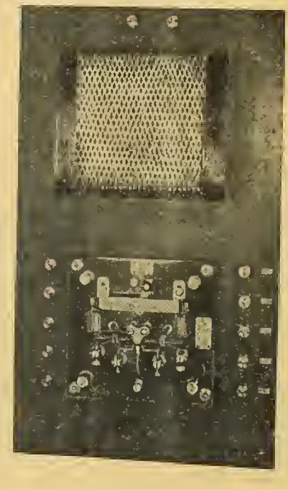

LIST B.

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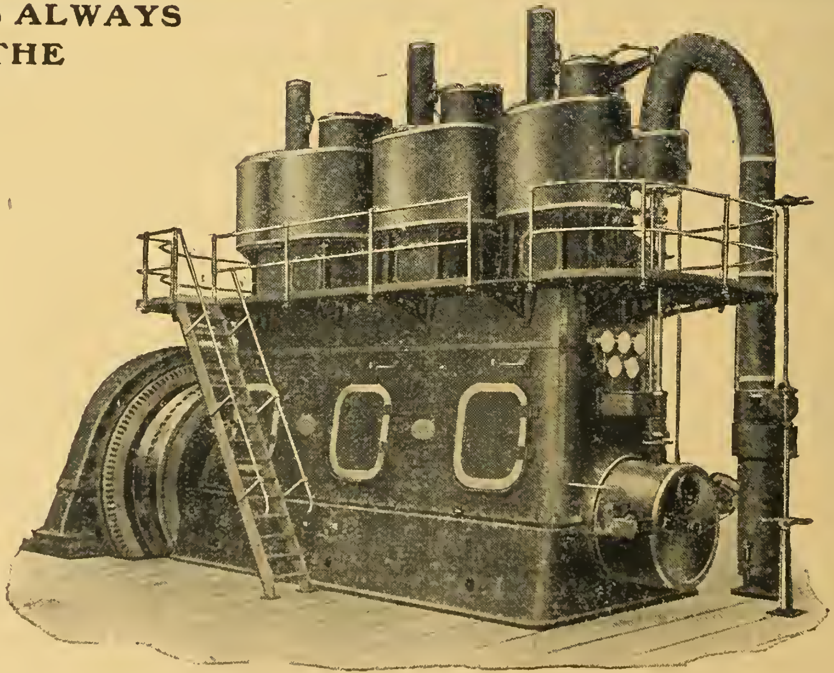

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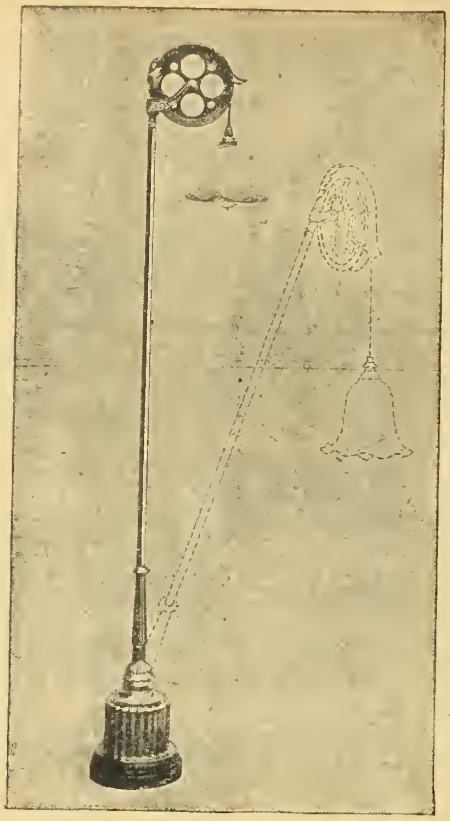

Fig. 191.

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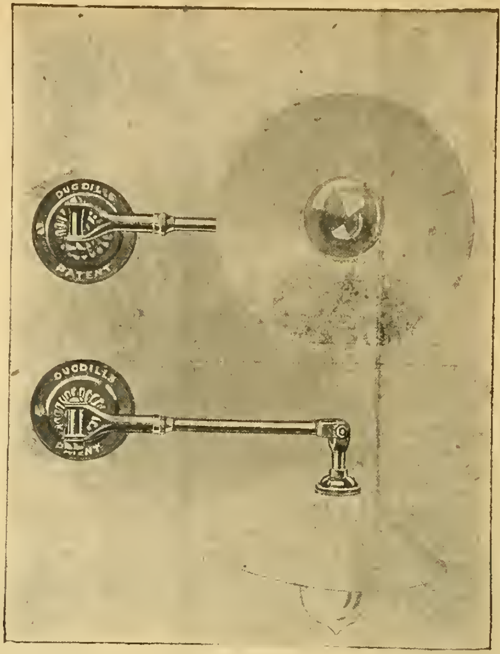

Fig. 220.

FIG 220.

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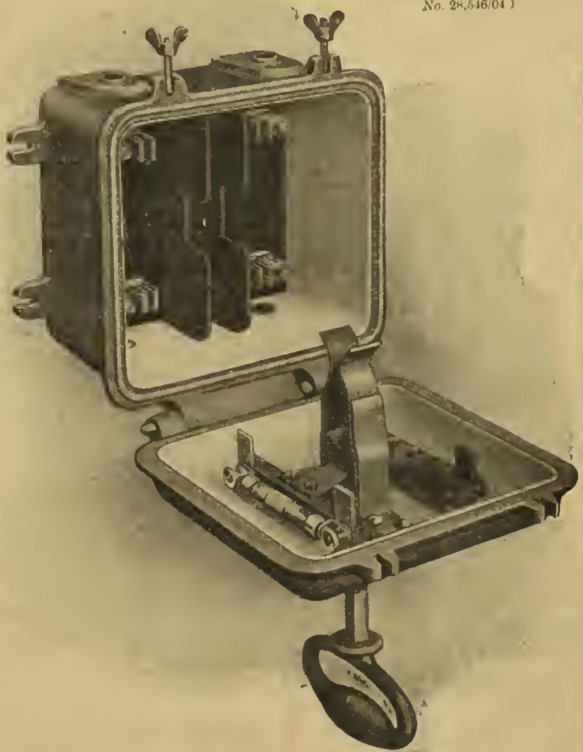

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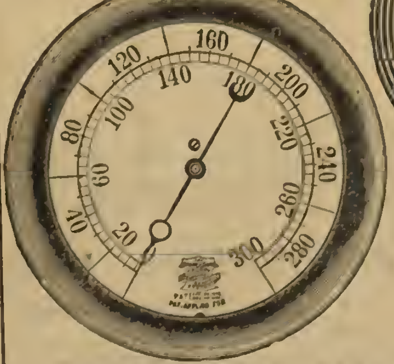

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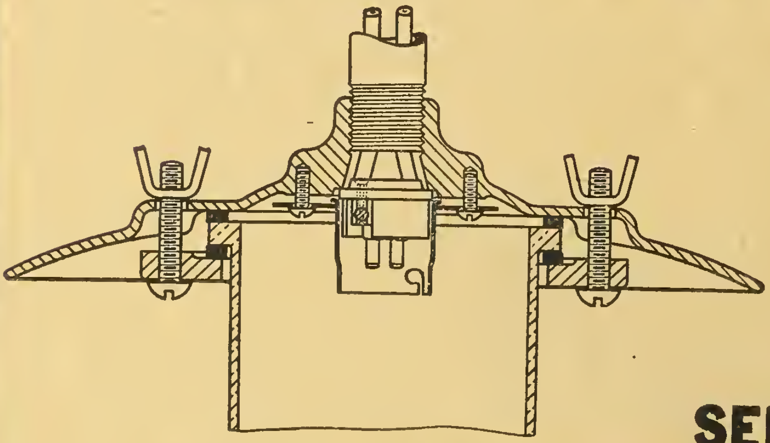

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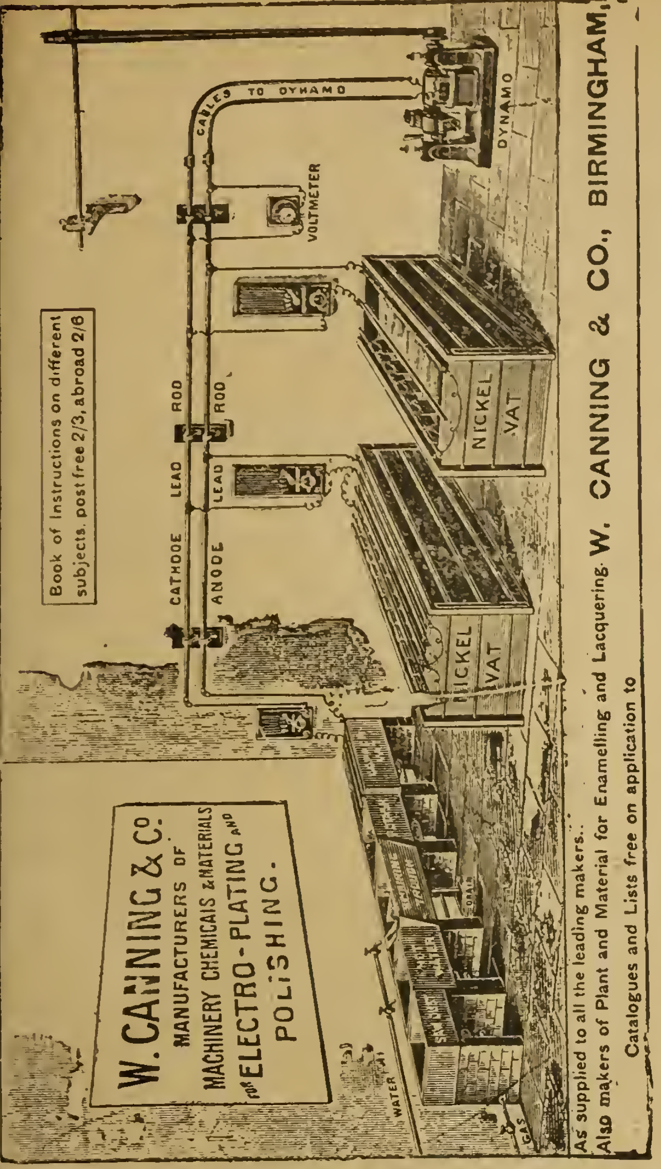

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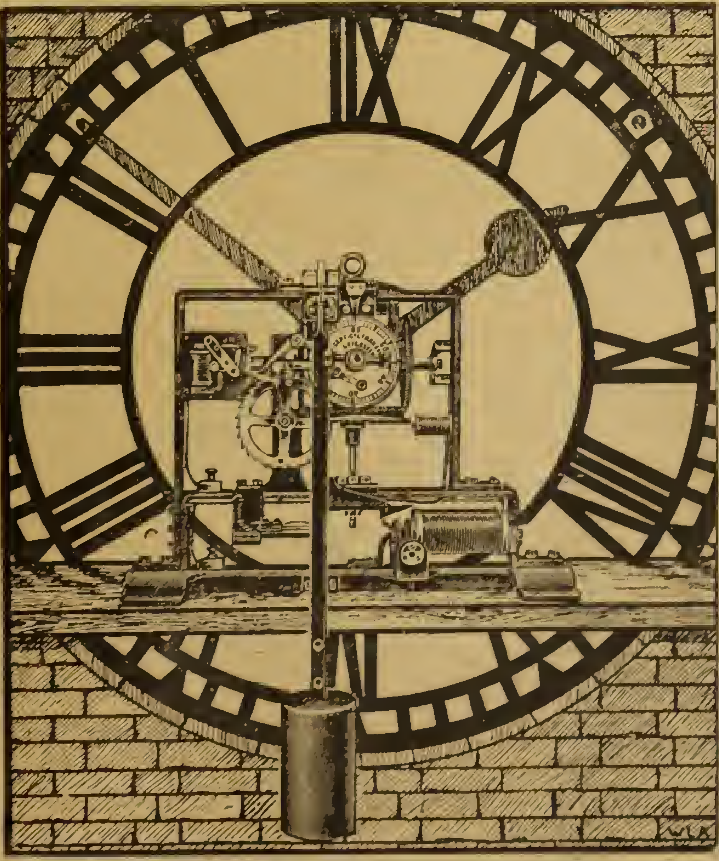

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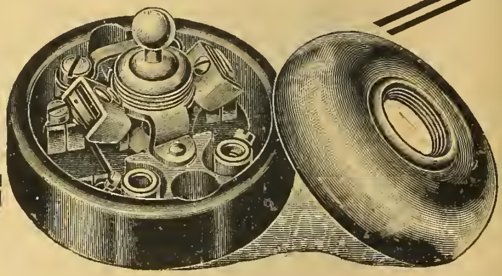

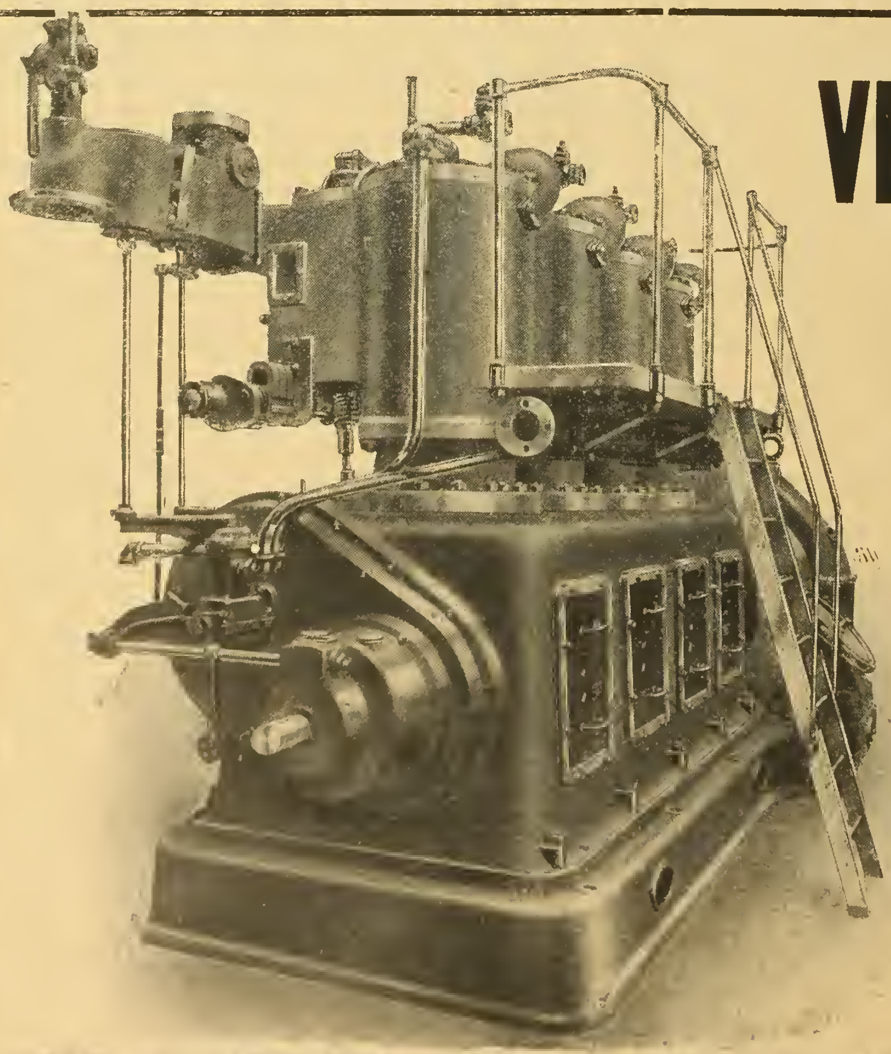

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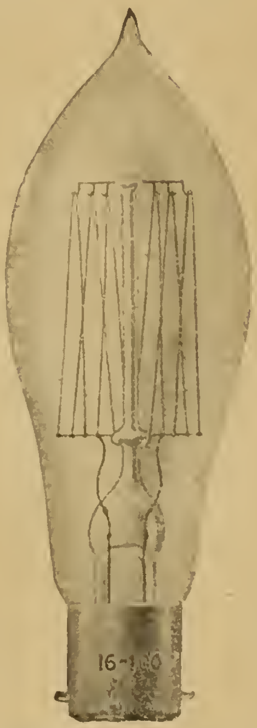

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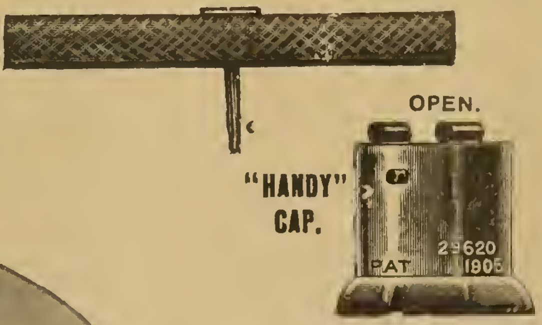

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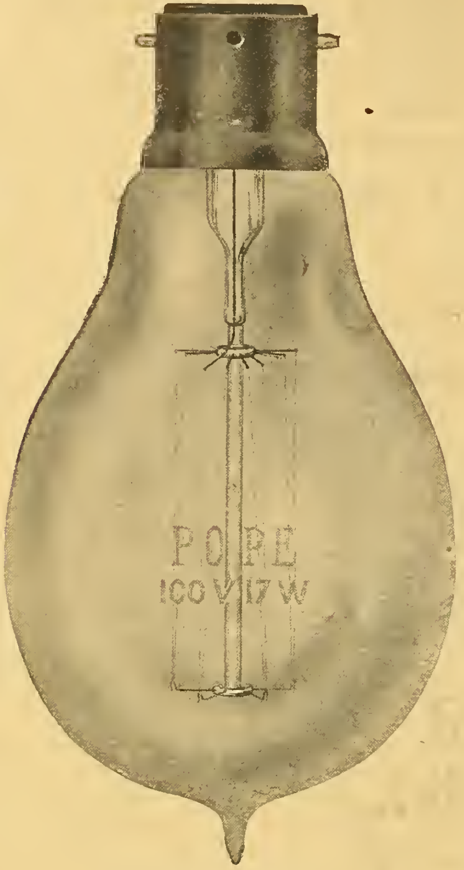

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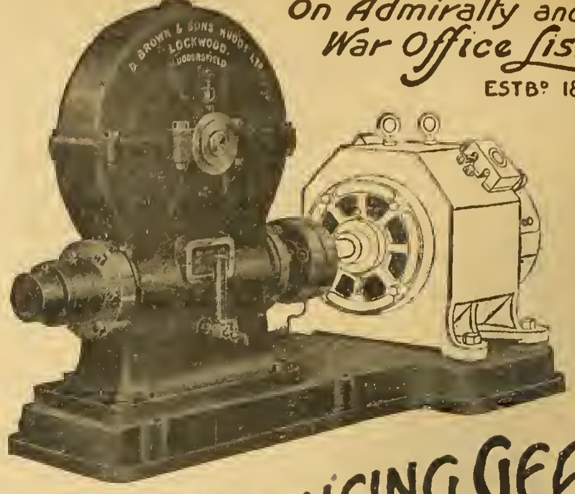

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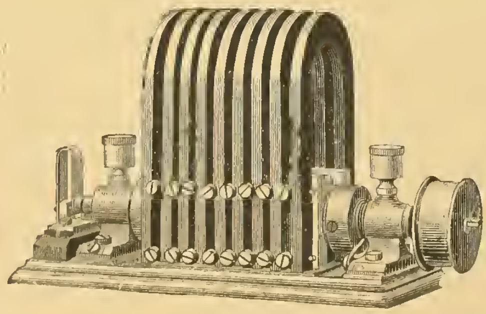

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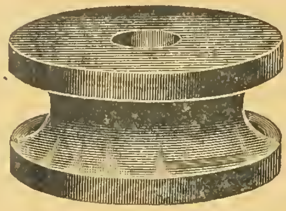

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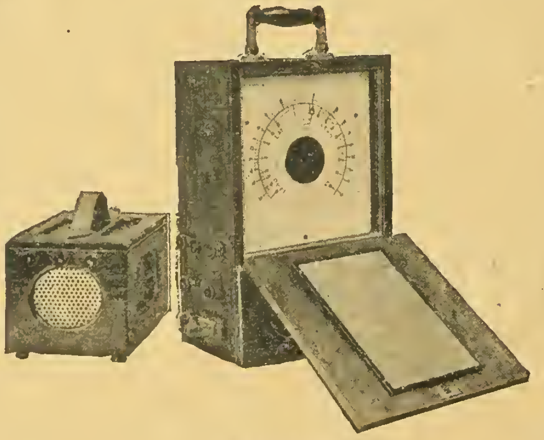

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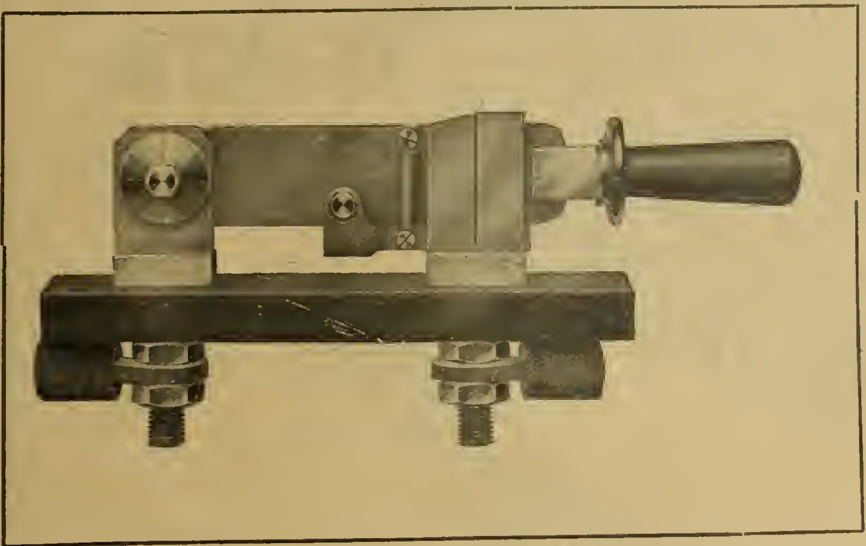

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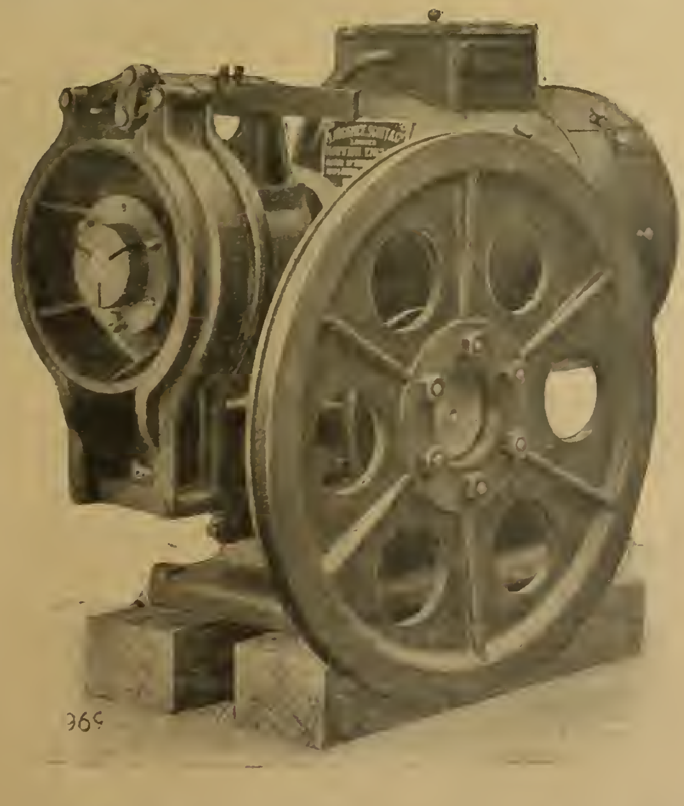

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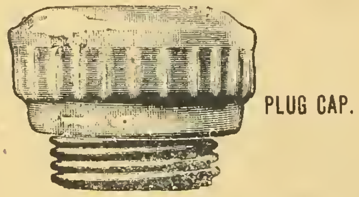

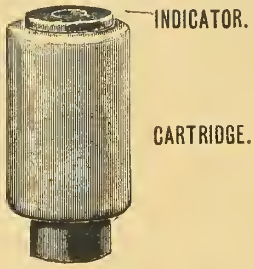

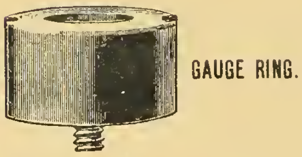

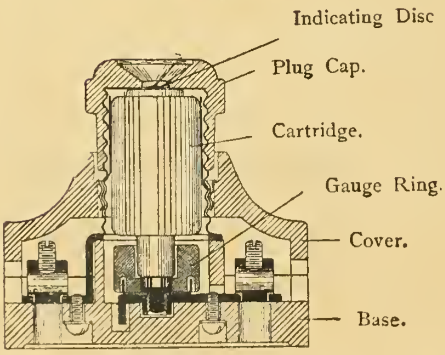

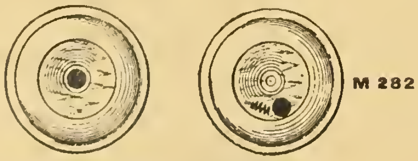

Normal appearance. Fuse blown.

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(Continued on next page.)

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(Continued on next page.)

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ADVERTISER (26) desires position as Shift Engineer, H.T. D.C. central station experience, steam and gas engines, turbines, boiler house, workshop, and technically trained.—6202, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER (33) desires permanency, Working Foreman or Superintendent; practical experience, installations, maintenance, lighting, power, &c. Good knowledge of commercial motor (petrol) vehicles. Excellent testimonials.—"Electrician," c/o R. Hanlon, 91, Chippenham Road, West Kilburn. 6323

ADVERTISER (24) seeks situation, Storekeeper, Despatch Clerk, or any capacity; excellent references.—Brown, 129, Coventry Street, Cambridge Road, N.E. 6332

AS Accountant and Bookkeeper or Assistant; 10 years' experience with one of the largest Cable Makers and Contractors. Highest testimonials.—6203, Electrical Review, 4, Ludgate Hill, London.

COMPETENT Accountant and Book-keeper requires engagement, used to taking entire charge of counting-house, and control over staff; balances own books, &c., &c.—Write Leyell, 11, Sedgemere Avenue, East Finchley, N. 6221

CONTRACT Engineer (33), experienced in erection and running of complete central station plants and distribution systems, requires responsible position, some experience abroad.—Apply 6286, Electrical Review, 4, Ludgate Hill, London.

DRIVER, married, seeks charge; plant, steam or gas-driven, no objection to other work, abstainer, good testimonials.—6317, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Wireman wants sit., 10 years' experience, good ref.—W., 90, Pownall Road, Dalston. 6334

ELECTRICAL Engineer (20), requires situation. Technically trained. Practical experience with gas engines and dynamos. Good references.—6270, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, 20 years' general all-round experience, 2 years seagoing, last eleven years with large corporation electric supply department, seeks new appointment as foreman or otherwise, well educated (age 35), good references.—Apply 6321, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN.—Does anybody want an industrious and trustworthy man to take charge of private plant, factory, small station, or anything? 13 years' experience, light, power, accumulators, &c., steam, gas, and water power.—6324, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN desires permanency, can estimate, take charge, &c., good wireman.—6310, Electrical Review 4, Ludgate Hill, London.

ENGINEER and Fitter (27), four years sea-going in charge engines and boilers, holding B.O.T. certificate, desires situation as Junior Driver Mechanic in lighting station or power house. Commencing wage 20s. weekly, for experience.—6281, Electrical Review, 4, Ludgate Hill, London.

ENGINEER, A.M.I.E.E. (27), Electrical and Mechanical, six years' central station experience, including alternating (high and extra high-tension) and direct-current supply for lighting, power and traction purposes, also accumulators, requires post as Chief Assistant or Station Superintendent.—6255, Electrical Review, 4, Ludgate Hill, London.

FOREMAN, electrical and telegraph instruments, wide experience, energetic, good timekeeper, estimates, &c.—6320, Electrical Review, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS WANTED.—*Continued.*

PUBLICITY.—Adept at preparation of catalogues, advertisements and all classes of advertising literature, engineering training, disengaged shortly.—6160, **Electrical Review**, 4, Ludgate Hill, London

SALES Manager, well-up in all descriptions of Electrical Plant, Cables, &c., can handle large or small stuff; well-known; London District. — 6231, **Electrical Review**, 4, Ludgate Hill, London.

STOREKEEPER or Stores Clerk, seeks situation. Age 21. Experienced in contractors and wholesale business. Town or country. Highest references.—Riddle, 44, Geneva Road, Brixton, London. 6193

WIREMAN, quick, competent all systems, any distance, references.—85, Westbury Road, Ilford. 6218

WIREMAN, disengaged, seeks Employment; all systems; good references.— Tomlin, 60, Clarendon Street, Leamington. 6318

WIREMAN seeks engagement, town or country.—H. D., 84, Pelham Road, Wood Green, N. 6325

WIREMAN, disengaged; all-round experience.—H., 28, Cassland Road, Hackney. 6297

PARTNERSHIPS.

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ENGINEER (A.M.I E.E.), many years' central station and general experience, good testimonials, requires employment. Could invest small capital.—6313, **Electrical Review**, 4, Ludgate Hill, London.

AGENCIES.

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AGENTS required in all large centres of the United Kingdom to represent manufacturers of British-made metal filament lamps upon commission terms.—Apply 6328, **Electrical Review**, 4, Ludgate Hill, London.

AGENTS wanted in provincial centres for old-established firm of high-class Electric Lift and Crane Manufacturers. Only those having connection with leading architects, consulting engineers, contractors, and builders need apply.—Reply 6327, **Electrical Review**, 4, Ludgate Hill, London.

AGENCIES.—*Continued.*

A.M.I.E.E., good connection, London district, is open to represent firm making V.I.R. Cables, &c.—6232, **Electrical Review**, 4, Ludgate Hill, London.

COMMERCIAL Engineer, Yorkshire connection, desires to represent good electrical house.—105, Exchange, Huddersfield. 6319

SMART Agents wanted in Leeds, Birmingham and Bristol to push the sale of well-introduced Flame and Enclosed Lamps. Only those with live connection with Engineering Works and Contractors need apply stating age, references, and full particulars of career to 5778, **Electrical Review**, 4, Ludgate London.

BUSINESSES FOR SALE AND WANTED.

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ELECTRICAL Contractor.—High-class suburb, S.W. district. Sacrifice at stock valuation, £150. Fine position, inclusive rent £20. Owner going abroad; excellent opportunity for branch. —6187, **Electrical Review**, 4, Ludgate Hill, London

ELECTRICAL Contractor's Business for Sale, London district, flourishing business. Good connection. Fullest investigation; £350, stock included.—6217, **Electrical Review**, 4, Ludgate Hill, London.

FOR Sale, in north-east coast town, Established Electrical Contractor's Business. Good workshop and offices; rent only £25; price £250—£350.— Apply 6182, **Electrical Review**, 4, Ludgate Hill, London.

WANTED, Mechanical or Electrical Business, from £200 to £500, must be sound and genuine affair, also show further scope with additional capital. — 6289, **Electrical Review**, 4, Ludgate Hill, London.

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DYNAMOS, 3000, 1500, 1000 and 750 amperes, at 6 volts, ready for delivery; also smaller sizes delivered from stock. Machines let out on hire.—Canning & Co., Electro - Platers' Engineers, Birmingham. 8025

(*Continued on next page.*)

FOR SALE.—*Continued.*

DYNAMO (Byng-Hawkins), 110 v., 450 amperes, 600 revs., compound.—MARTIN, Witton Road, Birmingham. 6183

DYNAMO by Elwell-Parker, 100—140 volts, 70 amps., 8-H.P. 110-volt Motor, condition as new, also 3-H.P. ditto, and smaller sizes in stock, for Sale cheap.—HARRY H. GARDAM, Staines. 4004

ELECTRICAL Plant.—One Parker's No. 12 Dynamo, set slide rails to ditto; one Otto Gas Engine, 24 B.H.P., and Self-starter, three Tanks, Volt-meter, Batteries, Switchboards and connections, all in excellent condition. To be sold at about half-cost price.—Apply THE BURTON BREWERY CO., LTD., Burton-on-Trent. 6337

FOR Sale.—Bound Volumes of "Proceedings of Institution Electrical Engineers" from 1890 to present time; also "Proceedings Institution Civil Engineers, from 1904 to date.—Offers to 6322, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 24 KW. D.C. Generator Set, 530 to 110 volts, almost new, leading makers, cheap.—WINDER, Cross Belgrave Street, Leeds. 6258

FOR Sale immediately, Steam-Driven Electric Lighting Plant, consisting of:—100-B.H.P. Tangyes Horizontal Engine, with Pickering Governor, 75 lbs. steam pressure; four-pole Bruce Peebles Dynamo, compound wound, 300 amps. 255 volts; Switchboard, three marble panels with voltmeter and ammeter. May be seen in operation.—Further particulars may be obtained from, and offers to be sent to, HURST, NELSON & CO., Limited, Motherwell. 6259

FOR Sale.—Four nearly new 3-ton Electric Locomotive Travelling Cranes, made by Jessop and Appleby, each with 23 ft. steel braced derricking jib to lift 3-tons at 18 ft. radius, cast-iron carriage, doubled geared hoisting barrel grooved for $\frac{3}{4}''$ diam. steel rope 80 ft. long; worked by 30 H.P. series-wound reversing motor, 650 revs., 400 volts, raw hide pinion gearing. Type H.I "Brush" Controller, main switch fuse and resistance, automatic brake; corrugated iron sheeted cab. If voltage unsuitable, we are prepared to quote alternative prices for required voltage. Gauge $4'\ 8\frac{1}{2}''$ up to 12 feet to suit. Catalogues post free.—THOS. W. WARD, LTD., Albion Works, Sheffield. Telegraphic Address: "Forward, Sheffield." 6216

FOR Sale or Hire, high-class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & CO., 72, Finsbury Pavement, E.C. 5689

NEW Dynamo (Compound), 80 volts 300 amps., £50; Dynamo, 40 amps. 140 volts, £17.—Apply 6311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

20-H.P. Crossley Gas Engine, with tanks, pipes, &c., E.C.C. Dynamo, 100 v. 160 a., 915 r.p.m., Marble Switchboard, &c. All in perfect working order. Cheap.—HURRY BROTHERS, Sugar-house Lane, Greenock. 6314

ARTICLES WANTED.

WANTED TO PURCHASE FROM ELECTRIC LIGHTING Companies and Electrical Engineers, Dynamos, Motors, Cable, Wire, Instruments, and every description of Electrical Material, also Manufacturers' Surplus Stocks. The bulk being for re-use, high cash prices can be paid.—A. VEREY & CO., Dover. Principal in London three days a week. Telegraphic Address: "Verey, Dover." 8514

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ACCUMULATORS, Second-hand, any type, wanted; also Dynamos and Machinery, Lead Peroxide, Old Copper Cable, Scrap Metals, and every description of Metallic Dross purchased for cash, town or country.—Write A. BROWN & SONS, 142, Lower Clapton Road, N.E. Telephone: Dalston 555. 4338

OLD Electric Lamp Ends, Cable and Wire bought for cash.—SMITH & CO., 2, Ranelagh Road, East Ham, London, E. 2818

ONE 50-KW. and one 100-KW. (second-hand) three-phase, 50 cycles, 550-volts, direct-coupled Steam Sets, 70 lbs. steam pressure, or alternatively, three-phase Generators of these sizes to be belt-driven from independent engines. Prompt delivery required. Reply, giving full particulars and prices, to 6336, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & CO., LTD., 44, Clerkenwell Road, London. 6522

WANTED Surface Condenser about 5000 to 7000 lbs. of steam; also air and circulating pumps motor-driven.—Full particulars to 6225, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 6 H.P. Motor, alternating 200 volts, 50 periods, also 4, 3, 2, & $\frac{1}{2}$ H.P. ditto.—G., 163, Church Lane, Old Charlton. 6290

WANTED, 20 to 30 cwt. Electric Pulley Block Hoist for attaching to travelling crane 110 volts.—FIELDING & PLATT, Gloucester. 6331

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LEAD-Burning, Tanks, Accumulators, Oxy-Acetylene, Welding, Casting Repaired. Any distance.—H., 3, College Street, Putney. 6173

(Continued on next page.)

MISCELLANEOUS.—*Continued.*

TO THE TRADE.—Private lines erected, and all systems of intercommunicating telephones installed and repaired.—HORACE LAVY, Telephone Engineer, 6, Maddox Street, London, W. Telephone: Gerrard 8820. 6284

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"Instructions as to the treatment of persons suffering from electric shock shall be affixed in all premises where electrical energy is used other than at low pressure, generated or transformed above low pressure, and in any premises at low pressure in which the Home Office directs that they shall be affixed."

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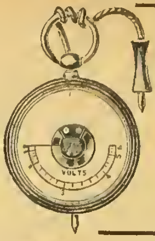

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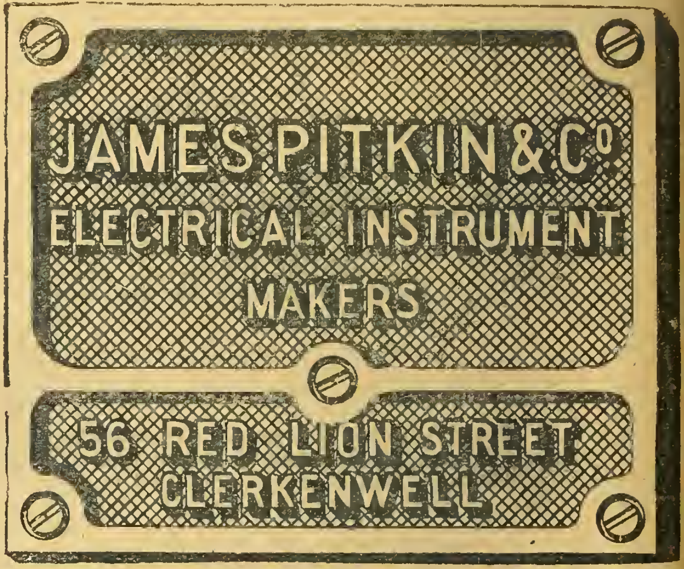

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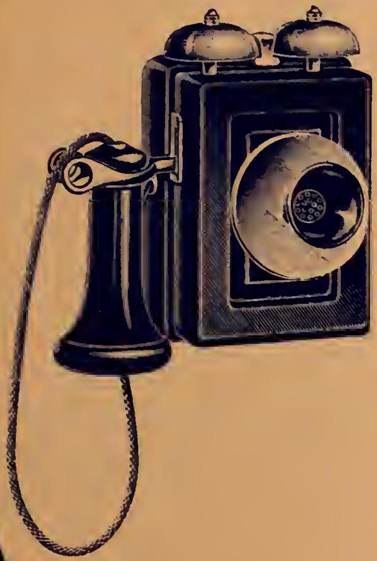

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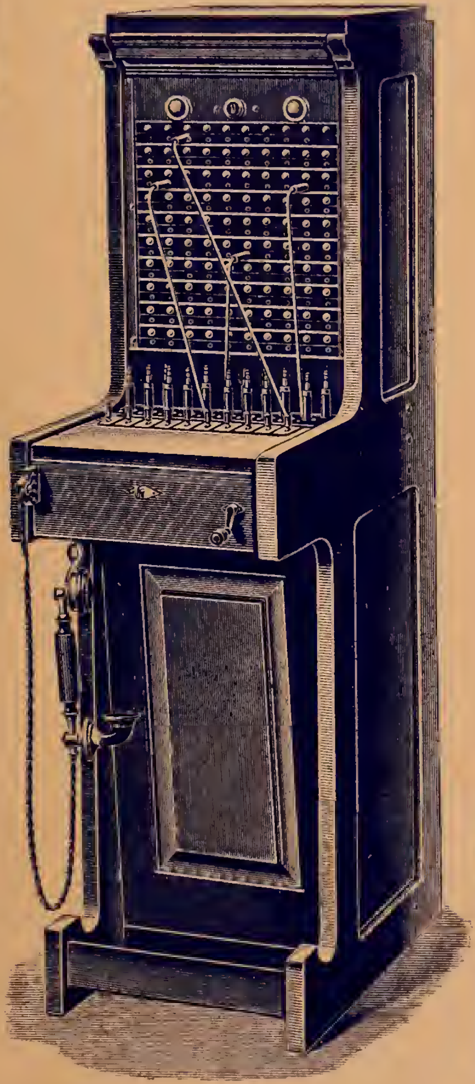

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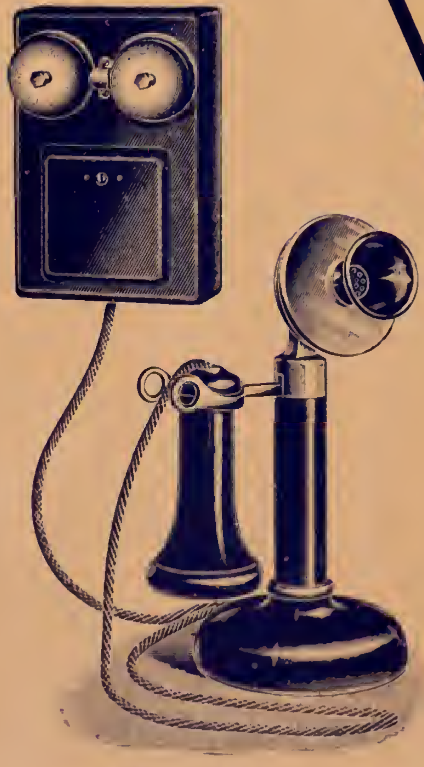

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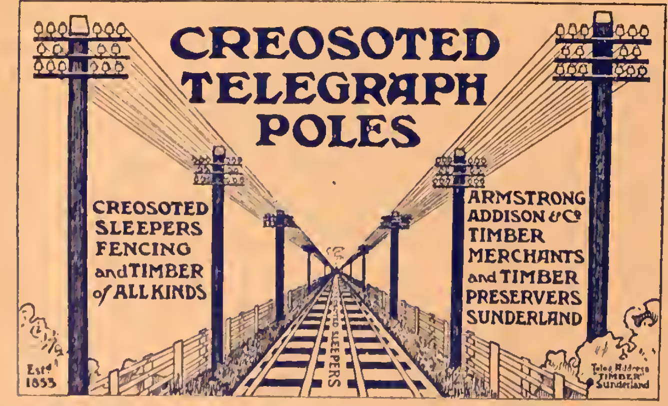

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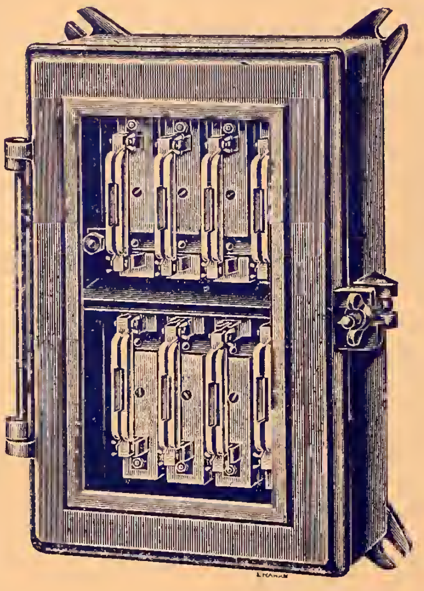

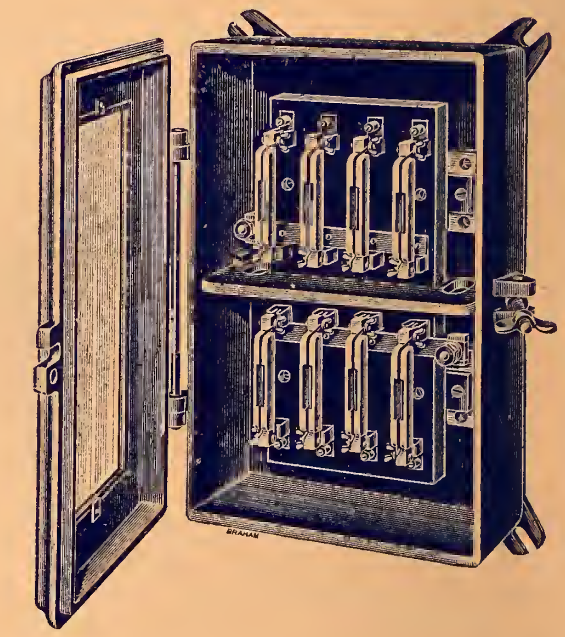

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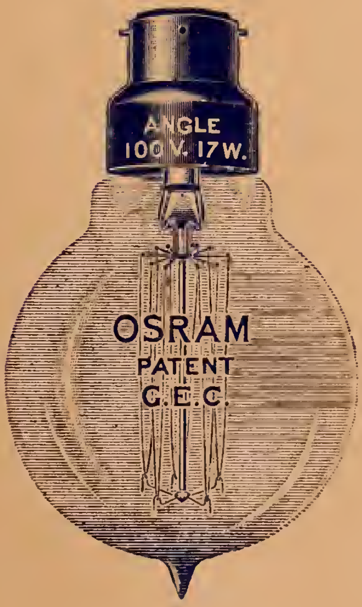

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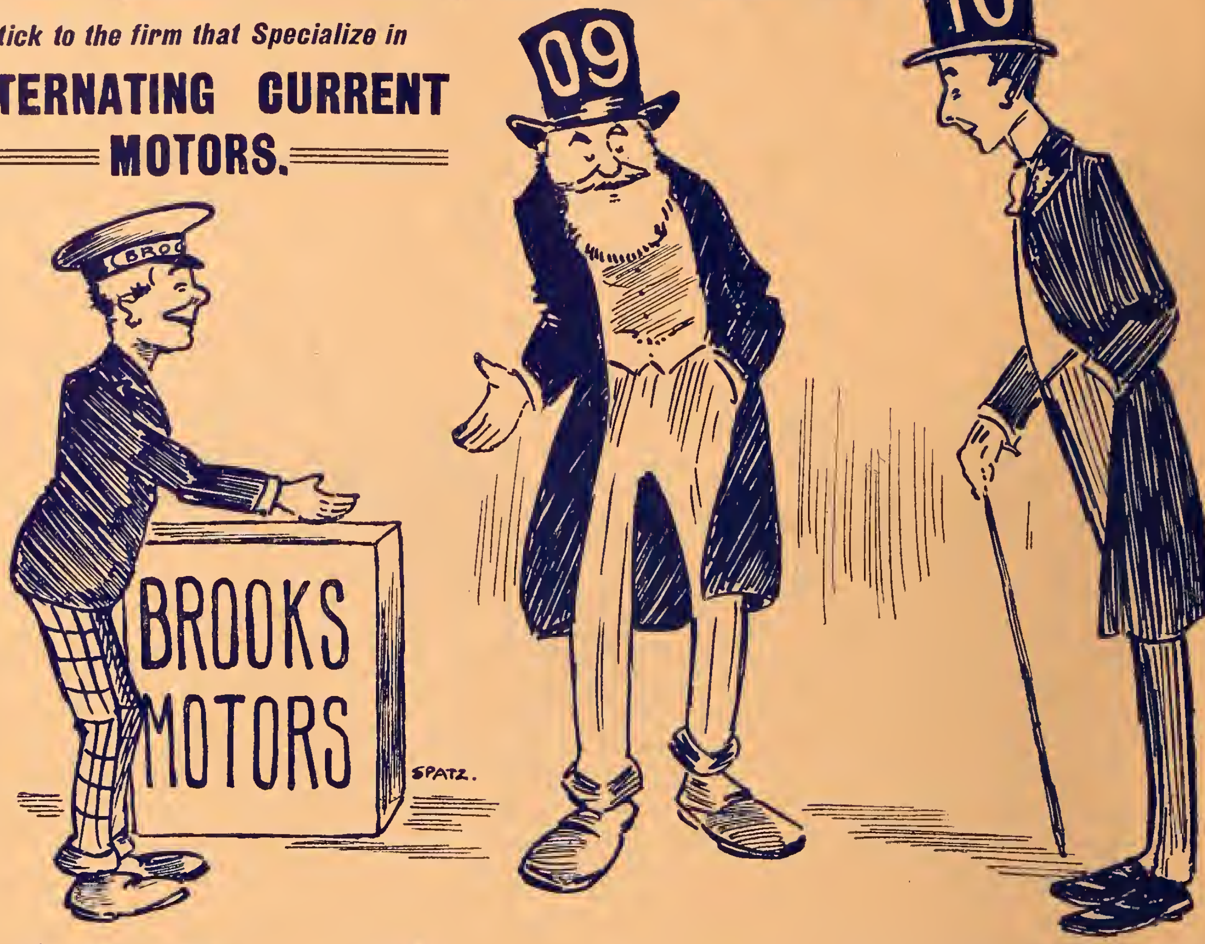

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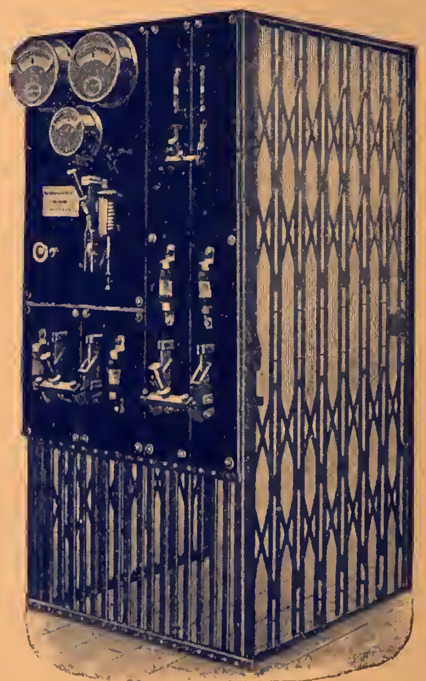

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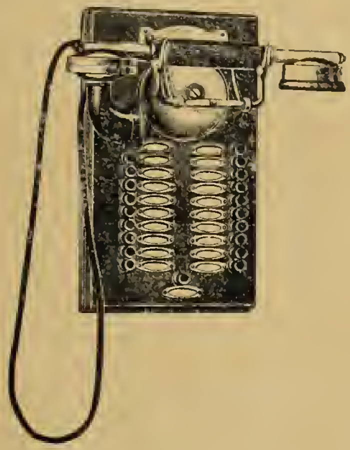

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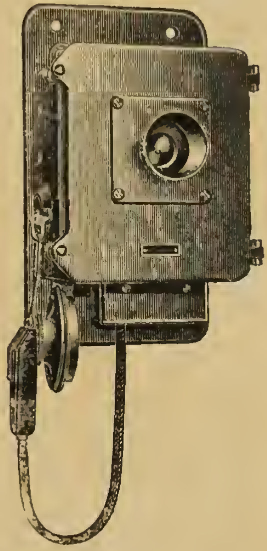

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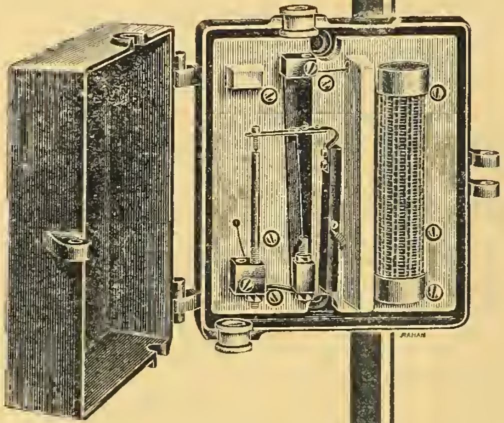

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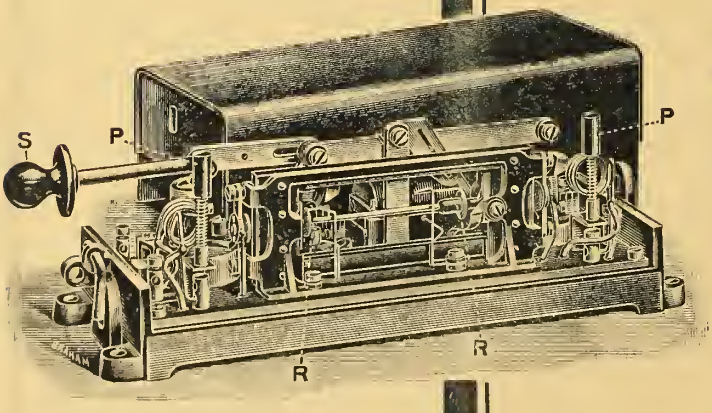

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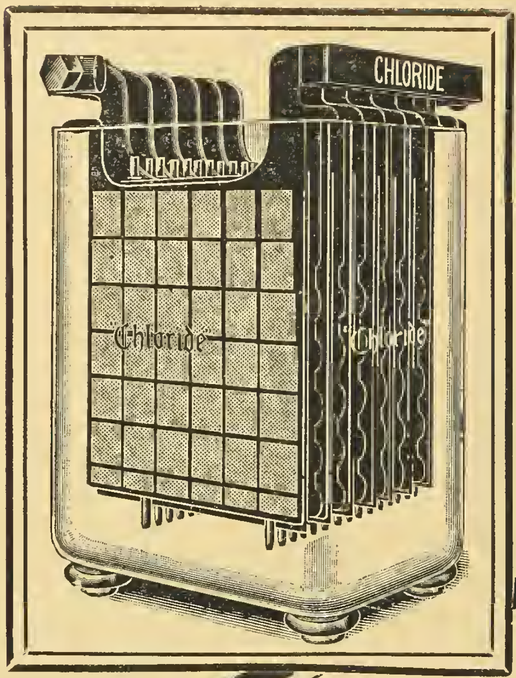
(*Continued on page* 47.)



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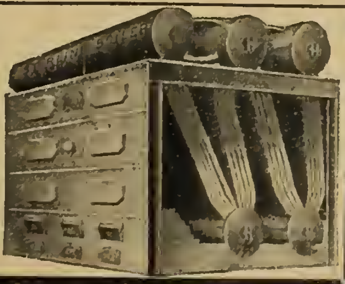

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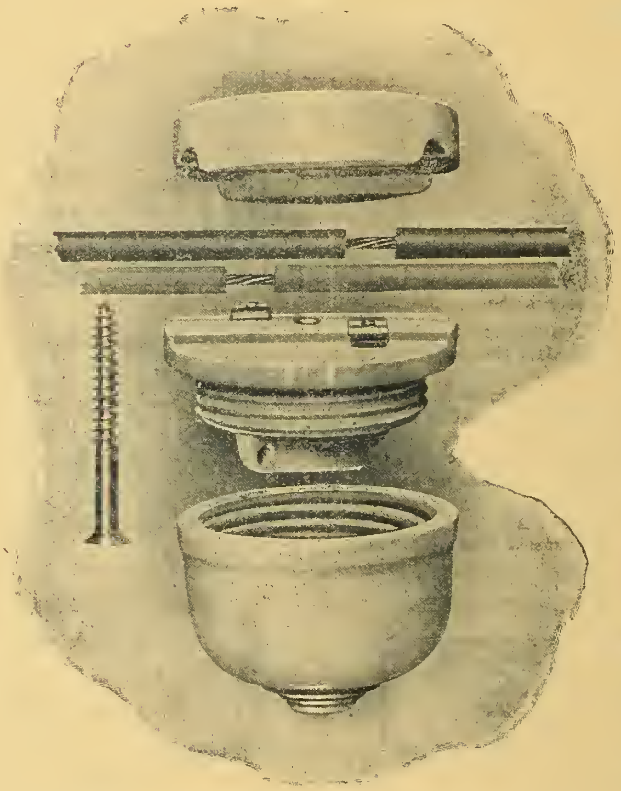

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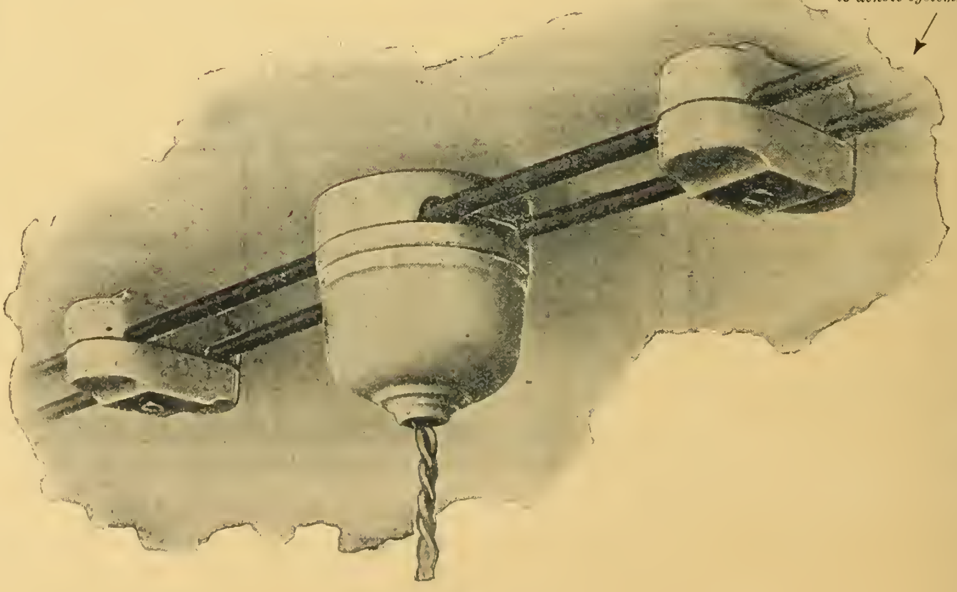

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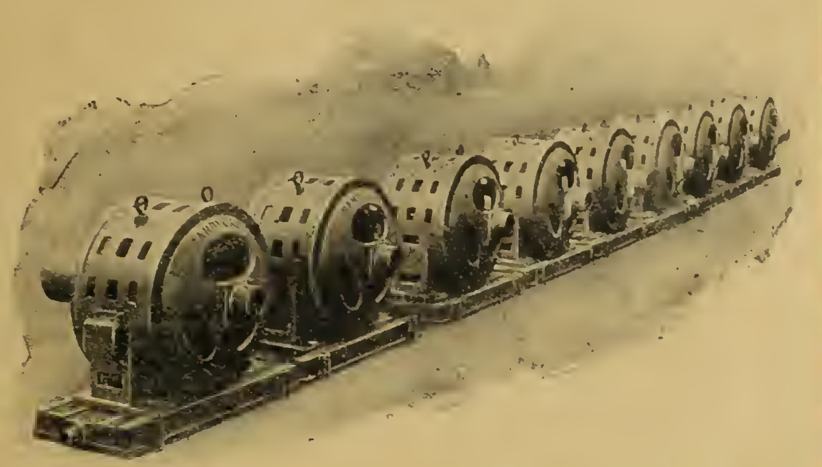

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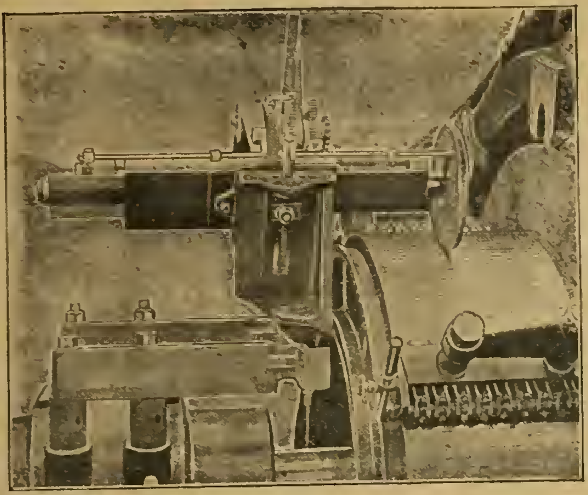

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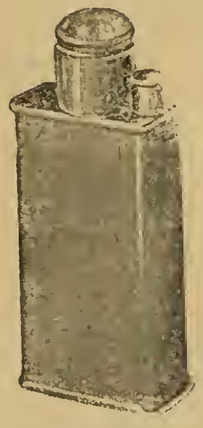

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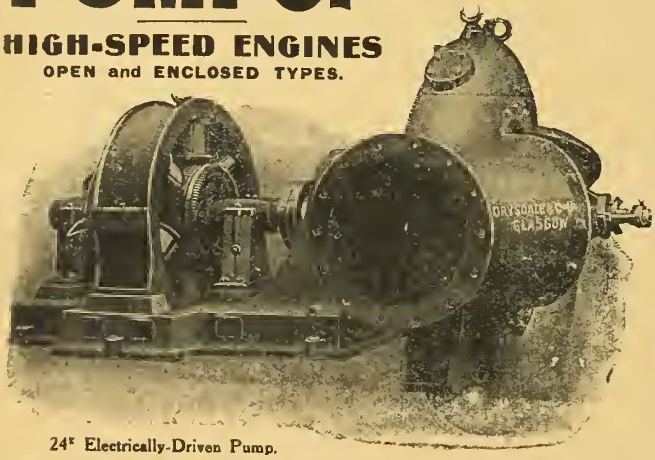

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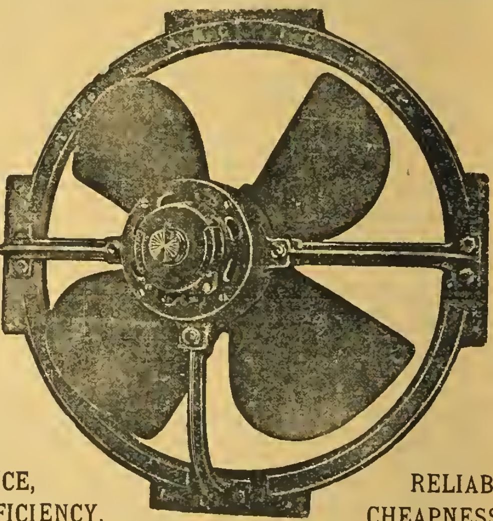

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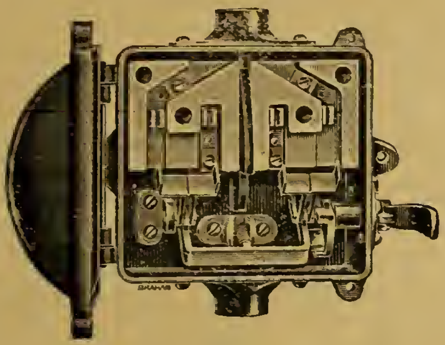

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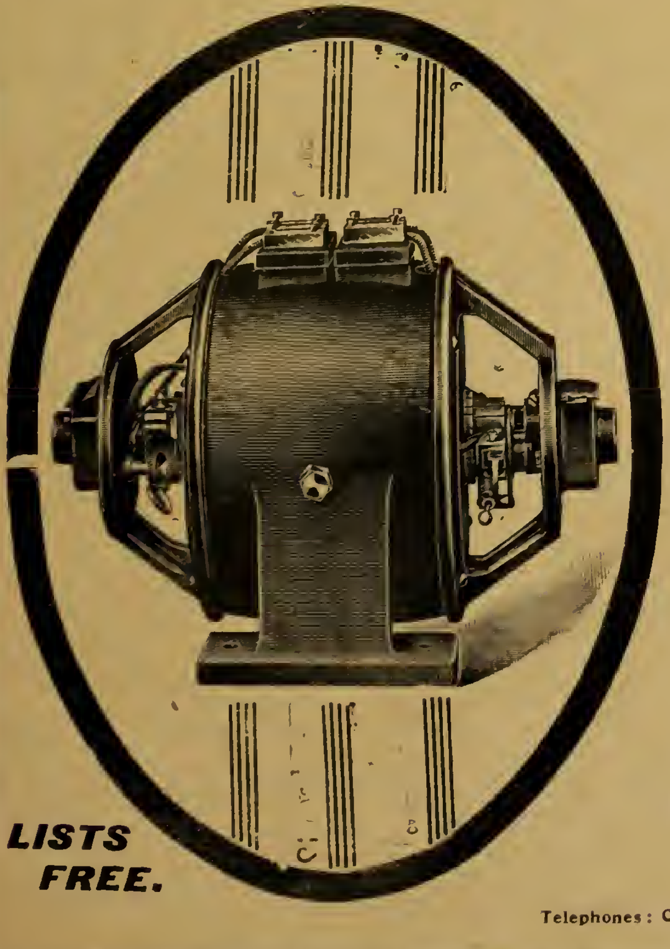

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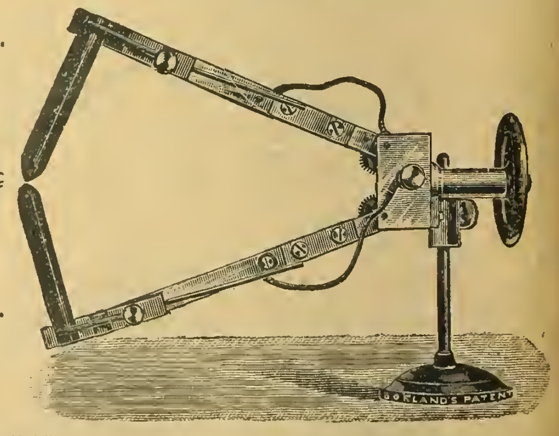

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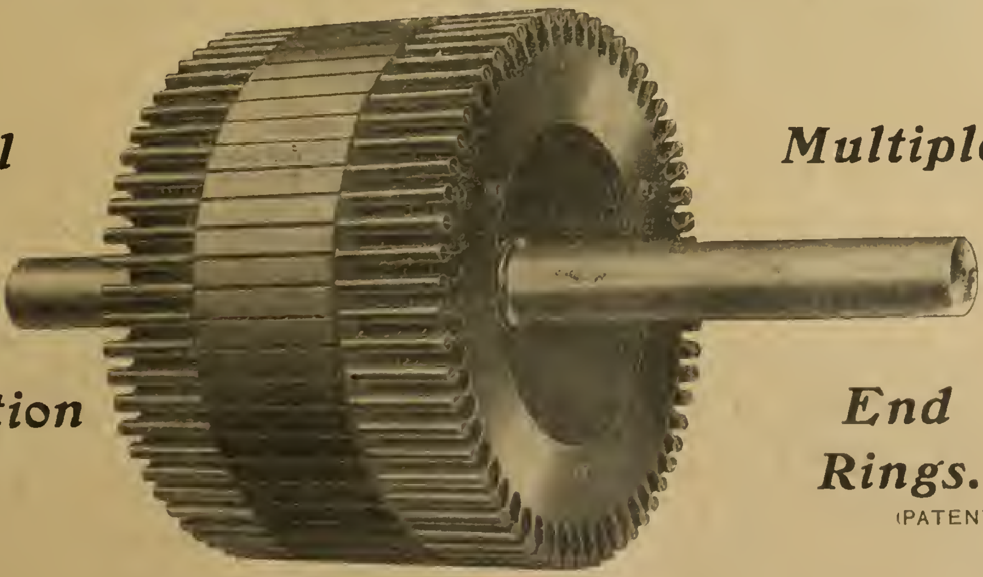

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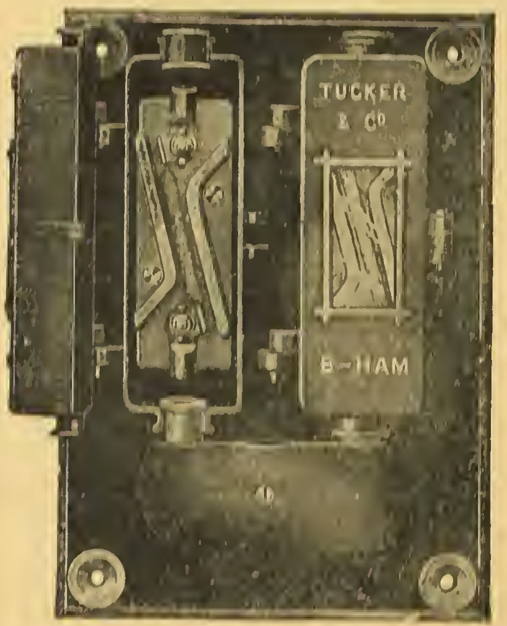

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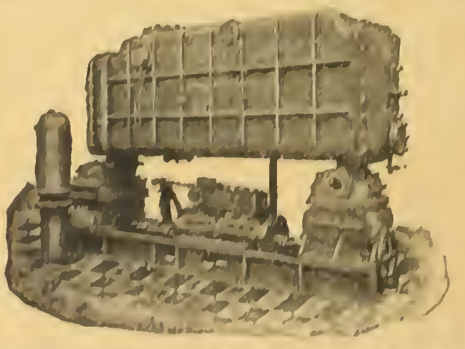

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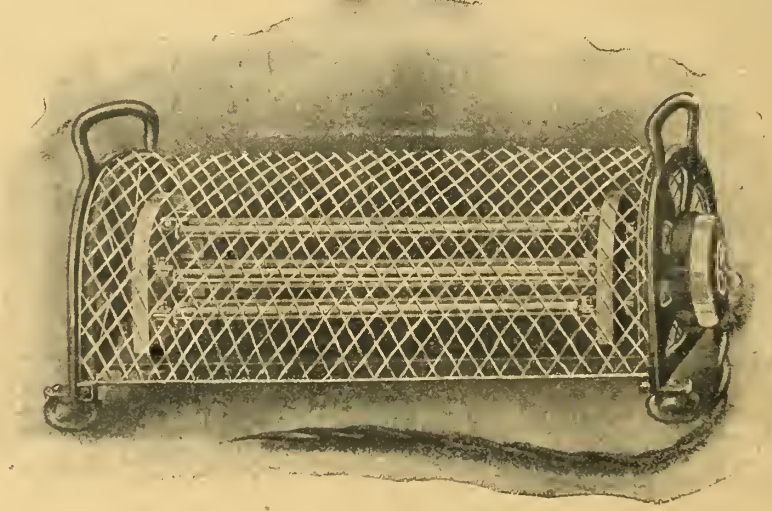

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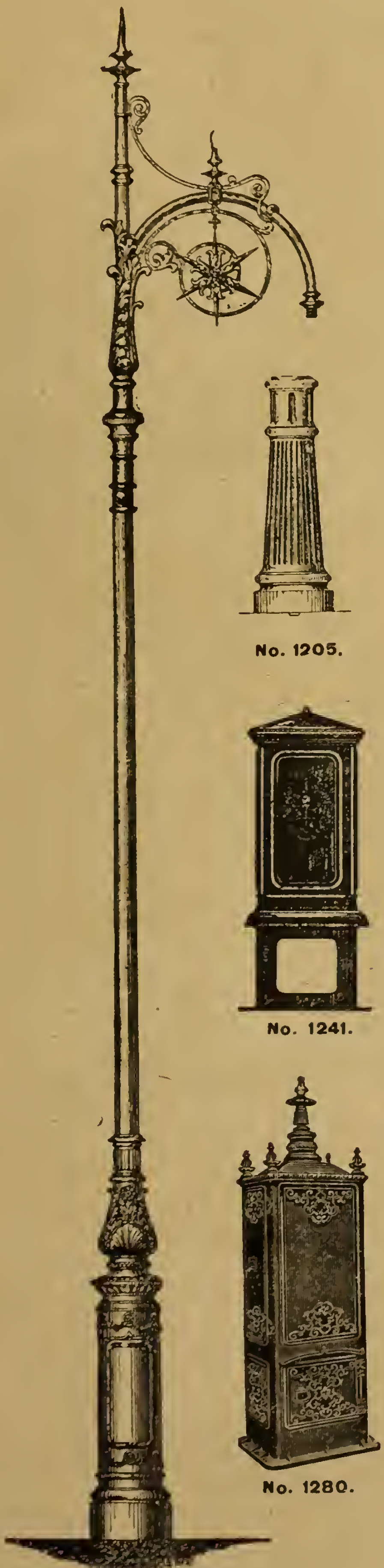

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[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEENSHIRE.—Alterations at United Free Church, Blairdaff by Kemnay; Kelly & Nicol, architects, 367, Union Street, Aberdeen.

ANNFIELD PLAIN (Co. Durham).—Five houses in William Street; W. G. Fawsett. Six houses in Mitchell Street; J. J. Bulmer.

ASHFORD.—Probable re-instatement (after fire) of portion of Eastwell House (premises lit by electricity), for H. J. King.

ATHERTON.—Further developments projected; Fletcher Burrows & Co.

AYLESBURY.—Alterations to business premises, Stoke Road, for P. J. Scott. Additions to factory, Clovelly Road, for G. A. Mower. Three houses, Highbridge Road, for Mr. Bliss.

BARNSLEY.—Four houses, Park Street, for T. Lindley. Six houses, Holgate Avenue, for E. W. Dyson. Four shops, Dodworth Road, for F. Hey. Four houses, Wilby Lane, for A. Wilby. Sixteen houses, St. Edmund's Avenue; W. Healey, builder, Barnsley. Rink, Doncaster Road; Central Hall Skating Rink Co., Barnsley.

BECKENHAM.—Additions to "Southmer," Westmoreland Road; J. Elliman, builder, Albermarle Road. Eight houses, St. James' Avenue; Hetherington & Co., builders. Eight houses, Elwill Way; H. & G. Taylor, builders, Park Langley.

BEDWELLTY.—Additions to the workhouse for the B.G. (£2,720).

BELFAST.—New premises in York Street and York Lane, for the Belfast Co-operative Society, Ltd.; S. Stevenson, architect, 83, Royal Avenue, Belfast. New theatre, corner of Grosvenor Road and Durham Street, for the Alexandra Theatre Co.

BOLTON.—Probable re-instatement (after fire) of portion of the Vernon Mill, for the Union Spinning Co. (premises lit by electricity; damage, £1,000). Developments and extensions at mills; Messrs. Ainsworth, spinners, Haslam Spinning Co., and Messrs. Crooks, spinners.

BRADFORD.—Warehouse and shed, for J. Ambler & Sons, Ltd., Midland Mills, Bradford; S. Jackson & Son, architects, 11, Tanfield Chambers, Bradford.

BRIGG.—Offices in connection with new steel works, for J. Lysaght, Ltd., Newport, Mon.

BRIGHTON.—Additional police offices at the Town Hall; Borough Surveyor, Town Hall, Brighton.

BRISTOL.—New music hall, at Bedminster, for Bristol Grand Theatre of Varieties, Ltd. (new company); J. Bannister Howard, director. Skating rink, with public hall and café, Park Row; M. Green, secretary of the company, 17, Bridge Street, Bristol. Additions to Eastville Workhouse, for the B.G.; J. J. Simpson, clerk, St. Peter's Hospital, Bristol.

BROADSTAIRS.—Shop and house, corner of Ramsgate Road and Queen's Road, for H. J. Harris; four houses and shops, Charlotte Street, for C. Britton. Two houses, Napier Road; A. Foster, architect, Pierremont Estate Office, Broadstairs.

BROMLEY.—Alterations to "Oldfield," Oldfield Road; F. P. Duthoit, builder, Westmoreland Road. Twelve houses, Foxbury Road; F. G. Crickett, architect.

BURSLEM.—Roller skating rink; E. T. Watkin, architect, Swan Chambers, Burslem.

BUTE.—Prospective rebuilding of Kyles of Bute Hydro (destroyed by fire); D. Hill, Jack & Sons, secretaries.

CADISHEAD (near Manchester).—Adaptation of patent fuel works for seed crushing; Secretary, Manchester Oil-seed Crushers, Ltd., 20, Princess Street, Manchester.

CANTERBURY.—Drill hall for the Kent Territorial Association (£5,975).

CASTLEFORD.—Premises, off Albion Street, for Lumb & Co., glass bottle manufacturers; offices, Bridge Street, for W. Shepherd.

CHELMSFORD.—Skating rink, for the Chelmsford Rink and Picture Palace Co.

CHIGWELL (Essex).—Dining hall, workshop, &c., and alterations to existing buildings at Chigwell School; H. Tooley, architect, Council Offices, Buckhurst Hill, Essex.

CHISWICK.—Two schools (200 places each); H. G. Crothall, architect, Middlesex Education Committee, Guildhall, Westminster, S.W.

CLEETHORPES (near Grimsby).—Public hall at rear of Council offices, for the U.D.C.

CLITHEROE.—Probable re-erection, after fire, of bungalow, Middlewood Hall, for W. King-Wilkinson.

COATBRIDGE.—Villa in Blair Road (£900); G. Reid, builder.

COLNE.—Probable re-erection, after fire, of premises, for the Liberal Club (damage, £2,000).

COPPULL (near Chorley).—New church, Park Road, gift of J. Darlington, The Hill, Lutterworth, and A. Hewlett, Haseley Manor, Warwick.

COVENTRY.—Proposed important additions to the Inland Revenue and County Court offices, for H.M. Office of Works, London.

CROYDON.—Adaptation of The Lindens and The Crosslands for children's homes (£600); H. List, clerk, Croydon Board of Guardians, Mayday Road, Thornton Heath.

DEVONPORT.—Married soldiers' quarters at Old Granby Barracks; Director of Barrack Construction, 80, Pall Mall, S.W.

DEWSBURY.—Residence, Healds Road; R. Castle & Son, architects, Cleckheaton.

DONCASTER.—New Roman Catholic Schools in Lord Street.

DUBLIN.—New boardroom and additions to offices, for the Rathdown Union; G. T. Moore, architect, 1 and 2, Foster Place, Dublin.

DUNDEE.—Rink, West End Street; R. M. Cameron, architect, 53, Great King Street, Edinburgh.

EPSOM.—Additions to Frances Lodge, Woodcote Sidy, for Gerrard Miles.

ERDINGTON (Birmingham).—Church; Rev. H. Roe, Homeleigh, Erdington.

EXETER.—Headquarters for Artillery Brigades (£5,000); Dymond & Parsons, architects, Southern Bay, Exeter.

FERRYHILL (Co. Durham).—Sixty-seven houses, Chilton Lane, for G. W. Lazenby.

GLASGOW.—Coffee factory at Shieldhall for Co-operative Society (£2,000); J. Davidson, architect, 95, Morrison Street, Glasgow.

HALIFAX.—Enlargement of the Post Office for H.M. Office Works, Storey's Gate, Westminster, S.W. Extensions to Stoney Royd Hospital, for the T.C. (£1,700); Mr. Lord, Borough Engineer. Branch Police Station at King Cross, for the T.C.

HASTINGS.—Two houses and shop, St. Helen's Down; F. H. Humphreys, architect, 6, Trinity Street, Hastings. Alterations to residence, "Westcliff," St. Leonards; Coussens & Rothwell, architects, Hastings. Alterations to "Vaenor," Laton Road, Hastings; Coussens and Rothwell, architects, Hastings. Alterations to Warrior House Hotel, St. Leonards; J. B. Wall, architect, 13, Devonshire Road, Bexhill. Pair of semi-detached villas, Barry Road, Silverhill, St. Leonards; D. J. Neame, owner and builder. Additions to business premises, 5, Claremont, Hastings; W. J. Taylor, architect, Hastings.

HATHERSAGE (near Sheffield).—Bank, for Crompton & Evans; J. S. Dalton, builder, Hathersage.

HYDE (Cheshire).—Six houses, Cleveland Avenue, for T. Fowden.

JARROW.—New public baths; J. H. Morton, architect, 50, King Street, South Shields.

KINGSTOWN (Dublin).—Probable rebuilding of premises of E. Lee, Ltd., after fire (£15,000).

LEEDS.—Training College and Hostels, Beckett's Park, for the T.C.; G. W. Atkinson, architect, 1, Mark Lane, Leeds.

LEITH.—Rope works at Morayfield, Restalrig, for J. Ross & Co., rope manufacturers, 23, Bath Street, Leith. Two new Salvation Army halls in Bangor Road.

LINTHWAITE.—Five houses, off William Street, Milnsbridge, for B. S. Butterworth. Four houses, Manchester Road, for J. Wimpenny and Co. Alterations to dye-house, Stanley Mills, for Crowther Bros.

LLANDYSSUL.—Residence (£600); W. D. Jenkins, architect, George Street, Llandilo; I. Jones, builder, Llangranog.

LLANELLY.—Drill hall, Murray Street, for the War Office.

LLANWRYTD WELLS (Brecon).—Boarding house (£1,500); W. D. Jenkins, architect, Llandilo, Carmarthenshire.

LONDON (S.W.).—Re-appropriation of A.S.C. Block and additions to provide accommodation for the R.A.M.C., Millbank; Director of Barrack Construction, 80, Pall Mall, S.W.

(Clapham Junction, S.W.).—Prospective rebuilding (after fire) of premises for Arding & Hobbs.

(Lewisham, S.E.).—Six houses, Arran Road; J. Watt, builder, The Lodge, Bromley Road, Catford, S.E. Six houses, Bromley Road; T. A. Boughton, builder, 87, Culverley Road, Catford, S.E. Eight houses, Brownhill Road; Norfolk & Prior, architects, 4, Station Buildings, Catford Bridge, S.E.

(Walthamstow, N.E.).—Six houses, Cazenove Road; H. Brodey, architect, 259, High Street, Walthamstow.

(Shepherd's Bush, W.).—Block of shops, Uxbridge Road (£6,600); F. H. Witts, architect, 39, Agate Road, Hammersmith, W.; Kingerlee & Sons, builders, Oxford.

(Tottenham, N.).—Additions to St. Andrew's Church, Clarence Road, for Rev. F. Rice. Two houses and shop, 75 and 77, Thackeray Avenue; G. W. Rowley, builder, 278, Philip Lane, N. Skating rink, High Road; Norfolk & Prior, architects, 4, Station Buildings, Catford Bridge, S.E.

(Buckingham Gate, S.W.).—Building, Wilfred Street; Barlow and Roberts, builders, 15, Redcross Street, Southwark, S.E.

(Blackfriars Road, S.E.).—Building, corner of Green Street and Friar Street; W. K. Smith, 52, Cann Hall Road, Leytonstone, N.E.

(Southwark, S.E.).—Building, Rockingham Street, for J. Newton and Co., hair felt manufacturers, Verney Road, Rotherhithe New Road, S.E.

(Lambeth, S.E.).—Six houses on site of Knolly's Croft, Leigham Court Road; F. P. Wooding & Son, builders, 3, Harborough Road, S.W.

(Stoke Newington, N.).—Mission Hall, Chapel Court, High Street; Humphreys, Ltd., builders, Knightsbridge, S.W.

(Wood Green, N.).—Public baths (£8,000); H. Burgess, architect, 51, Dunloe Avenue, West Green, N.

LYNTON.—Business premises, for A. Rose, fishmonger.

MALDON.—County school (500 places); A. S. R. Ley, architect, 55 Bishopsgate Street Without, London, E.C.

MALTON.—New post-office, for H.M. Office of Works, Storey's Gate, Westminster, S.W.

MARK (near Highbridge, Somerset).—Probable re-erection, after fire, of business premises, for W. G. Frost, grocer (damage, £1,000).

MEDOMSLEY.—Hall (£2,000); G. T. Wilson, architect, Blackhill; T. Gallagher, builder, Blackhill.

MICKLEOVER.—Wesleyan Church.

MORECAMBE.—Conversion of the Grand Hotel into hydro (£9,000).

MOSBOROUGH (near Sheffield).—Probable re-erection (after fire) of Knowle Hill Flour Mills, for B. Lawrence (damage, £1,200).

NEWCASTLE-ON-TYNE.—New naval shipbuilding yard, Walker, for Sir W. G. Armstrong, Whitworth & Co.

NEWPORT (Mon.).—Extensions to docks (electrically equipped) for the Cardiff Channel Dry Docks and Pontoon Co., Ltd.; Topham, Jones and Railton, Ltd., contractors, Newport. New works, Somerton Estate, for the manufacture of light iron goods, for a Birmingham firm.

NEWQUAY (Cornwall).—Alterations and additions to the Atlantic Hotel, for the Cornish Hotel Co.; G. Miners & Son, builders, Marazion.

NOTTINGHAM.—Probable reinstatement (after fire) of factory, Newdigate Street, for H. T. Gamble.

OCKLINGE.—Additions to St. Michael's Church (£10,000); the Vicar.

OLDHAM.—Church Institute (£2,500); C. Taylor, architect, 10, Clegg Street, Oldham.

PAISLEY.—New Ralston United Free Church (£2,250); W. D. McLennan, architect, 95, High Street, Paisley.

PITSEA (Essex).—County school (£3,000); F. Whitmore, county architect, Chelmsford.

PLYMOUTH.—Territorial headquarters, Millbay; F. A. Clark, architect, 83, Old Town Street, Plymouth.

PRESTWICH.—Primitive Methodist Church.

RAVENSTHORPE (Yorks.).—Laboratory at Howroyd & Oldroyd's chemical works. Fitting shed, for Bell Bros.

RAWMARSH.—Thirty-two houses; A. Pugh, builder, New Road, Rawmarsh.

READING.—Buildings in Earley Place, Minster Street, for W. L. Moule; buildings in Fobney Street, for H. & G. Simonds, Ltd., brewers, Reading; houses in Whitley Wood Lane, for W. Harrington, Whitley Wood Lane.

RHYL.—Pair of villas in Grange Road; R. Jones, 20, River Street. Addition to laundry, Grange Road.

RICHMOND-ON-THAMES.—Additions to Holbrook Motor Works, Hillrise, for R. Cowper & Son. Alterations to 1, Halford Road; Brewer, Smith and Brewer, architects, Richmond.

ST. ALBANS.—Artillery barracks, for the Herts Territorial Association; H. F. Mence, architect, Town Hall Chambers, St. Albans.

ST. IVES.—Proposed new municipal offices.

ST. MARGARETS-AT-CLIFF (near Dover).—Probable re-erection (after fire) of the Hope Inn, for Thompson & Son, brewers, Walmer.

SEAHAM HARBOUR.—Co-operative premises; Secretary, Ryhope and Silksworth Co-operative Society, Ltd.

SLOUGH.—Four houses, Arthur Road, for R. Cozens; skating rink, High Street, for A. C. Corfield and R. Viveash.

SMETHWICK.—Bank, in High Street, for the London, City and Midland Bank, Ltd.; alterations to Beehive Inn, Cape Hill, and alterations to Blue Gates Hotel, for Mitchells & Butlers, Ltd.; 26 houses, in Arden Road, for C. Hougham.

SOUTHEND.—Alterations, Army and Navy Hotel, Marine Parade, for H. F. Holland.

SOUTH SHIELDS.—Alterations, Havelock Arms, for the Lawson Trust; F. Rennoldson, architect, King Street, South Shields. Houses, Sunderland Road, for T. J. & T. G. Bell; J. H. Morton, architect, King Street, South Shields. Café, in Sea Road, for W. Parker; C. W. Bell, architect, 17, Norfolk Street, Sunderland.

(*Continued on page* 62.)

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SWANAGE.—Two houses, King's Road, for G. Hardy. Ten houses, Chapel Lane, for J. Parsons. Houses, Court Hill, for F. W. Pond.

SWANSEA.—Additions and plant at the Lion stores, North Dock, for D. Jones and Co., wholesale provision dealers, Redcross Street, Liverpool (£2,000).

SWINDON.—Skating rink, for the Premier Rinks, Ltd., King's House. King Street, London, E.C.; Sutton & Gregory, architects, Bromley House, Nottingham.

TRURO.—Proposed conversion of Market House into public hall and skating rink, to be lit by electricity (£2,000); R. Thomas, Penzance, managing director of the syndicate.

WALKDEN.—Mill extension; Messrs. Storrs, contractors, Stalybridge.

WALLSEND-ON-TYNE.—Probable re-erection (after fire) of business premises, High Street East, for W. Broomfield, tailor (damage, over £2,000).

WARRINGTON.—Rebuilding shop (after fire) in Buttermarket Street; Mr. Knox, greengrocer.

WHITEHAVEN.—Alterations to business premises, Newtown, for Mr. Carr, jeweller.

WHITTINGTON (near LICHFIELD).—County school extensions (£1,021); E. J. Chattle, builder, Lichfield.

WIGAN.—Eight houses, bakery and stables, Roscoe Street and Hunt Street, for W. T. Speakman. Four houses, Platt Lane, for G. H. Rhodes. Houses and shops, Wigan Lane, for the Executors of the late T. Halton.

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WOMBWELL (YORKS.).—Ten houses and shop, Main Street, for W. Johnson; three houses, Wath Road, for A. Dobson; skating rink, for the Wombwell Empire Skating Rink Co.

WORKINGTON.—Secondary and technical school (£14,000); Clark & Moscrop, architects, Darlington.

WORTHING.—Rink, Marine Parade (£6,000); C. A. Seebold, manager, The Royal Theatre, Worthing.

YARMOUTH.—Probable re-erection (after fire) of factory, for Slater & Sons.

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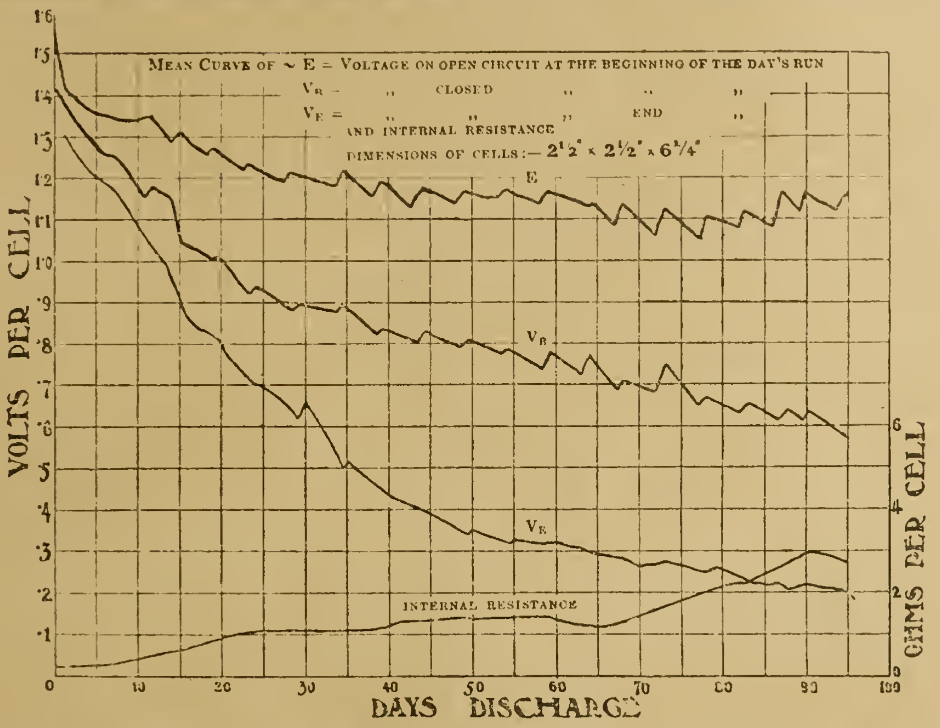

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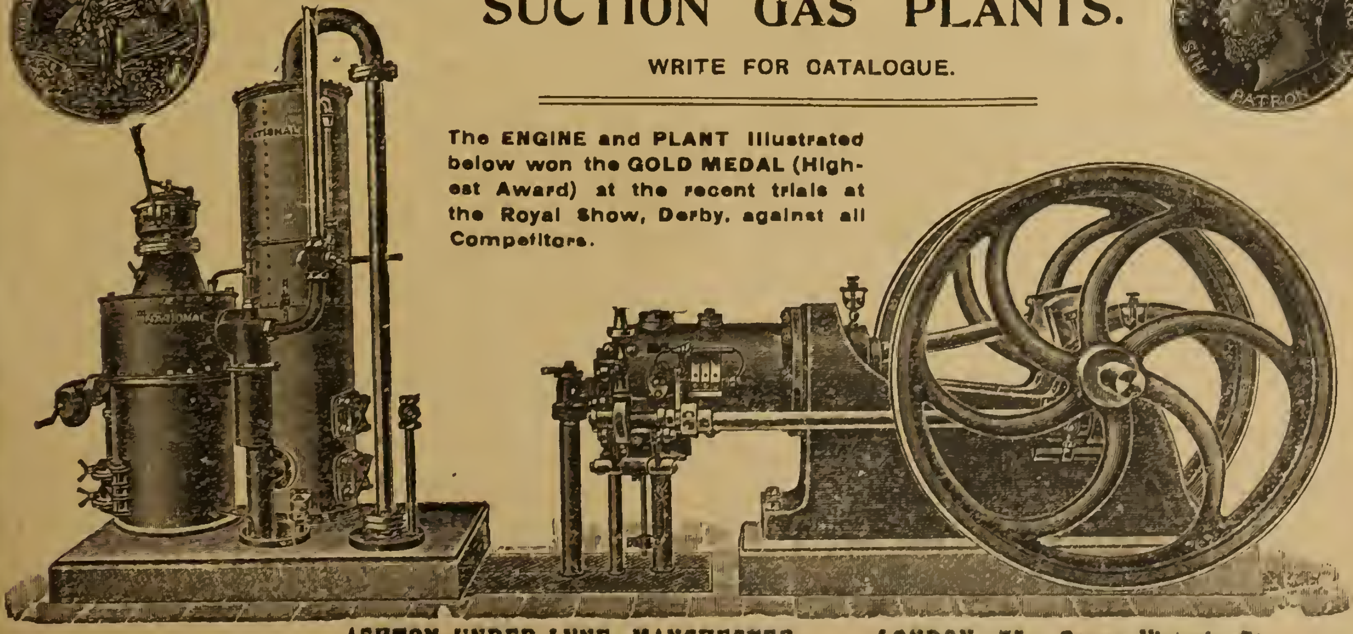

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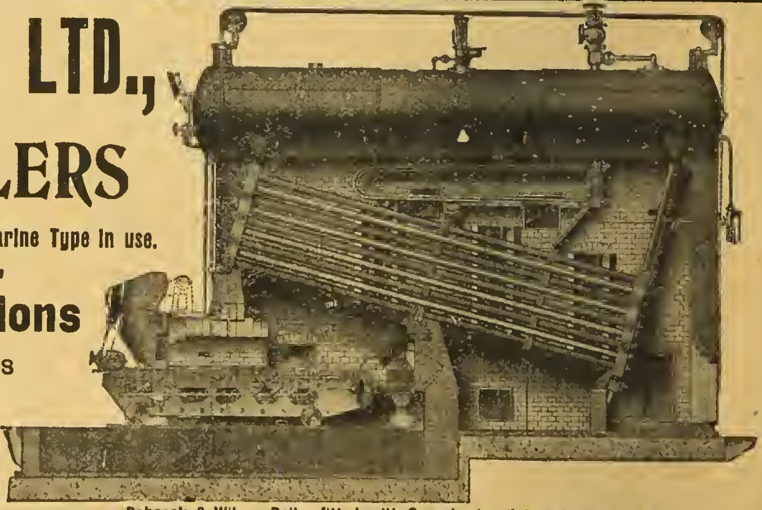

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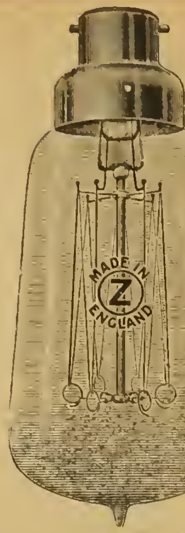

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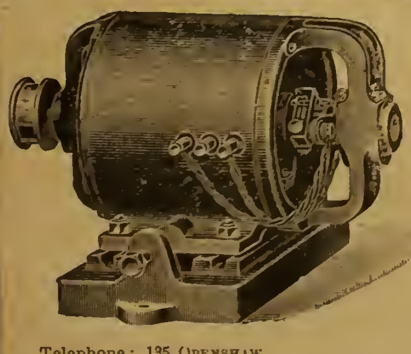

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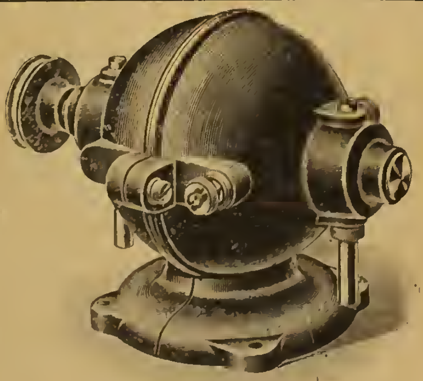

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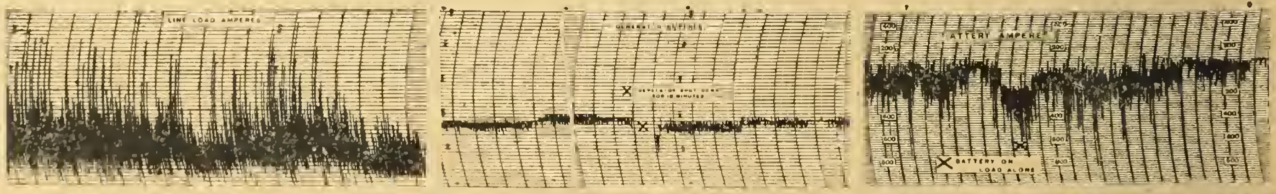

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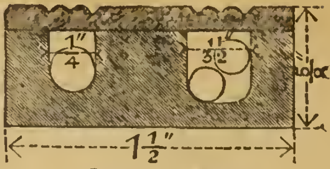

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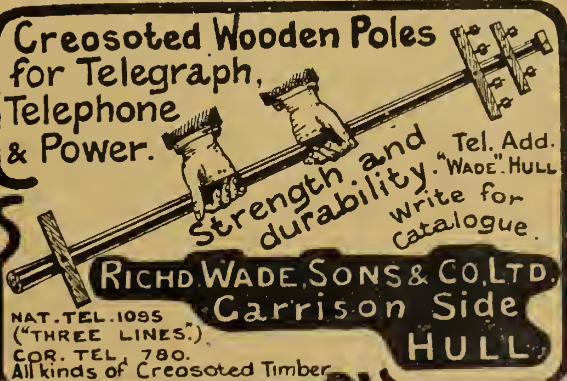
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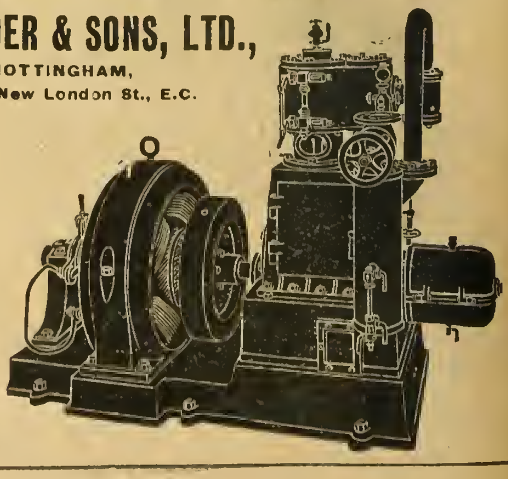

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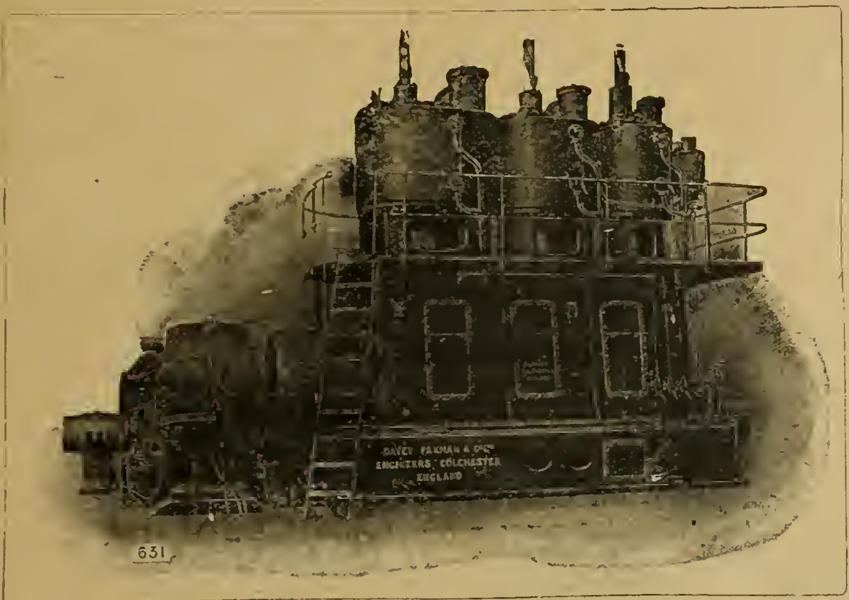

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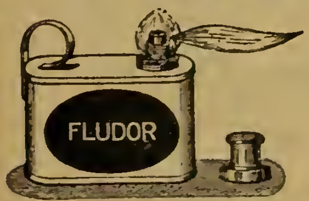

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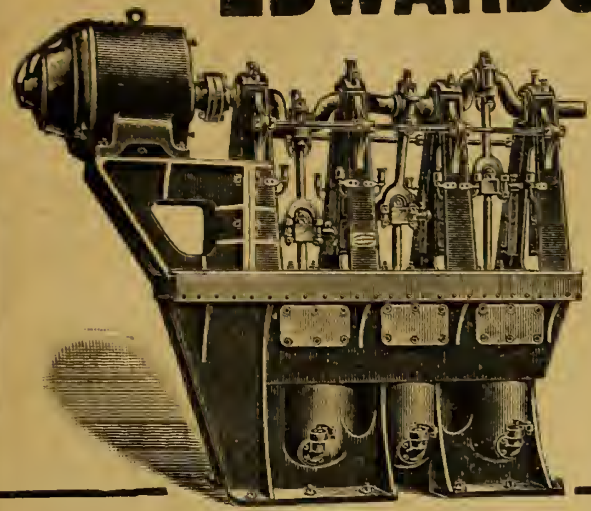

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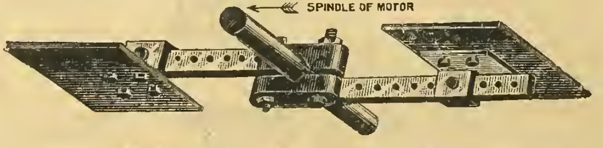

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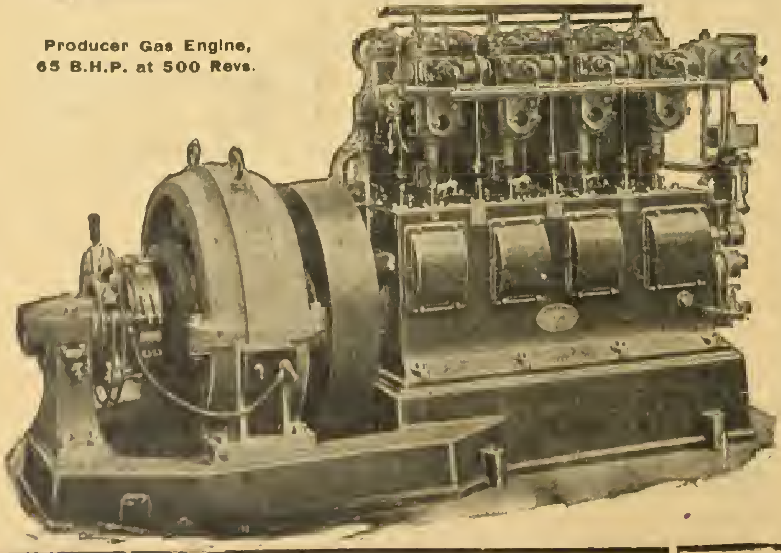

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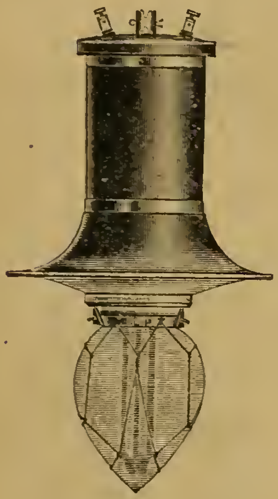

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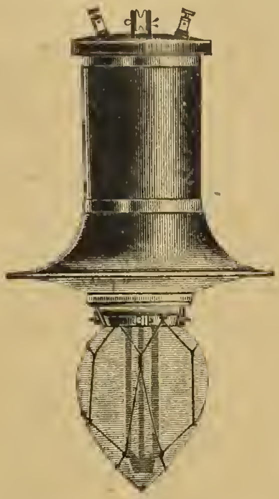

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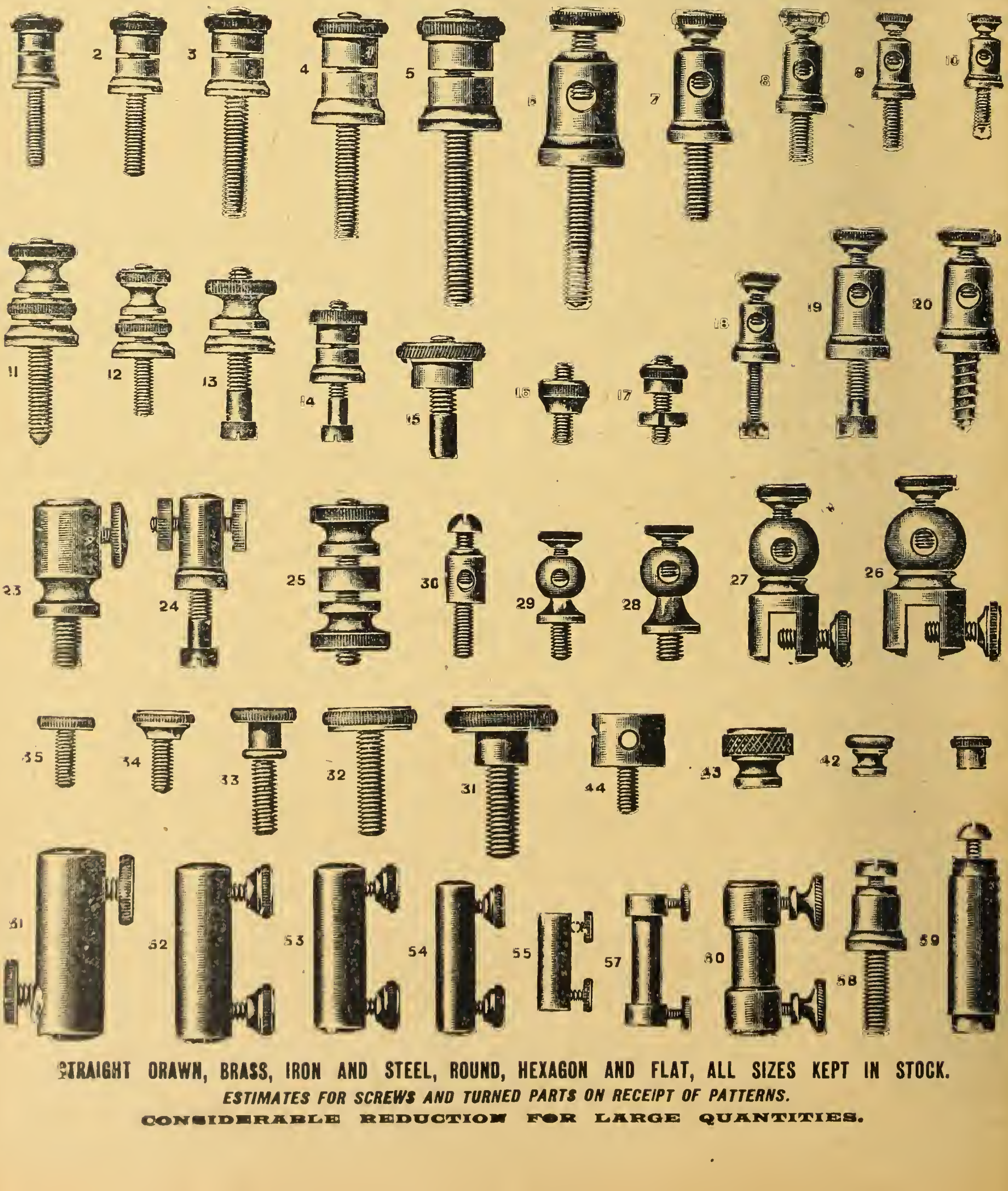

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